

School of Theoretical and Applied Science

Proposal: Graduate Certificates in Data Science

Program Summary and Objectives

The Data Science Convening Group proposes three certificate programs utilizing existing MSDS courses - (1) Data Analyst, (2) Data Modeler, and (3) Machine Learning Engineer. The Analyst certificate is geared towards students most interested in learning data/business analytics skills - the interpretation and presentation of data. The Modeler certificate provides skills in statistics and underlying methods of synthesizing raw data into actionable information. The Machine Learning Engineer certificate is for students seeking to develop the software, programming skills, and mathematical underpinnings to work with machine learning and big data.

Each certificate is a three-course sequence, with two required courses and one elective. Students completing all three will have two remaining courses to complete their MSDS - DATA 620 Ethics in Data and Computing and their MSDS Thesis (DATA 750). The certificate programs share electives, and students will be permitted to double count one course towards two credentials.

The certificate courses are regular graduate level courses, offered as part of the MSDS, MSAM, and MSCS graduate programs. There are no additional instructional costs associated with these certificates, certificate-level students will be occupying empty seats within regularly scheduled sections.

Certificate Requirements

Each graduate certificate includes two required courses and one elective. Students will be permitted to double-count **one** course towards no more than two certificates. This means the minimum number of courses taken to earn two certificates is **five**, and the minimum to earn three certificates is **eight**. Note, students completing eight courses and three certificates will need only to complete DATA 620 and DATA 750 to complete an MS in Data Science, as the other 8 requirements are spread across these certificates already.

Data Analyst

1. DATA 601 - INTRODUCTION TO DATA SCIENCE
 2. DATA 670 - DATA VISUALIZATION
 3. BADM 501 - DATA ANALYTICS
- OR
MBAD 615 - BUSINESS ANALYTICS

Data Modeler

1. MATH 570 - APPLIED STATISTICS
 2. MATH 680 - ADVANCED MATHEMATICAL MODELING
 3. CMPS 620 - MACHINE LEARNING
- OR
MATH 562 - APPLIED LINEAR ALGEBRA
- OR
DATA 670 - DATA VISUALIZATION
- OR
DATA 687 - TIME SERIES DATA

Machine Learning Engineer

1. CMPS 530 - PYTHON FOR DATA SCIENCE
 2. CMPS 620 - MACHINE LEARNING
 3. CMPS 664 - ADVANCED DATABASE AND BIG DATA SYSTEMS
- OR
MATH 562 - APPLIED LINEAR ALGEBRA
- OR
DATA 670 - DATA VISUALIZATION
- OR
DATA 687 - TIME SERIES DATA

Program's Impact on Other College Programs

Programs directly impacted include MS Data Science, MS Computer Science, MS Applied Mathematics, and ASB's MBA program. The impact to these programs is limited to certificate students requesting to enroll in a subset of the programs' sections, when seats are available. Program Directors of each graduate program welcome this opportunity to fill additional seats. The curriculum (and expected student preparation) in these courses remains unchanged.

Program's Need

Graduate Certificates create opportunities for working professionals to pursue a credential in Data Science with lower commitment. As evidenced by feedback from our own MSDS students, there is demand among Data Science *practitioners* in industry for a credential - as many employees working in Data-oriented roles are self-taught, and lack the formal training to advance their careers in the field. A certificate requiring three courses can be obtained in one calendar year, while continuing their demanding work schedules. Our certification programs also offer choice - allowing students to select the set of courses that most closely align with the specific area of data science they are interested in. The job market for data science roles is extremely strong.

The certificate programs create opportunities for professionals to diversify their skills - augmenting degrees in business, life science, and computer science. It also creates a clear pathway to obtaining an MS degree, while providing *achievement milestones* along the way.

Alignment with College's Strategic Plan

Boldly Ascending Strategic Plan Goal 1: Academic Excellence and Student Success; Objective a.: Provide learning environments and opportunities that encourage the development of deep content knowledge that leads to discerning engagement in work and the world.

Similar Programs in New Jersey

While there are no other programs in the State that completely fit the design of this certificate, there are many graduate certificate programs at competitor institutions in the Data Science, Computer Science, and similar technical fields. The MSDS Graduate Certificate offers a unique enough curriculum and opportunity profile to be distinctive, however is in line with what the market has already shown a demand for.

- **Fairleigh Dickenson:** Graduate Certifications - 18 Credits (Computer Science, Information Security, Data Management)
 - <https://www.fdu.edu/program/graduate-certificate-advanced-computer-programming/>
 - <https://www.fdu.edu/program/graduate-certificate-computer-security-and-forensic-administration/>
 - <https://www.fdu.edu/program/graduate-certificate-database-administration/>
- **Montclair State University:** Graduate Certificate - 12-credit (Data Management)
 - <https://www.montclair.edu/graduate/programs-of-study/data-collection-and-management-certificate/>
- **NJIT:** Graduate Certificate - 12 Credit (Information Security)
 - <http://www5.njit.edu/graduatestudies/degree-programs/graduatecertificates/information-security-cert/>
- **Stevens Institute of Technology:** Graduate Certificate - 15 Credits (Data Exploration and Visualization)
 - <https://www.stevens.edu/school-systems-enterprises/graduate-certificates/data-exploration-and-visualization>
 - *Note Stevens offers 4 different graduate certificates in related fields with similar structure.*

Anticipated Enrollment

No new sections are being offered as a result of the proposed certificates, and thus no new instructional costs to be offset by enrollment tuition. We anticipate 5-10 students enrolling across all three certificates during the first few years, with each individual student being a net positive for the College from a tuition standpoint.

Additional Resources Needed

The certificate programs come with no additional resource needs. Each certificate makes use of courses that are already offered on a regular basis at Ramapo College, and which generally have ample seats available. We anticipate the ability to serve at least 10 additional students each semester across the courses included in the certificate programs without adding new sections.

In the unlikely event that additional sections of courses become necessary to meet demand, these sections would only benefit our fully matriculated graduate students in MSDS, MSAM, and MSCS - and would be welcomed. Staffing across Data Science, Computer Science, and Mathematics is adequate to accommodate additional sections if the need were to arise.