Programme Title: MSc in Big Data Science with Industrial Experience

# Programme Specification

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| Awarding Body/Institution | Queen Mary, University of London |
| Teaching Institution | Queen Mary, University of London |
| Name of Final Award and Programme Title | Master of Science (MSc) in Big Data Science with Industrial Experience |
| Name of Interim Award(s) | PG Certificate and PG Diploma |
| Duration of Study / Period of Registration | 24 months FT |
| QM Programme Code / UCAS Code(s) | H6L1 |
| QAA Benchmark Group | Computing |
| FHEQ Level of Award | Level 7 |
| Programme Accredited by | BCS |
| Date Programme Specification Approved | |
| Responsible School / Institute | School of Electronic Engineering & Computer Science |

| Schools which will also be involved in teaching part of the programme |
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| N/A |

| Institution(s) other than Queen Mary that will provide some teaching for the programme |
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| N/A |

## Programme Outline

The Big Data science movement is transforming how Internet companies and researchers over the world address traditional problems. Big Data refers to the ability of exploiting the massive amounts of unstructured data that is generated continuously by companies, users, devices, and extract key understanding from it.

A Data Scientist is a highly skilled professional, who is able to combine state of the art computer science techniques for processing massive amounts of data with modern methods of statistical analysis to extract understanding from massive amounts of data and create new services that are based on mining the knowledge behind the data. The job market is currently in shortage of trained professionals with that set of skills, and the demand is expected to increase significantly over the following years.

The course leverages the world-leading expertise in research at Queen Mary with our strategic partnership with IBM and other leading IT sector companies to offer to students a foundational MSc on the field of Data Science. The MSc modules cover the following aspects:

- Statistical Data Modeling, data visualization and prediction
- Machine Learning techniques for cluster detection, and automated classification

- Big Data Processing techniques for processing massive amounts of data
- Domain-specific techniques for applying Data Science to different domains: Computer Vision, Social Network Analysis, Bio Engineering, Intelligent Sensing and Internet of Things
- Use case-based projects that show the practical application of the skills in real industrial and research scenarios.

Students will be offered lectures that explain the core concepts, techniques and tools required for large-scale data analysis. Laboratory sessions and tutorials will put these elements to practice through the execution of use cases extracted from real domains. Students will also undertake a large project where they will demonstrate the application of Data Science skills in a complex scenario.

The programme is offered by academics from the Networks, Centre for Intelligent Sensing, Risk and Information Management, Computer Vision and Cognitive Science research groups from the School of Electronic Engineering and Computer Science. This is a team of more than 100 researchers (academics, post-docs, research fellows and PhD students), performing world leading research in the fields of Intelligent Sensing, Network Analytics, Big Data Processing platforms, Machine Learning for Multimedia Pattern Recognition, Social Network Analysis, and Multimedia Indexing.

The programme includes a year in industry between the taught component and the project.

## Aims of the Programme

The course will provide students with cutting edge tools, methods, and techniques for analysing large-scale datasets in order to detect patterns/trends and extract valuable information from raw data. Programme graduates will be able to pursue careers in Data Scientist positions in Industry, as well as initiate research in multiple scientific domains that rely on performing advanced data analysis.

The programme will cover the following topics:

- Statistical Data Modeling, data visualization and prediction
- Machine Learning techniques for cluster detection, and automated classification
- Big Data Processing techniques for processing massive amounts of data
- Domain-specific techniques for applying Data Science to different domains: Computer Vision, Social Network Analysis, Bio Engineering, Intelligent Sensing and Internet of Things
- Use case-based projects that show the practical application of the skills in real industrial and research scenarios.

The aims of the placement year are to:
• Ground the taught components of the programme in practical experience at a scale not possible within the College;
• Improve career preparation, giving students a better understanding of future career options and enhancing their career prospects.

## What Will You Be Expected to Achieve?

Knowledge and understanding of the following items:

| Academic Content: | |
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| A1 | Statistical modeling of real data sources for trend detection and prediction |
| A2 | Programming tools and techniques for processing massive amounts of data such as Map/Reduce and Hadoop |
| A3 | Methods and techniques for automated classification and pattern recognition |

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| Disciplinary Skills - able to: | |
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| B 1 | Evaluate the scientific, mathematical and software 'tools' relevant to the problem domain of Big Data science |
| B 2 | Develop novel techniques for analyzing unstructured data sources |
| B 3 | Establish hypotheses on data sources, and validate them through statistical techniques |

| Attributes: | |
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| C 1 | Engage critically with knowledge in the domain of Big Data science |
| C 2 | Develop a global perspective on the sources and uses of new data |
| C 3 | Develop information expertise in the domain |

## How Will You Learn?

Each non-project-based course unit involves lectures, problem solving coursework and practical sessions. Lectures are used to introduce principles and methods and also to illustrate how they can be applied in practice. Coursework allows students to develop their skills in problem solving and to gain practical experience.

Tutorial sessions actively engage students on applying the techniques and tools presented in the lectures to solve practical problems. These sessions take the form of exercise classes and programming laboratories under the guidance of the teaching staff. In addition to the project, other modules introduce project working skills.

## How Will You Be Assessed?

The assessment of the taught course units takes place through a written examination and coursework.

The project is examined on the basis of a written report, a formal oral presentation, and a demonstration of the piece of software developed or the insights from the data analysis carried by the student. The projects will have two examiners each, with a third if there is disagreement.

The industrial placement is assessed by a combination of written report, viva, learning journal and 2 employer evaluations. The first employer evaluation takes place a few months into the placement and the second takes places shortly before the end of the placement. Each evaluation involves employer and student jointly setting appropriate objectives within a structured framework of categories; progress is later measured against these objectives using set marking criteria.

## How is the Programme Structured?

The programme is organised in three semesters. The first semester is composed by three compulsory modules plus one optional module that will cover the foundational techniques and tools employed for Big Data Science analysis. For students who cannot

demonstrate solid skills in programming, the module Advanced Program Design will be a mandatory choice in the first semester, so that the adequate software development skills can be acquired for the remaining modules.
The second semester has four modules that are chosen among a set of options. The module selection allows students to focus on domain-specific research or industry applications for Big Data Science. Module options allow students to specialize in several areas: Computer Vision, Internet Services (Semantic Web and Social Media), Business, and Internet of Things.
Students undertake their placement between the taught modules and the project.
Students carry out a large project full time in the third semester, after agreeing to a topic and supervisor in the first semester, and completing the preparation phase over the second semester.

Semester 1
ECS764P Applied Statistics (15 credits)
ECS765P Big Data Processing (15 credits)
ECS766P Data Mining (15 credits)
Select one option from:
ECS708P Machine Learning (15 credits)
ECS782P Introduction to IOT
ECS789P Semi-Structured Data and Advanced Data Modelling15 credits)
ECS793P Introduction to Object Oriented Programming (15 credits)

Semester 2
Four options from:
ECS735P The Semantic Web (15 credits)
ECS757P Digital Media and Social Networks (15 credits)
ECS763P Natural Language Processing (15 credits)
ECS781P Cloud Computing (15 credits)
ECS784P Data Analytics (15 credits)
ECS794P Machine Learning for Visual Data Analytics (15 credits)
ECS795P Deep Learning and Computer Vision

Semester 3
ECS751P Project

Year 2

ECS774P MSc Industrial Placement Project

Academic Year of Study 1

| Module Title | Module Code | Credits | Level | Module Selection Status | Academic Year of Study | Semester |
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## What Are the Entry Requirements?

A good Honours degree (first or upper-second class honours) in Computer Science, Electronic Engineering, Maths, Physics or related disciplines is required.
International students must have English Language skills to a recognised standard. The minimum requirement is:
IELTS 6.5, TOEFL (CBT) 237, 92 (iBT) or TOEFL (written test) 580.

Good knowledge of computer programming (in a modern structured/OO programming language such as C, python or Java) is highly recommended for students. Otherwise, students will need to select Advanced Program Design as the optional module for the first semester in order to fulfill the requirements for the remaining modules.

## How Do We Listen and Act on Your Feedback?

The Staff-Student Liaison Committee provides a formal means of communication and discussion between Schools and its students. The committee consists of student representatives from each year in the school/institute together with appropriate representation from staff within the school/institute. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. Staff-Student Liaison Committees meet regularly throughout the year.

Each school operates a Learning and Teaching Committee, or equivalent, which advises the School/Institute Director of Taught Programmes on all matters relating to the delivery of taught programmes at school level including monitoring the application of relevant QM policies and reviewing all proposals for module and programme approval and amendment before submission to Taught Programmes Board. Student views are incorporated in this Committee's work in a number of ways, such as through student membership, or consideration of student surveys.

All schools operate an Annual Programme Review of their taught undergraduate and postgraduate provision. The process is normally organised at a School-level basis with the Head of School, or equivalent, responsible for the completion of the school's Annual Programme Reviews. Schools/institutes are required to produce a separate Annual Programme Review for undergraduate programmes and for postgraduate taught programmes using the relevant Undergraduate or Postgraduate Annual Programme Review pro-forma. Students' views are considered in this process through analysis of the NSS and module evaluations.

## Academic Support

All students will be assigned a tutor, with whom they will have bi-weekly meetings. In addition the students will have all the standard induction, advice and supervisory arrangements normally offered to students within EECS.

The school handbook will be provided (and made accessible at all times) to students, where all the channels of support will be outlined. These include the support channels within the school and also those available at College level.

The year in industry is supported by a dedicated Industrial Placements Manager.

## Programme-specific Rules and Facts

N/A

## Specific Support for Disabled Students

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites.

Students can access advice, guidance and support in the following areas:
• Finding out if you have a specific learning difficulty like dyslexia
• Applying for funding through the Disabled Students' Allowance (DSA)

- Arranging DSA assessments of need
- Special arrangements in examinations
- Accessing loaned equipment (e.g. digital recorders)
- Specialist one-to-one "study skills" tuition
- Ensuring access to course materials in alternative formats (e.g. Braille)
- Providing educational support workers (e.g. note-takers, readers, library assistants)
- Mentoring support for students with mental health issues and conditions on the autistic spectrum.

## Links With Employers, Placement Opportunities and Transferable Skills

The staff involved in the MSc of Big Data Science have strong links and research collaboration with industrial partners including IBM, HP, BBC, and Tech City IT startups. Several of these companies will be involved in the teaching activities, providing guest lectures, as well as business use cases for applying Big Data Science techniques.
Additionally, several of the MSc projects offered to the students will be performed in collaboration with an industry partner, including summer placement opportunities.

## Programme Specification Approval

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| **Person completing Programme Specification** | Jennifer Richards |
| **Person responsible for management of programme** | Rupal Vaja |
| **Date Programme Specification produced/amended by School Learning and Teaching Committee** | 18th Jan 2017 |
| **Date Programme Specification approved by Taught Programmes Board** | |