Programme Specification

MSc Artificial Intelligence (2020-21)

This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities that are provided.

Awarding Institution	University of Southampton
Teaching Institution	University of Southampton
Mode of Study	Full-time
Duration in years	1
Accreditation details	British Computer Society (BCS)
Final award	Master of Science (MSc)
Name of award	Artificial Intelligence
Interim Exit awards	Postgraduate Certificate in Higher Education
	Postgraduate Diploma in Higher Education
FHEQ level of final award	Level 7
UCAS code	N/A
Programme code	4475
QAA Subject Benchmark or other external reference	Master's Degrees In Computing 2011
Programme Lead	Richard Watson

Programme Overview

Brief outline of the programme

This research-led MSc takes a contemporary approach and covers the fundamental aspects of traditional symbolic and sub-symbolic aspects.

The programme will give you a solid awareness of the key concepts of Artificial Intelligence. You will also learn the techniques that form the current basis of machine learning and data mining. You will develop a wide-ranging skill set that supports further study or that you can use in application development.

As a result of the leading research being undertaken at Southampton, the course is able to offer a wide range of options that cover state-of-the-art techniques, which directly reflect research directions in ECS. These include:

- intelligent agents
- computer vision
- machine learning
- deep learning
- evolutionary algorithms
- bio-inspired robotics
- computational finance
- simulation modelling

The first semester consists of three compulsory modules, including a review of Artificial Intelligence foundations. In another compulsory module, which runs over both semesters, the focus is on preparing students for their project and enhancing their dissertation writing skills. Students can then select four optional modules in the second semester, allowing them to tailor the programme to suit their interests. Finally, the summer research project enables students to demonstrate their mastery of specialist techniques and relevant methods of enquiry, and their ability to design and deliver advanced applications, systems and solutions to a tight deadline, including the production of a substantial dissertation.

Your contact hours will vary depending on your module/option choices. Full information about contact hours is provided in individual module profiles.

Learning and teaching

Learning and teaching methods are explained in the following sections covering programme learning outcomes.

Assessment

Assessment methods are explained in the following sections covering programme learning outcomes.

Special Features of the programme

N/A

Please note: As a research-led University, we undertake a continuous review of our programmes to ensure quality enhancement and to manage our resources. As a result, this programme may be revised during a student's period of registration; however, any revision will be balanced against the requirement that the student should receive the educational service expected. Please read our Disclaimer to see why, when and how changes may be made to a student's programme.

Programmes and major changes to programmes are approved through the University's programme validation process which is described in the University's Quality handbook.

Educational Aims of the Programme

The aims of the programme are to: The aims of the programme are to enable you to:

1) Develop original ideas and solve complex problems in new or unfamiliar environments, based on advanced knowledge of the principles and methodologies of Artificial Intelligence (AI)
2) Integrate knowledge and handle complexity in this area of computer science, formulating sound judgements with incomplete or limited data
3) Communicate your conclusions and the underpinning knowledge and rationale clearly and unambiguously to specialist and non-specialist audiences
4) Develop your independent learning skills as required for continued professional development

Programme Learning Outcomes

Having successfully completed this programme you will be able to demonstrate knowledge and understanding of:

Knowledge and Understanding

On successful completion of this programme you will have knowledge and understanding of:

A1.   Key concepts of Artificial Intelligence

A2.   Advanced concepts in specialist areas of articial intelligence, such as machine learning, intelligent agents and computer vision

A3.   State of the art techniques, technologies and tools used in these specialist areas

A4.   Methods of design, analysis, implementation and verification in these specialist areas

A5.   Applicable methods of research and enquiry within the discipline

Teaching and Learning Methods

A1-A5: Most modules consist of a combination of lectures, small group teaching, practical work, directed reading and coursework assignments. At the end of the taught part of the course you will undertake an individual project associated with a research group. Small group teaching, including all practical work, and the individual project accommodate different learning styles. One-on-one tutorials can support full-class lectures, when required.

Assessment Methods

Testing of the knowledge base is through a combination of unseen written examinations and assessed coursework in the form of problem solving exercises, laboratory reports with literature review components, design exercises, and individual and small-group projects.

Subject Specific Intellectual and Research Skills

On successful completion of this programme you will be able to:

B1.   Specify, design and realise advanced and specialised AI (sub-)systems

B2.   Test and evaluate the behaviour of AI (sub-)systems at an appropriate level of detail

B3.   Analyse AI problems to determine appropriate methods of design, testing and evaluation

B4.   Find, read, understand and explain literature related to advanced and specialised areas of artificial intelligence, including scientific publications, industrial documentation, standards, ethical, legal and environmental guidance

B5.   Formulate a research project involving an advanced and specialised AI application or system using appropriate state of the art techniques, technologies and tools

Teaching and Learning Methods

B1-B4: Most modules consist of a combination of lectures, small group teaching, and computer-based practical work including advanced software development tools, directed reading and coursework assignments, which can include a literature review. B4, B5: The Project Preparation module and the Individual Project itself concern the formulation of a research project. Small group teaching, including all practical work, and the individual project accommodate different learning styles. One-on-one tutorials can support full-class lectures, when required.

Assessment Methods

B1-B5: Testing of the subject specific intellectual and research skills is through a combination of unseen written examinations and assessed coursework in the form of problem solving exercises, laboratory reports with literature review components, design exercises, and individual and small-group projects.
B4: The Project Preparation module and the dissertation from the MSc Project include a significant literature survey and peer review, and have assessment criteria related specifically to these skills.
B5: The Project dissertation is centrally focussed on assessing research and development skills.

Transferable and Generic Skills

On successful completion of this programme you will be able to:

C1.   Use conventional and electronic indexing and search methods to find technical information

C2.   Present technical information concisely in written and verbal forms to a range of audiences

C3.   Work in a pair or in a small group on a given task, managing your own contribution and the overall task

C4.   Work independently on a significant research project, managing time and risk in an effective manner

C5.   Recognise legal and ethical issues of concern to business, professional bodies, and society, including but not limited to information security, and follow relevant guidelines to address these issues

Teaching and Learning Methods

A number of courses have a significant coursework element. This can range from design work through to presentations resulting from directed reading. The individual project includes independent research, project management and report writing.
C1-C3: Most modules include small group teaching, practical work with one or more lab partners, directed reading and coursework assignments with a literature review component. The Project Preparation module includes project management and the delivery of a project plan via a presentation. Small group teaching, including all practical work, and the individual project accommodate different learning styles.
C4: The individual project includes independent research and report writing.

C5: Legal, ethical and professional issues are covered in the compulsory taught modules.

Assessment Methods

Coursework is generally assessed through written reports. The individual project is assessed by a dissertation of up to 15,000 words. The Project Preparation module is assessed via a literature review, as well as written and presentation versions of the project plan.

Subject Specific Practical Skills

On successful completion of this programme you will be able to:

D1.   Use specialist tools for the design, implementation and verification of AI systems

Teaching and Learning Methods

Most modules include practical work, involving use of specialised tools for system design, implementation and verification

Assessment Methods

Assessment is based on coursework in the form of technical reports and programmed code, and also the MSc dissertation.

Programme Structure

The programme structure table is below:

Information about pre and co-requisites is included in individual module profiles.

Where optional modules have been specified, the following is an indicative list of available optional modules, which are subject to change each academic year. Please note in some instances modules have limited spaces available.

Part I

Typical course content

The programme consists of eight taught modules, each worth 7.5 ECTS credit points (15 CATS) and an individual research project worth 30 ECTS credit points (60 CATS). Three compulsory technical modules cover core material for artificial intelligence. In the compulsory module Research Methods and Project Preparation, which runs over both semesters, you will undertake appropriate preparatory study for your research project and you will also examine ethical and legal issues around professional practice. Four optional modules can be selected to tailor the programme to your interests. Your research project will enable you to explore in depth some aspect of artificial intelligence: for example you might investigate and evaluate a new AI method, technique or tool, or some key technology underpinning an AI application.

Programme details

The programme runs over three semesters. The first semester consists of three compulsory technical modules including Foundations of AI, Intelligent Agents and Machine Learning. Semester 2 consists of four optional modules. The compulsory Research Methods and Project Preparation module runs over both semesters. Exceptionally well-prepared students may take a relevant option instead of a compulsory module; this requires written permission from their tutor and programme leader. Following the first two semesters of the taught component of the programme, the students will undertake a research project which will be assessed by a degree dissertation.

There are two variations of Machine Learning in semester 1, COMP6245 and COMP6246. One of these should be taken. COMP6245 'Foundations' has a deeper focus on the mathematical foundations of machine learning and aims to serve as a launching point for further study. The practical parts of 'Foundations' focus on understanding how to implement machine learning techniques and understanding how those techniques work. COMP6246 'Technologies' has a technological focus, and allows students to get hands-on experience with modern machine learning techniques. Students studying 'Technologies' will be taught how to use machine learning libraries and tools, and will be expected to achieve a conceptual understanding of how the different techniques work, as well as an understanding of their advantages and disadvantages. COMP6245 and COMP6246 are mutually exclusive; it is not possible to take both modules. Note that some semester 2 modules have COMP6245 or COMP6246 as a prerequisite (see the module specifications). For 'Foundations' it is assumed that students have prior knowledge of linear algebra (including eigenvectors), Calculus (including partial differentiation), probability and statistics. For 'Technologies' students should be comfortable with basic linear algebra and the fundamental concepts of Calculus.

Most modules are shared with our Master of Engineering programmes in Computer Science and our specialist MSc programmes. It should be noted that it may not be possible to run some optional modules if the number of students registered on the module is very small. It should also be noted that optional module choice can be restricted by the University Timetable, which varies from year to year: some optional modules may clash with other optional or compulsory modules. Please be aware that many modules are shared between different cohorts; the class size depends on cohort size, which varies from year to year.

Examinations are held at the end of Semester 1 (January) and at the end of Semester 2 (May/June). Students who have successfully completed 30 ECTS (60 CATS) or 60 ECTS (120 CATS) at the level of the award may exit with a Postgraduate Certificate or Postgraduate Diploma, respectively.

The following is the normal pattern of study for a full-time student, completing the programme within 12 calendar months.

Semester 1:
Three compulsory modules. Examinations are held in January.

Semester 2:
Four optional modules. Examinations are held in May/June.

Summer/Semester 3:
You will undertake a research project lasting 3 to 4 months, which is assessed by a 15,000 word dissertation.

The programme structure, including the compulsory and optional modules for each semester, is summarised below.

Some semester 2 modules have the semester 1 module COMP6245 as pre-requisite. This can be checked in the module specifications.

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SEMESTER 1

COMP6203 - compulsory
COMP6231 - compulsory
COMP6245 or COMP6246 - compulsory
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SEMESTER 1 + 2:

ELEC6259 - compulsory
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SEMESTER 2 - four optional modules

COMP6202 - optional
COMP6207 - optional
COMP6208 - optional
COMP6211 - optional
COMP6212 - optional
COMP6215 - optional
COMP6216 - optional
COMP6223 - optional
COMP6237 - optional
COMP6241 - optional
COMP6247 - optional
COMP6248 - optional
ELEC6212 - optional
ELEC6213 - optional
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SUMMER

COMP6200 - core
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Part I Compulsory

Code	Module Title	ECTS	Type
COMP6231	Foundations of Artificial Intelligence	7.5	Compulsory
COMP6203	Intelligent Agents	7.5	Compulsory
ELEC6259	Research Methods and Project Preparation	7.5	Compulsory

Part I Compulsory Optional

You must select only one variation of Machine Learning (MSc).

Code	Module Title	ECTS	Type
COMP6245	Foundations of Machine Learning (MSc)	7.5	Compulsory

Code	Module Title	ECTS	Type
COMP6246	Machine Learning Technologies (MSc)	7.5	Compulsory

Part I Core

Code	Module Title	ECTS	Type
COMP6200	MSc Project	30	Core

Part I Optional

It is optional to select the semester 1 module COMP6223 (7.5 ECTS/15 CATS) from the list below. If COMP6223 is chosen, select three semester 2 modules (22.5 ECTS/45 CATS) from the list below, or if COMP6223 is not chosen, select four semester 2 modules (30 ECTS/60 CATS) from the following:

Code	Module Title	ECTS	Type
COMP6208	Advanced Machine Learning	7.5	Optional
COMP6241	Advanced Topics in Human-Systems Interaction	7.5	Optional
COMP6207	Algorithmic Game Theory	7.5	Optional
ELEC6212	Biologically Inspired Robotics	7.5	Optional
COMP6211	Biometrics	7.5	Optional
COMP6212	Computational Finance	7.5	Optional
COMP6223	Computer Vision (MSc)	7.5	Optional
COMP6237	Data Mining	7.5	Optional
COMP6248	Deep Learning	7.5	Optional
COMP6202	Evolution of Complexity	7.5	Optional
ELEC6213	Image Processing	7.5	Optional
COMP6247	Reinforcement and Online Learning	7.5	Optional
COMP6215	Semantic Web Technologies	7.5	Optional

COMP6216	Simulation Modelling for Computer Science	7.5	Optional

Progression Requirements

The programme follows the University's regulations for *Progression, Determination and Classification of Results : Undergraduate and Integrated Masters Programmes* and *Progression, Determination and Classification of Results: Postgraduate Master's Programmes* Any exemptions or variations to the University regulations, approved by AQSC are located in *section VI of the University Calendar*.

Support for student learning

There are facilities and services to support your learning some of which are accessible to students across the University and some of which will be geared more particularly to students in your particular Faculty or discipline area.

The University provides:
- library resources, including e-books, on-line journals and databases, which are comprehensive and up-to-date; together with assistance from Library staff to enable you to make the best use of these resources
- high speed access to online electronic learning resources on the Internet from dedicated PC Workstations onsite and from your own devices; laptops, smartphones and tablet PCs via the Eduroam wireless network. There is a wide range of application software available from the Student Public Workstations.
- computer accounts which will connect you to a number of learning technologies for example, the Blackboard virtual learning environment (which facilitates online learning and access to specific learning resources)
- standard ICT tools such as Email, secure filestore and calendars.
- access to key information through the MySouthampton Student Mobile Portal which delivers timetables, Module information, Locations, Tutor details, Library account, bus timetables etc. while you are on the move.
- IT support through a comprehensive website, telephone and online ticketed support and a dedicated helpdesk in the Hartley Library.
- Enabling Services offering support services and resources via a triage model to access crisis management, mental health support and counselling. Support includes daily Drop In at Highfield campus at 13.00 – 15.00 (Monday, Wednesday and Friday out of term-time) or via on-line chat on weekdays from 14.00 – 16.00. Arrangements can also be made for meetings via Skype.
- assessment and support (including specialist IT support) facilities if you have a disability, long term health problem or Specific Learning Difficulty (e.g. dyslexia).
- the Student Services Centre (SSC) to assist you with a range of general enquiries including financial matters, accommodation, exams, graduation, student visas, ID cards
- Career and Employability services, advising on job search, applications, interviews, paid work, volunteering and internship opportunities and getting the most out of your extra-curricular activities alongside your degree programme when writing your CV
- Other support that includes health services (GPs), chaplaincy (for all faiths) and 'out of hours' support for students in Halls and in the local community, (18.00-08.00)
- A Centre for Language Study, providing assistance in the development of English language and study skills for non-native speakers.

The Students' Union provides
- an academic student representation system, consisting of Course Representatives, Academic Presidents, Faculty Officers and the Vice-President Education; SUSU provides training and support for all these representatives, whose role is to represent students' views to the University.
- opportunities for extracurricular activities and volunteering
- an Advice Centre offering free and confidential advice including support if you need to make an academic appeal
- Support for student peer-to-peer groups, such as Nightline.

Associated with your programme you will be able to access:

In the School you will be able to access:

· The tutorial system – you will have a personal tutor whom you can meet on request for advice on your programme and choice of options, or for pastoral support
· A mentor (usually a postgraduate student who has previously taken the course) that sees you weekly
· The ECS senior tutor who provides additional pastoral support
· ECS computer workstations, with a range of manuals and books
· Specialist project laboratories

- Personal email account and web access, including use of on-line collaboration tools
- Helpdesk (programming advisory)
- There are systems for the support of student learning in ECS as well as available from demonstrators who provide additional support for your design projects
- A web-site for each taught module, typically with teaching materials

Methods for evaluating the quality of teaching and learning

You will have the opportunity to have your say on the quality of the programme in the following ways:

- Completing student evaluation questionnaires for each module of the programme.
- Acting as a student representative on various committees, e.g. Staff/Student Liaison Committees, School Programmes Committee OR providing comments to your student representative to feedback on your behalf.
- Serving as a student representative on Faculty Scrutiny Groups for programme validation.
- Taking part in programme validation meetings by joining a panel of students to meet with the Faculty Scrutiny Group.

Further details on the University's quality assurance processes are given in the *Quality Handbook.*

Career Opportunities

Graduates from our MSc programme are employed worldwide in development and consultancy roles in a number of leading companies at the forefront of information technology; and some have gone on to doctoral study and University careers, while others have been involved in IT start-ups. ECS runs a dedicated careers hub which is affiliated with over 100 renowned companies like IBM, ARM, Microsoft Research, Imagination Technologies, Nvidia, Samsung and Google to name a few. Visit our careers hub for more information.

External Examiner(s) for the programme

Name: Professor George Coghill - University of Aberdeen

Students must not contact External Examiner(s) directly, and external examiners have been advised to refer any such communications back to the University. Students should raise any general queries about the assessment and examination process for the programme with their Course Representative, for consideration through Staff: Student Liaison Committee in the first instance, and Student representatives on Staff: Student Liaison Committees will have the opportunity to consider external examiners' reports as part of the University's quality assurance process.

External examiners do not have a direct role in determining results for individual students, and students wishing to discuss their own performance in assessment should contact their Personal Academic Tutor in the first instance.

Please note: This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if they take full advantage of the learning opportunities that are provided. More detailed information can be found in the programme handbook.

Appendix 1:

Students are responsible for meeting the cost of essential textbooks, and of producing such essays, assignments, laboratory reports and dissertations as are required to fulfil the academic requirements for each programme of study. In addition to this, students registered for this programme also have to pay for:

Additional Costs

Type	Details
Approved Calculators	Candidates may use calculators in the examination room only as specified by the University and as permitted by the rubric of individual examination papers. The University approved models are Casio FX- 570 and Casio FX-85GT Plus. These may be purchased from any source and no longer need to carry the University logo.
Printing and Photocopying Costs	In the majority of cases, coursework such as essays; projects; dissertations is likely to be submitted on line. However, there are some items where it is not possible to submit on line and students will be asked to provide a printed copy.
Stationery	You will be expected to provide your own day-to-day stationary items, e.g. pens, pencils, notebooks, etc). Any specialist stationery items will be specified under the Additional Costs tab of the relevant module profile.
Textbooks	Where a module specifies essential (or core) texts, these should be available in the library. Where possible, primary provision will be in electronic format. However, due to demand students may prefer to buy their own copies; these can be purchased from any source. Some modules suggest optional additional or (background) reading texts. The library will hold copies of such texts, or alternatively you may wish to purchase your own copies. Although not essential reading, you may benefit from the additional reading materials for the module.

In some cases you'll be able to choose modules (which may have different costs associated with that module) which will change the overall cost of a programme to you. Details of such costs will be listed in the Module Profile. Please also ensure you read the section on additional costs in the University's Fees, Charges and Expenses Regulations in the University Calendar available at www.calendar.soton.ac.uk.