MASTERS OF SCIENCE IN DATA SCIENCE

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WHAT IS DATA SCIENCE?

• The goal of data science is to improve decision making by basing decisions on insights extracted from large data sets.

• Data science encompasses a set of principles, problem definitions, algorithms, and processes for extracting nonobvious and useful patterns from large data sets.

• Interdisciplinary Field
  • Computer Science, Statistics, and Business
Data Science Process

1. Reality
2. Raw Data Collected
3. Data Is Processed
4. Clean Dataset
5. Exploratory Data Analysis
6. Models & Algorithms
7. Communicate Visualize Report
8. Data Product
9. Make Decisions
NEED FOR DATA SCIENTISTS

• “A shortage of the analytical and managerial talent necessary to make the most of Big Data is a significant and pressing challenge (for the U.S)” – McKinsey Global Institute
  • Large numbers of positions will only be filled through training or retraining.
  • A need for 1.5 million more managers and analysts with deep analytical and technical skills “who can ask the right questions and consume the results of analysis of big data effectively.”
• “The demand for data scientists in 2020 has increased by an average of 50% across healthcare, telecommunications, media/entertainment, and the banking, financial Services, and insurance (BFSI) sectors, among others” – Dice Report
• About 11.5 Million jobs will be created by 2026 – U.S. Bureau of Labor Statistics
In 2015, there was a national surplus of people with data science skills. But today, 3 years later, the picture has changed markedly: data science skills shortages are present in almost every large U.S. city. Nationally, we have a shortage of 151,717 people with data science skills. As more industries rely on big data to make decisions, data science has become increasingly important across all industries, not just tech and finance. In that sense, it’s a good proxy for how today’s cutting-edge skills like AI & machine learning may spread to other industries and geographies in the future.
% increase of Data Science jobs on the West Coast and East Coast of America
(January to June 2018 vs January to June 2019)

174%

273%

harnham
harnham.com/us
States With the Highest Volume of Data Science Jobs

Number of data science job postings, as listed on Indeed.com, March 2019.

1. California
2. Washington, DC
3. New York
4. Virginia
5. Washington
6. Texas
7. Massachusetts
8. Illinois
9. Maryland
10. Pennsylvania
11. North Carolina
12. Georgia
13. Colorado
14. New Jersey
15. Florida

Data Science Job Titles
Data Science Job Titles

This breakdown of job titles is based on data from Indeed.com, March 2019.

- Data Engineer: 47%
- Data Analyst: 34%
- Data Scientist: 13%
- ML Engineer: 6%

Total: 124,049
## Average Salaries by State and Job Title for the Top 15 Markets

<table>
<thead>
<tr>
<th>State</th>
<th>Data Scientist</th>
<th>Data Analyst</th>
<th>Data Engineer</th>
<th>Machine Learning Engineer</th>
<th>Number of 'data science' job postings</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>$142,338</td>
<td>$90,562</td>
<td>$138,215</td>
<td>$114,826</td>
<td>3,521</td>
</tr>
<tr>
<td>Washington, DC</td>
<td>$105,975</td>
<td>$73,015</td>
<td>$124,571</td>
<td>$134,467</td>
<td>1,683</td>
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<tr>
<td>New York</td>
<td>$115,815</td>
<td>$71,589</td>
<td>$123,070</td>
<td>$117,268</td>
<td>1,322</td>
</tr>
<tr>
<td>Virginia</td>
<td>$98,216</td>
<td>$71,175</td>
<td>$97,059</td>
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<td>Washington</td>
<td>$117,345</td>
<td>$117,345</td>
<td>$116,591</td>
<td>$150,430</td>
<td>1,075</td>
</tr>
<tr>
<td>Texas</td>
<td>$101,208</td>
<td>$68,020</td>
<td>$88,383</td>
<td>$120,645</td>
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<tr>
<td>Massachusetts</td>
<td>$112,059</td>
<td>$70,529</td>
<td>$104,200</td>
<td>$160,110</td>
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</tr>
<tr>
<td>Illinois</td>
<td>$106,135</td>
<td>$65,273</td>
<td>$103,113</td>
<td>$129,958</td>
<td>659</td>
</tr>
<tr>
<td>Maryland</td>
<td>$117,345</td>
<td>$67,377</td>
<td>$116,591</td>
<td>$128,970</td>
<td>509</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>$103,995</td>
<td>$63,977</td>
<td>$95,332</td>
<td>$115,838</td>
<td>455</td>
</tr>
<tr>
<td>North Carolina</td>
<td>$117,345</td>
<td>$67,377</td>
<td>$116,591</td>
<td>$144,444</td>
<td>428</td>
</tr>
<tr>
<td>Georgia</td>
<td>$98,202</td>
<td>$65,207</td>
<td>$92,190</td>
<td>$69,707</td>
<td>321</td>
</tr>
<tr>
<td>Colorado</td>
<td>$106,025</td>
<td>$67,091</td>
<td>$103,633</td>
<td>$128,000</td>
<td>313</td>
</tr>
<tr>
<td>New Jersey</td>
<td>$117,345</td>
<td>$67,377</td>
<td>$116,591</td>
<td>$118,522</td>
<td>313</td>
</tr>
<tr>
<td>Florida</td>
<td>$99,167</td>
<td>$67,377</td>
<td>$116,591</td>
<td>$124,464</td>
<td>302</td>
</tr>
</tbody>
</table>

Sources: Glassdoor and PayScale, March 2019.
EMPLOYEE BENEFITS

- #1 for Work-Life Balance Rating
- National Average Base Pay for Data Scientist: $115,943
- Baltimore Average Base Pay for Data Scientist: $101,722
# DATA SCIENTIST ROLES AND AVERAGE SALARIES: MAY 26, 2020

<table>
<thead>
<tr>
<th>Data Scientist Roles</th>
<th>Average Salary (in $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junior/Associate Data Scientist</td>
<td>91,000</td>
</tr>
<tr>
<td>Data Scientist</td>
<td>108,000</td>
</tr>
<tr>
<td>A.I./Machine Learning Engineer</td>
<td>127,000</td>
</tr>
<tr>
<td>Data Science Manager/Architect</td>
<td>140,000</td>
</tr>
<tr>
<td>Chief/Senior/Principal Data Scientist</td>
<td>146,000</td>
</tr>
<tr>
<td>Director of Data Science</td>
<td>169,000</td>
</tr>
</tbody>
</table>

Source: Dice.com
# Data Scientist Salary, by Education:
## May 26, 2020

<table>
<thead>
<tr>
<th>Education</th>
<th>25th Quartile</th>
<th>Median</th>
<th>75th Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor's degree</td>
<td>95,000</td>
<td>111,000</td>
<td>125,000</td>
</tr>
<tr>
<td>Master's degree</td>
<td>10,000</td>
<td>115,000</td>
<td>129,000</td>
</tr>
<tr>
<td>Doctoral degree</td>
<td>101,000</td>
<td>115,000</td>
<td>129,000</td>
</tr>
</tbody>
</table>

Source: Burning Glass
THE PROGRAM

• Credits: 31-34
• Cost per Credit: $875
• Delivery: 100% Online
  • For students beginning in Fall 2021 and thereafter, all courses will be offered online.
  • Depending on the instructor, the course may be offered either synchronously or asynchronously.
• Format: Full or Part-time
THE PROGRAM

Specializations
- Technical Specialization
- Business Analytics Specialization

Two-semester Capstone Practicum
- A strength of the program is the required two-semester capstone practicum, which could include a summer internship. The practicum is an independent or group project that uses the data science techniques acquired during the program in an applied manner to solve a practical problem with a local partner.
- **Fall Semester:** In the first semester, students design the project and present their plan to the program's board; this could be part of a paid internship. The program director works to develop opportunities by developing a strong advisory board, comprised of industry, government, and not-for-profit representatives.
- **Spring Semester:** In the second semester, students implement their project and present the results of the project to the board for approval.
## DEGREE REQUIREMENTS

<table>
<thead>
<tr>
<th>TECHNICAL SPECIALIZATION</th>
<th>DATA ANALYTICS SPECIALIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-34 Credits</td>
<td>31 Credits</td>
</tr>
<tr>
<td>The technical specialization focuses on providing additional training in computer science and machine learning.</td>
<td>The data analytics specialization allows for greater course flexibility allowing students to focus their degree towards data analytics.</td>
</tr>
<tr>
<td>CS 701 - Introduction to Programming (may be waived)</td>
<td>CS 701 - Introduction to Programming or Program Elective</td>
</tr>
<tr>
<td>CS 703 - Programming for Data Science</td>
<td></td>
</tr>
<tr>
<td>ST 710 - Statistical Computing</td>
<td></td>
</tr>
<tr>
<td>DS 730 - Introduction to Data Science</td>
<td></td>
</tr>
<tr>
<td>DS 851 - Business Intelligence and Data Mining</td>
<td></td>
</tr>
<tr>
<td>DS 795 - Data Science Project Planning</td>
<td></td>
</tr>
<tr>
<td>DS 796 - Data Science Project</td>
<td></td>
</tr>
<tr>
<td>ST 765 - Linear Statistical Models</td>
<td></td>
</tr>
<tr>
<td>CS 737 - Machine Learning</td>
<td></td>
</tr>
<tr>
<td>Computer Science Elective</td>
<td>Program Elective</td>
</tr>
<tr>
<td>Statistics Elective</td>
<td>Program Elective</td>
</tr>
<tr>
<td>Program Elective</td>
<td>Program Elective</td>
</tr>
</tbody>
</table>
PROGRAM OF STUDY
FIRST YEAR

Fall Term
• CS 703 – Programming for Data Science (CS 701)
• DS 730 – Introduction to Data Science

Spring Term
• CS 737 – Machine Learning (only Technical Specialization)
• ST 710 – Statistical Computing
PROGRAM OF STUDY
SECOND YEAR

Summer Term
- DS 851 – Business Intelligence and Data Mining (DS 730)
- Statistics Elective

Fall Term
- DS 795 – Data Science Project Design (CS 703, DS 851, ST 710)
- ST 765 – Linear Statical Models (ST 710)
- Computer Science Elective

Spring Term
- DS 795 – Data Science Project (DS 795)
- Computer Science Elective or Statistics Elective or Business Elective
MICRO-CREDENTIALS

Analytics Micro-Credential
- CS 701 – Introduction to Programming
- DS 730 – Introduction to Data Science
- ST 710 – Statistical Computing

Data Science Micro-Credential
- CS 703 – Programming for Data Science
- DS 730 – Introduction to Data Science
- ST 710 – Statistical Computing
ACCELERATED PROGRAM

The accelerated Master of Science in Data Science program streamlines and accelerates the application process for current Loyola undergraduate students while reducing the combined total tuition costs. The accelerated program is a great option for Loyola undergraduates to complete both an undergraduate and master’s degree in just five years at Loyola.

- **CS 703** – Programming for Data Science (in place of DS 303)
- **DS 851** – Business Intelligence and Data Mining (IS 358)
- **ST 710** – Statistical Computing (ST 310)

The following courses apply towards both programs: **CS 737 (CS 484)**; **ST 765 (ST 465)**; **ST 767 (ST 472)**; **GB/DS 736 (IS 460)**; **GB/DS 739 (IS 353)**.
ACCELERATED PROGRAM BENEFITS

Complete both an undergraduate and graduate degree in just five years

15% Double Greyhound tuition discount for Loyola alumni
  • A 15% tuition discount is available to Loyola alumni enrolled in graduate degree programs beginning with the 2021-2022 academic year (i.e. starting June 1, 2021) and beyond. Tuition discounts will apply to posted tuition charges and will be automatically deducted from student billing accounts.

Students may count a maximum of three courses (9 credits) towards both their undergraduate and graduate degrees

Application fee waiver

Transcript submission waiver
INDUSTRIAL ADVISORY BOARD

- Jason Barbour - Erias Ventures, Data Works MD
- Michael Carlin - Boardroom Alpha
- Neta Ezer - Northrop Grumman
- Edward Fortunato - Constellation
- Franklin Hernandez - Synchrony
- Daniel Hood - ClearEdge
- Scott Jachimski - Booz Allen Hamilton
- Kevin McMahon - Department of Defense
- Ed Mullin - Think
- Stephanie Poisson - MasterPeace Solutions
- Elizabeth Rhoades - National Cryptologic School
- Melissa Ross - VisiQuate, Inc. - Melissa Ross Webpage
- Amit Kumar Singh - Asymmetrik
- Joseph Warfield - The Johns Hopkins University Applied Physics Laboratory
GRADUATE LEARNING GOALS

Graduates of Loyola University Maryland's graduate programs should:

• **Master knowledge and skills:**
  • Master the skills, methods and knowledge appropriate to the discipline.
  • Synthesize knowledge using interdisciplinary approaches.
  • Acquire the tools to continue professional development and life-long learning.

• **Think critically:**
  • Access, analyze and evaluate information effectively.
  • Disseminate and communicate information effectively.

• **Manifest leadership and social responsibility in the workplace and community:**
  • Understand and value individual differences and have the skills for working effectively in a diverse and changing world.
  • Comprehend the ethical principles appropriate to the discipline, have the ability to identify ethical dilemmas, and understand the frameworks for selecting and defending a right course of action.
  • Contribute professionally and personally to the broader community.
  • Consider issues of justice in making decisions.
LEARNING AIMS

Students will be able to:

• Perform an appropriate analysis of data in the context of a business/organizational problem.
• Apply programming languages to solve data science problems.
• Apply machine learning to data science problems.
• Effectively communicate key elements of the data science process.
• Recognize professional responsibilities and make informed judgments in practicing data science.
Students will understand the underlying principles of data science and be able to keep up with this expanding field.

Students will be proficient in analyzing complex data from diverse sources by discovering key relationships within the data.

Students will be able to model data using machine learning techniques.

Students will be able to model data using statistical models.

Students will be able to predict future outcomes that can be used to advise decision makers on their course of action.

Students will be knowledgeable of general ethical principles, how these principles apply to data science, and the social context of data science.
Technical Specialization

- Students are expected to have an introductory computing course or be using computing in their profession. Students are expected to have had an introductory statistics course. The statistics requirement can be satisfied by taking Loyola's preparatory course, DS 510 or another approved introductory statistics course. To be successful in the Technical specialization, it is advisable for the student to have some level of mathematical maturity.

Business Analytics Specialization

- This specialization is open to students from any major. Students are expected to have taken an introductory statistics course. It is expected that the student will have taken an introductory computing course or be using computing in their profession. The statistics requirement can be satisfied by taking Loyola's preparatory course, DS 510 or another approved introductory statistics course.
ADMISSION

Application Deadlines

• Fall Semester: August 1
• Spring Semester: December 1

*At the discretion of the department, applications will continue to be reviewed after the deadline on a space-available basis.

Application Requirements

• Online Application
• Non-refundable $60 application fee
• Official transcripts from all degree-granting institutions attended
• Essay: Describe how Loyola's graduate program in Data Science will help you fulfill your academic/professional goals
• Professional resume

*International applicants are eligible to complete this program fully online outside of the United States. Please note: a Form I-20 cannot be issued for this program.
The Data Science Program consists of 31-34 graduate credit hours.

The following rates are subject to change each academic year:

$875 per credit
SCHOLARSHIPS AND AWARDS

Merit-based Scholarships
- Merit-based scholarships are awarded to Master's of Data Science students based on prior academic excellence.
- All students are eligible to receive merit-based scholarships, and every student who completes an application for admission is automatically considered for merit scholarship funding. No separate application is required. Please submit completed program application and all supplemental documents to the Office of Graduate Admission by the application deadline to be considered.
- You will be notified of your merit scholarship at the time of admission.

Graduate Assistantships
- Graduate assistants provide research, instructional, and administrative support to Loyola's faculty and administration. Most spend between seven and 15 hours per week in their assistantship or fellowship role and devote the remainder of their time to their academic pursuits.
WHY LOYOLA?

- Integration of ethics into learning aims and additional program goals
- Care for the whole person
- Student-faculty relationship
- Location, Location, Location
  - Top employers in the Baltimore Metropolitan Area
  - Lockheed Martin, Northrop Grumman, Booz-Allen Hamilton, Dow Jones, UPS, IBM, Accenture, Bell Atlantic, AAI Corporation, AT&T, BG&E, Dickerson-Heffner, and Computer Sciences Corp.
- Teaching with an interdisciplinary approach
- Supporting students through times of change
- Meeting a growing range of societal demands
OSEI

“I would strongly recommend Loyola's Data Science program to anyone who is interested in the field. It is demanding—but it is great for being able to balance work and school.”
“Everything I’ve learned has enabled me to gain a better appreciation and improved understanding of the many ways data can be leveraged to solve any challenge.”
CONTACT INFORMATION

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QUESTIONS?