

Artificial Intelligence (MSc)

Artificial intelligence (AI) is a field of computer science that enables computers and machines to perform tasks normally requiring human intelligence. Its many applications range from chess-playing robots and autonomous cars to speech, image, and language processing, robotic manufacturing, and surveillance systems. AI simulates human intelligence processes by combining large datasets, machine learning, and computational power with algorithms capable of solving problems.

<http://cs.cit.ie/ai>

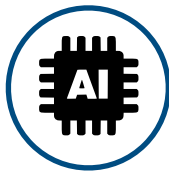


MSc in Artificial Intelligence

This master's degree programme provides a technical deep-dive into the area of Artificial Intelligence (AI). The programme will produce AI developers with a highly relevant skillset in AI topics. You'll learn how to use and develop intelligent computer systems that can learn from experience, recognise patterns in vast amounts of data and reason strategically in complex decision making situations. The programme places significant emphasis on student learning by doing. It adopts a practical, hands-on, approach to learning, where all modules are fully assessed using continuous assessment methods.

Who Should Apply?

Are you an analytical thinker who enjoys working with intelligent computer systems? Do you like solving challenging problems? Have you got strong coding and mathematical skills? Would you like to know more about topics such as Machine Learning, Metaheuristic Optimisation, Big Data and Large Scale Computing, Deep Learning, Decision Analytics, Robotics and Autonomous Systems, Research Practice and Ethics? Do you hold an honours degree in Computer Science, Engineering or in a cognate discipline? If so, this Master of Science in Artificial Intelligence degree is the right choice for you.



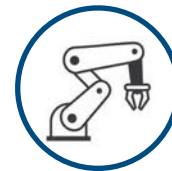
MODERN

You'll also have an opportunity to work on modern research case studies linked to the domain expertise of staff in the department.



FOCUSED

The programme contains challenging and interesting modules delivered by lecturers who are experts in Artificial Intelligence.



APPLIED

Continuous assessment methods are used for each module. This ensures that you will learn by doing from the first module to the last.

Please contact us for further details - ✉ cs@cit.ie, ☎ +353 21 4335160

In the twenty-first century, AI techniques have experienced a resurgence following concurrent advances in computer power, large amounts of data, and theoretical understanding. AI techniques have become an essential part of the technology industry, helping to solve many challenging problems in computer science.

This Master of Science in Artificial Intelligence programme will be delivered full-time from September 2018. It comprises of two 30 credit semesters. The programme is currently going through a validation and approval process with the following modules and structure.

Semester 1	Module Type	Credits
Practical Machine Learning	Mandatory	5
Metaheuristic Optimisation	Mandatory	5
Big Data and Large Scale Computing	Mandatory	5
Robotics and Autonomous Systems	Mandatory	5
Research Practice & Ethics	Mandatory	5
Knowledge Representation & Reasoning	Elective	5
Recommender Systems	Elective	5
AI for Computational Sustainability	Elective	5

Semester 2	Module Type	Credits
Deep Learning	Mandatory	5
Decision Analytics	Mandatory	5
Research Project	Mandatory	15
Natural Language Processing	Elective	5
Planning and Scheduling	Elective	5
Fraud and Anomaly Detection	Elective	5

Cork Institute of Technology has an excellent national and international record in the application of Artificial Intelligence and Machine Learning research in sectors ranging from renewable energy to life science. It is funded by Science Foundation Ireland, Enterprise Ireland, Irish Research Council, Health Research Board and the European Commission. The following are a sample of recent applied AI and Machine Learning research projects:

- Machine Learning for Monitoring Dementia Patients
- Machine Learning for Cancer Genomics
- Artificial Intelligence for Marine Renewable Energy Installations
- Machine Learning for Prediction and Managing Greenhouse Gas Emissions from Agriculture
- Machine Learning for location tracking of Firefighters in Real Time
- Artificial Intelligence for Smart Ambulance Deployment
- Machine Learning for detection Antibiotic Resistance.

On successful completion of this Master of Science in Artificial Intelligence degree students will be able to progress to PhD research opportunities in the Department of Computer Science.

Semester 1	Module Description
Practical Machine Learning Mandatory - 5 credits	The module will provide a comprehensive foundation in the application and implementation of machine learning techniques. The module focuses on supervised and unsupervised learning algorithms, specifically classification, regression and clustering techniques.
Metaheuristic Optimisation Mandatory - 5 credits	This module explores techniques for the analysis and design of efficient techniques to solve real-life problems. In this module the learner will be introduced to the complexity of solving hard combinatorial problems, i.e., recognise and prove NP-hard problems. Additionally, the module covers effective and efficient meta-heuristic techniques to tackle complex decision problems, especially combinatorial optimisation problems.
Big Data and Large Scale Computing Mandatory - 5 credits	In this module, the learner will be introduced to distributed programming, big data distributed architectures and the underlying distributed algorithms supported by them so as to analyse large-scale datasets. The (industrial) data framework of Apache Hadoop will be used to demonstrate the concepts being presented. The module includes an overview of the Hadoop ecosystem, with a special emphasis on the design of algorithms for performing data analysis over real-life datasets using MapReduce and Spark.
Robotics and Autonomous Systems Mandatory - 5 credits	This module gives a solid and broad understanding of the latest developments in intelligent articulated and autonomous robotic systems. This module will introduce and cover at an advanced level robotic control theory and systems, sensing, manipulation and interaction, navigation and systems engineering. The module will consider kinematics and inverse kinematics especially in the context of articulated systems. The application of reinforcement learning to articulated and autonomous robotic systems will then be explored with an emphasis on multi-robotic systems and navigation.
Research Practice & Ethics Mandatory - 5 credits	The purpose of this module is to introduce students to the tools and techniques for doing research. In this module the nature of research will be examined and the methods to undertake investigations across a broad range of subjects presented. On completion of this module students will have identified a research topic and developed a research proposal outlining the context of the topic, its research aims, objectives, methodologies, work plan etc.
Natural Language Processing Elective - 5 credits	This module will provide learners with a comprehensive introduction to the theory underpinning Natural Language Processing (NLP) and will also equip learners with the knowledge and skills to implement and apply NLP algorithms and techniques to real-world problems such as sentiment analysis.
Recommender Systems Elective - 5 credits	AI-based recommender systems are widely used across a broad range of domains including e-commerce, marketing, movie recommendations etc. In this applied module, learners will focus on a number of case studies and will develop intelligent decision support systems and recommender systems for these specific problem domains. The module will demonstrate how to analyse a problem domain and subsequently design, implement and integrate artificial intelligence models into an intelligent decision support system. In terms of recommender systems, the module will focus on collaborative, content-based filtering and hybrid recommender systems. Students will develop and evaluate either a collaborative or content-based system for a real-world case study.
AI for Computational Sustainability Elective - 5 credits	Artificial intelligence will play an important role in addressing critical sustainability challenges faced by present and future generations. The aim of this module is to introduce students to a range of sustainability challenges and to computational methods in Artificial Intelligence that will help to address such challenges. In this module, students will identify real-life applications and learn optimisation techniques to minimise the utilisation of resources used to support the sustainability of our planet. In addition, students will learn problem solving techniques for sustainability via computational models and algorithms in AI.

Semester 2

Module Description

Deep Learning

Mandatory - 5 credits

Deep learning techniques have led to significant advances in the application of machine learning to challenging real-world problems such as natural language processing and image recognition. This module focuses on equipping students with both the theoretical and practical skills that will enable them to build and apply deep learning neural networks to real-world problems. More specifically the module will look at multiple linear regression, logistic regression and neural networks. It will then specifically focus on convolutional neural networks and recurrent neural networks. It will also examine best-practice methods of improving the performance of deep learning systems through hyper-parameter tuning, regularisation and optimisation.

Decision Analytics

Mandatory - 5 credits

Many real-world problems require the optimisation of an objective function or a range of parameters, while satisfying underlying constraints. In this module students will learn how to model real-world problems defined by various parameters and constraints. They will also learn to select and apply appropriate optimisation algorithms, which will generate optimal solutions and facilitate informed decision making.

Research Project

Mandatory - 15 credits

Prior to completing this module the student through the employment of various research methods and selected practices will have identified their chosen research question. As part of this module, the student will complete their research project and implementation relevant to their field or domain of expertise. The student will be expected to disseminate the research work and outcomes through an oral/poster presentation and submission of a dissertation.

Planning and Scheduling

Elective - 5 credits

Planning and scheduling are emerging areas derived from Artificial intelligence with important applications ranging from process planning, web-based information gathering, autonomous agents, space mission control, and creating schedules of product operations in truck movements in transportation and aircraft crews.

Knowledge Representation & Reasoning

Elective - 5 credits

Knowledge discovery is a broad field of study, involving research into the automated identification of novel patterns in data that are potentially useful and understandable. It differs from related fields, such as data mining and machine learning, in that it is concerned with the entire process from data acquisition to the eventual feedback of novel discoveries to the domain from which the data originated.

Enabling these discoveries relies on an implicit understanding of the processes being undertaken (Selection, Pre-processing, Transformation, Data Mining, Interpretation/Evaluation) as well as the representation of the data at each stage (Data, Target Data, Pre-processed Data, Transformed Data, Patterns, Knowledge).

Fraud and Anomaly Detection

Elective - 5 credits

Machine learning and data mining play significant roles in cybersecurity, especially as more challenges appear with the dynamic change of threats, and the severe imbalanced classes of normal and anomalous behaviours.

Programme Development Team

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