MSc Advanced Computer Science

http://www.reading.ac.uk/computer-science/dcs-postgraduate.aspx

Duration and mode of delivery

Full-time (1 year), part-time (2 years) or flexible-modular (up to 5 years). It is a 12 month course, beginning in the last week of September 2018 and finishing in September 2019. The part-time and the flexible mode give the opportunity to individuals who are in full-time employment to gain an MSc award (180 credits), a Postgraduate Diploma (120 credits) or a Postgraduate Certificate (60 credits), or to take some modules as free-standing Continuing Professional Development (CPD) courses.

Taught modules are delivered during the Autumn and Spring terms, written examinations take place during the Summer term (typically in May with resit in August/September) and the MSc project is carried out over from the second part of the Spring term till September.

It is also possible to take the taught modules as free-standing training courses with two enrolment options:

- Continuing Professional Development (CPD) undertaking no assessment;
- Taught module with assessment, which would then contribute towards a postgraduate qualification (MSc, Diploma, or Certificate).

Opportunities – links with industry and other HE institutions

The MSc programme also offers opportunities for carrying out industrial projects (with/without short placements/internships) and for visiting and studying in one of our partner HE institutions in Europe within the Erasmus student exchange programme.

Admission requirements

A suitable undergraduate degree: at least a 2.1 Honours UK BSc degree or overseas equivalent to 60% in a Computing-related discipline. For overseas candidates, proof of English competency is required.

General enquiries:

For general enquiries on Computer Science PG programmes, please contact:
Email: pgcompsci@reading.ac.uk, Tel. +44 (0) 118 378 6603

Further information on the programme content:

Dr. G. Nicosia, Programme Director
Email: g.nicosia@reading.ac.uk

Further information on application procedure, tuition fee, enrolment:

University of Reading postgraduate admission office
Email: pgadmissions@reading.ac.uk, Tel.: +44 (0)118 378 5289

Online applications: http://www.reading.ac.uk/pgapply
Modules 2018-2019

180 credits over 1 year (full-time), 2 years (part-time) or 5 years (flexible-modular):
- 80 credits from the compulsory MSc Project module, CSMPR16
- 60 credits from compulsory (C) taught modules
- 40 credits from optional (O) taught modules

Listed modules

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Notes:
- Module taught over an entire term (11 weeks): typically a module has two-hour lectures each week.
- MMM038 and MMM077 are delivered by the Henley Business School, University of Reading.
- The project formally starts in week 6 of the Spring Term (around mid of February) and completes with the submission of the project report in September.

The European Credit Transfer and Accumulation System (ECTS) is a standard of grading scale defined by the European Commission.
Compulsory Modules - Description

Mathematics and Statistics
Module code: CSMMA16
Assessment: 100% coursework
The module aims to bring students up to the appropriate level as regards the Mathematics necessary for the modules taught as part of the MSc programmes. It contains a number of topics and students will focus on those they have not met before and which are most relevant to their degree. Students will be able to perform appropriate mathematical techniques, which they will then be able to use in other modules. The module covers the topics of calculus, vectors and matrices, probability and statistical modelling. It also includes an introduction to MatLab and R programming language, and exercises where students use MatLab with relevant mathematical topics.

Research Studies
Module code: CSMRS16
Assessment: 100% coursework
The aim of the module is to provide training in the use of available literature and to be able to critically evaluate a given topic in computer science. The students will select a topic of research and improve the ability to formulate a critical approach, to search for relevant literature from a wide range of sources and to select appropriate key literature, to write an extended essay using good scientific writing and presentation skills, according to a specified set of requirements, to assess critically the methods, results and conclusions reported by other researchers and to present the work orally to a group. This module provides experience in the use of library and computer-based literature search facilities, in the selection of material, in the writing of an extended essay, in the use of English for scientific writing. The format will be primarily student led with an emphasis on professionally presenting their work through written reports and oral presentations.

Data Analytics and Mining
Module code: CSMDM16
Assessment: 100% coursework
Automated data collection tools and mature database technology lead to tremendous amounts of data stored in databases, data warehouses and other information repositories. Automated data analytics mining techniques are becoming essential components to any information system. In the Knowledge Discovery process large data sets have to be cleaned, pre-processed, selected, merged, etc., and finally processed for the automatic extraction of interesting knowledge (rules, regularities, patterns, constraints). This module focuses on concepts, techniques, algorithms and tools for the design, management and deployment of the Knowledge Discovery process. In particular, tools for data analytics (R) and workflow management (KNIME) will be adopted for hands-on activities on several case studies.

Big Data Analytics
Module code: CSMBD16
Assessment: 50% exam – 50% coursework
The analysis of Big Data is not just the analysis of very large data sources. Typically data comprises four aspects, Volume, Velocity, Variety, and Veracity. Volume refers to the actual size of the data, which requires scalable and computationally efficient methods. Velocity refers to the very fast generation of data, which requires data stream processing methods for time critical applications. Variety refers to the different types of data, structured and unstructured data, such as video streams, click streams or audio files. Veracity refers to the challenge of establishing the trust of decision makers in the Knowledge extracted from Big Data Analytics techniques. This unit’s aim is to address the challenges of Big Data Analytics and, in particular, scalable parallel data mining algorithms (e.g., run on computer clusters with Hadoop); data stream mining for the analysis of high velocity data; sentiment analysis techniques for unstructured data such as micro-blogging data and social network data; and scalable recommender systems. A further aim of the unit is to introduce software systems used for Big Data Analytics such as Hadoop and Mahout.
Cloud Computing
Module code: CSMCC16
Assessment: 50% exam – 50% coursework
The massively increased uptake of computing in the last decade, with devices at all scales of operation, has driven the development of large-scale distributed systems capable of meeting the demands placed on service providers. This course gives an insight into the techniques used for producing very large scale robust distributed systems such as those used to drive the world's largest and most popular websites. The course covers Cloud computing (IaaS, PaaS, SaaS), techniques for processing big data (Map/Reduce), large-scale systems architectures (RESTful systems and an architectural analysis of the Web as a whole), distributed systems utilising message passing (MPI and Erlang), methods for producing robustness in distributed applications, and some of the hardware and software technologies used in supercomputing.

Machine Learning
Module code: CSMML16
Assessment: 100% exam
The dramatic growth in practical applications for machine learning has been accompanied by many important developments in the underlying algorithms and techniques. This module will introduce the major concepts and algorithms in the field of machine learning. Content includes vector calculus and Lagrange method, Gaussian distribution and Parzen window, the k-nearest neighbour and K-means clustering, mixture of Gaussians, probabilistic neural networks, linear discriminant, neural Networks, radial basis function neural, KKT condition, support vector machine, boosting.

MSc Project
Module code: CSMPR16
Assessment: 90% dissertation – 10% oral assessment and presentation
This module aims to provide the framework for a student to manage a major piece of research project work in a professional manner in his/her subject area, to introduce appropriate research skills, to demonstrate initiative and creativity in applying skill and knowledge and experience gained from previous work in an individual practical, problem solving project, and to further develop generic, project related skills including those of project management, written and verbal communication, and system presentation and demonstration, to provide the experience of managing a project and delivering a solution to a potential customer/ supervisor as realistically as possible in an academic context. The project can be either an individual research project or an industry project. An individual research project will usually be related to current research activities in the School or to a multidisciplinary application under the co-supervision of two academic staff members, one from the School for the Computer Science aspects and one from another School for the aspect related to the particular application domain. An industry project is carried out with one of the industry partners of the School under the co-supervision of an academic staff member and an industry manager.
Optional Modules - Description

**Image Processing**
*Module code: CSMIP16*
*Assessment: 70% exam – 30% coursework*

The module aims to provide students with practical and theoretical knowledge of digital image processing from various techniques and applications. Basic skills for image analysis; the ability to address issues associated with techniques of image transformation, histogram analysis and modification, image morphological operations and colour image manipulation; skills to develop algorithms for digital image compression and texture-based image segmentation. Programming skills can be improved from coursework assignments, which are associated with practical sessions in PC labs. Topics include digital image fundamentals; image enhancement in the spatial and in the frequency domain; colour image processing; mathematical morphology in image processing; image compression; image segmentation.

**Visual Intelligence**
*Module code: CSMVI16*
*Assessment: 70% exam – 30% coursework*

This module aims at providing students with an appreciation of human cognitive abilities in visual perception, fundamental knowledge in high level computer vision, and examples of application areas including video surveillance. The module provides basic knowledge of human perceptual skills relating to vision; the ability to address high level issues relating to computer vision including pattern classification, geometric-based vision and appearance-based vision; knowledge of application of computer vision including generic object recognition, cognitive computer vision and computational visual surveillance. Programming skills can be improved through practical work. Topics include an introduction to natural vision (human perception); theory of image-based pattern classification; geometric-based vision; appearance-based vision; object recognition; applications of computer vision.

**Virtual Reality**
*Module code: CSMVR16*
*Assessment: 70% exam – 30% coursework*

In a virtual reality, users can interact within a 3D computer-generated environment through multi-modal displays that support interaction through vision, hearing, and touch. This course will discuss what is (and is not) virtual reality, introduce topics relating to perception of virtual environments (e.g. stereo vision and sound localisation), and introduce a range of display and input technologies (e.g. head-mounted displays, cubic projection displays, tracking technologies). The course will develop the mathematical and programming framework for interactive environments including modelling and animation of 3D objects, and the programming techniques used to render these in real-time.

**Concurrent Systems**
*Module code: CS3CS16 (level 6 module)*
*Assessment: 70% exam – 30% coursework*

Concurrent systems are becoming ubiquitous. Multi-core processors, Supercomputers, heterogeneous network of computers or a Web server, although appearing radically different, have an underlying unifying principle of computational processes interacting to achieve an overall computational goal. The aim of this module is to develop an appreciation of this unifying principle and the benefits of concurrency. General concepts of concurrency are introduced using the calculus of Communicating Sequential Processes (CSP) and its use in the design of concurrent systems is explored through several examples of applications.

**Social, Legal and Ethical Aspects in Engineering**
*Module code: CS3SL16 (level 6 module)*
*Assessment: academic paper 40%, group based assignment 50%, multiple choice test 10%*

This module recommended for students (e.g. international students) who did not take a course with similar content in their UG studies. The aim of this module is to provide students with the basic background to develop their professional role in the workplace, beyond simply performing technical tasks assigned to them. It is also designed to encourage them to consider the impacts that technologies they are developing and using
could have on individuals, local, global and business communities as well as the wider world around them. A subsidiary aim is to provide an opportunity for the students to exercise the critical and argumentation faculties they have developed as part of other modules. The module covers several topics, including social impact of technological change addressing a range of topics (e.g., communications, medical technologies, bio-engineering, education, entertainment, military, industry, commerce and working practices, globalisation, public understanding of science, environmental impact of high technology), legal and ethical implications of providing or using a service or a product, intellectual property rights, copyright, contractual issues (e.g. payment terms, service level agreements and maintenance commitments), licensing, legal and ethical issues of holding and using data, data ownership and records management, governance processes and procedures.

**Practice of Entrepreneurship**

*Module code: MMM038 (Henley Business School, Term-based lectures)*

*Assessment: Bi-weekly assignment 50%, Individual Reflective Component 15%, Individual Case Study 15%, Group Presentation 20%*

This module aims at equipping the students with entrepreneurial skills, including networking, team building, creativity and presentation skills. Students can find the inspiration and confidence to consider creating their own venture as a future career option as the module provides the baseline knowledge on how to access resources and make their ideas a reality. The topics include an introduction to entrepreneurial forms and behaviours, creativity and innovation, developing ideas and how to carry out a feasibility test, understanding market dynamics and satisfying customers, raising finance, protecting your intellectual property, building an entrepreneurial team, networking and social capital, writing a business plan, pitching your ideas to potential investors.

**Digital Marketing**

*Module code: MMM077 (Henley Business School, Term-based lectures)*

*Assessment: written assignment including essay (50%) and project output (50%)*

The growth of internet technology has created significant new opportunities for organisations to reach and build relationships with customers. At the same time, many firms struggle with making a successful transition from offline to online marketing. This module provides knowledge of the key tools required to implement a successful digital marketing strategy. This includes search engine marketing, effective engagement with social media and improving performance using web analytics. Students will also build an understanding of the important ethical issues around consumer privacy and personal data created through digital marketing activities.