

## UMBC UGC Program Changes & Other Request: Create Data Science track within the CMSC BS program

Date Submitted:

Proposed Effective Date: 8/2016

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### Specifics (see instructions):

We propose creating a track in *Data Science (DS)*, within the Department of *Computer Science and Electrical Engineering (CSEE)*. Students pursuing the Data Science track/certificate at UMBC will mostly be from *Computer Science (CMSC)* program, and some from the *Computer Engineering (CMPE)* program, though students from any UMBC program or department would also be eligible for the certificate, if they complete the requirements. This track will not create a new degree program nor will it change any existing degree requirements.

To be admitted into the undergraduate track program, each student must first satisfy a technical prerequisite in Computer Science (CMSC 341 Data Structures) and in Mathematics (MATH 221 Linear Algebra). Each prerequisite course must be completed with grade C or higher (as is currently required by the CMSC major). These prerequisite courses do not count toward the track. Students who lack the technical prerequisites are invited to satisfy them at UMBC, for example, as special students.

To satisfy the undergraduate track in *Data Science (DS)*, the student should satisfy each of the following four requirements. Throughout, the term “Director” refers to the Director of the Undergraduate Data Science track.

- I. *Technical Prerequisites in Computer Science.* CMSC 341 Data Structures and MATH 221 Linear Algebra, or equivalent courses at other institutions, as determined by the Director.
- II. *Core Data Science Courses.* Complete any two courses from the list of approved courses for the Data Science core. We are currently piloting a special topics course CMSC 491/691 Big Data, and we propose to make this single introductory course to Data Science as required; when this happens, a student will need to take this introductory core course and one more of the other core courses (listed in the table below).

Data Science Core courses
CMSC 436 Data Visualization
CMSC 461 Database Management Systems
CMSC 478 Introduction to Machine Learning
<i>CMSC 491 Big Data</i>

These courses are already electives for the current CMSC BS degree program requirements.

- III. *Elective Data Science Courses.* Students in the undergraduate track should complete two courses from the list of approved core and elective Data Science cores.. At this point, the list contains only courses within CSEE. Courses from other departments (e.g. Math/Stat, Sociology, Economics, ...) might also be appropriate, especially those that show how data science can be applied to physical and social sciences, as well as digital humanities. If other departments indicate interest in accepting CSEE students into these courses, the list of electives can be expanded. The list of these track elective courses is provided below.
- IV.

<b>Data Science Electives</b>
CMPE 422 Digital Signal Processing
CMPE 491 Data-Driven Signal Processing
CMSC 427 Wearable Computing
CMSC 433 Scripting Languages
CMSC 435 Computer Graphics
CMSC 442 Information and Coding Theory
CMSC 455 Numerical Computations
CMSC 471 Introduction to Artificial Intelligence
CMSC 473 Introduction to Natural Language Processing
CMSC 475 Introduction to Neural Networks
CMSC 476 Information Retrieval
CMSC 483 Parallel and Distributed Processing
CMSC 491 Computer Vision
CMSC 491 Hadoop
CMSC 491 Mobile Computing
CMSC 491 Semantic Web

- V. *Practical Hands-On Experience.* Document practical hands-on experience in Data Science, as judged by the Director. To satisfy this requirement, a student might take a course with a significant data science related project component, complete and document an internship, complete and document a practical research project as an independent study or honors thesis with a CSEE faculty member, complete a course at training centers, or document significant professional or life experience.

**Rationale (see instructions):**

Data science (also described as big data and analytics) is a significant growth area both within computing disciplines, and their applications to a variety of domains such as healthcare. There is significant industrial demand for people with this skill set. The track will add value to a student’s degree or resume, and make him or her more marketable, by documenting his or her depth and breadth of knowledge in the Data Science area. The track is of high academic quality with significant technical breadth and hands-on requirements. It is a concrete option for gaining expertise in Data Science. Given the very significant demand in the local area for students qualified in this specialty, this will be a clear win for the students and make their UMBC degree more attractive. The track program also signals to the public UMBC’s strength and opportunities in this area of specialty. Data Science provides an opportunity for collaborative and interdisciplinary research among faculty and students in computer science, computer engineering, electrical engineering, information systems, economics, mathematics and statistics, biology and chemistry, sociology, Earth Science, and astronomy.

**a) What are the major departures from the current structure and why is the new structure preferable?**

The proposed track provides guidance to students wishing to further enhance their knowledge in Data Science as the courses that they should be choose as part of their electives. Except for shaping the electives chosen by students, it does not change the requirements for the CMSC major in any way. It offers a good mix of foundations and practical hands on experience. The track signals to potential employers that a student has a broad training in technical aspects of Data Science.

**b) What provisions will be made to accommodate current students if courses are discontinued?**

Students are given two groups of courses to choose from as their track core or track elective courses. These two groups contain courses that are at the heart of the CMSC program. Each group will always have at least two courses while the CMSC program exists.

**c) If there is a change in required credits, please provide a specific justification for that change.**

There is no change in the required credits.