

## PROGRAMME SPECIFICATION – POSTGRADUATE PROGRAMMES

### KEY FACTS

Programme name	MSc in Artificial Intelligence
Award	MSc
School	SMCSE
Department or equivalent	Computer Science
Programme code	PSARIN
Type of study	Full time
Total UK credits	180
Total ECTS	90
Partner (partnership programmes only)	None
Type of partnership	

### PROGRAMME SUMMARY

The MSc in Artificial Intelligence will prepare you for a successful career as a professional in artificial intelligence. Artificial Intelligence is the area of work concerned with simulating intelligent behaviour with formal and computational models, techniques and tools, and with the application of the resulting algorithms and architectures to solve real-life problems.

The programme covers the study and integration of advanced methods and techniques with an emphasis on Deep Learning technology applied to classification, prediction and control tasks. It will enable you to specialise in an application area of Artificial Intelligence, from image recognition (e.g., fMRI in diagnosing mental conditions) and time series analysis (e.g., financial data), to control tasks (e.g., learn how to play games like Go, or to build efficient controllers for the distribution of renewable energy in smart grids and EDVs), and to engage with researchers to develop your scientific knowledge and skills in each of the above core areas.

The programme is intended to first form students with fundamental nature-inspired Artificial Intelligence knowledge and skills at the three Marr's levels, computational (modelling of cognitive process), algorithmic (neural networks, genetic algorithms, symbolic approaches), and implementational (programming code and mathematical expressions). With such bases, students will specialize in the second semester on cutting-edge Deep Learning techniques such as convolutional and recurrent networks, deep Q-networks and hybrid symbolic networks, the most promising Artificial Intelligence technology, for which both industry and government demand trained professionals. The programme is completed with a series of guest lectures on the business aspects of running an Artificial Intelligence company, and a module in which we explore how the above-mentioned methods can be integrated in the Internet of Things.

The programme will include hands-on, lab-based tutorials and coursework, and the use of tools and technologies which will equip you to pursue a practical MSc Artificial Intelligence project in an application area of choice. During the project, you will solve a real-world problem using real data from industry, academia or government. The learning outcomes are assessed by coursework only and you will be provided with continuous

formative feedback.

The programme is designed for those who have completed a first degree in science and technology subjects including computer science, mathematics, physics, and engineering. However, if you have a degree in another area, like psychology or biology, and have competence in programming and mathematics, this course may also be of interest to you.

### Aims

This programme aims to prepare you with the knowledge, skills and values needed for a technical career in Artificial Intelligence by

- (a) Equipping you with a breadth of knowledge, skills and techniques needed as a professional in modern Artificial Intelligence;
- (b) Developing your knowledge in specialised and advanced topics in Artificial Intelligence, with an emphasis in Deep Learning technology;
- (c) Enabling you to work with and learn from active researchers in Artificial Intelligence;
- (d) Training you to critically evaluate the technical, social and management dimensions of Artificial Intelligence systems and technologies.

There are three types of awards that you can get (please see the section “WHAT AWARD CAN I GET?”).

### **Postgraduate Certificate in Artificial Intelligence**

For all of you completing the Postgraduate Certificate you will have had the opportunity to examine the theories related to the analysis, design, and evaluation of artificial intelligence systems, and demonstrated sufficient ability in at least four taught modules (60 credits), which can be any combination of modules among the available ones.

### **Postgraduate Diploma in Artificial Intelligence**

For all of you completing the Postgraduate Diploma, in addition to the above you will have explored the theory and practice, and demonstrated ability in all the different aspects of artificial intelligence, considering such aspects from different perspectives and demonstrating critical insight on the applicable methods and techniques used in artificial intelligence. You will have demonstrated ability in analysing, designing, developing and evaluating artificial intelligence systems, which equates to passing all eight taught modules, worth 120 credits.

### **MSc in Artificial Intelligence**

For all of you completing the MSc in Artificial Intelligence, in addition to the above you will have demonstrated original application of knowledge in the area, either through the analysis, design, and evaluation of an artificial intelligence artefact -- the design and implementation of an artificial intelligence solution that meets a client's needs, or the critical evaluation and extension of the knowledge in the area through a research-led project, which can involve the development of software artefacts as well, e.g. a deep learning-enabled system to help people carry out particular tasks. This will be achieved

through your individual project, a substantial module worth 60 credits that you can commence once you have successfully passed all your taught modules.

## **WHAT WILL I BE EXPECTED TO ACHIEVE?**

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

### Knowledge and understanding:

1. Synthesise the acquired knowledge to demonstrate the ability to use artificial intelligence methods and techniques (e.g. in machine learning, mathematical modelling and simulation, computational cognition);
2. Review and critically evaluate the literature and current developments and challenges in artificial intelligence, such as deep learning algorithms;
3. Analyse and solve problems and develop innovative solutions, processing real data in classification, prediction and optimization tasks, designing, implementing and testing artificial intelligence methods and tools;
4. Critically evaluate professional, legal, social, cultural and ethical issues related to artificial intelligence;
5. Identify and manage scientific and technical risks associated with artificial intelligence and applications.

### Skills:

1. Analyse, develop and select algorithms and tools that can simulate intelligence;
2. Specify, design, build and evaluate Artificial Intelligence programs and systems;
3. Use cutting-edge hardware and software methods to create human-like Artificial Intelligence systems and to apply them to image recognition, time series analysis and control tasks;
4. Use new technologies to communicate topics in Artificial Intelligence effectively to technical and non-technical audiences.

### Values and attitudes:

1. Embrace technical challenges as an opportunity for personal development;
2. Rationally exploit both traditional and novel technological approaches;
3. Rigorously assess alternative approaches and novel designs;
4. Gain skills about professional ethics and privacy in the context of Artificial Intelligence.

This programme has been developed in accordance with the QAA Subject Benchmark for Computing (2016).

## **HOW WILL I LEARN?**

The teaching and learning methods used are such that the levels of both specialisation of content and autonomy of learning increase as you progress through each module and

the programme. This progression will be guided by active researchers in Artificial Intelligence in the Department of Computer Science and the Department of Electrical and Electronic Engineering, culminating with an individual project containing an original piece of research conducted largely independently with appropriate academic supervision and, where appropriate, in collaboration with industrial partners.

The standard format is that taught modules are delivered through a series of lectures and tutorials/laboratory sessions –the exact number of which will depend on the nature of the module, for instance, practical modules involving intensive programming will consist mainly of laboratory sessions, whereas modules which focus on theory will be delivered mostly through lectures.

Lectures are normally used to: (a) present and exemplify the concepts underpinning a particular subject; (b) highlight the most significant aspects of the syllabus; and (c) indicate additional topics and resources for private study.

Tutorials are used to help you develop skills in applying the concepts covered in the lectures, normally in practical problem-solving contexts.

Laboratory sessions serve a similar purpose as the tutorials but their strategy is to demonstrate application of concepts and techniques through the use of state-of-the-art software development tools and environments.

You are expected to undertake independent study and do substantial coursework assignments for each module, amounting approximately to 120 hours per module.

In addition to lecture, laboratory and tutorial support, each student will be assigned a personal tutor, and the programme is supported by City's Moodle learning environment, which will contain resources for each of the modules. This includes materials such as lecture notes and lab sheets, as well as interactive components, such as a discussion forum.

### **WHAT TYPES OF ASSESSMENT AND FEEDBACK CAN I EXPECT?**

Modules will be assessed through coursework only, one per module. These can take the form of theoretical questions, including small essays and mathematical aspects, and practical assignments requiring the analysis and exemplifying of artificial intelligence methods and techniques. The output of each coursework will be marked along with an oral presentation of the work done.

The coursework takes many forms, including coding programs, theoretical work, and essays, as well as oral presentations. Teamwork is an integral part of the programme: Real-life research and practice in Artificial Intelligence involves working in groups of experts with interdisciplinary backgrounds.

The individual project is a substantial task that develops a research related topic, and is performed under the supervision of academic staff. The assessment of projects relies on a project report and an oral presentation. During the project, you will be given an

opportunity to solve a real problem (e.g., collecting and processing real data, and designing and implementing Artificial Intelligence systems, and applying and evaluating them.)

The individual project can be carried out as a 6-month internship e.g. in one of the companies with which City has a long-standing relationship and history of collaboration (for instance, Google DeepMind or Facebook AI Research).

### Assessment and Assessment Criteria

Assessment Criteria are descriptions, based on the intended learning outcomes, of the skills, knowledge or attitudes that you need to demonstrate in order to complete an assessment successfully, providing a mechanism by which the quality of an assessment can be measured. Grade-Related Criteria are descriptions of the level of skills, knowledge or attributes that you need to demonstrate in order to achieve a certain grade or mark in an assessment, providing a mechanism by which the quality of an assessment can be measured and placed within the overall set of marks. Assessment Criteria and Grade-Related Criteria will be made available to you to support you in completing assessments. These may be provided in programme handbooks, module specifications, on the virtual learning environment or attached to a specific assessment task.

The assessment criteria will reflect the learning outcomes of the modules and the programme as a whole.

### Feedback on assessment

Feedback will be provided in line with our Assessment and Feedback Policy. In particular, you will normally be provided with evaluative feedback within three weeks of the submission deadline or assessment date, which will include a provisional grade or mark. Laboratory and tutorial sessions will be dedicated to the completion of tasks the coursework consists of. Formative feedback will be provided for each task at every session. The timescale for feedback on final year projects or dissertations will be similar.

### Assessment Regulations

In order to pass your Programme, you should complete successfully or be exempted from the relevant modules and assessments and will therefore acquire the required number of credits.

The pass mark for each module is 50%.

If you receive a compensated pass in a module you will be awarded the credit for that module. The original component marks will be retained in the record of marks and your original module mark shall be used for the purpose of your Award calculation.

1. Resit: where you are not eligible for compensation at the first attempt, you will be offered one resit attempt.

If you are successful in the resit, you will be awarded the credit for that module. The mark for each assessment component that is subject to a resit will be capped at the pass

mark for the module. This capped mark will be used in the calculation of the final module mark together with the original marks for the components that you passed at first attempt.

If you do not meet the pass the requirements for a module and do not complete your resit by the date specified you will not progress and the Assessment Board will require that you be withdrawn from the Programme.

If you fail to meet the requirements for the Programme, the Assessment Board will consider whether you are eligible for an Exit Award as per the table below.

If you would like to know more about the way in which assessment works at City, please see the full version of the Assessment Regulations at:  
[http://www.city.ac.uk/data/assets/word\\_doc/0003/69249/s19.doc](http://www.city.ac.uk/data/assets/word_doc/0003/69249/s19.doc)

### WHAT AWARD CAN I GET?

#### Master's Degree:

	HE Level	Credits	Weighting (%)
Taught	7	120	67%
Dissertation	7	60	33%

Class	% required
With Distinction	70
With Merit	60
Without classification	50

#### Postgraduate Diploma:

	HE Level	Credits	Weighting (%)
Taught	7	120	100

Class	% required
With Distinction	70
With Merit	60
Without classification	50

#### Postgraduate Certificate:

	HE Level	Credits	Weighting (%)
Taught	7	60	100

Class	% required
With Distinction	70
With Merit	60
Without classification	50

### WHAT WILL I STUDY?

#### Taught component

There are 8 taught components in total, all core modules and a dissertation. There are no pre/co requisite modules.

Module Title	SITS Code	Module Credits	Core/ Elective	Compensation Yes/No	Level
Principles of Artificial Intelligence	INM701	15	Core	No	7
Programming and Mathematics for Artificial Intelligence	INM702	15	Core	No	7
Computational Cognitive Systems	INM703	15	Core	No	7
Agents and Multi-Agent Systems	INM704	15	Core	No	7
Deep Learning for Image Analysis	INM705	15	Core	No	7
Deep Learning for Sequence Analysis	INM706	15	Core	No	7
Deep Reinforcement Learning	INM707	15	Core	No	7
Explainable Artificial Intelligence	INM708	15	Core	No	7

*Dissertation component*

Module Title	SITS Code	Module Credits	Core/ Elective	Compensation Yes/No	Level
Individual Project	INM363	60	Core	No	7

*You are normally required to complete all the taught modules successfully before progressing to the dissertation*

### **TO WHAT KIND OF CAREER MIGHT I GO ON?**

Artificial Intelligent students can expect to achieve employment in a range of businesses, from Artificial Intelligence developer to jobs that benefit from a deep understanding of cutting-edge Artificial Intelligence techniques and tools in, for instance, health, finance, energy, and transport, or in government. The emphasis of this programme on nature-inspired Artificial Intelligence and Deep Learning, and City's internships and links with industrial partners at Tech City (e.g., Google DeepMind, Facebook AI Research, IBM Research AI) and the Knowledge Quarter (e.g., The Alan Turing Institute) will particularly enable students to gain appointments as specialists in Artificial Intelligence companies, and institutions.

Graduates starting a new business can benefit from City 's London City Incubator, providing support for start-up businesses.

If you would like more information on the Careers support available at City, please go to: <http://www.city.ac.uk/careers/for-students-and-recent-graduates>.

### **WHAT STUDY ABROAD OPTIONS ARE AVAILABLE?**

None

#### **WHAT PLACEMENT OPPORTUNITIES ARE AVAILABLE?**

Internships: You can participate in our professional placement programme, which is supported by the Professional Liaison Unit. This will enable you to undertake your final project within an industrial or research placement over an extended period compared to regular projects.

#### **WILL I GET ANY PROFESSIONAL RECOGNITION?**

We will apply for BCS accreditation.

#### **HOW DO I ENTER THE PROGRAMME?**

1. The programme is designed for those who have completed a first (or upper second class) degree in science and technology subjects including computer science, mathematics, physics, engineering, psychology or biology. The strict requirement however that is you have competence in at least one object-oriented programming language (preferably Python, but Java or C++ are also adequate) and mathematics (linear algebra and calculus, in particular). In case of doubt, we will help you ascertain whether your level of programming and mathematics is adequate to join the programme by running a series of on-line exercise. For those overseas applicants, whose first language is not English or their country has not been exempted from the English language requirement by the UK Home Office, they will need to provide one of the following English test qualifications:
2. IELTS : 6.5 (minimum of 6.0 in all four components)
3. TOEFL 92 (minimum of 20 in Listening, Reading and Speaking, and 22 in Writing)
4. For the availability of scholarships please enquire at the Programmes Office of the School of Mathematics, Computer Science and Engineering.

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