ILLINOIS

Proposal to the Senate Educational Policy Committee

PROPOSAL TITLE: Add Geography & Geographic Information Science (GIS) to the list of units participating in the BSLAS in Computer Science and an LAS Discipline (CS + X)

SPONSOR: Julie Cidell, Associate Professor and Director of Undergraduate Studies, Department of Geography and Geographic Information Science, jcidell@illinois.edu, 244-4665

COLLEGE CONTACT: Kelly Ritter, Associate Dean for Curricula and Academic Policy, College of Liberal Arts and Sciences, ritterk@illinois.edu, 333-1350

BRIEF DESCRIPTION: The BSLAS in Computer Science and an LAS Discipline was established in 2013 with four LAS units participating: Anthropology, Astronomy, Chemistry, and Linguistics. The major was designed to enable other LAS units to participate if they wished, upon collaboration with Computer Science and approval by the College of LAS. This proposal seeks to add Geography & Geographic Information Science to the CS+X suite of programs.

JUSTIFICATION:
For decades, geographers have addressed diverse geographic and social issues through a range of computational and visualization methods, including agent-based models, evolutionary algorithms, neural networks, geosimulation, and 3D geovisualization. In recent years, the widespread use of location-aware devices (GPS-equipped smartphones) and geospatial technologies (e.g., nighttime images) has led to the generation of massive amounts of data. These data often contain high-resolution and continuous space-time information about a wide variety of phenomena of interest to geographers and social and environmental scientists (e.g., GPS tracks of moving objects). Because these data are generated with tremendous volume, velocity and variety (big data), advanced computational methods such as spatiotemporal data mining and trajectory analysis are often needed to process and analyze them. With the emergence of big data, the development and application of computational algorithms or methods in geography has become increasingly important in the discipline of geography.

According to the U.S. Department of Labor, geospatial technology is a high growth industry: over the next ten years, cartography is projected to grow by 29%, compared to an average of 7% for all occupations. Recent employers of GGIS graduates include Boeing, Orbitz, Google, ESRI, the National Center for Geospatial Intelligence and Analysis, and the U.S. State Department; however, many other firms and organizations are beginning to use spatial data in areas such as business location, marketing, logistics, environmental impact assessment, and spatial analysis. Graduates can work as programmers, analysts, and researchers in roles varying from developing geographic information software and analytic techniques to solving spatial problems related to healthcare, transportation, national security, environmental degradation, natural hazards, and more.

Course Requirements
The CS + GGIS major follows the outline of coursework established in 2012 and revised in 2016 – 32-33 hours of CS courses, 9-10 hours in Math, a minimum of 24 hours in an LAS Discipline (this proposal requires 24 hours in Geography and GIS). In addition, IBHE requires that all new undergraduate degrees require 40 credit hours in upper division courses. Upper division courses have been described as 300- and 400-level coursework and some 200-level courses in which multiple prerequisites are required. The CS + GGIS major itself requires 31 hours of upper division courses. Students pursing this degree will also take many additional upper level courses, such as those fulfilling the campus Advanced Composition requirement and electives in CS and Geography and GIS at the 300 and 400-level.

BUDGETARY AND STAFF IMPLICATIONS:

1) Resources
    a) How does the unit intend to financially support this proposal?
We will support this proposal with our existing resources, as the two departments involved have agreed that there will be no more than 10 students admitted to the degree program (see below).
    b) How will the unit create capacity or surplus to appropriately resource this program? If applicable, what functions or programs will the unit no longer support to create capacity?
Our existing courses have sufficient capacity to handle ten additional students.
    c) Will the unit need to seek campus or other external resources?
No.

2) Resource Implications
    a) Please address the impact on faculty resources including the changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc.
Our existing courses have sufficient capacity to handle ten additional students.
    b) Please address the impact on course enrollment in other units and provide an explanation of discussions with representatives of those units.
CS has limited the number of students entering the program in order to fit within their existing capacity.
    c) Please address the impact on the University Library.
None.
    d) Please address the impact on technology and space (e.g. computer use, laboratory use, equipment, etc.)
The renovated Natural History Building includes new lab space for both physical geography and GIS courses. There is also a computer lab for majors to use in completing homework assignments or working on projects.

LOGISTICS

Proposed Selection of Students

Freshman Applications .

When the CS+GIS curriculum is available for Freshman applications, students interested in the major should select CS+GIS as their first choice, and list Geography & GIS as their second major choice. Thus, if they are not selected for CS+GIS, they may be considered for the Geography & GIS major and work towards a transfer into the major.

ICT/IDT
Initially, we will only accept a limited number of current UIUC students (ICT/Transfer into CS+GGIS) and reevaluate in future semesters. In order to be eligible, students must meet the following declaration criteria, which are consistent with current CS+X transfer requirements

- At least two CS courses on this campus, excluding CS 125, with a B+ or higher in each course.
- Two approved courses in Geography & GIS with grades of B or higher.
- Overall 3.5 GPA or higher (both UIUC and Combined)
- *Students meeting these requirements will request CS+GGIS in the LAS College Office during the declaration periods. A decision to transfer must be approved by the CS and GGIS academic offices, and such decisions will be made taking into account the capacity of the program.*
- *Students falling beneath these requirements may petition the CS Department.*

Academic Advising
Students would work closely with both the CS and GGIS Advisors, and the Advisors will coordinate across the two departments. The Director for Undergraduate Studies in GGIS will advise students on GGIS courses, and they will oversee and manage overall enrollments in consultation with LAS and the CS Department.

DESIRED EFFECTIVE DATE: Fall 2018

CLEARANCES:

Signatures:

_____   __September 20, 2017_____

Unit Representative: Date:

_____   _____
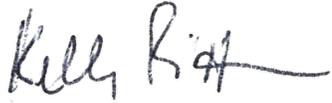
College Representative: Date:

12-14-17

Statement for Academic Catalog

Computer Science and Liberal Arts and Sciences Discipline
The LAS major in Computer Science and an LAS Discipline is a flexible program for students who plan to pursue technical or professional careers in arts and sciences areas requiring a sound grounding in computer science. This major allows students to combine study of computer science with training in a field in Liberal Arts and Sciences to offer students novel perspectives in interdisciplinary work. Students can use the supporting coursework to prepare for employment immediately upon graduation or for pursuing graduate study in a wide variety of fields or to complete a significant body of courses in a single area, such as a double major or minor.

Students are strongly encouraged to get involved in undergraduate research through independent studies and funded research experiences, with the goal of learning from the University of Illinois CS and LAS internationally recognized scholars outside the classroom and participating in the exciting quest for new contributions to the field.

Students interested in Mathematics or Statistics should enroll in the Math/CS or Stat/CS degree.

Current approved curricula include:

Computer Science and Anthropology

Today, anthropologists use computational tools and algorithms to analyze large amounts of data either gathered from a field site or by studying on-line social communities and social networks. Students majoring in CS + Anthropology will have knowledge of how people live and communicate as social beings, which can inform best designs and user interfaces for software.

Computer Science and Astronomy

Astronomy is a computation-intensive discipline. Computational challenges in astronomy, including radio astronomical data processing, analysis of large optical image data sets, and dynamical and statistical simulation of astronomical systems, test the limits of currently available hardware and software and have led to significant advances in computational science. This major will offer computationally focused students with a grounding in astronomy for them to understand astronomically motivated computational challenges such as mysteries of the origins of life and our universe.

Computer Science and Chemistry

Students majoring in Computer Science and Chemistry are prepared for a variety of careers, including helping manufacturers design more productive and efficient processes, helping pharmaceutical firms characterize new compounds for drug discovery, and conducting research that requires studying the fundamental properties of atoms, molecules, and chemical reactions. Computer Science and Chemistry majors might develop computer models or simulate chemical and biochemical processes, perform statistical analysis of large data sets, or create visualizations of reaction pathways, molecular interactions, or other phenomena.

Computer Science and Economics

The Computer Science and Economics program provides students with enhanced quantitative analysis and programming skills. Students learn a variety of economic analytical skills, both theoretical and empirical, and computational skills. These are an asset for students interested in nearly all fields of economics, including the three of the core fields (microeconomics, macroeconomics, and econometrics), but also the applied fields of industrial organization, public economics, labor economics, development economics, international economics, and financial economics.

There is an increasing need for more sophisticated skills to examine large administrative datasets ("Big Data"), thus combining the computer science and economics curriculums will produce students who are able to write their own code and develop their own software for analyzing these data sets. Possible job opportunities for graduates include area such as banking, finance, insurance, policy centers, government agencies and non-profit organizations. The degree will also prepare students for various graduate programs, including areas of economics, finance, policy, and financial engineering.

Computer Science and Geographic Information Science

The widespread use of location-aware devices (GPS-equipped smartphones) and geospatial technologies (e.g., remote sensing) has led to the generation of massive amounts of place-based data. These data often contain high-resolution and continuous space-time information about a wide variety of phenomena of interest to geographers (e.g., the spatial patterns of people moving through a city). The development and application of computational algorithms or methods in geography has become increasingly important in understanding the physical and social processes that shape the landscape, from public health to urban sustainability to ecological modeling. Students in Computer Science and Geographic Information Science will bring together social, physical, and computer sciences to investigate spatial processes and solve geographic problems.

Computer Science and Linguistics

The Computer Science and Linguistics program brings together students and faculty interested in different aspects of the computer – natural language relationship – i.e., studying the cognitive aspects of natural languages; endowing computers with human-

like behavior and understanding of spoken and written natural language; and designing user-friendly computer programs and interfaces using natural language communication.

Students will be exposed to the tools of both disciplines — formal methods, philosophical analysis, computer programming, and empirical research — with the aim of acquiring the appropriate skills required by the field. Graduates will be successful in landing jobs in various areas, including natural language software design and applications, teaching and research, law, medicine, and public service. The innovative aspect of the program is its focus on relating computers to language, technology, and society where the combination has potential for great impact.

Computer Science and Philosophy

The computer science and philosophy major provides students strong analytical, critical, technical, and communication skills that will prove useful for careers in academia, industry, public service, and elsewhere. Computer science and philosophy share deep historical roots. Questions about the nature of algorithms, complexity, the ability of computers to think, and computation itself are as much philosophical as they are technical. Likewise, many basic philosophical questions – what does it take to know something, when does something cause something else, what makes an action right or wrong to do – matter for practical computer science applications. As computers and machines continue to play an ever-increasing role in our daily lives, there is also a corresponding need to think clearly about the ethical implications of machine technology with respect to, e.g., questions of privacy, security, equality, and justice. Tools from both computer science and philosophy help to clarify and to answer such questions, as well as many others.

Majors tab (edits to add Geographic Information Science in Yellow)

Computer Science and Anthropology
Computer Science and Astronomy
Computer Science and Chemistry
Computer Science and Economics
Computer Science and Geographic Information Science
Computer Science and Linguistics
Computer Science and Philosophy

Computer Science and Geographic Information Science **web page**

Computer Science and Geographic Information Science

For the degree of Bachelor of Science in Liberal Arts and Sciences

Major in Sciences and Letters Curriculum

Please see the computer science advisor as well as the Geography advisor.

Computer Science email: academic@cs.illinois.edu
Geography and GIS email: ggis-advisor@illinois.edu

Minimum required major and supporting course work normally equates to 66 hours, including 32 in Computer Science and 24 in the LAS discipline.

General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

Twelve hours of 300- and 400-level courses in the major must be taken on this campus.

A Major Plan of Study Form must be completed and submitted to the LAS Student Affairs Office by the beginning of the fifth semester (60-75 hours). Please see the computer science advisor as well as the advisor in your LAS discipline.

Minimum hours required for graduation: 120 hours

Required Computer Science Courses:		
CS 100	Freshman Orientation (recommended)	0-1
CS 125	Intro to Computer Science	4
CS 126	Software Design Studio	3
CS 173	Discrete Structures	3
CS 225	Data Structures	4
CS 233	Computer Architecture	4
CS 241	System Programming	4

Choose one of the following
  STAT 200-Statistical Analysis
  STAT 212-Biostatistics
  CS 361-Probability & Statistics for Computer Science (recommended)
		3

CS 374	Algorithms & Models of Computation	4
CS 421	Progrmg Languages & Compilers	3
Mathematics (may also fulfill the General Education Quantitative Reasoning I and II requirements)		
MATH 220 or 221	Calculus I	4-5
MATH 225	Introductory Matrix Theory	2
MATH 231	Calculus II	3
Required Geographic Information Science Coursework- Minimum of 24 hours		
GEOG 371 - Spatial Analysis		4 hours
GEOG 379 - GIS I: Intro to Geographic Information Systems		4 hours
GEOG 380 - GIS II: Spatial Problem Solving		4 hours
2 additional GIS courses from the following list: GEOG 205 Business Location Decisions		6 hours (min.)

GEOG 280 Intro to Social Statistics GEOG 412 Geospatial Tech & Society GEOG 421 Earth Systems Modeling GEOG 439 Health Applications of GIS GEOG 440 Business Applications of GIS GEOG 460 Aerial Photo Analysis GEOG 468 Biological Modeling GEOG 473 Digital Cartography & Map Design GEOG 476 Applied GIS to Environ Studies GEOG 477 Introduction to Remote Sensing GEOG 478 Techniques of Remote Sensing GEOG 479 Advanced Topics in GIS GEOG 480 Principles of GIS GEOG 489 Programming for GIS	
2 human and/or physical geography courses: GEOG 204 Cities of the World GEOG 210 Social & Environmental Issues GEOG 215 Resource Conflicts GEOG 221 Geographies of Global Conflict GEOG 222 Big Rivers of the World GEOG 224 Geographical Patterns of Illinois GEOG 287 Environment and Society GEOG 310 Political Geography GEOG 350 Sustainability and the City GEOG 356 Geography of South Asia GEOG 370 Water Planet, Water Crisis GEOG 373 Spring Field Course GEOG 381 Environmental Perspectives GEOG 384 Population Geography GEOG 401 Watershed Hydrology GEOG 406 Fluvial Geomorphology GEOG 408 Humans and River Systems GEOG 410 Geography of Dev & Underdev GEOG 436 Biogeography GEOG 438 Geography of Health Care GEOG 446 Sustainable Planning Seminar GEOG 455 Geography of Sub-Saharan Africa GEOG 465 Transportation and Sustainability GEOG 466 Environmental Policy GEOG 471 Recent Trends in Geographic Thought GEOG 481 International Environmental Cooperation GEOG 482 Challenges of Sustainability GEOG 483 Urban Geography GEOG 484 Cities, Crime, and Space GEOG 493 Democracy and Environment GEOG 496 Climate and Social Vulnerability	6 hours (min.)
Total Hours	**65-67**

Appendix A: Faculty

CS Faculty with relevant interests

Jiawei Han, Professor, has been working on research into data mining, data warehousing, database systems, data mining from spatiotemporal data, multimedia data, stream and RFID data, social network data, and biological data, with over 350 journal and conference publications. He is also serving as the founding Editor-In-Chief of ACM Transactions on Knowledge Discovery from Data. He is an ACM Fellow and has received 2004 ACM SIGKDD Innovations Award and 2005 IEEE Computer Society Technical Achievement Award. His book "Data Mining: Concepts and Techniques" (2nd ed., Morgan Kaufmann, 2006) has been popularly used as a textbook worldwide.

Karrie Karahalios is an Associate Professor in Computer Science at the University of Illinois where she heads the Social Spaces Group. Her work focuses on the interaction between people and the social cues they emit and perceive in face-to-face and mediated electronic spaces. Her work is informed by communication studies and visualizations of social communities. Of particular interest to her are interfaces for pubic online and physical gathering spaces such as twitter, chatrooms, cafes, parks, etc. Research projects range from studying tie strength between people to encouraging vocalization through visualization. A major theme in her work is to create interfaces that enable users to perceive conversational patterns that are present, but not obvious, in traditional communication interfaces.

Hari Sundaram is an Associate Professor at the University of Illinois and holds a joint appointment between Computer Science and Advertising. Sundaram's current research is motivated by the challenge: how can we persuade millions of people to adopt behaviors that would be beneficial to them? Example behaviors include: leading healthy lifestyles; reducing individual energy consumption and greater civic engagement. The widespread adoption of these behaviors would lead to large scale societal benefits such as reduced healthcare costs, sustainability and a vibrant community. His research interests lie in large scale network analysis, using smartphones and designing wearable sensors for analyzing human activity, and in computational advertising.

Derek Hoiem is an associate professor Computer Science at the University of Illinois at Urbana-Champaign. His primary research goal is to model the physical and semantic structure of the world, so computers can better understand scenes from images. In particular, he develops algorithms to interpret physical space from images and to relate objects to their environment and to each other. Example applications include creating 3D models of scenes and objects from one image, photorealistic rendering of object models into images, robot navigation, and creating and matching as-built 3D models of construction scenes to planned models. Derek has published dozens of papers and several patents, and his work has been recognized with awards including an ACM Doctoral Dissertation Award honorable mention, CVPR best paper award, Intel Early Career Faculty award, Sloan Fellowship, and PAMI Significant Young Researcher award. Derek Hoiem is also co-founder and CTO of Reconstruct, which visually documents construction sites, matching images to plans and analyzing productivity and risk for delay.

John C. Hart is a Professor in the Department of Computer Science at the University of Illinois, Urbana-Champaign where he studies computer graphics, data visualization and computational topology. He is also Executive Associate Dean of the Graduate College. Prof. Hart's research on

computer graphics and related areas over the past 25 years has been supported by Adobe, AT&T, DARPA, IBM, Intel, Microsoft, Nokia, NVIDIA and the NSF.

Geography & Geographic Information Science Faculty Involvement

Shakil Bin Kashem is interested in multifaceted applications of geospatial technologies and ways to incorporate them in GIScience pedagogy. His research interests center on social vulnerability, climate change adaptation, urban growth modeling, and disaster risk management.

Mei-Po Kwan's research addresses health, social, transportation, and environmental issues in urban areas through the application of innovative GIS methods. She is interested in understanding how social differences (e.g., gender, race, ethnicity, and religion) shape urban residents' everyday experiences and perceptions/use of the built environment. Her research interests include environmental health, human mobility, access to healthcare, neighborhood effects, sustainable travel and cities, and application of GIS methods in geographic research.

Sara McLafferty is interested in how the places where we live, work and interact affect our health and well-being. Her current research uses GIS and spatial analysis to investigate place-based inequalities in health and well-being and access to health services for women, immigrants and racial/ethnic minorities in the United States. An ongoing multidisciplinary project, funded by the American Cancer Society, examines the impact of inequalities in spatial and social accessibility to health services on racial disparities in prostate and colorectal cancer outcomes in Chicago.

Bruce Rhoads' research interests range from investigations aimed at improving our basic scientific understanding of the geomorphology of rivers to studies focusing on issues of importance for river management and policy. Much of his work emphasizes field measurements of process-form interactions, but he also collaborates on laboratory experiments and numerical modeling.

Shaowen Wang is the founding director of the CyberGIS Center for Advanced Digital and Spatial Studies. His research and teaching interests include geographic information science and systems (GIS), advanced cyberinfrastructure and cyberGIS, complex environmental and geospatial problems, computational and data sciences, high performance and distributed computing, and spatial analysis and modeling.

Hi Lenny:

I was wondering if that wasn't the case, but I wanted to be sure! Thanks for confirming. Hopefully there will be no problems at all in committee, but if anything comes up we will let you and GIS know.

Looking forward to working with you as well,

Kelly

Kelly Ritter
Associate Dean for Curricula and Academic Policy
Professor of English and Writing Studies
College of Liberal Arts and Sciences
University of Illinois Urbana-Champaign
(217) 333-1350
ritterk@illinois.edu

From: Pitt, Leonard B
Sent: Wednesday, September 20, 2017 4:58 PM
To: Ritter, Kelly Allison
Subject: Re: CS + GIS proposal

Kelly - CS worked with GIS to develop this, and the CS department faculty have approved it. We fully support it.

-Lenny

p.s. I'm not sure if congrats or sympathies are in order for your new assoc. dean position, but I wish you both, and look forward to working with you.

Lenny Pitt
Professor and Associate Head
Director of Undergraduate Programs
Computer Science Department
University of Illinois
pitt@illinois.edu
217-333-7505

On Sep 20, 2017, at Sep 20,4:39 PM, Ritter, Kelly Allison <ritterk@illinois.edu> wrote:

Dear Lenny (if I may):

My name is Kelly Ritter, and I am the new Associate Dean for Curricula and Academic Policy, taking over the work of Karen Carney, who recently retired, as you know. Amy Elli is on vacation for a few days, so I'm forwarding to you a proposal for CS+GIS; I'm hoping you could send us your approval and/or any concerns you might have about the proposal before we take it to our LAS Courses and Curricula Committee on (hopefully) October 5th.

Thanks for your time!

Kelly

Kelly Ritter
Associate Dean for Curricula and Academic Policy
Professor of English and Writing Studies
College of Liberal Arts and Sciences
University of Illinois Urbana-Champaign
(217) 333-1350
ritterk@illinois.edu

From: Cidell, Julie L
Sent: Wednesday, September 20, 2017 11:29 AM
To: Ritter, Kelly Allison
Cc: Wang, Shaowen
Subject: CS + GIS proposal

Dear Kelly,

Please find attached our proposal for a new CS + degree, CS + GIS. If any additional information is needed, please let me know.

--Julie Cidell

Associate Professor and Director of Undergraduate Studies
Department of Geography & GIS
University of Illinois
2068 Natural History Building
1301 W. Green St.
Urbana, IL 61801
217-244-4665

Office of the Provost and Vice Chancellor for Academic
Affairs

Swanlund Administration Building
601 East John Street
Champaign, IL 61820

January 12, 2018

Gay Miller, Chair
Senate Committee on Educational Policy
Office of the Senate
228 English Building, MC-461

Dear Professor Miller:

Enclosed is a copy of a proposal from the College of Liberal Arts and Sciences to add
Geography and Geographic Information Systems to the list of majors available for the Bachelor
of Science in Liberal Arts and Sciences in Computer Science and a Liberal Arts and Sciences
discipline (CS + X).

Sincerely,
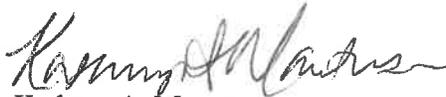
Kathryn A. Martensen
Assistant Provost

Enclosures

c: K. Ritter
     A. Elli
     A. Edwards
     E. Stuby

December 14, 2017

Kathryn Martensen
Associate Provost
Office of the Provost and Vice Chancellor for Academic Affairs
207 Swanlund Administration Building
MC-304

Dear Kathy:

The Committee on Courses and Curricula on behalf of the Faculty of the College of Liberal Arts and Sciences has voted to approve the following proposal:

Add Geography and Geographic Information Science to the BSLAS in Computer Science and an LAS Discipline

Please address all correspondence concerning this proposal to me. Per our earlier correspondence on how to add future pairings to the CS + X Degree, the BSLAS in Computer Science and Geography and GIS should be submitted as an administrative request to EPC. A copy of that correspondence it attached.

Sincerely,

Kelly Ritter
Associate Dean

enclosures
C: Professor Julie Cidell
       Professor Lenny Pitt