HUNTER COLLEGE
OF
THE CITY UNIVERSITY OF NEW YORK

PROPOSAL TO ESTABLISH A PROGRAM IN GEOINFORMATICS LEADING TO THE MASTER OF SCIENCE DEGREE
EFFECTIVE SPRING 2016

SPONSORED BY THE DEPARTMENT OF GEOGRAPHY

APPROVED BY

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EXECUTIVE SUMMARY

The proposed Master of Science in GeoInformatics (MGEOi) at Hunter College of the City University of New York is a science and technology based program with a focus on computational GeoInformatics – the intersection between Geographic Information Science and Computational Science. Proposed by the Department of Geography, the program is unique in CUNY and the New York City area. The new degree program will provide instruction/training for research and professional careers in academia, government, and the private sector. The goal is to offer world-class education in GeoInformatics in an effort to train the next generation of geospatial leaders and thinkers. It is a unique opportunity to provide a context for students to address the geospatial problems confronted by society and to leverage the current widespread interest in Data and Information Science programs in the U.S.

There is a growing demand both locally and globally for graduates with strong geospatial technical and analytical skills and the Hunter MGEOi program will meet this demand through a program that focuses on computational methods for spatial-temporal analysis and big data analytics. Several recent national surveys have indicated that demand for GeoInformatics skills will continue to increase over the coming decade and the MGEOi program is well positioned to play an important role in developing the workforce necessary to meet this need.

The program is designed to facilitate completion of the degree by moving students through research “tracks” that allow them to focus on particular areas of interest while also acquiring strong basic GeoInformatics skills. Students are also introduced to high-level theoretical concepts in GIScience, making them capable of advanced research in related fields. Graduating students will be met with a strong demand for their skills at the job market and many opportunities to continue their research should they choose to pursue a Ph.D. or advanced research position. The proposed curriculum has received overwhelming positive comments from the external reviewer.

The proposed MGEOi program will primarily involve faculty members who are currently teaching the GTECH (Geographic technologies) and GEOG (Geography) graduate courses at the Department of Geography. Therefore, graduate course offerings in GeoInformatics will continue to be staffed at the existing level and there is no need for hiring additional full-time faculty provided that the projected enrollments of approximately 25 students is not exceeded significantly. Despite the high tech nature of this program, the request for addition funds for capital expenditures is minimal. The program is expected to pay for itself and return revenue to the College.
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ABSTRACT
The proposed Master of Science in GeoInformatics (MGEOi) at Hunter College of the City University of New York is a science and technology based program with a focus on computational GeoInformatics – the intersection between Geographic Information Science and Computational Science. Proposed by the Department of Geography, the program is unique in CUNY and the New York City area. The new degree program will provide instruction/training for research and professional careers in academia, government, and the private sector. The goal is to offer world-class education in GeoInformatics in an effort to train the next generation of geospatial leaders and thinkers. It is a unique opportunity to provide a context for students to address the geospatial problems confronted by society and to leverage the current widespread interest in Data and Information Science programs in the U.S.

There is a growing demand both locally and globally for graduates with strong geospatial technical and analytical skills and the Hunter MGEOi program will meet this demand through a program that focuses on computational methods for spatial-temporal analysis and big data analytics. Several recent national surveys have indicated that demand for GeoInformatics skills will continue to increase over the coming decade and the MGEOi program is well positioned to play an important role in developing the workforce necessary to meet this need.

The program is designed to facilitate completion of the degree by moving students through research “tracks” that allow them to focus on particular areas of interest while also acquiring strong basic GeoInformatics skills. Students are also introduced to high-level theoretical concepts in GIScience, making them capable of advanced research in related fields. Graduating students will be met with a strong demand for their skills at the job market and many opportunities to continue their research should they choose to pursue a Ph.D. or advanced research position.
1. PURPOSE AND GOALS

The proposed Hunter Master of Science in GeoInformatics (MGEOi) is a science and technology based degree program that will provide training for research and professional careers in local and national governments, international agencies, non-government organizations, corporations, consulting firms, and information technology companies as well as in academia. The focus on GeoInformatics which combines Geographic Information Science (GISci) with Computational Science makes the program unique within the New York City Metropolitan area. It will provide world-class education in GeoInformatics in an effort to train the next generation of analysts, thinkers, and leaders in the field of geospatial and informational technologies. Training in computational aspects of GIS (Geographic Information Systems) will include modeling and programming, remote sensing, visualization, databases, spatial ontologies, spatial statistics, big data, complexity, as well as applied research topics such as human and animal mobility, transportation, crime and health, environmental modeling, urban environments, biogeography, disaster management, and community-based GIS.

The proposed program is unique in that it bridges the gap among computer science, geography, and Geographic Information Science within a single program. As such, students will learn computational and technical skills, while also developing strong analytical skills, geographic and critical thinking, and higher-level geographical principles. Furthermore, many existing GIS programs in the region (such as the Master of Science in Geographic Information Science at Lehman College) and nationally, focus on analytic operations within Geographic Information Systems (computer technology for spatial analysis and mapping), whereas the goal of the proposed MGEOi is to provide more advanced training in topics such as spatial statistics, spatial-temporal modeling, remote sensing, computation, data analysis, as well as the social relevance of geospatial technologies. Students will, therefore, be distinct from graduates of other programs in how they think about and use spatial analytical principles and technologies – becoming highly skilled users and developers of advanced geoinformational technologies and tools. The MGEOi program extends the existing GIS-certificate programs at Hunter College by providing a more advanced technical and computational perspective. Graduates will be proficient not only in the use of geo-spatial technologies but also in their theoretical and computational foundations. They will be equipped with a skillset that will enable them to work both in upper management as well as in high level technical positions.

The Department of Geography includes experts on a wide range of topics in GeoInformatics and has a long history of excellent research and education in geographic information systems, science, and technology. The faculty is committed to build on this tradition and collaborate with faculty from departments of Computer Science and Urban Affairs and Planning (and possibly others in the future) to create a unique program that imparts skills that are in high demand in the job market. This collaboration will grow as the program matures and will contribute to interdisciplinary research and teaching across these departments by expanding the knowledge base from which students will learn. In addition, speakers from industry and the private sector will be

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invited to lecture on special topics to provide expertise in areas that pertain to the program but
are beyond the scope of the coursework offered by the college. Several local agencies and
organizations (e.g., Ontodia, CartoDB) have already been contacted in conjunction with this
proposal, and will be able to provide lectures and on-site demos to students enrolled in the
proposed MGEOi program. Additionally, plans are underway to develop an online-learning
component to the program, with several online offerings already available at the introductory
level.

The focus on GeoInformatics was chosen because both the increasing importance of this major
aspect of computational GIS and the research expertise of the existing faculty members uniquely
positions Hunter’s Department of Geography as an industry leader in this area. This focus also
distinguishes our MGEOi from other programs in the City of New York. The program will meet
a growing demand\(^3\) for scientists trained in the collection, organization, analysis, and
dissemination of geospatial data, particularly those who are able to devise and develop new
analytical methods and visualizations of large geospatial datasets. The focus on GeoInformatics,
therefore, provides a major competitive advantage to both the MGEOi program and its future
graduates.

2. NEED AND JUSTIFICATION

A. The needs of the students, the college, and the community.
The employment demand for advanced training in GeoInformatics in the New York area (and
globally) is currently increasing at a rapid rate. GIS as an industry is already well established, as
is evidenced by the large number of existing professional GIS organizations.\(^4\) Additionally, a
recent report by Oxera\(^5\) has shown that geo-services\(^6\) (of which GIS is a major component) are
estimated to directly contribute well over $150 billion in annual revenue globally. The global
added value of geo-services is estimated to be approximately $100 billion per year, with an
estimated $73 billion for the labor remunerations of the industry employees. The geo-service
industry as a whole is expected to remain strong, with an estimated steady increase in revenues
of 30% per annum. This same report also highlights the need and benefits of GIS education:

“… the demand for GIS-skilled labour is set to grow. In order to meet this growing
demand, the supply of skilled labour will need to increase, which will in turn depend on
the availability of appropriate courses, training and educational resources.”

A brief survey of job listings websites shows that there is a persistent demand for GIS specialists.
At the time of writing of this proposal, the NYC Public Service Careers website\(^7\) had 10 job

\(^4\) See [http://www.emerginggisleaders.org/gis-professional-organizations.html](http://www.emerginggisleaders.org/gis-professional-organizations.html) and/or
\(^6\) Geo-services are defined as all interactive digital mapping and location-based services. See Oxera report for further
details.
\(^7\) [http://www1.nyc.gov/jobs/index.page](http://www1.nyc.gov/jobs/index.page)
openings related to GIS, The New York Times job market\(^8\) had 37 openings, and indeed.com listed about 180 openings in the NYC area. Job prospects are especially good for graduates with technical skills in database administration, data analysis, as well as development and management of Geoweb services. Applicants with these skillsets and some years of experience find job opportunities with annual salaries above $100,000. Recent graduates with little or no work experience can expect to make somewhere between $65,000 and $90,000 a year. In general, the more technical and analytical the acquired skills are, the higher the salary will be. This aligns with the focus of MGEOi program on GeoInformatics which prioritizes training in technical and computational aspects of spatial analysis.

The success of the current GIS Certificate program at the Department of Geography also suggests that employment prospects of the future MGEOi graduates are bright. This is confirmed by informal and formal surveys of the two our existing programs: (1) MA program in Geography, in which many students take GIS courses, and (2) the GIS certificate program. The department conducted the surveys in conjunction with this proposal to further assess employability of GeoInformatics professionals in the New York City metropolitan area (official employment data for these programs does not exist). The formal survey was sent out to all current and past GIS Certificate students, recent MA in Geography graduates, and students enrolled in a GIS course as of Spring 2014 for whom we had current email addresses. We received 40 full responses to our formal survey, and were able to gather additional names for past students currently employed in GIS-related positions throughout New York City.

Initial informal assessment indicates that Hunter Geography graduates with core training in GIS hold employment positions in New York City departments and offices, including City Planning, Parks, Information Technology and Telecommunications, Emergency Management, Police, Environmental Protection, Education, Transportation, as well as a number of private sector companies. The US Environmental Protection Agency alone employs six former Hunter MA students. Additionally, the former senior cartographer at the United Nations received his MA from the Hunter Geography program. The formal survey, sent out to known recent and current GIS Certificate students\(^9\), indicated that a significant proportion of students obtained relevant employment during or after completion of their program. Many of these positions are entry-level GIS positions; with the proposed MGEOi program, we aim to increase student access to higher-level analytical, management, and research positions. Over the course of the last two years, one of our GIS faculty has also investigated this demand by talking directly to the employers and this has already led to curriculum innovations in teaching GIS.

In short, GIS-related employment is clearly a major job market growth area, both in terms of research and technology and service provision. In particular, the industry requires graduates with strong technical and analytical skills in GeoInformatics that the Hunter MGEOi program will uniquely provide.

An effort is currently under way within the New York GIS community to make the city a national GIS hub that would reflect the concentration of GIS educators, students, and professionals in the area. This effort involves creating an institute for geospatial technologies

\(^8\) http://jobmarket.nytimes.com/pages/jobs/index.html

\(^9\) 43 responses from an open survey sent out to current and past GTECH students via email.
with such elements as training, business startups, CADD-GIS integration/infrastructure analysis, and GIS applications for NYC government agencies. According to GISMO NYC (New York City Geospatial Information Systems and Mapping Organization, a user-oriented group of GIS professionals) board member Alan Leidner, the New York Geospatial Catalysts (NYGeoCATS) institute was formed in February 2015 as a Partner organization of the Fund for the City of New York led by President Mary McCormick. NYGeoCATS also has support from Manhattan Borough President Gale Brewer, Brooklyn Councilman Stephen Levin, and OEM Assistant Commissioner for GIS Jim McConnell, among others. Once NYGeoCATS gets off the ground, Hunter College is destined to become a center for GeoInformatics training for city and private industry workers, NGO employees, and community activists. In addition, the Department of Geography is currently discussing collaborations with the Manhattan Borough’s Senior Technology Advisor Will Colegrove to provide GIS expertise to community boards to organize and analyze the vast troves of spatial information recently made public by the passing of the NYC Open Data Law. The proposed MGEOi program, therefore, would play a key role in the development of geospatial expertise in New York City in the context of these efforts. Please see Appendix F for letters of support from many public organizations and private industry representatives.

Additional justification for the proposed program is the prospect for further collaboration between Departments of Computer Science and Geography at Hunter College as well as the CUNY Institute for Computer Simulation, Stochastic Modeling and Optimization (please see Appendix F for their letters of support). While the initial proposal calls for some Computer Science courses as electives in the MGEOi program, future integration may include developing specific advanced Computer Science courses and joint supervision of MS in GeoInformatics students by faculty of two departments as well as research and other synergies with the CUNY Institute for Computer Simulation. The dual benefit of this integration is that it promotes cross-disciplinary research and training and provides a wider range of skills to both Computer Science and GeoInformatics graduate students.

In a recent experiment with a course on Location-Based Services that was offered by Geography and cross-listed with Computer Science, we have already seen great interest in geoinformatics-related courses by computer science students who made up almost a third of those enrolled in the course (5 out 18). In the absence of a graduate program in Computer Science at Hunter College students with undergraduate BA degree in this field would benefit from moving into the computationally focused MGEOi program. This, in turn, would create wider opportunities for joint supervision of graduate students and research collaborations. Even more so, opportunities will be created for employing MGEOi students as part-time research assistants in third-party funded projects in both departments. Involvement in ongoing research will clearly benefit students through exposure to faculty mentoring and honing their research skills.

Finally, strong technical and analytical geocomputational skills acquired while in MGEOi program will prepare students not only to demands of the job market but provide those research-minded students with the background necessary to continue in PhD programs in various types of GIS, Computer Science and related fields.
To conclude, the proposed MS in GeoInformatics is poised to meet students’ needs by providing them with highly employable analytical skills required for higher level professional positions in government agencies, NGOs, and private industry. The program will respond to these industry needs but will also support the larger transformation of New York City into the center for geospatial education and research. It will also create new mentoring opportunities and research collaborations across the departments at Hunter College and CUNY.

B. Relation to other programs
The focus of the proposed MGEOi on computational side of GIS provides a unique perspective on GIS education, research, and training. The establishment of several similar programs nationally and internationally shows precedence for this type of program, including two programs that offer similar training, the new MS in GeoInformatics and Geospatial Intelligence at George Mason University (George Mason also features an MS in Geographic and Cartographic Sciences) and the highly successful Penn State Online GIS program. The George Mason program\(^{10}\) offers a curriculum that is similar to that proposed here with training that “addresses the emerging demand for scientists trained in the collection, organization, analysis, and dissemination of information about physical features, man-made structures, moving objects, people, and events that are geo-referenced or geo-located.” In particular, this program “focuses primarily on the computational approaches that support the synthesis and analysis of diverse types of data…” something the proposed MGEOi program will also feature heavily. The George Mason program is relatively new but it points that the demand for such programs exists and hosting such a program at Hunter College has clear benefits. Conversely, Penn State’s online GIS program has been a leader in online education since 1998. This well-established program has a strong track record for excellence and is geared towards professionals who are already engaged in GIS work. While not a direct competitor to the type of program proposed here, it provides an excellent example of the success of an educational program that has adapted to advances in GIS technologies (including cloud computing, big data research, and web-based mapping technologies, and online-training), something we also emphasize with the proposed MGEOi program or plan to add to it in the future (e.g., online course offerings).

Within the CUNY system, Lehman College currently offers a Master of Science in Geographic Information Science (MS-GISc). The MS-GISc Program at Lehman has been officially recognized as a Professional Science Master’s (PSM) program by the National PSM Association (NPSMA). While there is a certain unavoidable overlap in the course content (especially at the introductory level), the two programs diverge sharply in their advanced course content, faculty expertise that supports each program, and the student population they serve. As it is clear from the description of the curriculum in Section 4, the proposed MGEOi program explicitly focuses on GeoInformatics and computational GIS while Lehman MS-GISc program provides strong background in GIS analysis and applications area. In particular, the MGEOi program is oriented towards programming, computational and information sciences as they relate to spatial data analysis, simulation and modeling, while Lehman’s MS-GISc program is geared towards GIS analysis and advanced applications in medical geography, public health, and environmental modeling. This means that the programs will respond to different student needs.

\(^{10}\) http://catalog.gmu.edu/preview_program.php?catoid=25&poid=22164&returnto=4959
The difference in focus stems from differences in faculty expertise. Most GIS faculty at Hunter have primary specialization in the field of Geographic Information Science and GeoInformatics. At least four professors (Ahearn, Albrecht, and Kessler) publish their research primarily in GIS journals covering topics that range from spatial-temporal data modeling, agent-based models, and geospatial semantics, to movement pattern analysis, spatial statistics, gazetteers, and GeoComputation. They also do research on Big Data applications that require processing very large and dynamic datasets, such as the real-time sensor network data and social media streams. One faculty member (Ni-Meister) specializes in remote sensing and LiDAR technology. Two more professors (Gong and Pavlovskaya) contribute expertise in applications of GIS in transportation, urban spatial analysis, and social geography as well as critical GIS (effects of geospatial technologies on society).

Geographically, Hunter College is accessible from Brooklyn, Queens, Staten Island, and New Jersey which provides an opportunity to potential students who are not able to commute to Lehman College.

In short, the content of each program, faculty expertise that supports it, and potential student populations differentiate the two programs significantly. Thus, we see Lehman’s MS-GISc program and our MGEOi as complementary and not redundant, responding to different student needs, attracting different students, and providing education in different aspects of the GIScience field.

Within the Department of Geography at Hunter College, our post-baccalaureate GIS Certificate program and MA program in Geography will both be affected. Some of the course content, for example, will overlap with both programs, especially with the GIS Certificate program. Yet, the target audience for the proposed MGEOi program is significantly different from that of the GIS Certificate. The MGEOi is focused on higher-level professional GIS positions in management and research and students planning to continue to Ph.D.-level GIS research, while the GIS Certificate is geared primarily towards entry-level GIS positions, professional development, and skills upgrading. Our MA program in Geography embraces a broad range of geographic disciplines. It draws students with interests in human geography, environmental science, and nature-society relations. While many of these students take GIS courses and many even receive a GIS certificate in addition to their master’s in geography, their main interests do not lie with the technical and computational sides of GIS. They learn it from a user perspective, as one of the analytical tools and methods applicable to their field. In other words, the three programs are considerably different and students will choose between them according to their interests and needs.

The MGEOi program will allow the transfer of up to six credits from other programs. This applies to outside programs as well as our own GIS Certificate and MA in Geography programs. Transfer of six credits is allowed for two reasons. First, we want encourage students to take background courses within the program itself to assure continued student success in MGEOi. The course content is specialized and subsequent courses build upon these background courses to a large degree.
Certain current GIS certificate students and technically inclined MA Geography students would, however, be more interested in graduating from the MGEOi program. For GIS certificate students it will provide a chance to earn an advanced degree in the technical field they study. For current MA Geography students who are taking primarily GIS-related courses in an effort to specialize in GeoInformatics, it will be an opportunity to pursue the degree they really want to earn. Therefore, the GIS certificate and MA Geography programs may experience some initial reduction in enrollment when the MGEOi program takes off.

We will make special arrangements during the first semester of the program for students who are in the process of completing the GIS certificate or master’s in geography to facilitate their transfer into the MGEOi program, if accepted, without repeating courses.

In general, however, it is worth noting again that the target student audiences for the two graduate programs and GIS certificate programs are significantly different: the MA in Geography program attracts students interested in academic and applied aspects of human and physical geography who may be have an interest in applied GIS; MGEOi program will attract students who seek a graduate degree in GIS technologies, Geo-Computation, and GIScience; while GIS certificate program will serve students how need medium-level expertise in Geoinformatics. We expect all three programs in our department to thrive in the future.

3. STUDENT INTEREST/ENROLLMENT

A. Interest/Demand

Over 40 students per semester take the introductory GIS courses. Of the 107 students who have enrolled in the Geography MA program since 2009, over 80 (~76%) have enrolled in three or more GTECH (Geographic Technology) courses. Students who specialize in GIS while in the MA in Geography are drawn from this cohort: they either enroll into the Geography MA program with the intention to study GIS or develop the strong interest from taking the introductory GIS courses. Currently, many such MA students concurrently fulfill the GIS Certificate Program. The MGEOi program will allow these students to participate in a master’s degree program directly related to their area of interest while students with a complementary interest in GIS will continue to opt for an MA in Geography and the GIS certificate.

The Oxera report mentioned previously has shown that students educated using Geo-services (see definition in Section 1 Purpose and Goals) can expect 3% higher average wages five years after graduation than those who were not. Indeed, a survey[11] of recent and current GIS Certificate students (also mentioned in Section 2 Need and Justification) revealed that a large number of students and employers place a strong emphasis on having a GIS designation on a degree or certificate (95%). Furthermore, many students felt that having a GIS certificate helped them obtain employment (70%). Of the 43 responses obtained from the student survey, over 90% indicated that employability was a major “motivation for taking GIS courses at Hunter College, CUNY.” This is in line with national statistics[12], which indicate that 38% of GIS professionals hold at least a master’s degree. These levels of employment are also predicted to increase over

[11] 43 responses from an open survey sent out to current and past GTECH students via email.
the next few years: GIS-related employment is predicted to grow faster than the average job growth in the USA, at between 16% and 35% between 2010 and 2020. This should lead to benefits for students such as increased earning potential and higher average wages. Indeed, in the US, GIS-related jobs tend to have higher median pay than the median pay for all occupations.

The focus on computational GIS is a particularly attractive and differentiating feature of the program. In the same survey mentioned above, students indicated that programming skills were something that they felt they needed in their current employment. And a large majority of respondents indicated that they would have taken more courses in programming and web-based cartography had more been available (>60%). Outside student surveys, computational and big data skills are major employment boosters, especially given the potential shortage of 140,000 to 190,000 US workers with the skills needed to analyze and understand big data.

B. Enrollment Projections

With current student interest, past GIS Certificate enrollment/completion rates (~87% since 2010), and these major employment considerations in mind, we anticipate the enrollment numbers for the first five years of the program as shown in Table 1:

Table 1. Projected student enrollment with attrition.

<table>
<thead>
<tr>
<th>Year</th>
<th>New Full-Time</th>
<th>New Part-Time</th>
<th>Attrition</th>
<th>Number Graduated</th>
<th>Total in Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Year 2</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Year 3</td>
<td>8</td>
<td>7</td>
<td>3</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>Year 4</td>
<td>8</td>
<td>8</td>
<td>3</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Year 5</td>
<td>11</td>
<td>9</td>
<td>4</td>
<td>14</td>
<td>27</td>
</tr>
</tbody>
</table>

We expect the enrollment to increase steadily to about 10-12 new full-time and a slightly lower number of part-time students. We plan to achieve these targets by the fifth year of the program by steadily increasing the number of new students as the program establishes itself and its reputation grows. Because of highly technical content of the program, the expected attrition is 2-4 students. We project graduation at 10-15 students per year. The variation owes to a combination of full-time students who can graduate in less than two years and part-time students who will most likely take longer to complete the program. We, therefore, expect to maintain total enrollment at about 25-30 students in any given year with a relatively high throughput because of streamlined graduation in response to the job market demand. Also see Table 1 Student

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15 Big data: The next frontier for innovation, competition, and productivity: [http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation](http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation)

16 Some early graduations will be due to transfers into program.

Total=Previous year total + new full-time + new part-time – attrition - graduated
enrollment in Appendix A. Please note this SED form in Appendix A does not explicitly show attrition and graduation figures (which are shown in Table 1 above). Attrition and graduation are reflected on the SED form by lower continued student counts.

C. Admission and Exit Requirements

The applicants will be required to submit an on-line application that will be reviewed by the Department of Geography. Admission requirements will include a GPA of at least 3.0, GRE exam scores, BA or BS degree, two letters of recommendation, and a personal statement. Additionally, students are required to have taken an introductory statistics course (e.g., STAT 113 or 213) and an introductory computer science/programming course (e.g., CSCI 133) prior to beginning the program. Students will have the opportunity to challenge these requirements if they are able to prove proficiency in statistics and/or computer programming. Foreign students whose first language is not English must also take the Test of English as a Foreign Language (TOEFL) and meet the requirements set by Hunter College.\(^\text{17}\)

Progress requirements. Students are expected to maintain a cumulative GPA of at least 3.0 in order to continue in the program.

Exit standards. In order to graduate from the MGEOi program in Hunter College, students must have a cumulative GPA 3.0 or higher and they must have met the program requirements. In particular, they must have completed 33 (Thesis Option) or 37 (Exam Option) credits of coursework, and complete a thesis if they elect the Thesis option or take an exam and submit a research paper if they elect the Exam option. The details are outlined in Section 4.C.Additional Requirements.

4. CURRICULUM

A. Overview and intellectual rationale

The MS in GeoInformatics program is an interdisciplinary degree that features courses in GeoInformatics, GIScience, and some GIS application areas. It provides an opportunity to train students in aspects of GeoInformatics not covered by the current GIS Certificate Program. The MGEOi is a full, science-based MS program designed to prepare students for management- and advanced research-level employment positions and/or acceptance into PhD programs in GIS-related fields.

Students receiving a Master of Science in GeoInformatics must choose one of two program options: the Thesis Option or Exam Option. The Thesis Option is recommended for students who will subsequently pursue a Ph.D. For other students, either option is acceptable. The program curriculum and other requirements are outlined in subsequent sections. The MS in GeoInformatics requires completing 33 (the Thesis Option) or 37 (the Exam Option) graduate credits within three semesters of full-time study (part-time study is also permitted). Classes vary in their structure from lecture to computer laboratory classes to seminars. Most classes provide

\(^{17}\) Minimum score requirements are available here: [http://www.hunter.cuny.edu/graduateadmissions/faq/toefl-tse-twe-scores](http://www.hunter.cuny.edu/graduateadmissions/faq/toefl-tse-twe-scores)
hands-on computer experience. Students will be required to take courses from the following groups:

(1) GeoInformatics and GIS core courses (19 credits);
(2) Elective courses in GeoInformatics and GIS or allied fields (e.g., Geography, Computer Science, Urban Planning, Geology, Economics, etc… 12 credits);
(3) Two one credit courses in the Thesis Option (2 credits) OR two elective courses in Exam Option (6 credits).

In addition to traditional courses, students will have the opportunity to participate in an active technology and research seminar series, field trips to local private and public sector GIS groups and research sites, as well as contribute to real-world GIS projects through internal and external mentorship programs. In particular, we are working on an internship model with Manhattan Borough President’s Office of New York City.

**Learning outcomes**

Upon completion of the MGEOi program it is expected that students will be able to:

1. identify the theoretical and methodological foundations of GeoInformatics and GIScience including data models and data structures, spatial ontologies and linked data, simulation and spatial-temporal modeling, remote sensing and spatial data capture, as well as spatial analysis and computational methods;
2. apply a wide range of research methods and scientific computing skills for the analysis of spatial information that emphasize geospatial computation, modeling, and big data;
3. develop advanced spatial analytical software tools including web-based tools and implement these software tools in a range of application areas;
4. explain how governments and private corporations collect geospatial information for various purposes (e.g., population censuses, analyses of consumer behavior, and security and surveillance) and understand the ethical issues involved; and
5. explain the impacts of geospatial technologies on economic, social, institutional, and cultural practices locally and in the context of globalization, grass-roots movements, and democracy.

The primary goal of this program is to provide students with the advanced theoretical and technical knowledge of GeoInformatics and GIScience required for PhD-level graduate work and higher-level positions in the government and industry. Students will leave with hands-on analytical skills in different GIS and remote sensing software packages, open source geospatial software tools, experience working with high-performance computing (HPC) environments, and at least two different computer programming languages. The rise of Geoweb and its role as a source of geographic data and a device for its collection, mapping, and analysis will play a key role in this program. An emphasis on theory as well as techniques of GeoInformatics means that students will graduate prepared to assume positions as advanced practitioners and to contribute to the growing field of GeoInformatics itself.

**B. Semester by semester schedule**

Table 2 provides a sample of required (R) and elective (E) course sequence for a full-time student who has elected to complete the MGEOi Thesis Option. This sequence reflects only one possible sequence:
Table 2 Graduate program schedule

<table>
<thead>
<tr>
<th>YEAR 1</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>GTECH 70200: Quantitative Methods</td>
<td>3 cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>GTECH 70900: Introduction to Geographic Information Systems</td>
<td>3 cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>GTECH 71000: Concepts and Theories in GeoInformatics</td>
<td>3 cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>GTECH 71200: Remote Sensing of the Environment</td>
<td>3 cr</td>
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</tr>
<tr>
<td></td>
<td>Spring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>GTECH 78517: Free and Open Source GIS</td>
<td>3 cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>GTECH 73200: Advanced GeoInformatics</td>
<td>3 cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>GTECH 73500: Location Based Services (new course)</td>
<td>3 cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>GTECH 73100: GeoComputation I</td>
<td>4 cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>YEAR 2</td>
<td></td>
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<tr>
<td></td>
<td>Fall</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>GTECH 73300: GeoComputation II</td>
<td>3 cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>GTECH 78502: GIS Applications in Social Geography</td>
<td>3 cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>GTECH 70800: Seminar in GeoInformatics (new course)</td>
<td>1 cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>GTECH 79900: Thesis Credit (new course)</td>
<td>1 cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

The Exam option would have a similar sequence but in the third semester students would take two 3 credit elective courses instead of the two 1 credit courses required for the Thesis option. This would bring the total course work to 37 credits for the Exam option.

C. Course descriptions
The MGEOi program builds on our successful professional post-baccalaureate GIS Certificate program that we have built since 2002 and now expand to meet the needs of a new group of students and professionals. The curriculum for the core component of MGEOi, therefore, utilizes the existing GIS Certificate Program while adding GeoInformatics courses that enhance the geo-computational and analytical skills of participating students.

Core component
The core component of MGEOi is composed of required core courses and several additional requirements. It includes two introductory courses: GTECH 70900, Introduction to Geographic Systems and GTECH 71000, Concepts and Theories in GeoInformatics as well as one advanced course: GTECH 73200, Advanced GeoInformatics. This series of courses provides students with the theoretical background and foundational skills and techniques. Other core components (GTECH 70200, Quantitative Methods in Geography; GTECH 73100, GeoComputation I; and GTECH 71200, Remote Sensing of the Environment) extend the conceptual range and skillset as students begin to move into the elective component of the program.

Elective component (Topic tracks)
The curriculum for the elective component is relatively open although the program suggests several specialized tracks for developing expertise in specific areas of GeoInformatics. These tracks are informal designations and students may switch tracks or combine multiple tracks at any time in consultation with the program adviser and relevant faculty. We suggest four topic tracks that would help students focus the program according to their needs: 1) Spatial Data
Analytics and Geovisualization, 2) GeoComputational Modeling and Remote Sensing, 3) Distributed and Web-based GeoComputation, 4) Applied GIS and Management. A track sequence would typically involve taking three to four required courses and complementing them with several electives courses. Exam option students in each track must take two additional 3 credit elective courses from GTECH and GEOG including GIS applications courses (GTECH 785xx).

1. Spatial Data Analytics and Geovisualization:
The Spatial Data Analytics and Geovisualization track is designed for students who are interested in the analysis and exploration of geospatial information. This track focuses on core computational statistical methods as well as tools and techniques for effectively conveying research findings, in both static and interactive formats. The track includes the six required courses as well as GTECH 72100, Introduction to Cartographic Design & Geovisualization; GTECH 72200, Advanced Topics in Geovisualization; GTECH 70500, Spatial Data Analysis; and GTECH 73300, GeoComputation II. Students following the Spatial Data Analytics and Geovisualization track will be prepared to analyze and effectively communicate geospatial information to a wide range of audiences and research fields.

2. GeoComputational Modeling and Remote Sensing
The GeoComputational Modeling track is designed for students interested in spatial-temporal modeling and algorithm development. Students will acquire expertise in the development of conceptual models, turning them into computational models (i.e. data structures and algorithms), and validating the results of those models. A range of spatial-temporal models will be examined, programmed and applied to real-world problems that often require “big data” solutions. The track includes the six required courses as well as GTECH 73300, GeoComputation II; GTECH 71300, Image Processing and LiDAR Remote Sensing; GTECH 72100, GeoVisualization I; GTECH 78517, Open Source Geospatial Technologies; and GTECH 70500, Spatial Data Analysis. Students following the GeoComputational Modeling track will master the principles surrounding GeoComputational models and be able to write computer programs to create spatial-temporal models in both the research and application domains.

3. Distributed and Web-based GeoComputation
The Distributed and Web-based GeoComputation track is designed for students interested in GeoWeb services, spatial data infrastructures, cloud computing, location-based services, and Big Geospatial Data. The track focuses on the use and development of these technologies, including OGC18 web services, map service setups for raster and vector tiles, as well as distributed computing solutions such as MapReduce and Hadoop. In addition to the six required courses, the track will include GTECH 78517 Open Source Geospatial Technologies, GTECH 73300 GeoComputation II, GTECH 73500 Location-based Services, and GTECH 73400 GeoWeb services. The Distributed and Web-based GeoComputation track will prepare students to develop and manage geospatial software solutions that make use of the above-mentioned technologies.

4. Applied GIS and Management
The Applied GIS and Management track provides students with knowledge and skills necessary for taking the GISP (Geographic Information Systems Professional) exam administered by the GIS Certification Institute. The goal of this concentration is to help students fast track into

18 Open Geospatial Consortium, a standards organization for geospatial information systems.
positions in GIS management. As part of their education, they work with and learn from current GIS managers to look beyond the technical realm and understand GIS in a larger institutional context. In addition to six required courses, students will take GTECH 78514, GIS Program Management; GTECH 78515, GIS in Metro NY; and other GIS Applications courses from our GTECH 785xx range.

New courses
We add four new courses to the curriculum as follows: two required courses for the Thesis Option: GTECH 70800, Seminar in GIS (1cr), and GTECH 79900, Thesis credit (1 cr); and two elective courses: GTECH 73400, GeoWeb services, and GTECH 73500, Location-Based Services. The latter has already been taught as a special topics course GTECH 78516 Location-Based Services. An Internship course (GTECH 80000) is also anticipated to be proposed in the future, which will allow students to work with NYC GIS groups and earn three credits.

Program course requirements
Completing the MGEOi program includes at least 31 credits of coursework that are to be selected from the following list of required (19 credits) and elective (12 credits) courses. The Thesis Option includes two more required credits and the Exam Option includes six elective credits as explained in Additional requirements section below. (Please see detailed required and new course descriptions in Appendix B):

Required core courses (19 credits):

GTECH 70200 – Quantitative Methods in Geography (3 credits/3 hours)
  o Application of scientific methods to geographic research, including sampling, distribution measurement, characterizing relationships, multivariate analysis, and a strong focus on computational modeling statistical relationships using (either) R or Python.

GTECH 70900 – Introduction to Geographic Information Systems (3 credits/4 hours)
  o Co-requisite with GTECH 71000.
  o Thorough introduction to geographic information systems (GIS) using multiple desktop and web-based GIS with an emphasis on spatial data handling and project management.

GTECH 71000 – Concepts and Theories in GeoInformatics (3 credits/3 hours)
  o Co-requisite with GTECH 70900.
  o Conceptual introduction to GeoInformatics and geographic information science. Focus on theoretical aspects of GIS and spatial temporal information.

GTECH 71200 – Remote Sensing of the Environment (3 credits/4 hours)
  o Prerequisite: GTECH 71000 or permission of instructor.
  o An overall introduction to remote sensing, particularly focused on the use of satellite imagery to study our environment.

19 Some new courses will be developed over the next few years and incorporated into the MGEOi program. These courses include, for example, Transportation analysis, Internship course, and Open Data Modeling.
GTECH 73100 – GeoComputation I (4 credits/6 hours)
- Prerequisite: GTECH 71000.
- A comprehensive course in programming that concentrates on object-oriented programming methods and algorithms specific to geographic and cartographic applications.

GTECH 73200 – Advanced GeoInformatics (3 credits/3 hours)
- Prerequisite: GTECH 70900 and 71000.
- Expansion of GTECH 70900 and 71000 concentrating on advanced concepts in GeoInformatics, including data models, algorithms, GIS analysis and scripting.

Elective courses (12 credits):
- A minimum of six additional credits selected from GTECH20 courses. Most students choose a principal area of concentration (i.e., topic track) such as Spatial Data Analytics and GeoVisualization; GeoComputational Modeling and Remote Sensing; Distributed and Web-based GeoComputation; and Applied GIS and Management, in which they take most of their credits. Students are allowed a maximum of six credits from independent study courses, except in rare circumstances when the MGEOi advisor and the student's academic advisor agree to allow more.
- Some portion of the remaining six credits may be selected from Geography graduate courses or outside the Department of Geography (e.g., Computer Science, Economics, Public Health, Sociology, or Urban Planning), according to the policy outlined below.

The following is a non-exhaustive list of elective courses currently offered:

GTECH 70500 – Spatial Data Analysis (3 credits/3 hours)
- This course covers a number of techniques aimed at the analysis and understanding of spatial data, with a particular emphasis on computational issues and analytical capabilities. The primary software used for this course is the R statistical programming language.

GTECH 71300 – Image processing and LiDAR Remote Sensing (3 credits/3 hours)
- Quantitative processing of digital imagery; enhancement, information extraction, classification; algorithms, registration, rectification; and Light Detection and Ranging (LiDAR) technology.

GTECH 72100 – Introduction to Cartographic Design & Geovisualization (3 credits/5 hours)
- Acquisition of professional-level skills in cartography; production and design methods; color separations; use of automated techniques.

GTECH 72200 – Advanced Topics in Geovisualization (3 credits/5 hours)
- Computer and other automated applications; theory and algorithms; production of computer-generated maps.

20 A listing of GTECH courses is available here. Please note that we are in the process of changing many course titles to better reflect their current content and as of March 2015 this website has the old course titles and descriptions: http://www.geo.hunter.cuny.edu/programs/ma_courses.html#gtech.
GTECH 73300 – GeoComputation II (3 credits/3 hours)
  o Theory and applications of GeoComputing. Models and algorithms for advanced spatial and temporal modeling are examined and programmed. Emphasis is on an object-based computational paradigm and spatial data structures.

GTECH 73400 – GeoWeb services (3 credits/3 hours)
  o Thorough, hands on introduction to the setup, management, and use of different GeoWeb Services. New course.

GTECH 73500 – Location Based Services (3 credits/3 hours)
  o Hands on introduction to the development of Location Based Services. New course.

GTECH 785xx – Special Topics in GIS (3 credits/3 hours)
  o Courses under this label include “Open Source Geospatial Technologies,” “GIS Applications in Urban Geography,” ‘GIS Applications in Social Geography,” “GIS in Metro NY,” “GIS Program Management,” “PPGIS,” “GIS in Public Health,” and “Mapping Earth Surfaces.”

GEOG 70000 – level courses (3 credits/3 hours)
  o “Social Implications of GIS,” “Transportation Geography,” Geographies of Urban Space,” “Urban Theory,” “Migration and Ethnicity”

Additional requirements:

Thesis option (2 credits and a thesis)
Two required courses and completion of a thesis:

GTECH 70800 – Seminar in GeoInformatics (1 credit/1 hour)
  o This seminar introduces students to the wider GeoInformatics field/industry and GIS/GeoInformatics community of New York City area, which includes regular attendance at seminars, presentation of the students work at a student seminar, and preparation of a literature review (as part of the students thesis).
  o Required for Thesis Option only. New course.

GTECH 79900 - Thesis Credit (1 credit/1 hour)
  o Leads to a thesis approved by the student’s committee.
  o Required for Thesis Option only. New course.

  • Formal approval of a proposal for thesis research is also required. The student’s committee determines whether the proposal is of a breadth, depth, and quality consistent with the expectations for a master’s degree thesis.
  • A thesis of a breadth, depth, and quality consistent with the expectations for a master’s degree thesis prepared in a format conforming with Hunter College guidelines. The student’s committee determines whether the thesis is acceptable.

Exam option (6 credits, exam, and research paper)
  • An additional six credits of GTECH or outside courses.
• A passing grade on the comprehensive examination conducted by the student’s graduate committee.
• A research paper of a breadth, depth, and quality consistent with expectations for a master’s degree student prepared in the format of Transactions in GIS or its equivalent.

**Additional internal and external activities**

MGEOi faculty are active members of the NYC geospatial community. As such, they maintain many active links with local GIS groups, agencies, and organizations. Students will benefit from these linkages through three primary internal/external programs:

1) Technology and research seminar series. This seminar series, developed in conjunction with the GeoNYC Meetup Group, will be an external Meetup group that features speakers and topics relevant to GeoInformatics. Students will be encouraged to attend and participate in the Meetups, which will expose them to real-world applications as well as local GIS/GeoInformatics experts (this approach has recently been adopted by the CUSP program at New York University).

2) Field trips to local private and public sector GIS groups. Field trips will be conducted as part of regular course time when possible. This facilitates interaction between courses and topics while also providing students with the opportunity to interact with professionals outside of their everyday classroom experience.

3) Contribute to real-world GIS software through internal and external mentorship programs. Several MGEOi faculty members are active geospatial software developers and maintain links with the wider geospatial software community. For students who are developing expertise in computation and programming, this offers opportunities to actively participate in geospatial software projects. Initial partnerships have already been established with projects such as QGIS, CartoDB, R, and Python.

4) GIS projects with community groups and city agencies. As previously mentioned, a partnership is being developed with Manhattan Borough President’s Office.

**Policy for credits taken outside MGEOi program**

Master’s degree students are allowed to take up to six credits outside of the MGEOi program provided that the courses are acceptable for use towards completion of MGEOi degree. This includes courses at other institutions as well as courses from other Hunter College departments such as Computer Science, Urban Affairs and Planning, Economics, Art, or other related fields. Courses must meet the minimum requirements for transfer of graduate credits at Hunter College. For courses taken outside Hunter College, students must follow the Hunter College guidelines for transfer of graduate credit. Note that only courses for which a student received a grade of B or higher are accepted, and that there is a constraint of three years on how far in the past these credits are acceptable. The graduate adviser (program director), in consultation with the student’s academic adviser, determines which courses are acceptable for use towards completion of a MGEOi degree. For credits taken from other Hunter College departments, the grade will be transferred and count towards the student’s cumulative GPA. For credits taken at other institutions no grade will be transferred and, therefore, the grade will not affect the student’s cumulative GPA. No credit is given for internships undertaken via other institutions. This six-

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21 CUSP (Center for Urban Science and Progress) is a new Urban Informatics program at NYU supported by the Mayor’s Office with a substantial annual operating budget.

22 The requirements and the procedures can be found here: [http://www.hunter.cuny.edu/graduateadmissions/applying/degree-application/transfer-credit](http://www.hunter.cuny.edu/graduateadmissions/applying/degree-application/transfer-credit)
credit limit applies to incoming transfer credits and courses taken after students have started the MGEOi program.

D. Course Syllabi for new courses (see Appendix B)
Course syllabi for new courses GTECH 70800, Seminar in GeoInformatics; GTECH 73400, GeoWeb Services; and GTECH 73500, Location Based Services can be found in Appendix B.

5. COST ASSESMENT

A. Faculty Full-time (Table-FT faculty staffing)
The proposed MGEOi program will primarily involve faculty members who are currently teaching the GTECH (Geographic technologies) and GEOG (Geography) graduate courses at the Department of Geography. The full-time geography faculty members responsible for required and elective courses are listed in Table 3 below (detailed information is in Appendix C). In addition, several full-time faculty from other departments (Computer Science and Urban Affairs and Planning) have expressed interest in teaching elective courses (hosted by their respective departments) in the MGEOi curriculum. These faculty members are listed separately in Table 3 below. While the graduate program at the Department of Computer Science currently is not active, some of its graduate courses will be adapted for MGEOi and offered at the graduate level.

Beginning in fall 2013, one new faculty member with expertise in GeoComputation has provided a significant boost to the GIS/GeoInformatics teaching roster at the Department of Geography. He has developed several new courses (see syllabi for new courses in Appendix B) and, together with the other GIS faculty, updated the content of the existing courses. Moreover, courses to be taught in the proposed MGEOi program overlap significantly with those offered within our post-baccalaureate GIS Certificate program and to a large degree with our MA program in Geography. Therefore, graduate course offerings in GeoInformatics within the MGEOi will continue to be staffed at the existing level and there is no need for hiring additional full-time faculty.

At the reviewer's suggestion, however, we have added a full-time line in the fourth year of the budget to be used if enrollment exceeds our projections. Also, the faculty in the program, through their involvement in local professional organizations and industry contacts, have cultivated a network of qualified local potential adjuncts to respond to the need to fill unanticipated openings and the need to remain topical (see section B below).
Table 3. Full-time faculty teaching assignments.  
(See Appendix C for specific courses to be taught by these faculty).

<table>
<thead>
<tr>
<th>Geography Faculty</th>
<th>Teaching/Research Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahearn, Sean</td>
<td>Programming and modeling, Space-time analysis, Advanced GIS</td>
</tr>
<tr>
<td>Albrecht, Jochen</td>
<td>Process GIS, Crime and Health, GIS Management, GIScience Theory</td>
</tr>
<tr>
<td>Gong, Hongmian</td>
<td>Urban Application of GIS, Applied GIS/GPS</td>
</tr>
<tr>
<td>Kessler, Carsten</td>
<td>Data modeling, Computer Science, Big Data</td>
</tr>
<tr>
<td>Ni-Meister, Wenge</td>
<td>Remote Sensing, Digital Image Processing</td>
</tr>
<tr>
<td>Pavlovskaya, Marianna</td>
<td>GIS Applications in Social Geography, Social Implications of GIS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Faculty from other departments</th>
<th>Teaching/Research Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Felisa Vázquez-Abad (Computer Science)</td>
<td>Machine learning, Data Analytics, Big Data</td>
</tr>
<tr>
<td>William Sakas (Computer Science)</td>
<td>Computational linguistics, natural language processing</td>
</tr>
<tr>
<td>Ioannis Stamos (Computer Science)</td>
<td>Computer Vision, 3-D modeling, 3-D Visualization</td>
</tr>
<tr>
<td>Lei Xie (Computer Science)</td>
<td>Big Data, Database Management</td>
</tr>
<tr>
<td>Ramasubramanian, Laxmi (Urban Affairs &amp; Planning)</td>
<td>PPGIS and Visualization, GIS for Planning</td>
</tr>
</tbody>
</table>

Three hours of course release time are requested for the program director to oversee the successful execution of the program. The program director will also be paid summer salary for administering the program during the summer. This assignment will be rotated among faculty members.

**B. Faculty Part-time**

Table 4 Part-time Faculty Staffing  
(See Appendix C for specific courses to be taught by these faculty).

<table>
<thead>
<tr>
<th>Geography Faculty</th>
<th>Teaching/Research Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doug Williamson, Ph.D.</td>
<td>Web Cartography, Crime Analysis</td>
</tr>
<tr>
<td>Gordon Green, Ph.D.</td>
<td>GIS programming</td>
</tr>
</tbody>
</table>

The number of adjunct professors required (approximately three per semester) will likely remain unchanged for the short-term. These adjunct professors (see Table 4 above and Appendix C) have taught GIS-related courses at the Department of Geography for many years. Both instructors have PhD degrees and have been employed for over a decade in professional GIS.

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23 Program Director in the first two years
positions in city agencies and private industry. They will contribute uniquely to the MGEOi program. Because the students will benefit significantly from their expertise, we include courses taught by these part-time instructors in the MGEOi curriculum.

The estimated number of six to eight full-time recruits per year should not require full-time faculty to offer additional courses but may necessitate opening additional sections in several courses. This is particularly true for the required GTECH 70900, GTECH 71000 and GTECH 73200 courses that already run several sections because lab seats are limited. Therefore, staffing additional sections with the adjunct instructors may also be needed.

As a result, we request $31,000 to $33,000 per year for three adjunct instructors to teach one course with lab sections at a rate of $5,000 per course. This rate level is low compared to other programs offering GIS-related courses (i.e., New York University, Columbia University, Parsons, The New School and other private institutions). Instruction in this area is expensive because of the technical nature of the courses and highly competitive skills. Two of our adjunct instructors also have Ph.D. degrees and years of experience working in the field of GeoInformatics in New York City government and private industry (please see Table 4 in Appendix C).

In sum, the program does not need new faculty appointments. The proposed curriculum will involve full-time and part-time faculty members who are currently teaching in the GIS certificate program and MA program in Geography.

C. Facilities and Equipment
The Department of Geography has two state-of-the-art computer labs in which MGEOi instruction will take place. Brand new computers were installed in both labs in January 2015 and AC units were replaced in spring 2015. In addition, the department is working with ICIT and Facilities on upgrading the network to 10Gb speed. Once the upgrade is completed in summer 2015, the labs and the network will be of the highest standard in the New York City area.

Separately from the facilities, there is a need to maintain funds for cloud-based GIS solutions. This is a major area of research and applied GIS work and is required if we are to provide our students with cutting-edge training. Not all programs are currently offering this type of training, which again would set our MGEOi program apart from the rest. We therefore request funds for cloud-based licenses on Amazon or Microsoft Azure for all students enrolled in the MGEOi program (estimated $10,000-$27,000/year, see Appendix D). We also request means for a maintenance fund ($10,000/year) for hardware updates in the GIS teaching labs because our computer replacement cycle needs to be faster than the typical CUNY cycle of once in every four years.

See Appendix D for financial projections and other relevant information.

D. Library and instructional materials
The Leon and Troy Cooperman Library at Hunter College works on expanding the information services across the college. It sees programs such as the existing undergraduate BioInformatics concentration at the Department of Computer Science and the proposed MS in GeoInformatics program as vehicles to increase information literacy in general and an opportunity to support the
advanced needs of the MGEOi specifically. The Library administration has agreed to work with us and the geospatial librarian at Baruch College to create a joint open geospatial repository using open source software developed at Tufts University. The two libraries together will seek funding for students enrolled into library science, computer science, and the new MGEOi programs to work on cataloging information and the provision of web services.

In addition, a subscription service for CartoDB, a web-based program environment that provides individual student accounts on a PostGIS server, will be used to teach students geospatial query and visualization techniques. Amazon web services will be used (approx. $1,000 per student per year) to teach students how to setup and administer web services. These subscriptions are superior to working in a university environment where IT services could be easily compromised. Amazon AWS provides a sandbox and alleviates the need to constantly upgrade hardware locally. Please see Appendix D.

E. Advertising costs

We anticipate three different advertising audiences. The first is undergraduate Hunter College students who seek advanced technical skills but graduate from other departments without technical graduate programs. One obvious example is our own Geography and Environmental majors as well as Computer Science undergraduates who will benefit from the MGEOi graduate degree and co-advising by Geography and Computer Science faculty. Technologically and quantitatively inclined students from Urban Affairs and Planning, Economics, Sociology, and various Arts programs are also potential recruits. These students will be reached through Hunter’s CRM system at no cost and by placing advertising materials for the new program throughout the college.

The second is the GIS community in the New York City Metropolitan area where simple acts of support in the form of hosting several Meetups groups would add a considerable amount of visibility to the new program as compared to the cost of hosting Meetups. In addition to the space, this requires catering beverages and light fare for on average 100 attendees per event (estimated $4,000/year for four events). The third audience addresses the unique theoretical specialization that our program offers at the national and international level. Producing attractive brochures about the new MGEOi program and making them available at academic conferences / annual meetings such as those of the Association of Computing Machinery (ACM), the American Association of Geography (AAG), the University Consortium for Geographic Information Science (UCGIS), or the Urban and Regional Information Systems Associations (URISA) would go a long way to reaching the very students and advising faculty who need to know about the MGEOi program. We will reach these organizations and programs via email lists that can be purchased by Hunter College and professional email lists that we subscribe to as members of various professional organizations. We will need to initially advertise in journals such as Transactions in GIS, AAG Newsletter, ESRI News and locally in special education editions of The New York Times and The Wall Street Journal as well as send posters and postcards to advisers in GIS-related undergraduate programs across North America and internationally. The goal is to spread the word about the program among academics so that they begin directing interested students to us. The estimated cost for advertising in professional journals and producing a brochure amount to approximately $15,000 in the first year, $12,000 in the second, $10,000 in the third, and $4,000 in the fourth and fifth year after the program has been approved (see Supporting materials for projected expenditures table in Appendix D)
F. Budget tables (Table-Financial tables)
The detailed financial tables can be found in Appendix D. They combine five-year financial projections with detailed accounting of projected revenue and expenditures. Table 5 New Resources details the expected costs/expenses including the estimated time the existing full-time and part-time faculty would devote to the program; cost of equipment replacement; support for computer labs, supplies and expenses. Table 6 Projected revenue explains the composition of the revenue flow fee.

Overall, according to Table 5, the annual costs of running the program will be $90,000-$100,000 (except year 4 when there is a possibility of an additional hire as discussed in section A above), while the revenue from the program (Table 6) is projected to increase from $53,000 in year one to about $207,000 in the fifth year. Thus the program should become self-sustaining relatively quickly. Table 9 presents five-year Enroll and Seat projections that support these calculations. Tables 7 and 8 show in detail the Supporting materials for projected expenditures and revenues.

The resulting revenue is subject to the same regulations as the OTPS funds and will be used to the benefit the MGEOi program and the Department of Geography students as a whole. In particular, we will use the funds to pay higher wages to an adjunct professor who will make a special contribution to the program and out of cycle teaching equipment upgrades. We will also pay for subscription to cloud storage and computing resources, and certain database access licenses. There will be other uses within the existing rules for the OTPS funds.

6. EVALUATION

A. Internal evaluation and outcomes
With the exception of GTECH 71000, all courses have a practical component, typically in the form of a semester-long software project, either on an individual basis or in the form of a group project. Students are encouraged to develop an online portfolio that will help them to effectively document their skills which is necessary for entering the competitive job market or a PhD program. Several of our courses (for example, GTECH 73300, GeoComputation II or GTECH 78514 GIS Program Management) can provide a capstone experience for those students who choose exam option.

Learning outcomes of the MGEOi program that are discussed in Section 4.A. of this proposal could be synthesized in the form of the student-centered learning outcomes as follows:

1. Identify the theoretical foundations of GeoInformatics;
2. Apply a wide range of research methods that emphasize geospatial computation, modeling, and big data;
3. Develop advanced spatial analytical software tools including web-based tools and implement these software tools in a range of application areas,
4. Explain how geospatial information is collected by government and private industry and understand the ethical issues involved.
5. Do all this according to a professional code of ethics and in awareness of societal impacts

These formulations will be used for the internal evaluation of the program. Dr. Albrecht, one of our GIS professors and currently a fellow of the Hunter College Office of Assessment, has been working on mapping these five program outcomes across the MGEOi program curriculum. In addition, he has been involved with the external assessment of the GIS program at the Borough of Manhattan Community College and this project has become an important case study for the Hunter College
Office of Assessment. This work has also led changes in how several of the required courses in the proposed MGEOi program are taught at the Department of Geography at Hunter College.

**B. External evaluation**

The external evaluator will assess the program goals and objectives, aims, and outcomes from multiple perspectives; (a) internal consistency, (b) market demand / uniqueness in a national context, (c) qualifications of program personnel, (d) feasibility given the anticipated resources provided. In addition, we expect the external evaluator to assist us in creating a plan for continuing program development that would start with the analysis of a curriculum map and lead to the institutionalization of self-assessment procedures.

At this point, we have identified several candidates to serve as external evaluators and have been working with CUNY office of Academic Affairs in order to check their credentials.

See the Appendix E for external evaluation form.
APPENDIX A

Table 1 Student enrollment table

<table>
<thead>
<tr>
<th></th>
<th>YEAR I</th>
<th></th>
<th>YEAR II</th>
<th></th>
<th>YEAR III</th>
<th></th>
<th>YEAR IV</th>
<th></th>
<th>YEAR V</th>
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</thead>
<tbody>
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<td>1</td>
<td>8</td>
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<td>7</td>
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<td>8</td>
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<td></td>
<td>22</td>
<td></td>
<td>25</td>
<td></td>
<td>27</td>
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</tbody>
</table>
### APPENDIX B

**Table 2 Graduate program schedule (SED Form)**

- Indicate academic calendar type: **Semester** _Quarter_ _Trimester_ _Other_ (describe)
- Label each term in sequence, consistent with the institution’s academic calendar (e.g., Fall 1, Spring 1, Fall 2)
- Use the table to show how a typical student may progress through the program; copy/expand the table as needed.

#### Term: Fall 1

<table>
<thead>
<tr>
<th>Course Number &amp; Title</th>
<th>Credits</th>
<th>New</th>
<th>Prerequisite(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTECH 70200: Quantitative Methods</td>
<td>3</td>
<td></td>
<td>None</td>
</tr>
<tr>
<td>GTECH 70900: Intro to Geographic Information Systems</td>
<td>3</td>
<td></td>
<td>Co-requisite with GTECH 71000</td>
</tr>
<tr>
<td>GTECH 71000: Concepts and Theories in GeoInformatics</td>
<td>3</td>
<td></td>
<td>Co-requisite with GTECH 70900</td>
</tr>
<tr>
<td>GTECH 71200: Remote Sensing of the Environment</td>
<td>3</td>
<td></td>
<td>GTECH 71000 or permission of the instructor</td>
</tr>
</tbody>
</table>

Term credit total: **12**

#### Term: Fall 2

<table>
<thead>
<tr>
<th>Course Number &amp; Title</th>
<th>Credits</th>
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<th>Prerequisite(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTECH 73300: GeoComputation II</td>
<td>3</td>
<td></td>
<td>GTECH 73100 and GTECH 73200</td>
</tr>
<tr>
<td>GTECH 78502: GIS Application for Social Geography</td>
<td>3</td>
<td></td>
<td>GTECH 70900 and GTECH 71000</td>
</tr>
<tr>
<td>GTECH 79900: Thesis Credit</td>
<td>1</td>
<td>X</td>
<td>Approval of thesis advisor</td>
</tr>
<tr>
<td>GTECH 70800: Seminar in GeoInformatics</td>
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<td>X</td>
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Term credit total: **8**

#### Term: Spring 1

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<th>Prerequisite(s)</th>
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</thead>
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<tr>
<td>GTECH 78517: Free and Open Source GIS</td>
<td>3</td>
<td></td>
<td>GTECH 70900 and 71000</td>
</tr>
<tr>
<td>GTECH 73200: Advanced GeoInformatics</td>
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<td></td>
<td>GTECH 70900</td>
</tr>
<tr>
<td>GTECH 73500: Location Based Services</td>
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<td>X</td>
<td>GTECH 70900 and GTECH 71000</td>
</tr>
<tr>
<td>GTECH 73100: GeoComputation I</td>
<td>4</td>
<td></td>
<td>GTECH 70900 and GTECH 71000</td>
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</table>

Term credit total: **13**

#### Term: Spring 2

<table>
<thead>
<tr>
<th>Course Number &amp; Title</th>
<th>Credits</th>
<th>New</th>
<th>Prerequisite(s)</th>
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</thead>
<tbody>
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<td></td>
</tr>
<tr>
<td></td>
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Term credit total:

#### Term: Program Totals:

<table>
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<th>Course Number &amp; Title</th>
<th>Credits</th>
<th>New</th>
<th>Prerequisite(s)</th>
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</thead>
<tbody>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Term credit total:

- Identify any comprehensive, culminating element(s) (e.g., thesis or examination), including course number if applicable:
  - GTECH 799, Thesis Credit for thesis option and final written examination for exam option
Course descriptions for required courses (19 credits)

GTECH 70200 – Quantitative Methods in Geography (3 credits/3 hours)
- Prerequisite: STAT 11300 or 21300 or permission of instructor
- This course is a statistics course based on the idea that modeling provides a unifying framework for much of statistics and that students can learn the important concepts of statistics by mastering “advanced” statistical techniques relating to modeling. GTECH 70200 covers the foundation of statistics with a strong emphasis on constructing models from data. Topics include exploratory data analysis, descriptive statistics, probability, multiple regression, analysis of variance, and logistic regression. Students will have a choice between two excellent software packages for conducting statistical analysis: the R statistical programming language and the Python programming language. These are both powerful software tools with strong user communities, plenty of excellent examples, and a syntax for modeling that is both intuitive and powerful. In addition to helping students develop strong statistical skills, this will prepare students for more advanced spatial analysis topics covered in courses such as GTECH 70500, Spatial Data Analysis.

GTECH 70800 – Seminar in GeoInformatics (1 credit/1 hour)
- This seminar is designed as an introduction to the wider GeoInformatics field/industry. Students will be exposed to a number of professionals and researchers in the NYC area, and each student will be required to organize their own speaker from the community. The goals of this seminar course are twofold: to introduce students to the wider GeoInformatics community, and to promote networking and lasting interactions with local and regional GeoInformatics professionals. In this course, students will identify, approach, and invite local and/or regional GeoInformatics professionals to give a talk in one of the weekly seminar sessions for this course. Each student will be responsible for bringing in a speaker, and at the end of the course, the student will be required to discuss the speaker’s work, and the research, news, or information that the speaker presented. Students will also be encouraged to participate in local GIS events, such as Meetups (local interest groups), Seminar series at other local institutions, GIS conferences, and more. Required for Thesis Option only.

GTECH 70900 – Introduction to Geographic Information Systems (3 credits/4 hours)
- Co-requisite with GTECH 71000.
- This course covers the whole GIS production process from data modeling and acquisition to editing, analysis, and yes, cartographic output. GTECH 70900 addresses students from both geography and other disciplines. Lecture examples, as well as hands-on exercises cover a range of application areas. The lectures introduce the concepts underlying all GIS and the lab exercises help you to familiarize yourself with many aspects of several software packages. You learn to see GIS as a process from conceptualizing spatial problems to different representations of spatial data, data sources, data organization, vector and raster
analysis, and map production. By the end of this course, you will be able to work independently with GIS.

GTECH 71000 – Concepts and Theories in GeoInformatics (3 credits/3 hours)
- Co-requisite with GTECH 70900.
- Concepts and theories in GeoInformatics is a thorough introduction to geoinformatics and geographic information science with an emphasis on theoretical concepts and how they relate to practical applications. Students will learn about core concepts of geographic information such as location, place, process, event, uncertainty, and spatial autocorrelation. Moreover, students will learn about the theoretical foundations of tools such as spatial databases, gazetteers and their role in geoparsing and geocoding, spatial data infrastructures, and geoweb services. The goal of this course is to lay the theoretical and conceptual foundations for specialized GTECH courses and establish a detailed understanding of those concepts through reading, writing, presentations, and discussions. The introduction of practical examples, use cases, and demos will illustrate the relevance of the theory for practical applications.

GTECH 71200 – Remote Sensing of the Environment (3 credits/4 hours).
- Prerequisite: GTECH 71000 or permission of instructor.
- Remote Sensing of the Environment will provide an overall introduction to remote sensing, focused particularly on the use of satellite imagery. The course covers two main topics: remote sensing principles and satellite sensors. The first half of semester will focus on physical processes involved in remote sensing, specifically the nature and properties of electromagnetic radiation and how it interacts with the atmosphere and Earth’s surface. The second half of the semester will concentrate on the wide variety of satellite sensors, which make measurements in the optical, thermal and microwave electromagnetic spectrum. Different sensors are designed for sense different attributes of the Earth and the atmosphere and for different applications. We explore how different sensors are used to study issues related to global environmental science and natural resource management. The course includes heavy laboratory components, which will be supplemented by topics covered during lectures. Laboratory assignments will include practical assignments, field exercises, and computer-based analysis of remotely-sensed images. The labs will be primarily devoted to learning how to use ENVI, an image processing software package, to analyze satellite images.

GTECH 73100 – GeoComputation I (4 credits/6 hours)
- Prerequisite: GTECH 71000 or equivalent prerequisite.
- This course introduces students to some of the main programming concepts and techniques relevant to GeoInformatics. It starts with the basics of the Python language, and moves to understanding and programing object-oriented data models and spatial data structures with a focus on geo-processing tasks. It examines additional spatial data processing and analysis methods using open-source and commercial geo-libraries. The goal is to provide students with the programming tools needed to extend their abilities.
to write code to process, analyze, and model geospatial data, in both academic and commercial endeavors.

GTECH 73200 – Advanced GeoInformatics (3 credits/3 hours)

- Prerequisite: GTECH 70900 and 71000
- Building on the contents of GTECH 70900 and 71000, where the emphasis is on capturing geographic relationships in geographic data structures, this course extends these to 3-D, network and field representations and their respective analysis functions. Conceptually, students are moving from GISystems to GeoInformatics - a melding of GIS and computer science. A focus of this course is the development of computational workflows. While most techniques have a geographic origin, students will address all geospatially relevant methods, including geophysical, landscape ecological, econometric, epidemiological, and regional science approaches. Students will conduct an individual software project that relates to GIS analysis. The choice of software is up to the student. Students will select their own application area (field) and will be responsible for gathering the necessary data. At the end of the semester students will be able to perform advanced selection and filtering techniques by space and/or attribute; understand the role of spatial relationships in landscape ecological analysis; distinguish the effect of data models on the choice of analysis methods; engage in spatial database design; mimic dynamics inside of GIS; distinguish between spatial statistics and spatial analysis; handle vague data; write software tools to automate GIS tasks; and, develop their own basic spatial decision support system, either stand-alone or as part of a larger application.
Syllabi for new courses

GTECH 70800, Seminar in GeoInformatics

GTECH 70800: Seminar in GeoInformatics

Instructor: TBD
Course Times: TBD
Course Room: TBD
Prerequisites: None
Description: Student-driven seminar series with external speakers from the GeoInformatics industry in and around New York City.

Overview
This seminar is designed as an introduction to the wider GeoInformatics field/industry. Students will be exposed to a number of professionals and researchers in the NYC area, and each student will be required to organize their own speaker from the community. The goals of this seminar course are twofold: to introduce students to the wider GeoInformatics community, and to promote networking and lasting interactions with local and regional GeoInformatics professionals.

In this course, students will identify, approach, and invite local and/or regional GeoInformatics professionals to give a talk in one of the weekly seminar sessions for this course. Each student will be responsible for bringing in a speaker, and at the end of the course, the student will be required to discuss the speaker’s work, and the research, news, or information that the speaker presented. Students will also be encouraged to participate in local GIS events, such as Meetups (local interest groups), Seminar series at other local institutions, GIS conferences, and more.

Textbook
No textbook is required. In addition to regular seminars, students will be given a series of readings collated by the current course instructor that feature a given aspect of the GeoInformatics field. Topics include the history of GIS, modern advances in GeoInformatics, as well as applied and theoretical topics in GeoInformatics research.

Additional reading materials relevant to this course will be discussed during our first few sessions. Supplementary reading material for each session will be made available in advance through BlackBoard.

Learning Objectives
Interacting with the wider GeoInformatics community is essential to building a functional and useful research network. However, knowing what organizations to approach and who within those organizations to interact with, can be difficult for those starting off in a new field. Through this course, students will become exposed to many of the GeoInformatics community organizations in the New York City metro area; this in turn will help students to learn to:

- Engage with local organizations and individuals
- Effectively present themselves to the wider business and academic communities
- Become exposed to a number of areas under the umbrella of GeoInformatics
- Become engaged and effective members of the wider GeoInformatics community

Expected Outcomes
By the end of this course, students will be able to:
• Identify key institutions, groups, researchers, and companies involved in the local GeoInformatics community.
• Effectively network with local GeoInformatics community members.
• Organize and schedule a guest speaker or speakers.
• Write a comprehensive report on the work of another researcher/developer/professional.
• Participate in discussions about research and the social implications of GIS.
• Synthesize technical and application domain knowledge to address scientific issues.
• Identify, read, and critically evaluate key research and technical documents in the GeoInformatics field.
• Apply critical thinking skills in both in-class discussion and written work.

Evaluation
Writeup: 20%
Readings: 20%
Speaker: 50%
Participation: 10%

Course Policies
Communication
All email messages about this course should include “GTECH 708” in the subject line and be signed with your full name.

Web-enhancement
Everything pertaining to this course will be communicated through Blackboard. You are required to check the Blackboard course site on a daily basis. All changes to the syllabus will be announced on the course home page. All lecture and lab materials are accessible through Blackboard, and this is also the place where you upload your assignments to. Your exams and lab assignments will be graded based on what you have uploaded to Blackboard and this is where you will find your grades and may access course statistics that help you to assess your standing at any given time.

Late Policy
All reading assignments are due within the first 10 minutes of the following week’s class. 10% will be deducted for every day late. All assignments must be submitted to get a mark in this course. Exceptions will only be granted for medical reasons (requiring a written note from a medical practitioner stating your inability to attend class) or other extreme personal crises.

Grading Policy
All grading for this course will follow the CUNY grading policy, which can be found in the online undergraduate (or graduate) catalog, available here. A final grade of IN (incomplete) will not be given except under the most extraordinary, and documented, circumstances.

Class Climate
Hunter has made a conscientious effort to increase diversity in the student, staff and faculty member populations. To ensure that all class members feel welcomed and equally able to contribute to class discussions, we will all endeavor to be respectful in our language, our
examples, and the manner in which we conduct our discussions and group work. If you have any concerns about the climate of the class, please see the instructor.

**Academic Standards**
Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures. Be sure and reference all material you use. If you have any questions, please contact me!

**Students with a Disability**
If you have any type of disability (emotional, medical, physical, learning, etc.), there are support systems, resources, and accommodation actions available to you. If you wish to access any of these supports, resources or accommodations, I encourage you to contact the Office of AccessABILITY, located in Room E1214B, to secure necessary academic accommodations. Please Note: You are under no obligation to disclose your disability.

**Syllabus Changes**
Except for changes that substantially affect implementation of the evaluation (grading) statement, the current syllabus is a guide for the course and is subject to change with advance notice. All changes will/would be announced on Blackboard, which you should check regularly.

**Final Report**
The goal of the final report is to get students to summarize the thoughts and ideas of their selected speaker, and to present this information to the rest of the class in a clear and concise final report. Additionally, students must present a short proposal outlining the speaker they would like to invite, their reasoning for selecting said speaker, and the topic(s) that they would like to speaker to present on. The proposal is designed to ensure that students are connecting with the right professionals, and thinking about the wider research/professional world.

**Course Schedule**
The following is a possible schedule of topics and readings. Each semester, the list of topics and order of readings will likely vary due to differences in who is teaching and the selected speakers.

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<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
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<td>Week 1</td>
<td>GeoInformatics Community</td>
<td>None</td>
</tr>
<tr>
<td>Week 2</td>
<td>Choosing the Right Speaker</td>
<td>History of GIScience</td>
</tr>
<tr>
<td>Week 3</td>
<td>Speaker Proposals Due</td>
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</tr>
<tr>
<td>Week 4</td>
<td>GIS Software Development</td>
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</tr>
<tr>
<td>Week 5</td>
<td>Applied GeoInformatics</td>
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</tr>
<tr>
<td>Week 6</td>
<td>Non-Profits</td>
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</tr>
<tr>
<td>Week 7</td>
<td>Project Management</td>
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</tr>
<tr>
<td>Week</td>
<td>Topic</td>
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<tr>
<td>--------</td>
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<tr>
<td>Week 8</td>
<td>Advanced GeoI Research</td>
<td>TBD</td>
</tr>
<tr>
<td>Week 9</td>
<td>Big Data and Analytics</td>
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<tr>
<td>Week 10</td>
<td>Location Based Services</td>
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<td>Week 11</td>
<td>Start-Ups and Funding</td>
<td>TBD</td>
</tr>
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<td>Week 12</td>
<td>Data Collection and Management</td>
<td>TBD</td>
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<tr>
<td>Week 13</td>
<td>Municipal and City GIS Shops</td>
<td>TBD</td>
</tr>
<tr>
<td>Week 14</td>
<td>The Future of GeoInformatics</td>
<td>TBD</td>
</tr>
<tr>
<td>Week 15</td>
<td>Wrapup and Final Comments</td>
<td>TBD</td>
</tr>
</tbody>
</table>
GTECH 73400, GeoWeb services

**GTECH 73400 - GeoWeb Services**

TBA

**Location:** TBA  
**Hours/Credits:** 3/3  
**Instructor:** Carsten Kessler (http://carsten.io)  
[carsten.kessler@hunter.cuny.edu](mailto:carsten.kessler@hunter.cuny.edu)  
**Office Hours:** TBA  
**Office:** HN 1025a  
**Prerequisite:** GTECH 73100, GeoComputation I

**Course Overview**
This course will examine the principles of GeoWeb services in a hands-on fashion. Students will learn about the different standards that are being used in the context of the GeoWeb. They will be introduced to different commercial and open source software solutions and learn how to set up, manage, and use these services. Students will explore the different technologies introduced in class in the lab assignments. Each student will present a topic to the class based on readings provided by the instructor. In the second half of the semester, each student will work on a project that involves the setup and use of GeoWeb services. Basic programming skills in any language are a prerequisite for this course.

**Required textbook**
There is no textbook required for this class. The instructor will provide readings on the specific topics covered.

**Learning Objectives**
By the end of the course it is expected that students will understand how GeoWeb Services work and be able to set up, manage, and use these services on their own. They will learn about spatial data infrastructures, web standards, different map services for raster and vector data, client-side applications, and innovative technologies such as cloud computing.

**Expected Outcomes**
By the end of this course, students will be able to:
- explain how the web services work, and which web standards they are based on;
- explain how spatial data infrastructures work;
- deploy and manage GeoWeb Service;
- connect GIS software to GeoWeb Services;
- develop client-side applications that make use of GeoWeb Services;
5. operate cloud computing environments.
Criteria for Evaluation

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labs</td>
<td>30%</td>
</tr>
<tr>
<td>Paper presentation</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm</td>
<td>20%</td>
</tr>
<tr>
<td>Final project</td>
<td>30%</td>
</tr>
</tbody>
</table>

The course will follow the CUNY grading policy that can be found in the online undergraduate/graduate catalog at [http://catalog.hunter.cuny.edu/](http://catalog.hunter.cuny.edu/).

Policy on Incomplete (IN) and Credit/No-Credit (CR/NC) grades

A final grade of IN (incomplete) will not be given except under the most extraordinary, and documented, circumstances CR/NC is not available to students enrolled in GTECH 73400 or any other graduate-level course in the Hunter College School of Arts & Sciences.

Course Policies

Communication

All email messages about this course should include [GeoWeb services course] in the subject line and be signed with your full name.

Web-enhancement

Everything pertaining to this course will be communicated through BlackBoard. You are required to check the BlackBoard course site on a daily basis. All changes to the syllabus will be announced on the course home page. All lecture and lab materials are accessible through BlackBoard, and this is also the place where you upload your assignments. Your exams and lab assignments will be graded based on what you have uploaded to BlackBoard and this is where you will find your grades and may access course statistics that help you to assess your standing at any given time.

Late Policy

Labs are due at the beginning of the class on the due day. Late submissions will be downgraded 10% for each day late after the due date. If you get behind in this course, it will be difficult to catch up. If you get behind for any reason talk to the class instructor early. Unless for a serious documented emergency reason, requests for handing in late work cannot be honored.

Class Climate

Hunter has made a conscientious effort to increase diversity in the student, staff and faculty member populations. To ensure that all class members feel welcomed and equally able to contribute to class discussions, we will all endeavor to be respectful in our language, our examples, and the manner in which we conduct our discussions and group work. If you have any concerns about the climate of the class, please contact me.

Hunter College Statement on Academic Integrity

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to
the Hunter College Academic Integrity Procedures. Plagiarism, dishonesty, or cheating in any portion of the work required for this course will be punished to the full extent allowed according to Hunter College regulations. Be sure and reference all material you use. If you have any questions, please contact me!

**Students with a Disability**
If you have any type of disability (emotional, medical, physical, learning, etc.), there are support systems, resources, and accommodation actions available to you. If you wish to access any of these supports, resources or accommodations, I encourage you to contact the Office of AccessABILITY, located in Room E1214B, to secure necessary academic accommodations. Please Note: You are under no obligation to disclose your disability.

**Syllabus Changes**
Except for changes that substantially affect implementation of the evaluation (grading) statement, the current syllabus is a guide for the course and is subject to change with advance notice. All changes will be announced on Blackboard.

**Tentative Schedule** – subject to change!

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction and spatial data infrastructures</td>
</tr>
<tr>
<td>2</td>
<td>A crash course in web standards I</td>
</tr>
<tr>
<td>3</td>
<td>A crash course in web standards II</td>
</tr>
<tr>
<td>4</td>
<td>OpenStreetMap</td>
</tr>
<tr>
<td>5</td>
<td>Raster tile services and Web Map Services</td>
</tr>
<tr>
<td>6</td>
<td>Vector tile services and Web Feature Services</td>
</tr>
<tr>
<td>7</td>
<td>MapServer and GeoServer</td>
</tr>
<tr>
<td>8</td>
<td>Midterm</td>
</tr>
<tr>
<td>9</td>
<td>More web services: Coverages, catalogs, and geoprocessing</td>
</tr>
<tr>
<td>10</td>
<td>Client-side applications: OpenLayers, leaflet.js, turf.js</td>
</tr>
<tr>
<td>11</td>
<td>Commercial GeoWeb services: An overview (ESRI, CartoDB, MapBox, ...)</td>
</tr>
<tr>
<td>12</td>
<td>Cloud computing</td>
</tr>
<tr>
<td>13</td>
<td>Crunching Big Data: Hadoop and MapReduce</td>
</tr>
<tr>
<td>14</td>
<td>Sensor Web and Internet of Things</td>
</tr>
<tr>
<td>15</td>
<td><strong>Final project presentations</strong></td>
</tr>
</tbody>
</table>
GTECH 73500, Location Based Services

Location Based Services
GTECH 73500

Location: TBA
Hours/Credits: 3/3
Instructor: Carsten Kessler (http://carsten.io)
carsten.kessler@hunter.cuny.edu
Office Hours: TBA
Office: HN 1025a
Prerequisites: One of the following: GTECH 70500, Spatial Data Analysis, or GTECH 73100, GeoComputation, or CSCI 13500, Software Design and Analysis I

Some computer programming background is required for this course. Students who have such experience, but have not taken any of the above courses can join the class with the instructor’s permission.

Course Overview
This course will examine the principles of Location Based Services (LBS) in a hands-on fashion. Students will learn how to design, implement, and test an LBS application in a group project. Therefore, basic programming skills in any language are a prerequisite for this course. The course will be highly interactive in two ways: Each student will present a topic to the class based on readings provided by the instructor, and each student will participate in the group work to develop a working LBS by the end of the semester. For this purpose, mobile devices (iPhones, Android phones, Google Glass) will be provided. Moreover, there will be a weekly reading assignment for which each student will write a short 100-word abstract and three questions for discussion in class.

Required textbook
There is no textbook required for this class. The instructor will provide focused articles on the specific topics covered.

Learning Objectives
By the end of the course it is expected that students will understand how Location Based Services work and be able to develop a basic service on their own. They will learn about position technologies, using external data sources and services, web mapping, and aspects of mobile technology such as mobile operating systems.

Expected Outcomes
By the end of this course, students will be able to:
- explain the different means by which a mobile device can obtain information about its position;
- explain how information is transmitted on the Web;
- work with an external API to obtain data;
- develop a location based service app on an operating system of their choice (either as a web app, or as a native Android or iOS app)

**Criteria for Evaluation**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper presentation</td>
<td>20%</td>
</tr>
<tr>
<td>Abstracts and questions</td>
<td>20%</td>
</tr>
<tr>
<td>Project participation</td>
<td>20%</td>
</tr>
<tr>
<td>Project outcome and presentation</td>
<td>20%</td>
</tr>
<tr>
<td>Project documentation</td>
<td>10%</td>
</tr>
<tr>
<td>Midterm</td>
<td>10%</td>
</tr>
</tbody>
</table>

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**Policy on Incomplete (IN) and Credit/No-Credit (CR/NC) grades**

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**Course Policies**

*Communication*

All email messages about this course should include [LBS course] in the subject line and be signed with your full name.

*Web-enhancement*

Everything pertaining to this course will be communicated through BlackBoard. You are required to check the BlackBoard course site on a daily basis. All changes to the syllabus will be announced on the course home page. All lecture and lab materials are accessible through BlackBoard, and this is also the place where you upload your assignments. Your exams and lab assignments will be graded based on what you have uploaded to BlackBoard and this is where you will find your grades and may access course statistics that help you to assess your standing at any given time.

*Late Policy*

Abstracts and questions are due one hour before the beginning of the class, i.e., at 4.35pm. Late submissions will be downgraded 10% for each day late after the due date. If you get behind in this course, it will be difficult to catch up. If you get behind for any reason talk to the class instructor early. Unless for a serious documented emergency reason, requests for handing in late work cannot be honored.

*Class Climate*

Hunter has made a conscientious effort to increase diversity in the student, staff and faculty member populations. To ensure that all class members feel welcomed and equally able to contribute to class discussions, we will all endeavor to be respectful in our language, our examples, and the manner in which we conduct our discussions and group work.

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**Syllabus Changes**

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**Tentative Schedule** – subject to change!

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction: Course organization (assignment of presentations and project groups) and history of LBS</td>
</tr>
<tr>
<td>2</td>
<td>Positioning technologies: Outdoor and indoor</td>
</tr>
<tr>
<td>3</td>
<td>Project proposal presentation</td>
</tr>
<tr>
<td>4</td>
<td>Web standards basics: HTTP, HTML, CSS, JS</td>
</tr>
<tr>
<td>5</td>
<td>Web apps</td>
</tr>
<tr>
<td>6</td>
<td>Mobile Operating Systems</td>
</tr>
<tr>
<td>7</td>
<td>Project review #1</td>
</tr>
<tr>
<td>8</td>
<td>Midterm</td>
</tr>
<tr>
<td>9</td>
<td>Using existing data sources in LBS</td>
</tr>
<tr>
<td>10</td>
<td>Mobile human-computer interaction and user interfaces</td>
</tr>
<tr>
<td>11</td>
<td>Usability and user testing</td>
</tr>
<tr>
<td>12</td>
<td>Project review #2</td>
</tr>
<tr>
<td>13</td>
<td>Context-aware computing</td>
</tr>
<tr>
<td>14</td>
<td>Economic aspects of LBS and privacy implications</td>
</tr>
<tr>
<td>15</td>
<td><strong>Final project presentations</strong></td>
</tr>
</tbody>
</table>
GTECH 72100, Introduction to Cartographic Design and GeoVisualization

GTECH 72100
Introduction to Cartographic Design and GeoVisualization

Instructor: Doug Williamson, PhD
Email: Douglas.Williamson@hunter.cuny.edu

Text (REQUIRED):

✓ Additional Readings to be provided in class and electronically.

Supplemental Readings (NOT required):
Selected readings from the following texts may be used, but it is not necessary to purchase these.


Comes with a 180-day trial version of ArcGIS Desktop, which will be useful for class assignments. If you have a PC running Windows 2000, XP, or Windows 7 you should install the software on your own computer. If not, the GIS lab will be available for you to do your assignments.

Relevant Books (NOT required):


Course Overview:
GTECH 72100 is designed as an introduction to modern cartographic theory and conventions, but also provides significant introductory hands-on experience in map design using computer software, specifically ESRI’s ArcGIS. The majority of topics covered in the course are divided into a lecture and laboratory section. Students are presented with fundamental design theories and principles associated with particular types of maps or related graphic materials in lectures, and then challenged to implement these principles in self guided hands-on exercises utilizing the software. The course is intended to cover the basic principles of cartography as well as modern techniques which influence map design, presentation, and interpretation processes. Students will develop a series of hard copy maps, charts, and graphics as well as design materials for presentation through digital media. With the exception of the instructor’s lectures, the class will consist primarily of class discussion. All
students are encouraged to participate and add to class discussions using knowledge from their own experiences, class readings, and/or additional readings.

A note about technology… while a familiarity with computer technology is important and we will be spending a considerable amount of time using specific software, this is not the focus of the class. As we all know, technology by definition is always changing. However, the principles that lead to good map design remain the constant. This class will emphasize design principles that transcend technology.

**Course Objectives:**
This course is designed to introduce you to maps and digital mapmaking. You will learn the fundamentals of compiling, designing, and using maps and mapped data. You will also learn the concepts and theory related to cartographic design and digital methods of production. The goal of this class is to teach you how to recognize, appreciate, and incorporate cartographic principles to make effective and esthetically pleasing maps.

**Selected Lecture Topics:**

- A Brief History of Cartography
- Cartographic Design Fundamentals
- Map Symbology
- Map Typography
- Map Projections, Coordinate Systems, and Scale
- Thematic Map Types
- Color-Use Guidelines
- Mapping Three Dimensional Data
- Digital Graphics
- Geographic Visualization

**Expected Student Outcomes:**

- Understand and apply fundamental cartographic design principles.
- Understand principles of color theory and how they affect map symbolization and interpretation.
- Choose appropriate symbols for point, line, and polygon features.
- Understand the effect of scale on generalization and how to improve readability of map features.
- Create balanced and informative layouts.
- Critique maps for improved design skills.
- Understand how various types of numeric and qualitative information is symbolized
- Describe visual thinking and visual communication and give examples of ways in which map design can support both of these activities.
- Identify and describe a map purpose and audience.
- Use and integrate presentation media skillfully (e.g. print, electronic).
- Design and produce effective small-scale and large-scale thematic maps.
- Use typography as a design variable skillfully.
- Understand cartographic conventions
- Create custom symbols using GIS software.
- Design feature and type symbolization schemes.
- Select an appropriate projection for a given map purpose.
- Use GIS software to create a 3D terrain representation.
- Produce multiple classifications of the same data set and analytically consider the advantages and disadvantages of each classification.
- Create and use a custom color ramp using GIS software.
- Choose a color scheme that is appropriate for the data characteristics.
- Select an appropriate symbolization strategy for a given data set.
- Devise an appropriate classification scheme for comparing patterns at multiple points in time.
- Select an appropriate visualization strategy for representing and comparing two or more variables.
- Effectively integrate information graphics within a map layout.

Policies:

Attendance
- Attendance is crucial, as I will be covering information in class that is not in the text.
- As with most math and science courses, you will need to understand material learned in earlier labs in order to complete later labs. If you get behind in this course, it is very difficult to catch up.

Academic Integrity
Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

Special Accommodations
If you need special accommodations, I encourage you to see me during my office hours or by appointment.

Lab Policies
Read and follow the lab rules. They are located here:
http://geography.hunter.cuny.edu/techsupport/rules.html

Grading: Evaluation of your performance in this course will be based on both lecture and laboratory components. Assignments will be graded on how well they meet the objectives of the specific assignments and the amount of attention paid to the details of map making. In short, YOUR grade is YOUR choice. If you contribute often to class discussions and put in ‘a little extra effort’ on each assignment you will get an A. If you fail to come to class, miss assignments or turn in substandard work, your grade will suffer. A note on the final project... For this, you will be graded by your peers based on what they have learned throughout the semester as to what Quality in Cartography looks like compared to your final project.
Final grades will be determined based on the CUNY grading policy that can be found in the college’s most recent online catalog available at: [http://catalog.hunter.cuny.edu/](http://catalog.hunter.cuny.edu/)

1) **ArcGIS Exercises.**
You will be performing several ‘hands-on’ exercises developed to teach you fundamental cartographic concepts and techniques.

2) **Final Project**
Create a presentation quality map from a variety of data sources using techniques learned in class

3) **Map Critique** (counts as an additional exercise)
Chose one low quality map and write a formal critique for each, explaining why it fails. Additional details will be provided for this assignment on Blackboard.

4) **Map Redesign** (counts as an additional exercise)
Redesign a low quality map so that it effectively communicates to the map reader.
# Hunter College: GTECH 72100

## Map Grading Criteria

<table>
<thead>
<tr>
<th>Category</th>
<th>VERY GOOD (5 points)</th>
<th>GOOD (4 points)</th>
<th>NEEDS IMPROVEMENT (3 points)</th>
<th>POOR (2 points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labels-Accuracy and Neatness</td>
<td>All of the appropriate features are labeled and located correctly and can be read easily (legible, not too many fonts).</td>
<td>The majority of the appropriate features are labeled and located correctly and can be read easily (legible, not too many fonts).</td>
<td>Some of the appropriate features are labeled and located correctly and can be read easily (legible, not too many fonts).</td>
<td>Very few of the appropriate features are labeled and located correctly and can be read easily (legible, not too many fonts).</td>
</tr>
<tr>
<td>Scale</td>
<td>All features on map are at the appropriate scale (no jagged or blocky features) and the scale used is clearly indicated on the map.</td>
<td>Most features on map are at the appropriate scale (no jagged or blocky features) and the scale used is clearly indicated on the map.</td>
<td>Many features on map are NOT at the appropriate scale (jagged or blocky features) even though the scale used is clearly indicated on the map.</td>
<td>Many features on map are NOT at the appropriate scale (jagged or blocky features) and/or the scale used is NOT indicated on the map.</td>
</tr>
<tr>
<td>Color</td>
<td>Color use is always appropriate for features (e.g. blue for water) on map, adds emphasis in appropriate places/ways, helps the reader in interpreting the map, and is sufficiently distinct without clashing or cluttering.</td>
<td>Color use is usually appropriate for features (e.g. blue for water) on map, adds emphasis in appropriate places/ways, helps the reader in interpreting the map, and are sufficiently distinct without clashing or cluttering.</td>
<td>Color use is sometimes appropriate for features (e.g. blue for water) on map, adds emphasis in appropriate places/ways, helps the reader in interpreting the map, and is sufficiently distinct without clashing or cluttering.</td>
<td>Color use is never appropriate for features (e.g. blue for water) on map, adds emphasis in appropriate places/ways, helps the reader in interpreting the map, and is sufficiently distinct without clashing or cluttering.</td>
</tr>
<tr>
<td>Metadata/Title/Legend</td>
<td>Map has exceptional documentation, including useful and appropriate title, legend, data sources, map credits, and other explanatory text.</td>
<td>Map has some documentation, including useful and appropriate title, legend, data sources, map credits, and other explanatory text.</td>
<td>Map has minimal documentation, including useful and appropriate title, legend, data sources, map credits, and other explanatory text.</td>
<td>Map has no documentation.</td>
</tr>
<tr>
<td>Cartographic Design</td>
<td>Exhibits highly refined map design (balance, alignment, visual hierarchy, contrast, use of white space) of symbology, labels and other cartographic elements (appropriately sized), including color, text, and composition.</td>
<td>Exhibits refined map design (balance, alignment, visual hierarchy, contrast, use of white space) of symbology, labels and other cartographic elements (appropriately sized), including color, text, and composition.</td>
<td>Exhibits basic map design (balance, alignment, visual hierarchy, contrast, use of white space) of symbology, labels and other cartographic elements (appropriately sized), including color, text, and composition.</td>
<td>Does not exhibit understanding of basic map design.</td>
</tr>
<tr>
<td>Overall Visual Impact</td>
<td>The overall purpose of the map and how it is to be read is easily understood and the map is polished and professional in appearance (ready for publication).</td>
<td>The overall purpose of the map and how it is to be read is understood and the map is fairly polished and professional in appearance (ready for publication).</td>
<td>The overall purpose of the map and how it is to be read is NOT understood or the map is NOT polished and professional in appearance (NOT ready for publication).</td>
<td>The overall purpose of the map and how it is to be read is NOT understood AND the map is NOT polished and professional in appearance (NOT ready for publication).</td>
</tr>
</tbody>
</table>

A note on map grading: Maps will be based on a scale from 1 to 30. The following sheet will be used in grading map exercises. The maximum value for each category is 5. Therefore, in order to get a perfect score (30), all of the following six (6) categories would need a score of five (5).
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Reading(s)</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Introduction Map Functions and Cartographic Process</td>
<td>Chapter 1-3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Earth Geometry Map Projections and Distortion Generalization Scale Effects on Map Data</td>
<td>Chapters 5, 6 &amp; 8</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Map Design</td>
<td>Chapter 7</td>
<td>Map Critique Due</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Visual Variables</td>
<td>Chapters 9</td>
<td>Draft Exercise 1: Due</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Typography</td>
<td>Chapter 10</td>
<td>Final Exercise 1: Due</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Color 1</td>
<td>Chapter 11</td>
<td>Draft Exercise 2: Due</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Color 2</td>
<td>Handouts</td>
<td>Final Exercise 2: Due</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Mapping Enumerated Data &amp; Tables, Graphs and Charts</td>
<td>Handouts</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Mapping Higher Dimensions</td>
<td>Chapter 12</td>
<td>Draft Exercise 3: Due</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Animated and Interactive Cartography</td>
<td>Handouts</td>
<td>Final Exercise 3: Due</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>SPRING BREAK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>Guest Lecturer: Matt Knutzen NYPL Map Division</td>
<td></td>
<td>Final Exercise 4: Due</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>Critique of Final Project Drafts</td>
<td>Handouts</td>
<td>Draft Final Project Due</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Final Project Display</td>
<td></td>
<td>Final Project Due</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Final Exam</td>
<td></td>
<td>Map Re-Designs Due</td>
</tr>
</tbody>
</table>
GTECH 72200, Advanced Topics in GeoVisualization

GTECH 72200
Advanced Topics in GeoVisualization
Hunter College, CUNY
Department of Geography

Spring 2016
Wednesdays 5:35PM to 9:15PM

Instructor: Doug Williamson, PhD
Email: Douglas.Williamson@hunter.cuny.edu
Office Hours: By Appointment
Geography Department Office: Room 1006 HN
Geography Department Phone: 212.772.4300

Required Texts:

Other Relevant Texts (NOT required):
- Cartography: Visualization of Geospatial Data, by Menno-Jan Kraak and Ferjan Ormel, Prentice Hall
- Cartographers’ Toolkit, by Gretchen Peterson, CRC Press, Taylor and Francis Group, 2012

Additional Readings:


Course Overview:
GTECH 722 immerses students in the current issues and technology in Cartography and Geographic Visualization. It takes the fundamentals learned in GTECH 721 and expands into animated and interactive maps, web mapping, and new visualization techniques. GTECH 722 is an advanced course in the theory of map design, the fundamentals of how interactive maps work and how information is transferred from map to reader and the practical application of these concepts into digital, interactive cartographic products. The digital revolution has changed how we make maps, how we use them, and how we think about them. The rapid and concurrent developments in desktop computing capabilities, the availability of digital geospatial data, and the growth of the Internet have radically changed the cartographic landscape. In an age where the user has increasingly become their own mapmaker (e.g., Google Maps, online GIS) this course examines recent issues in cartography related to map animation, the Internet, geovisualization, and on-demand cartographic systems—focusing on the new cartographic challenges and opportunities associated with interactive, digital mapping systems.

Course Objective:
By the end of the class you should be able to understand how interactive and dynamic maps are made, be able to articulate the conceptual strengths and weaknesses of these maps, and understand where this rapidly evolving field is headed. You will also gain valuable (and marketable) skills in designing and implementing working examples of dynamic Web maps using vector-based animation tools. The course consists of two closely related components: lectures and labs geared toward a symbiotic relationship between theory and practice. The lecture component of the course covers the extant cartographic theories and prior cartographic success stories that are important for thinking critically about the design and development of interactive maps. The laboratory component of the course emphasizes the practical skills needed to design cartographic interfaces. Following an introduction to the programming environment, each lab assignment requires you to grapple with topics previously discussed in lecture, with the final map deliverable representing your critical thinking and cartographic creativity regarding the topic.

Learning Outcomes
This is a practical, hands-on course; when you have completed it, you will be able to:
• Attain actionable knowledge of cartography and geovisualization.
• Design and construct interactive maps for communicating spatial information to others.
• Make war data and other information that provides geographic reference.
• Choose and arrange map and user interface elements for better cartographic communication.
• Choose and control labels, symbols and colors for best effect.
• Utilize a variety of thematic mapping and geovisualization techniques.
Assignments:
There are a number of assignments that are due throughout the semester. The assignments and brief descriptions are as follows:

2) Map Assignments (4)
Create a high quality map products from a variety of data sources based on principles discussed in class

3) Final Project

Policies:

Attendance
- Attendance is crucial, as a large percentage of your grade will be based on participation in class discussions
- Unexcused absences will lead to a drop in letter grade; an excused absence is at the discretion of the professor.

Hunter College Policy on Academic Integrity
Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

ADA Policy
In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical, and/or Learning) consult the Office of AccessABILITY, located in Room E1214B, to secure necessary academic accommodations. For further information and assistance, please call: (212) 772-4857 or (212) 650-3230.

Lab Policies
Read and follow the lab rules. They are located here:
http://geography.hunter.cuny.edu/techsupport/rules.html

Grading: Evaluation of your performance in this course will be based on both lecture (discussion) and laboratory components. Your grade can go up or down depending on whether you make a conscious effort or not. If you contribute often to class discussions and ‘go the extra mile’ on your final project, you will get an A. If you fail to come to class, miss assignments or turn in substandard work, your grade will be lowered accordingly. In short, your grade is your choice.
A note on the grading of your final projects... The grades for your final projects will be based on the oral critiques from your peers. Based on what they have learned throughout the semester, your peers will critique your drafts in class and then provide a grade for the final deliverable.

- Participation 20%
- Map Assignments 50%
- Final Project 30%

Final grades will be determined based on the CUNY grading policy that can be found in the college’s most recent online catalog available at: [http://catalog.hunter.cuny.edu/](http://catalog.hunter.cuny.edu/)
<table>
<thead>
<tr>
<th>Meeting</th>
<th>Date</th>
<th>Topic</th>
<th>Reading(s)</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>01/30</td>
<td>Course Introduction &amp; Overview</td>
<td>Ch. 1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>02/06</td>
<td>HCI and UI versus UX Design</td>
<td>Ch. 2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>02/13</td>
<td>Geovisualization, Exploration, and Insight</td>
<td>Ch. 11</td>
<td>Draft Assignment 1 Due</td>
</tr>
<tr>
<td>4</td>
<td>02/20</td>
<td>Productivity, Complexity, and Constraint</td>
<td>Ch. 7</td>
<td>Final Assignment 1 Due</td>
</tr>
<tr>
<td>5</td>
<td>02/27</td>
<td>Stages of Interaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>03/06</td>
<td>Interface Styles &amp; Design</td>
<td>Ch. 9</td>
<td>Draft Assignment 2 Due</td>
</tr>
<tr>
<td>7</td>
<td>03/13</td>
<td>Interactive Maps &amp; Usability Engineering I: Usability vs. Utility</td>
<td>Ch. 6</td>
<td>Final Assignment 2 Due</td>
</tr>
<tr>
<td>8</td>
<td>03/20</td>
<td>User-Centered Design</td>
<td>Ch. 5</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>03/27</td>
<td>Designing Infographics</td>
<td>AS-CIB: Ch. 7</td>
<td>Draft Assignment 3 Due</td>
</tr>
<tr>
<td>10</td>
<td>04/03</td>
<td>Web Mapping: Javascript</td>
<td>Fourth Group on BB &amp; AS-CIB: Ch. 5</td>
<td>Final Assignment 3 Due</td>
</tr>
<tr>
<td>11</td>
<td>04/10</td>
<td>SPRING BREAK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>04/17</td>
<td>Web Mapping: Javascript and Leaflet</td>
<td></td>
<td>Draft Assignment 4 Due</td>
</tr>
<tr>
<td>13</td>
<td>05/24</td>
<td>Web Mapping: Javascript and D3</td>
<td></td>
<td>Final Assignment 4 Due</td>
</tr>
<tr>
<td>14</td>
<td>05/01</td>
<td>Project Critiques</td>
<td></td>
<td>Draft Final Project Due</td>
</tr>
<tr>
<td>15</td>
<td>05/08</td>
<td>Project Presentations</td>
<td></td>
<td>Final Project Due</td>
</tr>
</tbody>
</table>
## APPENDIX C

### Table 3 Full-time faculty teaching assignments (SED Form)

Faculty teaching at the graduate level must have an earned doctorate/terminal degree or demonstrate special competence in the field. Provide information on faculty members who are **full-time at the institution** and who will be teaching each course in the major field or graduate program. The application addendum for professional licensure, teacher certification, or educational leadership certification programs may provide additional directions for those types of proposals.

<table>
<thead>
<tr>
<th>Faculty Member Name and Title (include and identify Program Director)</th>
<th>Program Courses to be Taught</th>
<th>Percent Time to Program</th>
<th>Highest and Other Applicable Earned Degrees &amp; Disciplines (include College/University)</th>
<th>Additional Qualifications: list related certifications/ licenses; occupational experience; scholarly contributions, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahearn, Sean (First Director)</td>
<td>GTECH 73100 GeoComputation I</td>
<td>80%</td>
<td>PhD, MSc University of Wisconsin-Madison</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GTECH 73300 GeoComputation II</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>GTECH 70900 Introduction to Geographic Information Systems</td>
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<tr>
<td></td>
<td>GTECH 73200 Advanced GeoInformatics</td>
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</tr>
<tr>
<td>Albrecht, Jochen</td>
<td>GTECH 70500 Spatial Data Analysis</td>
<td>80%</td>
<td>PhD, University of Vechta MSc, University of Hamburg BSc, University of Hamburg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GTECH 70800 Seminar in GeoInformatics</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>GTECH 70900 Introduction to Geographic Information Systems</td>
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</tr>
<tr>
<td></td>
<td>GTECH 71000 Concepts and Theories in GeoInformatics</td>
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<tr>
<td></td>
<td>GTECH 73200 Advanced GeoInformatics</td>
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<tr>
<td></td>
<td>GTECH 78514 GIS Program Management</td>
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<tr>
<td></td>
<td>GTECH 78515 GIS in Metro NY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Course/Book Title</td>
<td>Percentage</td>
<td>Education/Experience</td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------------</td>
<td>------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Gong, Hongmian</td>
<td>GTECH 78501 Urban Applications of GIS</td>
<td>33%</td>
<td>PhD, University of Georgia&lt;br&gt;MA, University of Akron&lt;br&gt;MS, Sun Yat-sen University&lt;br&gt;BS, Sun Yat-sen University</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kessler, Carsten</td>
<td>GTECH 70900: Introduction to Geographic Information Systems</td>
<td>100%</td>
<td>PhD, University of Münster&lt;br&gt;MSc, University of Münster&lt;br&gt;Consultant for United Nations Office for the Coordination of Humanitarian Affairs, 2012–2013</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GTECH 71000: Concepts and Theories in GeoInformatics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GTECH 73200: Advanced GeoInformatics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GTECH 78517: Free and Open Source GIS</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>GTECH 73500: Location Based Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GTECH 73400: GeoWeb Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pavlovskaya, Marianna</td>
<td>GTECH 78502 GIS Applications in Social Geography</td>
<td>20%</td>
<td>PhD, Clark University&lt;br&gt;MA, Moscow State University</td>
<td></td>
</tr>
<tr>
<td>Ni-Meister, Wenge</td>
<td>GTECH 712: Remote Sensing of Environment</td>
<td>50%</td>
<td>PhD, Boston University&lt;br&gt;M.S., University of Connecticut</td>
<td></td>
</tr>
</tbody>
</table>
Faculty teaching at the graduate level must have an earned doctorate/terminal degree or demonstrate special competence in the field. Provide information on part-time faculty members who will be teaching each course in the major field or graduate program. The application addendum for professional licensure, teacher certification, or educational leadership certification programs may provide additional directions for those types of proposals.

<table>
<thead>
<tr>
<th>Faculty Member Name and Title</th>
<th>Program Courses to be Taught</th>
<th>Highest and Other Applicable Earned Degrees &amp; Disciplines (include College/University)</th>
<th>Additional Qualifications: list related certifications/licenses; occupational experience; scholarly contributions, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Douglas Williamson</td>
<td>GTECH 72100 – Introduction to Cartographic Design &amp; Geovisualization</td>
<td>PhD, EES program, CUNY</td>
<td>Longterm employee of Department of Information Technology of New York City and now of New York Police Department</td>
</tr>
<tr>
<td></td>
<td>GTECH 72200 – Advanced Topics in Geovisualization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gordon Green</td>
<td>GTECH 73100 – GeoComputation I</td>
<td>PhD, EES program, CUNY</td>
<td>10+ years of experience of programming geospatial applications in private industry and consulting</td>
</tr>
<tr>
<td></td>
<td>GTECH 73300 – GeoComputation II</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# APPENDIX D

NOTE: Please note that the financial calculations are for convenience based on academic year although the effective date for the program is Spring 2016).

## Table 5 New resources table (CUNY)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full Time Faculty</strong></td>
<td>$ 14,868.00</td>
<td>$ 15,172.44</td>
<td>$ 15,482.54</td>
<td>$ 129,798.31</td>
<td>$ 16,121.16</td>
</tr>
<tr>
<td><strong>Part Time Faculty</strong></td>
<td>$ 31,241.56</td>
<td>$ 31,866.79</td>
<td>$ 32,504.45</td>
<td>$ 33,154.54</td>
<td>$ 33,817.06</td>
</tr>
<tr>
<td><strong>Full Time Staff</strong></td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td><strong>Part Time Staff</strong></td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td><strong>Library (Includes Staffing)</strong></td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td><strong>Equipment Replacement</strong></td>
<td>$ -</td>
<td>$ -</td>
<td>$ 10,000.00</td>
<td>$ 10,000.00</td>
<td>$ 10,000.00</td>
</tr>
<tr>
<td><strong>Laboratories</strong></td>
<td>$ 7,500.00</td>
<td>$ -</td>
<td>$ -</td>
<td>$ 5,000.00</td>
<td>$ -</td>
</tr>
<tr>
<td><strong>Supplies &amp; Expenses (Other than Personal Services)</strong></td>
<td>$ 23,500.00</td>
<td>$ 19,500.00</td>
<td>$ 18,500.00</td>
<td>$ 11,500.00</td>
<td>$ 12,500.00</td>
</tr>
<tr>
<td><strong>Capital Expenditures</strong></td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>$ 9,240.00</td>
<td>$ 16,128.00</td>
<td>$ 20,700.00</td>
<td>$ 21,060.00</td>
<td>$ 27,132.00</td>
</tr>
<tr>
<td><strong>Total all</strong></td>
<td>$ 86,349.56</td>
<td>$ 82,667.23</td>
<td>$ 97,186.99</td>
<td>$ 209,792.85</td>
<td>$ 99,570.22</td>
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</tbody>
</table>

[1] 2% inflation rate used for projections
Table 6 Projected revenue related to the proposed program (CUNY)

<table>
<thead>
<tr>
<th>Revenues[1]</th>
<th>1st Year Academic Year[2]</th>
<th>2nd Year Academic Year‡</th>
<th>3rd Year Academic Year‡</th>
<th>4th Year Academic Year‡</th>
<th>5th Year Academic Year‡</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tuition Revenue[3]</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01. From Existing Sources[4]</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>02. From New Sources[5]</td>
<td>$52,767</td>
<td>$110,083</td>
<td>$139,852</td>
<td>$152,787</td>
<td>$205,206</td>
</tr>
<tr>
<td>03. Total</td>
<td>$52,767</td>
<td>$110,083</td>
<td>$139,852</td>
<td>$152,787</td>
<td>$205,206</td>
</tr>
<tr>
<td><strong>Other Revenue[7]</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07. From Existing Sources‡</td>
<td>$240</td>
<td>$990</td>
<td>$1,260</td>
<td>$1,320</td>
<td>$1,590</td>
</tr>
<tr>
<td>08. From New Sources**</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
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<tr>
<td>09. Total</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
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<tr>
<td><strong>Grand Total[8]</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. From Existing Sources‡</td>
<td>$240</td>
<td>$990</td>
<td>$1,260</td>
<td>$1,320</td>
<td>$1,590</td>
</tr>
<tr>
<td>11. From New Sources**</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>TOTAL</td>
<td>$53,007</td>
<td>$111,073</td>
<td>$141,112</td>
<td>$154,107</td>
<td>$206,796</td>
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</table>
Table 7 Supporting materials for projected expenditures table (CUNY)

<table>
<thead>
<tr>
<th>DIRECT OPERATING EXPENSES</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
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</thead>
<tbody>
<tr>
<td>Include additional expenses incurred by other programs when satisfying needs of new program. Faculty need should be commensurate with &quot;net section needs&quot; based on enrollment (see &quot;Enroll &amp; Seat Need Projections&quot; tab)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Full Time Faculty Overload (include Summer)</td>
<td>10,500.00</td>
<td>10,715.00</td>
<td>10,934.00</td>
<td>11,157.00</td>
<td>11,385.00</td>
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<tr>
<td>New Full Time Faculty Base Salary (list separately)</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>80,000.00</td>
<td>-</td>
</tr>
<tr>
<td>New Full Time Faculty Overload (include Summer)</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>New Faculty Re-assigned Time (list separately)</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Full Time Employee Fringe Benefits (41.6%)</td>
<td>4368.00</td>
<td>4,457.44</td>
<td>4,548.54</td>
<td>37,921.31</td>
<td>4,736.16</td>
</tr>
<tr>
<td>Total (Links to Full-Time Faculty on Program Exp Worksheet)</td>
<td>$14,868.00</td>
<td>$15,172.44</td>
<td>$15,482.54</td>
<td>$129,078.31</td>
<td>$16,121.16</td>
</tr>
<tr>
<td>Part Time Faculty Actual Salaries</td>
<td>25,134.00</td>
<td>25,637.00</td>
<td>26,150.00</td>
<td>26,673.00</td>
<td>27,206.00</td>
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<tr>
<td>Part Time Faculty Actual Fringe Benefits (24.3%)</td>
<td>6,107.56</td>
<td>6,229.79</td>
<td>6,354.45</td>
<td>6,481.54</td>
<td>6,611.06</td>
</tr>
<tr>
<td>Total (Links to Part-Time Faculty Program Exp Worksheet)</td>
<td>$31,241.56</td>
<td>$31,866.79</td>
<td>$32,504.45</td>
<td>$33,154.54</td>
<td>$33,817.06</td>
</tr>
<tr>
<td>EQUIPMENT</td>
<td></td>
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<tr>
<td>Computer Hardware (PC replacement on a 2.5 year rotation)</td>
<td></td>
<td></td>
<td>$10,000.00</td>
<td>$10,000.00</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>Office Furniture</td>
<td></td>
<td></td>
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<tr>
<td>Other (Specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (Links to Equipment on Program Exp Worksheet)</td>
<td>$</td>
<td>$</td>
<td>$10,000.00</td>
<td>$10,000.00</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>LABORATORIES</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Laboratory Equipment</td>
<td>$7,500.00</td>
<td></td>
<td></td>
<td>$5,000.00</td>
<td></td>
</tr>
<tr>
<td>Other (list separately)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL (Links to Laboratories on Program Exp Worksheet)</td>
<td>$7,500.00</td>
<td>$-</td>
<td>$-</td>
<td>$5,000.00</td>
<td>$-</td>
</tr>
</tbody>
</table>

Continued on the next page.
### SUPPLIES AND EXPENSES (OTPS)

<table>
<thead>
<tr>
<th>Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultants and Honoraria</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
</tr>
<tr>
<td>Office Supplies</td>
<td>$ 500.00</td>
<td>$ 500.00</td>
<td>$ 500.00</td>
<td>$ 500.00</td>
<td>$ 500.00</td>
</tr>
<tr>
<td>Instructional Supplies</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
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<tr>
<td>Faculty Development</td>
<td>$2,000.00</td>
<td>$2,000.00</td>
<td>$2,000.00</td>
<td>$2,000.00</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>Travel and Conferences</td>
<td>$3,000.00</td>
<td>$3,000.00</td>
<td>$3,000.00</td>
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<tr>
<td>Advertising and Promotion</td>
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<td>$12,000.00</td>
<td>$10,000.00</td>
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<td>$4,000.00</td>
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<tr>
<td>Accreditation</td>
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<tr>
<td>Computer Software</td>
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<tr>
<td>Computer License Fees</td>
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<tr>
<td>Computer Repair and Maintenance</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
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<tr>
<td>Equipment Repair and Maintenance</td>
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**New Total Supplies and OTPS Expenses (Links to Supplies on Program Exp Worksheet)**

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL</strong></td>
<td>$23,500.00</td>
<td>$19,500.00</td>
<td>$18,500.00</td>
<td>$11,500.00</td>
<td>$12,500.00</td>
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</tbody>
</table>

### CAPITAL EXPENDITURES

<table>
<thead>
<tr>
<th>Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Renovations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classroom Equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (list separately)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL (Links to Capital Expenditures on Program Exp Worksheet)**

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL</strong></td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
</tr>
</tbody>
</table>

### Other (list separately)

- Amazon web services for 12 months for each student

<table>
<thead>
<tr>
<th>Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon web services for 12 months for each student</td>
<td>$9,240.00</td>
<td>$16,128.00</td>
<td>$20,700.00</td>
<td>$21,060.00</td>
<td>$27,132.00</td>
</tr>
</tbody>
</table>

**TOTAL (Links to Other on Program Exp Worksheet)**

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL</strong></td>
<td>$9,240.00</td>
<td>$16,128.00</td>
<td>$20,700.00</td>
<td>$21,060.00</td>
<td>$27,132.00</td>
</tr>
</tbody>
</table>
Table 8 Supporting materials for projected revenue table (CUNY)

<table>
<thead>
<tr>
<th>NEW FULL-TIME STUDENTS</th>
<th>Year One</th>
<th>Year Two</th>
<th>Year Three</th>
<th>Year Four</th>
<th>Year Five</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition &amp; Fees:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># of NEW FULL-TIME, In-State Students (linked from &quot;Enroll &amp; Seat Need Projections&quot;)</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Tuition Income (Calculates 2% increase per year after Fall 2015)</td>
<td>$10,645</td>
<td>$10,858</td>
<td>$11,075</td>
<td>$11,297</td>
<td>$11,522</td>
</tr>
<tr>
<td>Total Tuition</td>
<td>$31,935</td>
<td>$54,290</td>
<td>$77,525</td>
<td>$79,076</td>
<td>$103,702</td>
</tr>
<tr>
<td>Student Fees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Fees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total In-State Tuition &amp; Fees</strong></td>
<td>$31,935</td>
<td>$54,290</td>
<td>$77,525</td>
<td>$79,076</td>
<td>$103,702</td>
</tr>
</tbody>
</table>

| Tuition & Fees:        |          |          |            |           |           |
| # of NEW FULL-TIME, Out-of-State Students (linked from "Enroll & Seat Need Projections") | 0 | 1 | 1 | 1 | 2 |
| Annual Avg # of Credits per FT student (24-30) | 0 | 24 | 24 | 24 | 24 |
| Tuition Income (Specify Rate per credit. Calculates 2% increase per year after Fall 2015) | $796 | $812 | $828 | $845 | $862 |
| Total Tuition | $0 | $19,488 | $19,878 | $20,275 | $41,362 |
| Student Fees |          |          |            |           |           |
| Total Fees |          |          |            |           |           |
| **Total Out-of-State Tuition & Fees** | $0 | $19,488 | $19,878 | $20,275 | $41,362 |

**TOTAL NEW FULL-TIME TUITION REVENUE** | $31,935 | $73,778 | $97,403 | $99,351 | $145,064 |

Continued on the next page.
<table>
<thead>
<tr>
<th>NEW PART-TIME STUDENTS</th>
<th>Year One</th>
<th>Year Two</th>
<th>Year Three</th>
<th>Year Four</th>
<th>Year Five</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition &amp; Fees:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># of NEW PART-TIME, In-State Students (linked from &quot;Enroll &amp; Seat Need Projections&quot;)</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Total Enrolled Credits (Enter Avg # credits per student per year-Fall+Spring+Summer -- i.e. 6 Fall, 6 Spring, 3 Summer=15)</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Tuition Income (Specify Rate per credit. Calculates 2% increase per year after Fall 2015)</td>
<td>$434</td>
<td>$443</td>
<td>$452</td>
<td>$461</td>
<td>$470</td>
</tr>
<tr>
<td>Total Tuition</td>
<td>$20,832</td>
<td>$26,561</td>
<td>$32,510</td>
<td>$33,161</td>
<td>$39,461</td>
</tr>
<tr>
<td>Student Fees</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Total Fees</td>
<td>$20,832</td>
<td>$26,561</td>
<td>$32,510</td>
<td>$33,161</td>
<td>$39,461</td>
</tr>
<tr>
<td>Total In-State Tuition &amp; Fees</td>
<td>$20,832</td>
<td>$26,561</td>
<td>$32,510</td>
<td>$33,161</td>
<td>$39,461</td>
</tr>
<tr>
<td>Tuition &amp; Fees:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># of NEW PART-TIME, Out-of-State Students</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total Enrolled Credits (Enter Avg # credits per student per year-Fall+Spring+Summer -- i.e. 6 Fall, 6 Spring, 3 Summer=15)</td>
<td>0</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Tuition Income (Specify Rate per credit) calculates 2% increase per year</td>
<td>$796</td>
<td>$812</td>
<td>$828</td>
<td>$845</td>
<td>$862</td>
</tr>
<tr>
<td>Total Tuition</td>
<td>$0</td>
<td>$9,744</td>
<td>$9,939</td>
<td>$20,275</td>
<td>$20,681</td>
</tr>
<tr>
<td>Student Fees</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Total Fees</td>
<td>$0</td>
<td>$9,744</td>
<td>$9,939</td>
<td>$20,275</td>
<td>$20,681</td>
</tr>
<tr>
<td>Total Out-of-State Tuition &amp; Fees</td>
<td>$0</td>
<td>$9,744</td>
<td>$9,939</td>
<td>$20,275</td>
<td>$20,681</td>
</tr>
</tbody>
</table>

TOTAL NEW PART-TIME REVENUE | $20,832 | $36,305 | $42,449 | $53,436 | $60,142 |

TOTAL NEW REVENUE (LINKS TO REVENUE SPREADSHEET ROW 7) | $52,767 | $110,083 | $139,852 | $152,787 | $205,206 |

Continued on the next page.
<table>
<thead>
<tr>
<th>OTHER REVENUE</th>
<th>Year One</th>
<th>Year Two</th>
<th>Year Three</th>
<th>Year Four</th>
<th>Year Five</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Revenue From Existing Sources (specify and explain)-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LINKS TO REVENUE SPREADSHEET ROW13 CUNY approved lab fees of $15/course for all but three GTECH prefixed courses.</td>
<td>$240.00</td>
<td>$990.00</td>
<td>$1,260.00</td>
<td>$1,320.00</td>
<td>$1,590.00</td>
</tr>
<tr>
<td>Other Revenue New (specify and explain) (LINKS TO REVENUE SPREADSHEET ROW 15)</td>
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<td></td>
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</tbody>
</table>
Table 9 Enroll and seat projection (CUNY TABLE)

<table>
<thead>
<tr>
<th>Section Seats per Student</th>
<th>Year One</th>
<th>Year Two</th>
<th>Year Three</th>
<th>Year Four</th>
<th>Year Five</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full-time Students</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Courses</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>New Courses</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total (normally equals 10)</strong></td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td><strong>Part-Time Students</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Courses</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
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</tr>
<tr>
<td>New Courses</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td><strong>Total (normally equals 4-6)</strong></td>
<td>4</td>
<td>4</td>
<td>4</td>
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<td>4</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Seat &amp; Section Needs</th>
<th>Year One</th>
<th>Year Two</th>
<th>Year Three</th>
<th>Year Four</th>
<th>Year Five</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Change in Seat Need for Existing Students</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Courses</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>New Courses</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Seat Need for New Students</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Courses</td>
<td>40</td>
<td>54</td>
<td>69</td>
<td>72</td>
<td>93</td>
</tr>
<tr>
<td>New Courses</td>
<td>-</td>
<td>18</td>
<td>23</td>
<td>24</td>
<td>31</td>
</tr>
<tr>
<td><strong>Total Seat Need Change</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Courses</td>
<td>40</td>
<td>54</td>
<td>69</td>
<td>72</td>
<td>93</td>
</tr>
<tr>
<td>New Courses</td>
<td>-</td>
<td>18</td>
<td>23</td>
<td>24</td>
<td>31</td>
</tr>
<tr>
<td><strong>All Courses</strong></td>
<td>40</td>
<td>72</td>
<td>92</td>
<td>96</td>
<td>124</td>
</tr>
<tr>
<td><strong>Average Seats per Section</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Courses</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>New Courses</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
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<tr>
<td><strong>Net New Section Need</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Existing Courses</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>New Courses</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
APPENDIX E

Evaluation report form (NON TEACHER EDUCATION GRADUATE PROGRAM) (CUNY FORM)

Evaluation Report Form for Program Proposals

Institution: University of California Santa Barbara, Department of Geography
Evaluator: Prof. Dr. Werner Ruhn, Jack and Laura Dangermond Chair in Geographic Information Science, Director of Center for Spatial Studies
Program Title: Geoinformatics
Degree Title: Master of Science
Date of Evaluation: October 31, 2015

Note: I had to create this form myself, copying line by line from the a document I obtained from the pdf form, which unfortunately was not writable. For future evaluators, please provide a writeable pdf or doc file.

1. Program

1. Assess program purpose, structure, and requirements as well as formal mechanisms for program administration and monitoring.

Geoinformatics combines geographic and computational approaches to individual, commercial, and policy problems into an interdisciplinary field. It focuses on the collection, organization, analysis, and dissemination of geospatial data. It has started to leverage data science and big data for spatial problem solving in the private sector, government, and science.

The purpose of the proposed program is to educate the next generation of leaders in this field in a Master of Science degree. The program fills a niche between geography programs with a necessarily limited emphasis on computational data analysis on the one hand, and computational programs with necessarily limited foundations in spatial and spatio-temporal concepts such as scale, spatial autocorrelation, locational privacy, and global change modeling on the other hand. As such, it also complements and extends the existing program offerings in this field from Hunter College and neighboring universities (as well as nationally, in fact).

The program design around topical tracks allows for the necessary specialization in this broad field, while retaining a common core and basis in data-driven problem solving. A key feature is that the program breaks out of the traditional focus on GIS, adding significant computational techniques, for example from statistics, scientific visualization, and the semantic web. An important aspect is the plan to provide grounding in real-world technology uses through adjunct faculty, guest lectures, and on-site demos coming from local agencies and companies.

Offering both a thesis and an exam option, is certainly a good choice and in the interest of both students and employers. Equally beneficial is the proposed ratio of roughly 2:1 between required and elective courses. It provides enough flexibility for specialization while retaining a common core without which the program might fail to gain profile. Furthermore, it provides a more manageable distribution of teaching load across many departments, with beneficial effects on broad interdisciplinary learning and hopefully on interdisciplinary research collaboration.

2. Comment on the special focus of this program, if any, as it relates to the discipline.

The program is solidly based in the science and technology required for Geoinformatics careers. It is innovative and probably unique in the whole of the United States, where the (European) notion of Geoinformatics has not yet taken hold in the sense that this program pursues. The use of the term Geoinformatics in the US originates in the earth sciences and is narrower than the one in this program and in Europe. The broader idea underlying this program offers great potential for careers not only within the earth sciences and geography, but in engineering, physical and life sciences, social sciences, and the humanities.

3. Comment on the plans and expectations for continuing program development and self-assessment.

The projections on expected enrollment appear solid and conservative. They are also at a level that does not raise
concerns about the faculty being able to handle a large influx of new students. However, once the program becomes known and graduates get hired and appreciated, there is a chance that it may grow beyond these numbers and mechanisms need to be in place to expand the number of faculty or teaching personnel and make sure that any vacated positions can be rapidly and competently refilled.

4. Assess available support from related programs.

The proposal mentions support from departments of Computer Science and Urban Affairs and Planning and possibly others. The lack of a graduate program in Computer Science at Hunter appears to create an ideal pathway for undergraduates in that field to specialize in spatial computing. Some courses that are already offered in the current Hunter College Geography programs (GIS Certificate and MA) will provide economies of scale for the MSc, while these programs are clearly targeting lower technical skill levels and do not overlap in their outcomes. The proposed transfer option of just below 20% of total credits is valuable to accommodate individual backgrounds and interests of students. A certain amount of students transferring into the new program is in the interest of the labor market as well as of academic qualification paths. Clearly, the new program will and should mainly attract students with stronger computational backgrounds than the typical current MA students.

5. (Only for programs requiring master plan amendment.) What is the evidence of need and demand for the program locally, in the State, and in the field at large? What is the extent of occupational demand for graduates? What is the evidence that demand will continue?

There is an undisputed and sustained need for graduates at all educational levels with analytical skills to exploit location in data across a vast range of applications. This need has been documented in countless studies and prominent publications in Nature and other outlets. The proposal does a good job quoting some of this evidence. The skill needs include the use and design of GIS, semantic web technologies, mapping and visualization tools, spatial statistics, and others. These skills have to be anchored in a solid understanding of spatial and computational concepts as they apply to modeling the placement, interaction, and motion of people and goods in geographic space.

The proposed program addresses these needs at the level of Master of Science graduates, whether they go into the private sector and government jobs or continue with PhD studies. Graduates with degrees in any of the closely related fields of Geoinformatics, Geographic Information Science, or Geography with a GIS emphasis have been able to choose from multiple employment offers for several decades now. Also, careers for them seemed relatively unaffected by, for example, the bursting “dot com” bubble in 2000 or the financial crisis in 2008. In fact, the major crises and challenges facing society and the world, be they social or physical, tend to increase demand for such graduates.

The evidence provided in the proposal on the economic value of investing in this field and on actual job searches in the New York City area and beyond speaks for itself. The past success of Hunter College in placing their graduates in key government and private sector positions gives confidence that graduates from the new MSc program will be equally or even more sought after. New York City plans for a concerted GIS effort across agencies and companies provides additional growth perspectives. From an academic perspective, I can only state that my colleagues and myself at UCSB, seeking out the world’s best students for PhD studies in Geographic Information Science, would care more than welcome applications from graduates of the proposed program.

II. Faculty

6. Evaluate the faculty, individually and collectively, in regard to training, experience, research and publication, professional service, and recognition in the field.

The quality and diversity of the faculty involved in teaching is impressive. Not only do they cover a good part of the technical, social, and applied spectrum of Geoinformatics, but they have successfully worked together in existing programs and many of them are internationally renown scientists. I do not find myself in a position to evaluate the faculty individually, mainly due to my very uneven familiarity with the specifics of their research, teaching, and service achievements. The faculty I know personally, however (Albrecht, Kessler, Ramasubramanian) all have an excellent record of achievements at their respective seniority levels, in all three areas of academic work, and with distinctive international reputation.
7. Assess the faculty in terms of size and qualifications. What are plans for future staffing?

Given the existing teaching loads, the ambitious and successful research programs of the faculty, and the new obligations resulting from the program, it seems indicated to consider complementing the faculty as soon as possible with one more position in an area that is core to the teaching needs.

8. Evaluate credentials and involvement of adjunct and support faculty.

Two to three adjunct faculty appear to be a well chosen number for the requirements. Their specializations are very fitting, as currently chosen, but need to be kept flexible for a timely evolution of courses. Their affiliation with innovative and achieved agencies and enterprises is of utmost importance for the program to teach practically relevant skills (in addition to the more theoretical teaching coming from core faculty).

III. Resources

9. Comment on the adequacy of physical resources and facilities, e.g., library, computer, and laboratory facilities, practicum and internship sites, and support services for the program, including use of resources outside the institution.

The existing facilities are at par with other and often bigger GIS programs in the nation. As the proposers indicate, future (and in fact current) infrastructure needs move into the cloud, which will change the cost structure, but typically reducing infrastructure investment needs.

10. (Only for programs requiring master plan amendment.) What is the institution’s commitment to the program as demonstrated by the operating budget, faculty salaries, and the number of faculty lines relative to student numbers and workload.

I am not sure about the actual commitment, as opposed to the proposed budget, but if the budget has been committed, it is commendable and shows the recognition for the plan (and the faculty) in administration.

IV. Summary Comments and Additional Observations

11. Summarize the major strengths and weaknesses of the program as proposed with particular attention to feasibility of implementation and appropriateness of objectives for the degree offered. Include any further observations important to the evaluation of this program proposal and provide any recommendations for the proposed program.

In summary, I commend the team to have come up with a timely, well thought out, and attractive proposal for an MSc program in Geoinformatics. It optimizes value for education and training at a very reasonable (in fact, almost negligible) cost. And it has the potential to further promote the reputation of Hunter College as a key player in both, research and teaching around spatial information and computing. Its unique selling proposition is the Geoinformatics orientation that improves on existing GIScience programs by strengthening data science and computer science or informatics programs by specializing in the handling the dimensions of space and time, which are not just an application of computing, but an organizational structure.
of immense value in the sciences, social sciences, and humanities.

I see two main areas of potential improvements. One would be to improve the intellectual and practical basis (or make it more explicit) for the choice of the topic tracks. They appear somewhat haphazard to me, though I do realize that they have to depend on faculty specialization. The second would be to clarify to what extent the Master studies should enable graduates to do system design and development (and of what kinds of systems), as opposed to just system use, and how the program will achieve this. With web-based development and modern scripting languages such as Python or JavaScript, a new type of development is now in the hands of application specialists who tend not to have the skills required by older styles of programming around languages like C, C++, or Java. The proposing faculty know and practice this, of course, but to what extent the proposed program can actually teach these skills effectively by its structure and course catalogue (rather than by the interests and skills of particular faculty) is not entirely clear to me. However, this open question will not be a weakness of the program, if there are enough students who enroll in it with a stronger computational background (as can be expected). Then, in fact, it turns into a strength, by exploiting these skills productively in Master studies without an extra need for teaching them from the ground up.
GIS faculty response to the external evaluation

November 11, 2015

Dear Office of Academic Affairs Staff,

Please find enclosed the evaluation from the external reviewer Dr. Werner Kuhn of the proposed MS in GeoInformatics program. Dr. Kuhn is Jack and Laura Dangermond Chair in Geographic Information Science and the Director of the Center for Spatial Studies at the Department of Geography at the University of California Santa Barbara which is a premier department for GIS instruction in the United States. Dr. Kuhn has a particular expertise in the field of GeoInformatics.

The evaluation is overwhelmingly positive and supports the launching of the program on all counts. Dr. Kuhn offered several recommendations on how make the program even stronger, especially in the future. Here is the list of recommendations and our response to them:

1. To enhance the training in systems design, a course on lower-level programming languages would be useful.

   Low-level programming languages allow users for more control over the application design. Our programming course GTECHU3100 incorporates several higher-level languages (e.g., python and JavaScript) which we believe meets the current needs of the MGEoI program. We would consider offering a course on lower-level languages in the future once we discern the demand for it from the students. We have faculty expertise to offer such a course.

2. A better delineation of tracks would be helpful.

   As the reviewer observes, the tracks reflect both the needs of MS in GeoInformatics and the available faculty expertise. We will improve the description of tracks on the program’s webpage to make it easier for the students to identify the track they need. At the same time, we believe that the four tracks closely align with the current and future trends in the field of GeoInformatics and their choice is strategic for the success of the program.

   1. **Spatial Data Analytics and GeoVisualization**
   Data visualization is a central new thrust in GeoInformatics and geographers have taken this area in a new direction by spatializing abstract space. Analytics is a natural complement of visualization as these transformations require understanding multi-dimensional space and multivariate analytics. This track has relevance to a range of domains from business to biology to demographics to digital humanities.

   2. **GeoComputational Modeling and Remote Sensing**
   GeoComputational models represent a class of modeling that focuses on agents, cellular automata, and Markov processes that have important applications in geospatial simulation. Remote sensing systems often feed these and other GeoComputational Models. This track is geared more toward scientific research and applications as well environmental consulting and other applied research areas.

   3. **Distributed and Web-based GeoComputation**
   This track focuses on web-enabling geographic applications, a major thrust in the field. GeoComputational models are often web enabled so the tight coupling of web tools and the GeoComputational modeling is essential. This skill set generates very large demand in the market place and is the driver for many of the billion dollar “startups.”

Hunter College of The City University of New York

695 Park Avenue New York, NY 10065
4. Applied GIS and Management
There are few if any programs that focus on management expertise in geospatial enterprise systems while this expertise is vital for the success of institutional geospatial projects. This track responds to the growing demand for this expertise and also uniquely differentiates the MGE01 from other programs in the New York City region and nationally. 

3. Although the current faculty expertise is adequate for starting the new program, the program is expected to grow fast. It is important to hire an additional faculty in GeoInformatics in the future.

We absolutely agree with this recommendation. A new faculty line would assure the success of the program and would also increase our capacity to add new courses as the need develops.

Sincerely,

Dr. Marissa Pavlovskaya  
Professor, Department of Geography, Hunter College, CUNY  
Ph.D. Program in Earth and Environmental Sciences, CUNY Graduate Center  
Voice (212) 772-5320, mpavlov@hunter.cuny.edu,  
http://www.geo.hunter.cuny.edu/~mpavlov
CV of the External Evaluator

WERNER KUHN
Curriculum Vitae
April 2015

PERSONAL

Personal Data
Date of Birth: 24 August 1957
Place of Birth: Zürich, Switzerland
Nationality: Swiss
Languages: German, English, French (fluent in reading and writing),
Italian and Spanish (conversational).

Present Positions
Jack and Laura Dangermond Chair of Geography and Professor of Geography at the
University of California Santa Barbara (http://www.geog.ucsb.edu/~kuhn/)
Director of the Center for Spatial Studies, University of California Santa Barbara
(http://spatial.ucsb.edu/people/werner-kuhn/)
Associate Graduate Faculty, Spatial Informatics (https://spatial.unimaas.edu/), University
of Maine
Co-Founder and Partner, Vespucci Initiative for the Advancement of Geographic
Information in Science (http://www.vespucci.org)
Lecturer (Dozent), Department of Geoinformatics, Vienna University of Technology (TU
Wien), Austria (http://www.geoinfo.tuwien.ac.at/staff/index.php/Further_Lectures).

Previous Positions
Professor of Geoinformatics, Institute for Geoinformatics, University of Münster,
November 2003 to November 2013
Associate Professor, Institute for Geoinformatics, University of Münster, September 1996
to November 2003
Research Associate, Department of Geoinformation, Vienna University of Technology (TU
Vienna), Austria, August 1991 to August 1996
Adjunct Professor, Department of Spatial Information Science and Engineering, University
of Maine, USA, August 1991 to 1998
Post-doctoral Research Associate and Cooperating Assistant Professor, National Center for
Geographic Information and Analysis (NCGIA) and Department of Surveying
Engineering, University of Maine, June 1989 to July 1991
Research and Teaching Assistant, Institute of Geodesy and Photogrammetry, ETH Zürich,

Visiting Positions
Visiting Scientist and Theme Leader, British National e-Science Center, Edinburgh, January
2007 to February 2008 (part time)
Visiting Scientist, Meaning and Computation Laboratory (Prof. Joseph Goguen),
Department of Computer Science and Engineering, University of California San Diego,
October 2002 to April 2003
Visiting Assistant Professor, Department of Civil Engineering, University of Maine, September 1984 to August 1985.

Education and Degrees

Venia docendi (Habilitation) in Geographic Information Science (Geoinformationswesen), Vienna University of Technology (TU Wien), Austria, 29 June 1985

Dr. sc. techn., ETH Zürich. Thesis (in German): Human Interaction with Spatial Information Systems - From Constructing to Editing Geometric Models. First Advisors: Prof. R. Corti, then Prof. Dr. A. Caroio (Surveying Engineering), 30 May 1989

Dipl. Verr. Ing. ETH (Diploma in Surveying Engineering), ETH Zürich. Thesis (in German): Computation of the first gravimetric geoid for Switzerland, 30 April 1982

Courses in law, journalism, and foreign languages, University of Zürich, October 1978 to February 1979

Matura (High School Diploma), Mathematisch-Naturwissenschaftliches Gymnasium (MNG), Zürich, September 1976

Rudolf Steiner Schule Zürich (Primary and Secondary School), April 1964 to March 1972

Certified Courses

Summer Program in Abstraction and Specification, John Guttag and Barbara Linkov, Massachusetts Institute of Technology (MIT), June 1985

Certificat de Hautes Études de Lettres et Civilisation Françaises, Centre Universitaire d'Avignon, 8 August 1980

Awards

University Educator Award, University of Münster, 2004 (30,000 €)
Best Paper Award, AGILE 2003

Educator Best Practices, 3rd Place Winner, Intergraph Geospatial World Power to Learn Competition, 2002

Oracle Spatial Center of Excellence, 2002

Best Diploma Thesis, Schweizerischer Verein für Vermessungswesen und Kartentechnik (SVVK), 1982

Patents

Assistance System for Selecting Routes, with Markus Kober, Christoph Rüther, Dieter Vollmar, Daimler-Chrysler, 2001,

Consulting

MobileGIS, Cork (Ireland)
InGeoForum (Germany)
Mapping Agency of the State of Hesse (Germany)
Interior Ministry of North-Rhine Westphalia (Germany)
Federal Waterways Engineering and Research Institute (Germany)
Intergraph Corporation
Digital Equipment Corporation (DEC)

2 of 30
Professional Society Memberships

International Association for Applied Ontology (IAAO), 2005 to present
Association for Computing Machinery (ACM), 1982 to present
German Association for Computer Science (Gesellschaft für Informatik, GI), 1982-2013
Computer Society, Institute of Electrical and Electronics Engineers (IEEE), 1989-1999
American Congress on Surveying and Mapping (ACSM), 1989-1992

Research

Main Innovations in Research

Launched the LODUM (Linked Data University of Münster) initiative, to open up research data and link them spatially, temporally, and thematically.

Started the spatial@www symposium series, inspired by spatial@ucsb, to connect researchers at the university to spatial analysis.

Established and implemented the notion of Semantic Reference Systems for geospatial information.

Created MUSIL, the Münster Semantic Interoperability Laboratory, with lively research and publication activities.

Co-founded (with Michael Gould and Max Craglia) the Vespucci Initiative for Advancing Geographic Information in Science (http://www.vespucci.org/).

Research Grants Acquired in Past 10 Years

The amounts refer to any part of project funding if not otherwise indicated. Teaching and service grants are listed separately below.

Spatial Discovery Fund, Jack and Laura Dangermond, with the UCSB Library, 2015, 250k€ total.


LIFE, Linked Data For E-Science Services, German Science Foundation (DFG), with the WWU Library, 2013-2015, 182k€

Exploratory Workshop on Conceptualizing European Landscapes across Language, Cultures and Disciplines, European Science Foundation, with Nicolas Burenhult and David Mark, May 2012, 4k€

LODUM, Linked Data University of Münster, Start-up Funding from the rectorate of WWU, 2011, 45k€

ENVISION, ENVironmental Services Infrastructure with ONtologies, European Commission IST program, FP7-240170, 8 partners, January 2010 to February 2013, 680k€

IRTG SIGI, International Research Training Group on Semantic Integration of Geospatial Information, with the Universities of Bremen and Buffalo, 12 doctoral and 2 post-doctoral researchers, 2008-2013, 820k€

German Science Foundation (DFG): Semantic Reference Systems (SeRe$^2$), started in September 2008, 95 k€

European Commission, eContentPlus program (Grant ECP-2006-GEO-3 1001 1): GIS4EU: Provision of interoperable datasets for INSPIRE, with 21 partners in Europe, November 2007-October 2009, 120 k€
British Joint Information Systems Committee (JISC) e-Infrastructure Program: COMPASS project (Coastal Marine Perception Application for Scientific Scholarship), with 4 partners in Britain and Ireland, December 2007 to March 2009, 35 k€

German Ministry of Education and Science (BMBF): GDI-GRID project, with 11 partners in Germany, July 2007 to June 2010, 105 k€

European Commission, IST program: SWING project on Semantic Web services INteroperability for Geospatial decision making, with 5 partners in Europe, March 2006 to February 2009, 575 k€

German Science Foundation (DFG): SeReS project (Semantic Reference Systems), September 2004 to August 2006, 134 k€

German Ministry of Education and Science (BMBF) and German Science Foundation (DFG), Geotechnologies Program: Semantic Interoperability through Geoinformation Services; with 3 partners in Germany, October 2002 to September 2005, 226 k€

German Ministry of Education and Science (BMBF): FLUMAGIS (GIS support for river catchment management); with 6 partners in Germany, March 2003 to February 2005, 286 k€

European Commission, IST program: ACE-GIS project on service chaining, with 5 partners in Europe, September 2002 to August 2004, 277 k€

European Commission, IST program: BRIDGE-IT project on access to GI, with 10 partners in Europe, April 2002 to March 2004, 540 k€

TEACHING

Main Innovations in Teaching

Re-designed two Introduction to Geographic Information Science courses around a set of ten core concepts of geographic information

Re-designed an Introduction to Geoinformatics for geoscience students into a problem-based learning course ("labs with accompanying lectures")

Established the first course on Reference Systems for Geoinformation, spanning spatial, temporal, and thematic data

Implemented a system of doctoral studies at the University of Münster where doctoral students acquire their own research grants

Organized and taught major parts of the 1st and 3rd International Summer Schools in Geoinformatics

Established a successful program of guest lecturers at Münster, teaching courses to local and visiting students

Started course evaluation at the University of Münster

Courses Taught

Introduction to Geographic Information Systems and Science (2014 to present)

Spatial-Temporal Information in Society (2012)

Introduction to Geographic Information Science (2007 to present)

Schema Mapping in INSPIRE (2007/08)

Introduction to Geoinformatics for geoscience students (2007)

Reference Systems for Geoinformation (2003-2013)


Software Engineering in Geoinformatics (1994-1997)
The Role of Ontologies in GIS (1999)
GIS Project Seminar (2001-2002)
Multimedia GIS (1997)
GIS for Citizens (1997)
Geoinformation Sources (1996-1999)
Spatialization for User Interfaces (1996)
Temporal Data in GIS (1995)
Adjustment Computations and Parameter Estimation (1984-1985)
Physical and Mathematical Geodesy (1984-1985)
Field Surveying (1982, 1984)
Physics for Chemistry Professionals (1979-1980)
Post-graduate courses on GIS for practitioners (1992-2003)

Teaching-Related Grants Acquired in Past 10 Years

The amount refers to any part of the overall project funding if not otherwise indicated.
European Commission, ERASMUS Mundus Program: International Masters Program in Geospatial Technologies, with Universitat Jaume I (Castellon, Spain) and Universidade Nova de Lisboa, September 2012 to March 2018, total funding (for all three universities) ~3000 k€
European Commission, ERASMUS Mundus Program: International Masters Program in Geospatial Technologies, with Universitat Jaume I (Castellon, Spain) and Universidade Nova de Lisboa, February 2007 to March 2013, total funding (for all three universities) ~3800 k€
European Commission, eLearning Program, EAC/23/05 DE 01: Reuse and sharing of e-learning courses in eduGLI, with 6 partners in Europe, February 2006 to July 2007, 32 k€
European Commission, LEONARDO Program: GI indeed, e-Learning modules for professional GI education, with AGILE, October 2005 to September 2007, 8 k€
NRW Ministry of Science and Education, University of Münster, IKLEL, e-Learning modules for university courses, October 2005 to December 2005, 5 k€
European Commission, ALFA Program: eduGLI II Network for GI Science Education in Latin-America, with 6 partners in Europe and Latin America, December 2004 to November 2007, 30 k€
European Commission, ALFA Program: eduGLI I Network for GI Science Education in Latin-America, with 5 partners in Europe and Latin America, July 2003 to June 2004, 19 k€

German Academic Exchange Service (DAAD), ISAP Program: Exchange program with the University of Utah for students and faculty, August 2002 - May 2003, 16 k€

Habilitationen
Dr. Tomi Kauppinen, University of Münster, 2015
Dr. Martin Raubal, University of Münster, 2006
Dr. Hardy Pauth, University of Münster, 2003
Post-Doctoral Students

Dr. Antonio Mediano, April 2015 to present
Dr. Andrea Ballatore, February 2014 to present
Dr. Aurel Degruber, September 2014 to April 2015
Dr. Simon Scheider, August 2012 to 2014
Dr. Carsten Kreßler, July 2010 to 2013
Dr. Tomi Kauppinen, February 2010 to October 2012
Dr. Krzysztof Janowicz, July 2008 to December 2009
Dr. Florian Probst, October 2007 to March 2008
Dr. Martin Raubal, April 2002 to October 2005
Dr. Yves Bichler, April 1999 to December 2000
Dr. Hardy Paudel, September 1996 to March 2002.

Completed Ph.D. Theses (as first advisor)

Aurel Degruber: Spatial and Temporal Resolution of Sensor Observations, September 2014
Alejandro Llaves Arellano: Integration of Sensor Data by Means of an Event Abstraction Layer, November 2013
Jens Ottmann: Semantic Integration of Human and Technical Observations, January 2013
Patrick Manz: Places in the Long Tail, December 2012
Arnauzka Devanaj: Representing and Reasoning about Geographic Occurrences in the Sensor Web, April 2012
Simon Scheider: Grounding Geographic Information in Perceptual Operations, December 2011
Sven Scheide: Ontology-Driven Translation of Geospatial Data, June 2009
Krzysztof Janowicz: Computing Semantic Similarity among Geographic Feature Types Represented in Expressive Description Logics, University of Münster, July 2008
Efra Klen: Semantic Annotation of Geographic Information; University of Münster, May 2008

Floren Probst: Semantic Reference Systems for Observations and Measurements; University of Münster, October 2007
Angela Schwering: Semantic Similarity Measurement including Spatial Relations for Semantic Information Retrieval of Geo-Spatial Data; University of Münster, September 2006
Michael Lutz: Ontology-Based Discovery and Composition of Geographic Information Services; University of Münster, February 2006
Christoph Brox: Electronic Marketplaces for Geographic Information, University of Münster, October 2005
Sven Fuhmann: Facilitating Wayfinding in Geovirtual Environments; University of Münster, March 2002.

Doctoral Students Currently Supervised (as first advisor)

Behzad Vahedi: topic t.b.d.
Thomas Harvey: topic t.b.d.
Sara Lafia: topic t.b.d.
Thomas Bartoschek: A Geo-Tagging Infrastructure for Education
Member of other Ph.D. Thesis Committees (PhD completed)

Alessandro Benvenuto: From states to objects and events through stratification. University of Trento, April 2015
Cardin Deungs: From Text to Landscape. University of Zurich, September 2013
Christoph Stasz: Spatio-Temporal Aggregation in the Sensor Web. University of Münster, April 2013
Patrick Lischner: Characterising urban space from topographic databases: Cartographic pattern recognition based on semantic modeling of geographic phenomena. University of Zurich, 2011
Martin Trehlmayn: Geospatial Enablement for Enterprise Information Processing. University of Münster, 2011
Kuoppinen, Tomi: Methods for creating and using geospatio-temporal semantic web. Aalto University Helsinki, 2010
Urs-Jakob Rietzsch: Wayfinding in Scene Space - Modeling Transfers in Public Transport. University of Zurich, 2007
Rob Lemmens: Semantic Interoperability of distributed geo-services. Utrecht University, 2006
Eleftherios Pontikakis: A combined spatial and business model of navigation. Vienna University of Technology (TU Vienna), 2006
Ingo Simonis: Integration in interoperable Geo-informationssystemen. University of Münster, 2005
Chen-Chiuh Feng: Modeling Surface Hydrology Concepts. University at Buffalo, 2004
Paul Alonen-Rainio: Metadata Visualization. Helsinki University of Technology, 2004
Jean Broduer: Semantic Interoperability. Université Laval, 2003
Hartwig Hochmaier: Navigation in physical and web spaces. Vienna University of Technology (TU Vienna), 2002
Martin Raubal: A Simulation of Wayfinding Behavior at Airports. Vienna University of Technology (TU Vienna), 2001
Lars Bernard: Integration of GIS and dynamic atmospheric models. University of Münster, 2001
Harry Ultenmark: Ontology-Based Geographic Data Set Integration. University of Twente, 2001
Andreas Böhn: Sketch-based user interfaces for GIS. University of Maine, 2000
Kathleen Hornby: Modeling change in GIS. University of Maine, 2000
Kristin Stock: Semantics of Heterogeneous Spatial Databases. Queensland University of Technology, 2000
Andrea Rodríguez: Semantic similarity mappings in geoinformation. University of Maine, 1999
Lion Jäkel: Object-oriented approach to land information process reengineering. ITC Netherlands, 1999
Yaser Bishri: Semantic Interoperability for Geographic Information. ITC Netherlands, 1998
Matthias Bichler: Optimizing the collection of geodata for environmental information systems. University of Münster, 1997
Andrew Turk: GIS Interaction Modeling. Melbourne University, 1993

External Examiner on Habilitations

Dr. Dieter Drancourt: Activity Models for GIS Interaction. Habilitation, Free University of Berlin, 2002
Dr. Manfred Tscheligi: Interaktionsmodelle, Vienna University of Technology, 1995

SERVICE

Main Innovations in Service

Proposed a productivity-oriented faculty evaluation scheme for the geosciences at the University of Münster (December 2005)
Created a full time position of an innovation manager for the Institute of Geoinformatics in 2003
Created the first Junior Professor position at the University of Münster (2002) and upgraded it to tenure track (in 2007)
Designed the Spatial Data Infrastructure for North Rhine-Westphalia (GDI NRW), through its reference model; January to December 2000

Service Rendered

Appointed Member, Comité Scientifique du ERGM (French Geological Survey), since 2006
Elected Member, Council of AGILE (Association of Geographic Information Laboratories in Europe), http://www.agile-online.org, 1998-2002
Special advisor to OGC on harmonizing OGC and ISO/TC211 standardization processes, 1998
Member of the Austrian Delegation to CEN TC 287 (Geographic Information), 1992-1995
Service-Related Grants Acquired

The amounts indicate any part of the overall project funding if not stated otherwise.

Raoert modeling of vegetation analysis of animal disease spreading processes, Italian Health Ministry, June 2011 to May 2013, 3k€

State Chancellery of North-Rhine-Westphalia: Reference Model for the NRW Geospatial Data Infrastructure (GDI), January to December 2000, 192 k€

Ministry of Economic Affairs: GROBASIS NRW (Interoperability Standards for Geobase data), August 1999 to December 2000, 26 k€

European Commission: GIPSIE (GIS Interoperability Project Stimulating the Industry in Europe), with 6 partners in Europe, 1998-2000, 120 k€

Open Geospatial Consortium (OGC); GIPSIE-PLUS (Enabling European OGC Participation), 1998-2001, 144 k€

Association for Geographic Information Laboratories in Europe (AGILE): Design and Implementation of its first research agenda and newsletter, April 1996 to February 2001, 7 k€


Hessian Surveying and Mapping Agency (HLVA): ATKIS and OpenGIS, July 1997 to April 2001, 324 k€

Editorial Board Memberships

Annals of the Association of American Geographers (since 2013)

Semantic Web – Interoperability, Usability, Applicability (from its beginning in 2010)

Journal of Spatial Information Science (from its beginning in 2009)

International Journal of Spatial Data Infrastructure Research (from its beginning in 2006)


Journal of Applied Ontology (since 2007)

Spatial Cognition and Computation (since 2002)


Conference Organization

Running two Vespucci Institutes every year since 2003 (as main organizer since 2007)

Running annual specialist meetings in Santa Barbara as main organizer, since 2013

Co-organizer (with Stephan Winter and Antonino Krüger) of a workshop on Computational Models of Place, in conjunction with GI Science 2008, Park City (Utah), 23 September 2008

Co-organizer (with Krzysztof Janowicz, Angela Stentz, Martin Ramb) of a workshop on Semantic Similarity Measurements and Geospatial Applications, in conjunction with COSIT 2007, Melbourne, 19 September 2007

General Chair, Fourth International Conference on Geographic Information Science (GI Science 2006, Münster)
Co-organizer (with Martin Rauh and Peter Gardenfors) of a workshop on the Potential of Cognitive Semantics for Ontologies, in conjunction with FOIS 2004, Tonneo, 3 November 2004

General Chair, Geoinformatik-Tage Münster 2004

Program Co-Chair (with Michael Worboys), Conference on Spatial Information Theory (COSIT), Ittingen Switzerland, September 2003

Program Co-Chair (with Merno Jan Kraak), ESF / EureSCO Geo-Visualization Conference Series 2002-2004

Co-Organizer for Europe, Second International Conference of Geographic Information Science (GIScience 2002, Boulder)

Program Co-Chair (with Andrew Frank), Conference on Spatial Information Theory (COSIT), Semmering (Austria), 1995

Co-Founder and Member, Permanent Steering Committee of COSIT (Conferences on Spatial Information Theory, 1992 to present)

Regular Reviewing

German Science Foundation (Deutsche Forschungsgemeinschaft, DFG)
Swiss National Science Foundation (SNF)
Canadian Research Council
Conference on Spatial Information Theory (COSIT)
International Conferences on Geographic Information Science (GIScience)
Some Conferences of the Association of Geographic Information Laboratories in Europe (AGILE)
European Commission Conferences on Geographic Information (EC-GI)
GeoInfo Conferences Brazil
Conferences on Formal Ontology for Information Systems (FOIS)
International Journal of Geographic Information Science (IJGIS)
Geoinformatica Journal
Transactions on Geographic Information Systems
Spatial Cognition and Computation
International Journal of Geographical Systems
International Semantic Web Journal
External reviewer of tenure and promotion cases at universities in Germany, Austria, Switzerland, USA, Canada, Australia
Book reviews for MIT Press and Wiley

University Committees

Member, Council on Research and Instructional Resources, UCSB (2015-16)
Member, Advising Committee on University Planning and Structure, University of Münster (2010-2013)
Member, Committee for Evaluation, Planning, and Structure, Faculty of Geosciences, University of Münster (2010-2013)
Member, Committee for Information Processing (IV-Kommission), University of Münster (2003-2007)
Member, Faculty Assembly of Geosciences (Fachbereichsst), University of Münster (October 1996 to September 2006, April to September 2006)
Member, Committee for Teaching and Student Affairs (KLStA), University of Münster (1998-2002)
Member, Committee for Teaching and Student Affairs (ALStA), School of Geosciences (FB14), University of Münster (1998-2002)
Chair, Committee for the development of the Geoinformatics curriculum at the University of Münster (1997-1999)
Member, working group for the development of a new curriculum in Surveying Engineering, ETH Zürich (1987-1988)
Chair, committee on the use of computers in teaching and administration, Institute of Geodesy and Photogrammetry, ETH Zürich (1985-1989)

Standards Committees
Member, Austrian Delegation to CEN/TC287, European Standardization in the field of Geographic Information (1991-1996)
Member, Austrian Standards Committee for Surveying and Geoinformation (1991-1996)
Member, INTERLIS Design Team, Switzerland (1987-1989)

Industry Board Memberships
Environ, Board of Directors, Switzerland (2001-2002)
PUBLICATIONS

MONOGRAPHS


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Kuhn, W., Bahr, Y. and Hitchcock, A., 1999. OpenGIS - What's on the bookshelf for Europe? Tutorial at Interop 99, Zürich, Switzerland

REPORTS


Frank, A. U., W. Kuhn, et al. (1997). Georfer as used at GeoInfo/TU Vienna. Vienna, Austria, Department of Geoinformation, Technical University Vienna.


**OTHER PUBLICATIONS**


APPENDIX F - Letters of support
Please note that more letters of support will be coming in shortly.

A. Letters from Hunter College and CUNY

Department of Computer Science

Prof. Marianna Pavlovskaya, Acting Chair
Department of Geography
Hunter College, CUNY
19 March 2015

Dear Prof. Pavlovskaya,

Thank you for sharing your proposal for a new Masters in Geoinformatics at Hunter College. This Masters would clearly be a valuable addition the college’s offerings and the Department of Computer Science supports the proposal. Two areas, in particular, are of interest to our department.

First, from the students’ perspective, is that Computer Science could provide a pipeline into the Geoinformatics Masters for our graduating majors. Given the demand for technical skills in this area, and the high salaries of those with these skills, the program would be a very attractive post graduate option to many of our students.

In addition, some of our faculty, including myself, have expressed interest in working with and co-advising graduate students in the program. This could lead to a variety of interdisciplinary collaborative research projects between Geography and Computer Science. Down the road, in the event that we re-activate our own Masters Program, there would be many opportunities for cross-listed courses.

The proposed curriculum makes it clear that these opportunities – both for our faculty and for our students – will come to fruition.

Yours sincerely,

William Gregory Sakas, Chair

Hunter College of the City University of New York
March 2, 2015

Marianna Pavlovskaia  
Chair  
Department of Geography 
School of Arts and Sciences  
Hunter College, City University of New York 
695 Park Avenue, 
New York, NY 10065 

Dear Professor Pavlovskaia: 

Thank you for the opportunity to review the Geography's department's proposal to create a new degree program in Geoinformatics, leading to a Master of Science degree in Geoinformatics (MGEoI). After reviewing the proposal and discussing the issues with several faculty members in our department, I am happy to write in support of your efforts.

Geographic Information Science is a rapidly growing field with potential for strong job growth in specific industry sectors such as homeland security. The proposed MGEoI program appears unique within CUNY and in the New York region because it proposes the creation of a curriculum that links Computer Science, GIS, and Geography. The graduates from the proposed program will have strong computational and spatial analysis skills and are likely to be in high demand from both private and public sector employers in high-level technical positions.

Even as we strengthen our own departmental offerings in the GIS applications arena, we expect to advise and direct technically inclined students in our undergraduate and graduate programs to take advantage of the new course offerings in the Geography department so that they can deepen their understanding of the theoretical foundations of GIScience and learn how to program/code within a GIS environment. At the same time, we hope that some students from the MGEoI program will cross over to explore our courses on Participatory GIS and Urban Visualization.

We anticipate that a bigger draw for the proposed MGEoI program is likely to be students from other CUNY colleges who can now benefit by being able to access specialized GIS courses not available on their home campuses. Further, the new degree program is likely to be an excellent recruiting tool for talented students from around the country and the world.

We wish you success as you move this proposal forward through the various approval stages at Hunter College and CUNY.

Sincerely,

Joseph P. Viteritti  
Thomas Hunter Professor of Public Policy 
Chair, Urban Affairs and Planning Department
February 25, 2015

Marianna Pavlovskaya, Ph.D.
Professor and Interim Chair
Department of Geography
Hunter College

Dear Professor Pavlovskaya,

Thank you for the opportunity to review the proposed Master’s of Science in Geoinformatics program. I agree that this program would enable Hunter students to pursue careers in a burgeoning new area. I foresee potential career paths in academia, government and private businesses.

The program is likely to be of particular interest to Economics majors, because technical and analytical skills in big data and geospatial science are a natural complement to the skills they garner from their econ work. Many economics problems and research areas have a geo-spatial component and/or require work with big data. Geoscience quantitative skills are a useful extension of the skills econ majors pick up in the econometrics sequence. Acquiring this additional skill set will certainly enhance their careers and salary prospects.

I strongly recommend approval of this new program. Please let me know if I can be of further assistance.

Sincerely,

[Signature]
March 4, 2015

Prof. Marianna Pavlovskaya  
Professor and Interim Chair  
Department of Geography, Hunter College - CUNY

Dear Professor Pavlovskaya,

Thank you very much for contacting the CUNY Institute for Computer Simulation, Stochastic Modeling and Optimization (CoSSMO). We appreciate very much discussing with you the proposal for a new degree at Hunter College, namely that of the Master of Science in Geoinformatics, MGEOi. In addition to our role within CUNY, our Executive Director is a Professor at the Department of Computer Science at Hunter College, where our lab is also located, conveniently close to your Department.

Undoubtedly our modern society relies heavily on personal computing devices that make use of geographical information, and it is happening at an accelerated rate that we could have not foreseen decades ago. While job openings and career opportunities in the area are increasing, professionals are expected to have analytical knowledge and technical expertise beyond what current GIS programs provide. The requiredprofile integrates Geography with Informatics, which is the relatively new field of Geoinformatics.

Your proposed curriculum meets the needs of such a degree and addresses training on those specific areas in quantitative analysis and programming that will provide the graduates with the much needed profile. You have built some flexibility within your electives with the possibility of taking courses outside your Department, which we strongly support.

In addition to a background in Geography, learning specific technical skills in data management, data analytics and web site management will provide our graduates the required profile to place themselves at the forefront of the job queue. Your Department is particularly well suited to address this need, having just hired two new Professors with Computer Science background. In addition, because of the healthy relationship between the Departments of Geography and Computer Science (conveniently located on the same floor) students will benefit from collaborations and joint projects. As well, Faculty members in other Departments (notably CS, but
B. Letters from the New York City Metropolitan area

CartoDB – Industry

February 27, 2015

Marianna Pavlovskaya
Department of Geography,
Hunter College - City University of New York
695 Park Ave
New York, NY 10065

Dear Marianna –

My name is Andrew Hill PhD, and I’m the Chief Science Officer at CartoDB. I am writing a strong letter of support to endorse a proposed Master’s of Science in GeoInformatics program at Hunter College of the City University of New York (CUNY).

CartoDB is an open source tool that allows for the storage and visualization of geospatial data on the web. It was built to make it easier for people to tell stories with their data by providing them with flexible and intuitive ways to create maps and design geospatial applications. We employ over 50 people and have recently opened an office with 10 employees in Williamsburg, Brooklyn. In addition, we host a number of interns from local universities in and around New York City.

CartoDB maintains a network of over 60 partner organizations that are developing unique geospatial applications on top CartoDB’s platform. My company, and our partners, all share a similar need: spatially competent and computer programming-literate salespersons, sales engineers, and software developers.

Hunter College and the City University of New York are known for world-class faculty and bringing top-notch educational opportunities to New York residents and global citizens alike. I’m also aware of Hunter’s highly esteemed Professional Certificate in Geographic Information Systems, as one of my colleagues has completed most of that program. The proposed Master’s of Science in GeoInformatics program builds upon a strong foundation and I’m confident its graduates will find meaningful professional opportunities to utilize their geospatial knowledge, as there is increased attention on spatial analytics, location based services, and mobile data across many verticals.

Please do not hesitate to contact me should you have any questions or wish to discuss further.

Sincerely,

[Signature]

Andrew Hill, PhD
Chief Science Officer, CartoDB
andrew@cartodb.com
March 11, 2015

Dear Marianna Pavlovskaya, Ph.D.:

I am very interested in the development of a Geoinformatics program at Hunter College. We are definitely experiencing a need for interns with both experience with Geographic Information Systems (GIS) and Informatics.

The NYC Dept. of Education’s Office of School Support Services (OSSS) is responsible for the administration of all school lunches, all school busing and the high school athletic teams in New York City. I manage the GIS team within OSSS and work particularly closely with the Office of Pupil Transportation (OPT). In the past four years, we’ve hosted nine interns from the Hunter College Geography program. These interns performed a critical role in managing and updating the spatial data that determines which NYC students are eligible for free transportation to school. They also make ad-hoc maps and contribute spatial analysis to reports. My current staff is comprised of two graduates of the Hunter Geography M.A. program who began their work at OSSS as interns. All of the candidates from Hunter come to us with strong GIS skills, creative approaches to technical challenges and geographic perspectives to problem solving. As OSSS develops into a more data-driven enterprise, the need for people with more varied experience in modeling, programming, visualization and spatial statistics is increasing.

There are two technology trends that are disrupting the applicability of pure GIS skills in our work environment. The first is the expansion of easy-to-configure web mapping capabilities, like ArcGIS Online, is limiting the need for the kinds of detailed cartographic work required to produce maps on paper. Nowadays, it takes less time to produce a dynamic, interactive web map and a single person can make more maps in a day. This means there is less map-making work for an GIS professionals to do. The second is the expansion of Business Intelligence (BI) software that includes
map visualizations along with a host of other analytical capabilities, including modeling, statistics and Big Data analytics. Offices like ours are beginning to use these BI platforms to diagnose problems quickly and optimize solutions more quickly. Most of these BI applications have a similar architecture as GIS applications. Coupled with the fact that data visualization is at the core of creating maps, experience with GIS and Informatics fits the BI skillset very well.

At one time, a GIS professional was a jack-of-all-trades because the role involved synthesizing data from various sources into something that could be understood through spatial referencing and data visualization. Nowadays, spatial data is abundant and new visualization techniques. GIS professionals are at risk of becoming too specialized. In my office, our pure GIS work is seasonal and tied to specific projects; the Informatics/Data Analytics work is a program that undergoes constant development and is a core part of many projects. I foresee many more internship and job opportunities for persons with Geoinformatics skills than ever before. GIS is just one tool in an analyst’s toolbox, but it needs to be augmented with a variety of analytical skills. In the NYC Department of Education, we are witnessing the creation of many small analytics teams embedded within many offices, including SchoolFood, Pupil Transportation, Enrollment (which has an especially robust analytics unit), Policy Research and Finance. Developing a curriculum emphasizing informatics and GIS will surely produce graduates with the skills in demand today.

Sincerely,

Timothy Calabrese
NYGeoCATS and Gismo – GIS community

To: Marianna Pavlovskaya, Chair, Hunter College Department of Geography

From: Alan Leidner, Associate, Booz Allen Hamilton
       Board of Directors, NYC GISMO
       Chair, Regional Committee and Former President, NYS GIS Association
       Co-Founder and Co-Director, NY Geospatial Catalysts, a Fund For The City of New York Partner

Date: March 10, 2015

Thank you for the opportunity to comment on your proposed Geoinformatics Program.

Geospatial Information systems (GIS) have experienced significant growth at all levels of government and the private sector over the past twenty-five years that I have been involved with them. This is especially true in New York City where over $100 million has been spent building a City geo-data infrastructure and developing geo-enabled applications for almost every City agency. Perhaps the critical importance of geospatial systems can best be exemplified by the GIS response to the 9/11 attack on the World Trade Center. Following that disaster, the Emergency Mapping and Data Center (EMDC), which I directed, became the information assembly, analysis, visualization and dissemination hub for the entire response community. Emergency response without GIS has now become unthinkable.

It should also be pointed out that in the development of NYC’s enterprise GIS and in the responses to both 9/11 and to the spread of West Nile Virus, Hunter professors and staff have played leadership roles; and many Hunter graduates now serve in City agencies.

But as much as GIS has progressed over the past three decades, the future is both more challenging and holds even greater promise. We are seeing an explosion in information availability due to the continuing computer revolution, open data policies, the proliferation of smaller, better sensors; and the widespread adoption of social media applications and mobile technologies such as smart phones that operate through “cloud” environments. An awareness of the potential value of all this data has grown over the past few years and has spawned the field of “big data analytics (BDA)”. Everyone is looking for ways to analyze all this data in ways that creates the intelligence that improves decision making and increases the effectiveness of business and government operations.

However, all too often, when big data analytics is called upon to address a problem, it does not include the enormous power of geospatial data integration, visualization and analysis; even though the problem almost always involves multiple location issues. This is like playing tennis without a backhand: Huge areas of potential value are missed by not leveraging the spatial component. Part of the reason GIS has not been fully employed in big data analytics is a lack of awareness by conventional IT practitioners.
Another is the shortage of trained professional staff who can bring together standard data analytics with geospatial analytics.

The Hunter Geography Department is to be commended for identifying this gap and through their Masters in Science Geoinformatics Program, seeking to remedy it. Program curriculum is being designed to give students broad exposure to courses that integrate GIS with computational science within a framework of practical applications in areas such as public safety, health and transportation. The graduates of this program, which is unique within the NYC Metro Region, will be able to add enormous spatial queries, models and visualizations to information products that are now composed chiefly of columns, rows and pie charts. This will create a new paradigm for the most advanced and effective types of analysis.

From my perch at Booz Allen Hamilton I see the growing demand for data analytics in the private sector and in Federal agencies. From my roles with NYC GISMO and the NYS GIS Association I also see demand growing in State and Local government. I believe Hunter’s Geoinformatics Program will produce graduates who command premium salaries and are capable bringing the spatial dimension to current practice. I also think that the Hunter program will be a major step forward in confirming Hunter College’s position as a top GIS education center in the US.
C. Letters from outside the New York City Metropolitan area

Penn State Online Geospatial Education

February 27, 2015

Marina Pavlovskaia
Professor and Interim Chair, Department of Geography
Hunter College – CUNY
695 Park Avenue
New York, NY 10021

Professor Pavlovskaia,

It was my pleasure to receive your proposal for a new program in Geoinformatics at Hunter College. The proposed Master of Science in Geoinformatics (NGEO) features a forward-looking curriculum that builds on the core areas we see strong demand from students today in GIScience programs at Penn State. As Director of Penn State’s Online Geospatial Education programs, I oversee our Master of Geographic Information Systems program and several Certificate programs which are designed to meet the needs of current and aspiring geospatial professionals through distance education. We have been fortunate to see significant ongoing demand for these programs, and we currently serve over a thousand adult learners annually. I note that in particular we see strong growth among our analytical, software development, and emerging technology topics. Classes such as your proposed Computer Programming for Geographic Applications and Lidar Remote Sensing represent examples of these increasingly relevant topics.

Our programs differ from one another in their audience focus, with the proposed program focusing on recruiting students from the New York City area for an on-campus learning experience. I also see particular strength in your proposed program in the presence of multiple required courses on analytical methods and computation, which represents further differentiation from our program’s required core material. It is my belief that you will meet your enrollment goals and more importantly, that you will develop highly-desirable graduates for research and applied career paths that are in high demand. As you have noted in your proposal, the U.S. Department of Labor projects a significant gap over the next decade between the demand for graduates with geoinformatics skills and the anticipated supply of qualified candidates.

I am particularly excited to see the development of new programs such as yours which speak directly to the evolution of GIScience and its applied practice. There are a range of new entrants in this area at the moment, but few are from institutions with an established GIScience reputation such as yours, and fewer still have proposed an innovative mixture of analytical and computational offerings that will meet the future needs of our field.

Sincerely,

Anthony C. Robinson, Ph.D.
Assistant Professor, Department of Geography
Director of Online Geospatial Education, John A. Dutton e-Education Institute
Assistant Director, GeoVISTA Center

Penn State Online Geospatial Education

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