

# Applied Artificial Intelligence



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I became interested in AI while completing my BSc in Computer Science at Exeter. This MSc offered a chance to increase my knowledge of AI techniques and learn how to apply these in the real world. The programme encouraged dynamic thinking, for example working in a team to design a Genetic Programming algorithm to evolve the behaviour of an ant to fight in a competition. I particularly enjoyed working with colleagues who were genuinely enthused and knowledgeable in the same field that interested me and showed new ways to approach and solve problems.

I'm currently working as a Software Developer for BetGenius; a leading provider of technological and data-driven solutions to the sports betting industry. In the current financial climate the work place is very competitive and having an MSc allowed me to stand out from the crowd. Plus, the specific skills I gained can be directly applied to the development of risk management and market analysis solutions.

**TOM BARKER, MSC APPLIED ARTIFICIAL INTELLIGENCE 2007/08**

## WHY STUDY APPLIED ARTIFICIAL INTELLIGENCE AT EXETER?

- **Multidisciplinary research institutes in informatics, mathematics and advanced technologies**
- **Potential for cutting edge applied research with large organisations, such as the Peninsula College of Medicine and Dentistry**
- **Opportunities for collaborative training awards to gain teaching experience**
- **Generous scholarships**

The use of artificial intelligence (AI) techniques in the industrial and commercial sectors continues to expand and develop rapidly as computers get faster and more widespread. Many computational and algorithmic techniques in AI that were at the forefront of research are now widely and commonly used in practice. For instance, knowledge discovery in large databases (based on neural networks and other AI technologies) is a fast growing commercial area that many international blue-chip companies are increasingly reliant upon, with applications to determine user/buyer behaviour, and the games industry is increasingly dependent on AI to generate ever more realistic environments and opponents.

Novel computational techniques like evolutionary computing are being used in knowledge discovery and machine learning, especially for identifying relationships in temporal data and solutions to a variety of complex network problems, including scheduling and optimisation. These techniques have the potential to give companies a competitive edge in new product development, such as novel drugs and materials from high-throughput technologies. Additionally, international developments in e-Science make it imperative that next generation research scientists have detailed knowledge of how to access information through ontologies and how to apply computing to analyse the data held in information systems.

Our MSc in Applied Artificial Intelligence will provide you with the latest knowledge and computational skills in the areas of machine learning and intelligent discovery methods and of AI programming techniques such as evolutionary computation (genetic algorithms, genetic programming) and neural networks.

# Applied Artificial Intelligence



## KEY FACTS

### MSc in Applied Artificial Intelligence

**Duration** 12 months full-time

**Start-date** October

**Entry requirements** All applications are considered individually on merit. Normally a Second Class Honours degree or above (or equivalent) in an engineering or science subject is required. All international students whose first language is not English will need to satisfy our English Language requirements; for further information see the Postgraduate Prospectus at [www.exeter.ac.uk/postgraduate](http://www.exeter.ac.uk/postgraduate)

**Fees (2009/10)** UK/EU students: £4,500; International students: £12,250

**Funding opportunities** Generous international scholarships are available from the School; visit [www.exeter.ac.uk/secam/scholarships](http://www.exeter.ac.uk/secam/scholarships) for full details. There are also University scholarships including Full Fee Masters Scholarships, British Council Fellowships and Awards and Foreign and Commonwealth Scholarships. Visit [www.exeter.ac.uk/scholarships](http://www.exeter.ac.uk/scholarships) for further information.

## Programme overview

The degree is designed for those who wish to enhance their skills in the application of AI techniques to commercial and industrial problems. It is appropriate both for first degree graduates wanting to specialise in this area to enhance their employment prospects and for those already working in IT and related fields, such as software design, who are looking to upgrade their knowledge.

The programme opens up a wide range of employment opportunities and can also act as a foundation for further research at PhD level. The programme does not necessarily require a first degree or qualification in computing or computer science. As long as your first degree has a significant computing element you will be eligible to apply for the programme.



I graduated from Exeter University in 1987. I then worked in the IT departments of some big companies, such as Johnson & Johnson, Tesco and JP Morgan Chase until 2005 when I realised that I was bored. Business IT generally had not moved on much since I graduated, so I decided to return to Exeter for the MSc in AAI to learn new techniques that I could then apply to my work.

I really enjoyed going back to a learning environment where everything is geared towards being able to think and try out new ideas. Being introduced to the concept of computer programs that learn without the outcome being entirely predetermined by the program code was particularly exciting. I loved it so much that I am now studying for a PhD in pattern recognition here.

**JACQUELINE CHRISTMAS, MSC APPLIED  
ARTIFICIAL INTELLIGENCE GRADUATE 2006/07**

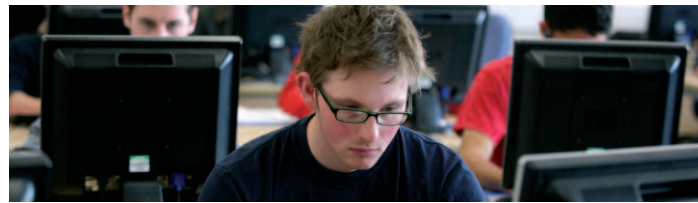
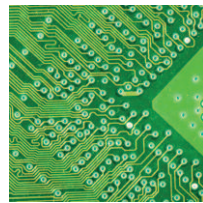
## Programme aims

- Provide you with a range of skills and experience for the successful application of AI academic and industrial problems;
- Train you in the development of AI solutions to difficult research and industrial problems;
- Equip you with the necessary decision-making skills to appropriately apply AI techniques;
- Provide you with the skills necessary to communicate complex research ideas through written and spoken formats.

## Programme outcomes

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

- Apply a broad range of nature-inspired and artificial intelligence techniques to practical problems;
- Demonstrate a theoretical understanding of the benefits and limitations of such techniques;
- Demonstrate a theoretical understanding of the difficulties associated with creating intelligent machines;
- Review and analyse the latest research from multiple traditional and online resources;
- Clearly present complex AI research topics to an audience;
- Research, design and implement an AI-based solution to a practical problem.



## Programme structure

This is a 180-credit course, consisting of multiple 15-credit taught modules in a variety of specific areas, together with a 60-credit independent research project.

The programme begins in October each year and the taught elements are concluded by May. The Research Project, under the personal supervision of a research expert in the chosen area, occupies the remaining six months. A Postgraduate Diploma will be awarded for the successful completion of 120 credits and a Postgraduate Certificate for 60 credits.

## Programme modules

### Tools and Techniques

This module teaches you the programming and mathematical skills to develop algorithms for manipulating and analysing data and to undertake personally-motivated, deeper explorations of the material covered in the remaining modules. You will cover computer program design and development, including algorithms and data structures, using Java in a Linux environment and the object-oriented paradigm. Structured e-learning packages will be used, alongside appropriate commercially available toolkits. You will also cover the mathematical skills necessary to pursue scientific research in AI, such as probability, calculus and linear algebra.

### Nature-Inspired Computation

Traditional computation finds it either difficult or impossible to perform a key range of tasks associated with design, decision making, logistics and scheduling, pattern recognition, problem solving and autonomous intelligence. Great progress towards designing software for such tasks has emerged by taking inspiration from a range of natural, mainly biological, systems. This module introduces the main nature-inspired algorithms and techniques and demonstrates their application to a range of AI problems. The focus will be on evolutionary algorithms, neural networks, swarm intelligence techniques and immune system methods.

### Machine Learning and Optimisation

Building on the content of Nature-Inspired Computation, this module provides a philosophical view of modern AI and considers a number of techniques that

can be used to build intelligent machines and to optimise systems. The core of the module comprises a theoretical and practical introduction to a range of current machine learning and optimisation techniques for supervised learning (principally classification) and unsupervised learning together with current evolutionary and population-based methods for optimising single and multiple objectives.

### Pattern Recognition

Humans are very good at recognising and classifying patterns and thereby extracting knowledge from their environment. Likewise, the recognition and classification of data is a significant computational task. This module provides a thorough grounding in the theory and application of pattern recognition, classification and learning from data. It considers pattern recognition from a general perspective, covering a wide range of practical methods, including linear models, neural networks, kernel machines, clustering, principal and independent component analysis.

### Intelligent Image Understanding

This module introduces you to computer understanding of digital images of real objects. The module describes various image processing methods that allow computers to select and recognise particular objects, segment them into regions of interest, extract suitable features and enable an efficient classification of the considered objects.

### Logic, Ontology and Knowledge Representation

An important goal of AI is to explore ways of endowing machines with the knowledge and reasoning capacities to enable them to behave in ways which we might recognise as intelligent. Of particular concern is the drive to emulate human 'common-sense' understanding, which requires the assimilation of a vast range of mundane facts, many of them seemingly trivial, on the basis of which we are able to conduct our day-to-day negotiations with the world and with each other. This module introduces some of the computer technology theory that has been employed to help answer these questions and illustrates its application through case studies.

### Selected Topics in Applied Artificial Intelligence

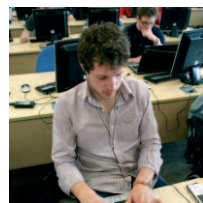
This module builds on the knowledge and skills acquired during the taught part of the programme. You will develop the necessary skills to research and write theoretical papers and scholarly reviews within the domain of applied AI. You will be encouraged to take an interdisciplinary approach and to generate a novel perspective and original hypotheses, opinions and arguments based on individually motivated research.

### Research Methodology

This module introduces you to undertaking independent but supervised research at postgraduate level. Good investigative research is a difficult skill involving the framing of research goals and investigative plans as well as critical evaluation of previously published results. This module explicitly addresses research planning and critical assessment in the context of your own research project.

### Research Project

The aim of the project module is to solve a research problem based on the topic chosen as a part of the 'Research Methodology' module. The project work should lead to a piece of work (dissertation) that shows project planning, analytical or experimental results and your interpretation, showing how the goals of the project have been met. In consultation with a project supervisor, a project will be selected which can involve an industrial placement. Industry-related projects will have an industrial supervisor as well as an academic supervisor. There is no formal taught component in a research project except formal meetings with the research supervisor on a suggested weekly basis. Research projects will require independent research on the chosen topic and the production of software to solve problems. Submission of project results takes the form of a paper (up to 8,000 words) where the emphasis is on succinct statement of problem, survey of relevant literature, explanation of method, results produced and the conclusions drawn.



## Research in the School

### Learning methods and academic support

Teaching is by lectures, example classes, computer classes, tutorials, set work, project work, reading and self-study. The exact form and number of the lectures and tutorials varies from module to module and is chosen according to the material to be covered. Some of the modules are delivered as short intensive courses while others have a mixture of seminars and lectures throughout the term.

The programme places particular value in encouraging transferable skills development including team working and communication skills, computational techniques, data handling and analysis, problem solving, decision making and research methodology.

You will be allocated a Personal Tutor who is available for advice and support throughout your studies. There is also a Postgraduate Tutor available to help with further guidance and advice.

## Research

Research within the School is organised into three Research Institutes; the Advanced Technologies Institute, the Mathematics Research Institute and the Informatics Research Institute. Each has its own Research Centre, providing the focus for significant multi-disciplinary research activity, transferring technology between academia and industry.

The **Advanced Technologies Research Institute** combines international quality research in the areas of materials, manufacturing and electronics, with particular interests in auxetic materials, bioengineering and biomedical materials, data storage and memory materials, devices and systems, agile and dynamic manufacturing systems and sea-wave prediction. The Institute has two renowned Research Centres, Exeter Advanced Technologies and the Exeter Manufacturing Enterprise Centre, which provide the focus for significant multi-disciplinary research activity, transferring technology between academia and industry.

The **Informatics Research Institute** builds on Exeter's international reputation for informatics activities and concentrates on the increasingly important areas of

hydroinformatics (water systems), bioinformatics and biomedical informatics, together with computational statistics and information systems research. Our computer science and informatics research outputs were recognised as having both industrial and social importance in the 2008 RAE with the institute's Centre for Water Systems noted as a clear area of strength.

The **Mathematics Research Institute** brings together our international quality research in various areas of pure and applied mathematics, in particular climate and environmental modelling, geophysical and astrophysical fluid dynamics, dynamical systems and control, and number theory. This Institute also forms the core of our increasingly close collaborations with the UK Met Office, who jointly fund three professorships in mathematics (Professors Cox, Stephenson and Thuburn). In the 2008 RAE the fluids, dynamical systems and climate groups were singled out as being very strong, with our partnership with the Met Office considered a particular strength.

## Postgraduate facilities and resources

The School provides a warm, friendly and supportive atmosphere. The close personal contact between staff and students contributes to a highly productive and well-organised research environment.

The School has excellent teaching and research resources and has recently invested £2.8 million into providing new academic and social facilities. You will have access to the School's fully-equipped research centres, comprehensive laboratories and workshops and computer facilities including wireless networking in most areas. The School has a brand new study area with core texts for courses, individual rooms for study groups to meet, and wireless connection for laptops and LCD TVs to display presentations.

Our Research Institutes offer weekly seminars which provide invaluable insights into current research as well as a place to meet staff and other students. There are also a range of extra-curricular activities organised by students, student societies and the Research Institutes that provide an opportunity to meet students and staff in more informal settings.

## International students

We pride ourselves on making our international students feel welcome and at home, with tutors offering guidance and support. International students appreciate Exeter's safe location and friendly atmosphere.

There is a thriving international student community of some 2,000 students from over 100 countries. There is a full-time International Student Adviser to help with welfare and visa issues. The INTO University of Exeter Centre provides courses for students who need to improve their English before starting a degree and free tuition during term-time. For further information visit [www.exeter.ac.uk/international](http://www.exeter.ac.uk/international)

Under the Post Study Work Scheme, international students who have graduated from one of our postgraduate programmes may be able to remain and work in the UK for up to 24 months after notification of their results. Students who wish to take advantage of the Scheme are encouraged to contact the University's Careers and Employment Service after they arrive at Exeter to discuss employment possibilities.

## Employment

The MSc in Applied Artificial Intelligence has been designed to develop the skills that are in considerable demand in today's technology and industry sectors. Alongside the specific technical expertise acquired, you will gain transferable skills that can be used within every sector of employment. Whilst some graduates will go on to work as Software Engineers System Analysts and AI Systems Developers, others may choose to continue their research on an MPhil or PhD.

The career and training destinations of a sample of recent graduates include:

- PhD Computer Science, University of Exeter
- Battle Programmer, Creative Assembly, Horsham
- Software Developer, Software Science, Honiton
- Software Developer, Thoughtspace, Exeter
- C# Developer, BetGenius, London



## Why choose Exeter?

### A top 15 research-led university

- The University of Exeter is ranked 13th in the *Times* and 14th in the *Guardian* and *Sunday Times* 2008 league tables. Nearly 90 per cent of Exeter's research was rated as being at internationally recognised levels in the 2008 Research Assessment Exercise. Sixteen of our 31 subjects are ranked in their respective top 10, with 27 in their respective top 20. Every subject was assessed as including world-leading (4\*) research.\*
- In the last year, £51 million was invested in research and the value of new research grants and contracts rose by 49 per cent.
- We are planning investment of £80 million in science, medicine and engineering over the next three years. £30 million of existing University funds and an anticipated £50 million from external sources will be spent on new appointments and infrastructure to boost research and teaching.

### Dedicated support and training

- We invest £4.5 million per year in scholarships and financial support for postgraduates.
- Our employment rates for postgraduates are above the national average;\*\* 97 per cent of postgraduates who graduated in 2006/7 entered employment or further study.\*\*\*
- The Postgraduate Centre on the Streatham Campus offers purpose-built study and leisure facilities, including a 24-hour computer room, lounges, seminar room, bar and dining room.
- The Postgraduate Union (PGU) represents postgraduates across

the University, organising the Postgraduate Forum which gives students the opportunity to provide feedback, as well as social events. Postgraduates are well represented on the Guild's award-winning media and wide range of clubs and societies. Each October, there is a Welcome Week specifically designed for new postgraduates.

### Investment in student and research facilities

- We are near to completing a £140 million investment programme in new buildings and facilities, ranging from dedicated postgraduate study facilities and new research centres to the Students' Guild building and nightclub.
- The University is now looking to the future with a planned £450 million investment in campus facilities by the end of the next decade. This will include a £40 million redevelopment of the centre of the Streatham Campus and a new £45 million INTO Centre for international students.
- Exeter's expenditure on library books, journals and electronic resources is 35 per cent above the national average in terms of spend per full-time student.\*\*\*\*
- An £8 million development programme has given Exeter some of the best sports facilities in the country. New indoor tennis facilities to LTA standards opened in 2004 on the Streatham Campus, making Exeter one of only nine UK universities to have such facilities. A new £2 million cricket centre will open in spring 2009.

### An exceptional location

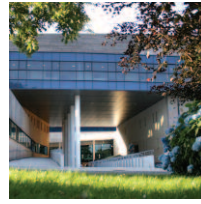
- The Streatham Campus in Exeter is one of the most beautiful in the country.
- A safe, student-friendly city, Exeter is consistently rated one of the best places to live in the UK for the quality of its facilities and low crime rate. For those looking to escape city life, sandy beaches, moorland and some of the most stunning countryside in Britain are all just a short journey away.
- No longer the 'sleepy cathedral town', Exeter is booming economically and culturally but without losing its human scale and relaxed ambience. Large companies like the Met Office are choosing to relocate and there are major developments in shopping, leisure and nightlife in the city centre, including a £200 million new retail centre. Exeter ranks joint 8th (just behind Brisbane, Shanghai, Sydney and London) in a worldwide study of promotion of inward investment and was voted 2nd best place for retail therapy in the UK outside London (Yellow Pages survey, 2007).

\* based on percentage of research categorised as 3\* and 4\* (internationally excellent or world leading)

\*\* HESA 2005/6

\*\*\* Figures as Jan 2008 as a percentage of Home Full-time graduates available for employment or further study

\*\*\*\* LISU/SCONUL figures, 2006/7



## Application procedure

You can apply online via the programme page on our website at [www.exeter.ac.uk/postgraduate](http://www.exeter.ac.uk/postgraduate)

Further information on application procedures can be found at [www.exeter.ac.uk/postgraduate/admissions](http://www.exeter.ac.uk/postgraduate/admissions)



## Useful contacts

### **School of Engineering, Computing and Mathematics**

Telephone: +44 (0)1392 263624

Email: [t.albutt@exeter.ac.uk](mailto:t.albutt@exeter.ac.uk)

[www.exeter.ac.uk/secam](http://www.exeter.ac.uk/secam)

### **Postgraduate admissions**

Telephone: +44 (0)1392 263316

Email: [pg-ad@exeter.ac.uk](mailto:pg-ad@exeter.ac.uk)

### **Information for international students**

Telephone: +44 (0)1392 263405

Email: [intoff@exeter.ac.uk](mailto:intoff@exeter.ac.uk)

[www.exeter.ac.uk/international](http://www.exeter.ac.uk/international)

### **University accommodation**

[www.exeter.ac.uk/postgraduate/accommodation](http://www.exeter.ac.uk/postgraduate/accommodation)

### **Fees and finance**

[www.exeter.ac.uk/postgraduate/money](http://www.exeter.ac.uk/postgraduate/money)

This document forms part of the University's Postgraduate Prospectus. Every effort has been made to ensure that the information contained in the Prospectus is correct at the time of going to press. However, the University cannot guarantee the accuracy of the information contained within the Prospectus and reserves the right to make variations to the services offered where such action is considered to be necessary by the University. For further information, please refer to the Postgraduate Prospectus (available at [www.exeter.ac.uk/pgp/disclaimer](http://www.exeter.ac.uk/pgp/disclaimer)).