Notice of Intent – B.S. in Data Science
University of Wisconsin–Milwaukee
November 2018

<u>Name of the proposed program</u>: Bachelor of Science in Data Science

<u>Institutional setting</u>: Joint degree awarded by the College of Engineering and Applied Sciences (Computer Science Division of the Department of Electrical Engineering and Computer Science) and the College of Letters and Sciences (Department of Mathematical Sciences)

<u>Mode of delivery</u>: Traditional in-person courses

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Description – Learning Outcomes

The objective of the BS major degree in Data Science is to prepare students for careers in data science, data analytics or related fields. To accomplish this goal, students will gain a solid foundation in statistical methods and programming techniques via a wide range of courses available through the Department of Mathematical Sciences at the College of Letters and Science and the Computer Science Division at the College of Engineering and Applied Sciences.

Upon completion of the program, students will:

- Be able to integrate methods and concepts from mathematics, statistics and computer science to solve data science problems, including data management and extraction of meaning from data.
- Demonstrate critical thinking related to data science problems and concepts.
- Demonstrate oral and written communication skills related to data science.
- Demonstrate awareness of the ethical aspects of data science.

Contents of the Program

The coursework consists of 120 total credits for the degree. There are 24 credits of preparatory courses, 36 credits of advanced core courses, plus electives and required UWM general education courses. The preparatory curriculum includes: calculus (12 credits), linear algebra (4 credits), introductory statistics (3 credits) and introductory computer programming (6 credits). The advanced curriculum includes: methodological statistics courses on regression models, multivariate analysis and statistical computing (12 credits), statistics and probability theory (6 credits), databases, artificial intelligence and data mining (15 credits), writing, communication and ethics (6 credits). There is a mandatory capstone course or internship at the end of the coursework, which will give students the opportunity to apply their skills in a real-world setting, in addition to electives from Computer Science, Mathematics or Mathematical Statistics.

Resources

No new resources are required for this program. The proposed coursework consists of courses regularly offered by the Computer Science Department and the Department of Mathematical Sciences.

Required approvals

Accreditation by the Higher Learning Commission.

Alignment with institutional mission

The proposed program responds to the following aspects of UWM Select Mission Statement, which can be found at https://uwm.edu/mission/:

> *To fulfill its mission as a major urban doctoral university and to meet the diverse needs of Wisconsin's largest metropolitan area, the University of Wisconsin–Milwaukee must provide a wide array of degree programs [...]. Fulfilling this mission requires the pursuit of these mutually reinforcing academic goals:*
>
> - *To develop and maintain high quality undergraduate, graduate and continuing education programs appropriate to a major urban doctoral university.*
>
> - *To attract highly qualified students who demonstrate the potential for intellectual development, innovation, and leadership for their communities.*
>
> - *To further academic and professional opportunities at all levels for women, minority, part-time, and financially or educationally disadvantaged students.*
>
> - *To promote public service and research efforts directed toward meeting the social, economic and cultural needs of the state of Wisconsin and its metropolitan areas.*
>
> - *To provide educational leadership in meeting future social, cultural, and technological challenges.*

The proposed Data Science program will advance these goals by providing students with a thorough preparation to meet the challenging requirements of the profession, by attracting students with strong STEM potential, and by fostering cooperation between UWM and the business community (e.g., through the Northwestern Mutual Data Science Institute).

Need for the program

Market demand

The job outlook for mathematicians and statisticians in the Occupational Outlook Handbook of the Bureau of Labor Statistics (https://www.bls.gov/ooh/math/mathematicians-and-statisticians.htm) states that "employment of statisticians is projected to grow 34 percent from 2016 to 2026, much faster than the average for all occupations. Growth is expected to result from more widespread use of statistical analysis to make informed business, healthcare, and policy decisions. In addition, the large increase in available data from the Internet will open up new areas for analysis. (...) The amount of digitally stored

data will increase over the next decade as more people and companies conduct business online and use social media, smartphones, and other mobile devices. As a result, businesses will increasingly need mathematicians to analyze the large amount of information and data collected." The handbook is very specific about data science, stating that "job opportunities are expected to be favorable for those with very strong quantitative and data analysis skills. Computer programming skills will remain important to many employers, as will be keeping up with new statistical methods and programming languages." According to this report there were 37,200 job positions for statisticians in the US in 2016, and this number is expected to grow to 49,800 in 2026.

For the state of Wisconsin, a labor market report generated at WisConomy, the Department of Workforce Development labor database (https://jobcenterofwisconsin.com/wisconomy/), shows that the number of job positions in Computer and Mathematical Occupations in the Professional, Scientific, and Technical Services industries is expected to grow from 17,299 in the year 2016 to 20,899 in 2026 (a 20.8% increase), and in the Finance and Insurance industries is expected to grow from 10,424 to 11,703 (a 12.3% increase) in the same period.

The recent creation of the Northwestern Mutual Data Science Institute at the University of Wisconsin-Milwaukee also demonstrates the demand for data science programs in the region.

Student demand

Graduation data for the majors offered by the Department of Mathematical Sciences for the semesters between Spring 2014 and Spring 2018 show that 48 students received BA degrees in Actuarial Science, 9 BA or BS in Mathematics with concentration in Applied Mathematics, 1 BS in Mathematics with concentration in Statistics, 2 BS in Mathematics with concentration in Computational Mathematics, 8 BA or BS in Mathematics with concentration in Pure Mathematics, and 41 Mathematics majors without specified concentration until Spring 2017 and 13 since Fall 2017 (concentrations were discontinued in Fall 2017, so the last figure includes students interested in either pure or applied mathematics.) These data show that a large proportion of undergraduate students in the Department of Mathematical Sciences show interest in statistics, actuarial science and applied mathematics. We expect that a BS in Data Science will increase the visibility of our departments in this area and give UWM an opportunity to recruit students who otherwise may not have attended UWM.

Similar programs in the system and the region

There is only one major degree in Data Science offered at a UW institution, a BS in Data Science and Predictive Analytics offered by the College of Business and Economics at UW-River Falls. There is also a minor offered by the Department of Computer Science at UW-Whitewater. No other undergraduate degrees on Data Science are currently offered in the University of Wisconsin system, although the UW-Madison has recently circulated a Notice of Intent for a BS major in Data Science. However, since UWM is the urban research university in the system, it is in a unique position to collaborate with the business community via e.g. student internships.

In the region of Southeast Wisconsin, only the Department of Statistics, Mathematics and Computer Science at Marquette University offers a Data Science major. However, Marquette is a private catholic university with a very different mission and student profile than UW-Milwaukee.

This program, then, will not create unnecessary duplication.