Programme Information		
Programme Title	Programme Code	HECoS Code
Applied Machine Learning	I460	For Registry Use Only

Award	Length of Study	Mode of Study	Entry Point(s)	Total Credits	
				ECTS	CATS
MSc	1 Calendar Year (12 months)	Full-Time	Annually in October	90	180

Ownership			
Awarding Institution	Imperial College London	Faculty	Faculty of Engineering
Teaching Institution	Imperial College London	Department	Electrical and Electronic Engineering
Associateship	N/A	Main Location(s) of Study	South Kensington Campus
External Reference			
Relevant QAA Benchmark Statement(s) and/or other external reference points		Master's Awards in Engineering	
FHEQ Level		Level 7 - Master's	
EHEA Level		2nd Cycle	
External Accreditor(s) (if applicable)			
External Accreditor 1:	N/A		
Accreditation received:	N/A	Accreditation renewal:	N/A
Collaborative Provision			
Collaborative partner	Collaboration type	Agreement effective date	Agreement expiry date
N/A	N/A	N/A	N/A
Specification Details			
Programme Lead		Prof Krystian Mikolajczyk, Dr Ad Spiers	
Student cohorts covered by specification		2021/22 entry	
Date of introduction of programme		01/10/2020	
Date of programme specification/revision		October 2021	

Programme Overview

This MSc programme will provide essential training and skills to design, implement and evaluate machine learning systems in several application domains (robotics, communication, speech and vision). It will be delivered within the department of Electrical and Electronic Engineering.

The programme consists of compulsory taught modules that provide general background theory, practical knowledge and skills (classical Machine Learning and Deep Learning), compulsory modules focusing on machine learning applied in engineering domains and delivered by internationally leading experts in their respective research fields (robotics, communication, speech and vision) and optional modules that allow students to broaden their experience with other applications of machine learning (AI, neuroscience and signal processing). The modules have a coursework component with the majority of the application modules assessed by coursework only.

The programme is intended for graduates in broad electrical and electronic engineering domains with substantial mathematics and engineering content that require machine learning knowledge and skills.

Most industries working with large amounts of sensors that produce data have recognized the value of machine learning technology. By intelligent processing of the data, organizations are able to offer new products with enhanced capabilities, optimize their processes and gain an advantage over competitors. These include manufacturing, communications, creative industries, health care, energy management, transportation etc. The data analysis and modelling aspects of machine learning are important tools to optimise and automise processes that most industries and services rely on.

During this course, students will focus on applying machine learning to electrical engineering. Applications include robotics, computer vision bio-inspired learning, communication and signal processing. This course is intended for graduates interested in developing real-world systems. These will involve signals, sensors and hardware, such as robots or communication devices.

Learning Outcomes

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

- Apply fundamental concepts and theoretical principles of machine learning for building signal and data representations and modelling target functions;
- Develop insight into the problems involved in applying a variety of machine learning techniques (such as neural networks, etc.) to deal with practical scenarios;
- Critically analyse suitable EEE tasks to which ML techniques can be applied;
- Formulate practical EEE problems as machine learning tasks;
- Calculate theoretical values of a learning model given input data and parameters;
- Analyse and compare the strengths and weaknesses of popular approaches;
- Design and implement various algorithms in a range of EEE applications through specific programming environments;
- Predict potential outcomes of applying various types of techniques to a given problem;
- Create data from various sensors for training modern machine learning models;
- Evaluate the effectiveness of a particular implementation through appropriate design and execution of experiments;
- Analyse and document evaluation results, draw appropriate conclusions and recommend actions to improve the performance.

The Imperial Graduate Attributes are a set of core competencies which we expect students to achieve through completion of any Imperial College degree programme. The Graduate Attributes are available at: www.imperial.ac.uk/students/academic-support/graduate-attributes

Entry Requirements	
Academic Requirement	The minimum requirement is normally a 1st Class Honours degree in in broad electrical and electronic engineering with substantial mathematics and engineering content, from a UK academic institution or equivalent from an overseas university. Chinese applicants are only considered if they are studying at C9 or Project 985 universities. The entry requirement for these students is an overall degree total of 85%+. The entry requirements for a Chinese student studying in the UK on a 2+2 Programme would be a 1st class degree with a minimum final year mark of 75%. Up-to-date entry requirements: can be found at: https://www.imperial.ac.uk/electrical-engineering/study/postgraduate/ Given the entry requirements to the programme, all admitted students will have knowledge and skills of programming, though we appreciate this will be in a variety of languages; provision will be made to ensure all students are able to translate their knowledge to the Python programming language. Online tutorials will be recommended at the beginning of the course. Offers made to students are initiated by the MSc Director and another member of staff closely related to the programme. When an applicant has a lesser degree qualification but has at least 3 years of work experience, exceptionally a special case for admission can be made; few such applications are made. For further information on entry requirements, please go to: www.imperial.ac.uk/study/pg/apply/requirements/pgacademic
Non-academic Requirements	N/A
English Language Requirement	Higher requirement (PG) Please check for other Accepted English Qualifications
Admissions Test/Interview	Applications are reviewed by a selection committee consisting of the course director and a nominated member of staff. The main criteria for selection are academic performance to date and academic potential. Applicants are not interviewed.
The programme's competency standards documents can be found at: TBC	

Learning & Teaching Approach

The learning and teaching approach consists of a combination of lectures, seminars, computer-based work, coursework and guided reading. Development of professional skills is supported by various aspects of the group and individual research project. The students are encouraged throughout to undertake independent reading both to supplement and consolidate material relevant to the lectures and project and to broaden their individual knowledge and understanding of the machine learning area.

Intellectual skills are developed through the teaching and learning methods, with some experience of team work. Practical skills are developed through the teaching and learning programme. Practical computational skills are developed through coursework and project work and through interaction with research supervisor(s) and (sometimes) research students.

Skills related to critical appraisal of machine learning algorithms and analysis of results are taught by guided reading with feedback associated with the group as well as individual project. Transferable skills are developed through Lab group projects, coursework and individual project work.

Overall Workload
Your overall workload consists of face-to-face sessions and independent learning. While the actual contact hours may vary according to the optional modules chosen to study, the following gives an indication of how much time will need to be allocated to different activities at each level of the programme. At Imperial, each ECTS credit taken equates to an expected total study time of 25 hours. Therefore, the expected total study time is 2,250 hours per year.

Assessment Strategy

Assessment Methods

This programme will employ both summative and formative assessments to support and assess your learning. The goal of the summative assessment is to award a grade against a set of criteria, which includes forms of written exams, coursework, laboratory work, written reports and oral presentation. The formative assessment is designed to support you to better perform in your summative assessment to meet the learning outcomes of the programme.

Assessment of the knowledge base is through a combination of unseen written examinations and assessed coursework. Assessment of intellectual, practical and transferable skills is through coursework and supervised project work.

Autumn modules are focused on theory and have significant part of assessment by written examinations. Spring modules are mainly assessed by coursework. The Summer term is full time project work.

Academic Feedback Policy

Written feedback will be available through Blackboard within a week of the submission of coursework assignment with a maximum time limit of two weeks.
This will be in the form of, for example:

- Marked-up coursework, laboratory exercises or tests
- Personal discussion
- Discussions in small-group tutorials
- Verbal presentation, e.g. during or after lectures
- Written class-wide summaries

In lieu of feedback on examinations, selected examination questions are routinely set as unassessed problems in later years, with model answers provided.

The College's Policy on Academic Feedback and guidance on issuing provisional marks to students is available at:
www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/

Re-sit Policy

The College's Policy on Re-sits is available at: www.imperial.ac.uk/student-records-and-data/for-current-students/undergraduate-and-taught-postgraduate/exams-assessments-and-regulations/

Mitigating Circumstances Policy

The College's Policy on Mitigating Circumstances is available at: www.imperial.ac.uk/student-records-and-data/for-current-students/undergraduate-and-taught-postgraduate/exams-assessments-and-regulations/

Additional Programme Costs		
This section should outline any additional costs relevant to this programme which are not included in students' tuition fees.		
Description	Mandatory/Optional	Approximate cost
N/A	N/A	N/A

Important notice: The Programme Specifications are the result of a large curriculum and pedagogy reform implemented by the Department and supported by the Learning and Teaching Strategy of Imperial College London. The modules, structure and assessments presented in this Programme Specification are correct at time of publication but might change as a result of student and staff feedback and the introduction of new or innovative approaches to teaching and learning. You will be consulted and notified in a timely manner of any changes to this document.

Programme Structure[1]					
Year 1 – FHEQ Level 7 **Students study all core modules.** **Students choose THREE electives from Group A, and THREE electives from Group B**					
Code	Module Title	Core/ Elective/ Compulsory	Group	Term	Credits
ELEC96031	Machine Learning	Core		Autumn	5
ELEC97116	LAB in Applied ML	Core		Autumn & Spring	10
ELEC96033	Deep Learning	Core		Spring	5
ELEC97117	Individual Project in Applied Machine Learning	Core		Summer	40
ELEC97073	Probability and Stochastic Processes	Elective	A	Autumn	5
ELEC97022	Digital Image Processing	Elective	A	Autumn	5
ELEC97089	Topics in Large Dimensional Data Processing	Elective	A	Autumn	5
ELEC97046	Human-Centered Robotics	Elective	A	Autumn	5
ELEC96005	Artificial Intelligence	Elective	A	Autumn	5
ELEC97080	Speech Processing	Elective	B	Spring	5
ELEC97003	Adaptive Signal Processing and Machine Intelligence	Elective	B	Spring	5
ELEC97105	Self-Organising Multi-Agent Systems	Elective	B	Spring	5
ELEC97113	Computer Vision and Pattern Recognition	Elective	B	Spring	5
ELEC97087	Topics in Control Systems	Elective	B	Spring	5
ELEC97093	Wavelets, Representation Learning and their Applications	Elective	B	Spring	5
				Credit Total	90

[1] **Core** modules are those which serve a fundamental role within the curriculum, and for which achievement of the credits for that module is essential for the achievement of the target award. Core modules must therefore be taken and passed in order to achieve that named award. **Compulsory** modules are those which are designated as necessary to be taken as part of the programme syllabus. Compulsory modules can be compensated. **Elective** modules are those which are in the same subject area as the field of study and are offered to students in order to offer an element of choice in the curriculum and from which students are able to select. Elective modules can be compensated.

Progression and Classification
Student progression and academic development will be monitored through formative and summative assessment. The following criteria for MSc are currently in place in EEE department. **MSc** 1. At least 40% for each of the 8 modules counted for the computation of the examinations average 2. At least 50% for the laboratory average 3. At least 50% for both the project and examinations average **MSc with Merit** 1. At least 40% for each of the 8 modules counted for the computation of the examinations average 2. At least 50% for the laboratory average 3. At least 60% for both the project and examinations average **MSc with Distinction** 1. At least 40% for each of the 8 modules counted for the computation of the examinations average 2. At least 50% for the laboratory average 3. At least 70% for both the project and examinations average
Programme Specific Regulations
N/A

Supporting Information
The Programme Handbook is available at: TBC
The Module Handbook is available at: http://intranet.ee.ic.ac.uk/electricalengineering/eecourses_t4/index.asp
The College's entry requirements for postgraduate programmes can be found at: www.imperial.ac.uk/study/pg/apply/requirements
The College's Quality & Enhancement Framework is available at: www.imperial.ac.uk/registry/proceduresandregulations/qualityassurance
The College's Academic and Examination Regulations can be found at: www.imperial.ac.uk/about/governance/academic-governance/regulations
Imperial College is an independent corporation whose legal status derives from a Royal Charter granted under Letters Patent in 1907. In 2007 a Supplemental Charter and Statutes was granted by HM Queen Elizabeth II. This Supplemental Charter, which came into force on the date of the College's Centenary, 8th July 2007, established the College as a University with the name and style of "The Imperial College of Science, Technology and Medicine". www.imperial.ac.uk/admin-services/secretariat/college-governance/charters/
Imperial College London is regulated by the Office for Students (OfS) www.officeforstudents.org.uk/advice-and-guidance/the-register/
This document provides a definitive record of the main features of the programme and the learning outcomes that a typical student may reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities provided. This programme specification is primarily intended as a reference point for prospective and current students, academic and support staff involved in delivering the programme and enabling student development and achievement, for its assessment by internal and external examiners, and in subsequent monitoring and review.

Modifications			
Description	**Approved**	**Date**	**Paper Reference**
N/A			