UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Department of Computer Science

201 North Goodwin Avenue
Urbana, IL 61801-2302 USA

The Department of Computer Science intends to deploy a specialization of its online Masters of Computer Science (MCS) degree focusing on data sciences. The MCS-DS will follow the model of the iMBA to utilize the Coursera MOOC platform for lecture delivery. The remaining course elements (assignments, exams, projects, office hours) will continue to be served by the existing MCS online infrastructure that has been in service for the past 15 years to assess completion of a credit bearing graduate course. Given the visibility of the Coursera MOOC platform and the high demand for computer science and data science education, the scalable nature of this new program delivery option will allow us to better meet market demand and enrollments will likely increase more than 25% per cohort.

Background

The Computer Science Department is consistently ranked among the top 5 CS programs in the nation. Its programs have some of the highest entrance requirements on campus, and its classes are notoriously overbooked. Its online MCS program was originally developed over 15 years ago to deliver the MCS to students in India, but is now a rather standard online masters degree and is largely unknown due to lack of attention in this highly competitive field.

The online MCS was reviewed by CEEED (the Committee on Extended Education and External Degrees) in April, 2014. The CEEED review found that the program was healthy with good levels of student satisfaction (20%/57%/23% moderately/very/extremely satisfied). One of the most common complaints was the use of classroom video capture for lecture delivery.

The CEEED review noted that the program only enrolls about 31 students each year, which is quite small given the high demand for skilled professionals in the computer sciences, and well below the CS Department's desired enrollment targets for this program. CS has hired a marketing specialist, contracted with an advertising agency for $18K/year, contributes $600/year to Engineering in support of their college-wide online degree marketing activities, and has also paid for an MBA marketing class study to develop new online MCS marketing strategies.

The CEEED review also noted the diversity challenges of the program. Over the previous three years, the program enrollment was only 4.2% female and 4.2% underrepresented minorities. At this same time, the CS campus graduate program has grown female enrollment from 15% to 20% and doubled its URM enrollment to 22 students.

In the meantime, Georgia Tech has offered a MOOC-based OMSCS (Online Masters of Science degree in Computer Science). The program immediately benefited from the press in the form of free advertising in nearly 700 articles, growing to a single cohort enrollment of 2,841 in just two years. Of its students, 13% are female, 16% URM and 79% domestic (US citizen or permanent resident). The Georgia Tech CS PhD program recruits the strongest candidates from its online Master's program to improve the diversity of its campus population.

telephone 217-333-3426 • *fax* 217-333-3501 • *email* admin@cs.uiuc.edu

A New Delivery Format for the Online MCS

We propose to offer a version of the online MCS degree that utilizes MOOC components similar to the Georgia Tech OMSCS and our campus's iMBA, and similarly benefis from the accompanying marketing and recruiting opportunities.,

Following the model of the iMBA[1], each course in this new online MCS delivery format would consist of two components. The Coursera MOOC component will consist of lecture videos with embedded quizzes, peer-evaluated assignments and learning community discussions. Students can complete the Coursera MOOC portions of these courses individually to simply learn the material, or in sequences to earn certificates in data science topics. The Department of Computer Science currently offers two such certificates, in cloud computing and in data mining.

In addition to the MOOC portion, each course taken for degree credit would also include a high-engagement component. This component provides high-engagement with faculty and teaching assistants through a learning management system (e.g. Compass). The LMS enables course staff to grade graduate-level assignments and online exams, via ProctorU, to provide verified assessment of the online graduate student's command of the credit-bearing course material. The LMS also provides enrolled students an additional forum for detailed discussion of these additional assignments and material, which can include virtual office hours organized as a kind of reddit AMA for faculty on course topics.

The courses in this new online delivery format have been organized into four week portions, based on the analysis of learning effectiveness for MOOC material. Given that existing online courses, including those of the iMBA, deliver full credit over an 8-week focused online sessions, our four-credit graduate courses are divided into two 2-credit four-week portions for delivery in this new format. The high-engagement portions of the courses will run during the academic year, with some courses also available in the summer, at a rate of four per semester (similar to the iMBA's schedule of two 8-week high engagement sessions per semester). The MOOC components of each course will run concurrently with the high engagement portions, but the MOOC components will also be available for non-credit learners throughout the year (and will attract further applications to the degree program).

The assessment of the proposed MCS will combine multiple existing and new assessment elements. The existing online MCS is LMS-based and includes assessment procedures that ensure the effective education of students. The program will also continue to be assessed periodically by the CEEED review. In addition to these existing assessments, the proposed MCS delivery format includes a MOOC portion, and Coursera provides ample, detailed assessment and feedback for all of its MOOCs.

The Data Sciences Specialization

Our initial offering of this MOOC-supported MCS degree is a specialization in the new field of data sciences. Data science has emerged as a "fourth approach to scientific discovery, in addition to experimentation, modeling and computation," as reported by U. Michigan [press release, Sep. 8, 2015] when they initiated their $100M data science program by announcing 35 new faculty positions. They are joined by Stanford, NYU, USC and others that have introduced similarly innovative master's degrees in data science, and online versions of these degrees have been designed and offered by UC Berkeley, Wisconsin and others.

In cooperation with the Statistics Department and our I-School, the Computer Science Department has approved a master's program in data sciences designed as a specialization of the online MCS program. This

[1] Full iMBA proposal available online at: *http://www.senate.illinois.edu/ep/Props/1415/FINAL/ep1542final.pdf*

MCS Data Sciences (MCS-DS) specialization satisfies all of the requirements of the MCS program while covering the key areas of data science across computer science, information science and statistics. In particular, its courses in four areas of data science satisfies the MCS's coursework requirements in four core areas of computer science.

Data Science Subject	Computer Science Core Area
Data Mining	Database, Information Systems and Bioinformatics
Data Visualization	Graphics, Visualization and Human-Computer Interaction
Applied Machine Learning	Artificial Intelligence
Cloud Computing	Systems and Networking

The proposed curriculum of courses available for the MCS-DS is attached. With it is attached the MCS program of study, and shows that the proposed MCS-DS curriculum provides sufficient coursework to satisfy the requirements of the MCS degree. Hence the MCS-DS does not represent a new program nor a new degree. Instead it is a selection of courses available in a new online delivery format.

We are well poised to launch the courses for the MCS-DS for Fall 2016. The CS department already has infrastructure, expertise and experience in developing online LMS-based courses from its existing online MCS program. MOOCs have already been developed for the data mining, data visualization and cloud computing courses for the department's certificate programs. The I-School courses are already part of their online masters degree offerings, and will require converting the lectures to MOOC format. The remaining courses will be produced on a timeline so they can be offered in the coming three semesters.

Once launched, the format can readily support the integration of additional CS courses. The MCS-DS supports only a minimum four core areas of CS. The addition of courses in other core areas will enable the delivery of an MCS without the constraint of the data sciences specialization. The MCS-DS supports a data science curriculum that includes significant computer science element, and could be broadened into a more fundamental data science masters degree program that does not require four core areas of computer science. Or the MCS-DS might not live up to its potential in which case the MOOCs could continue individually or as part of certificate sequences. The 32-hour coursework masters degree provides as flexible a platform as possible for such evolution. Students can complete the program within a single academic year, allowing the curriculum and course offerings to evolve annually, and students taking longer to complete can be transitioned to adapt to changes in course offerings and delivery formats as needed.