Coventry
University

Course Specification
Part A

MSc Data Science and Computational Intelligence
EECT044

Faculty of Engineering, Environment and Computing
School of Computing, Electronics and Mathematics

Academic Year: from 2021/2022

Please note: This specification provides a concise summary of the main features of the course 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. We regularly review our course content, to make it relevant and current for the benefit of our students. For these reasons, course modules may be updated.

More detailed information on the learning outcomes, content, and teaching, learning and assessment methods of each module can be found in the Module Information Directory (MID), student module guide(s) and the course handbook.

The accuracy of the information contained in this document is reviewed by the University and may be verified by the Quality Assurance Agency for Higher Education.

Coventry University's accreditation with CMI is currently ongoing for the relevant modules and is regularly reviewed and monitored by the CMI through their quality systems. Whilst Coventry University anticipates that these reviews will continue to be successful, if they were to be unsuccessful, the relevant module in this course would no longer be accredited and we would notify applicants and students of this change as soon as possible.

MSc Data Science and Computational Intelligence

1. Introduction

Data science refers to understanding, processing, extracting value from and representing very large amounts of data. It requires multidisciplinary skills including traditional computer science, mathematics, and statistics combined with business aptitude, curiosity and entrepreneurship.

Computational Intelligence (CI) is a branch of computer science studying problems for which there are no effective computational algorithms. Computational Intelligence approaches mimic human information processing and reasoning mechanisms as well as other biologically inspired processes such as evolution and collective intelligence found in many natural systems. The main areas of Computational Intelligence are Neural Networks, Evolutionary Computation and Fuzzy Systems.

The focus of the proposed MSc Data Science and Computational Intelligence Course is on applications of data science methods and tools combined with Computational intelligence techniques for data-driven problem solving, including the analysis, interpretation and visualisation of complex data, which is in increasing demand in fields such as marketing, pharmaceutics, finance, transportation, medicine, and management.

The course will provide students with the knowledge and understanding of the underlining theory of data science and CI methodologies and practical experience in applying these to real life problems in business, finance, security, autonomous transportation, banking, retail and bioinformatics. The unique selling point of the course will be the delivery through a wide range of activities and problem based learning in the context of the current research or industry consultancy projects, such as autonomous vehicle, Diabetes management through artificial intelligence and machine learning techniques, image processing, social network data analysis and web mining, smart cities, Bioinformatics problems, fault diagnosis, and prognosis, among others, conducted by the academics responsible for teaching on this course.

The course will equip students with strong analytical and problem solving skills, ability to apply computational intelligence methods, algorithms and techniques to tackle real world applications. There have been a growing demand for data specialists capable of analysing, interpreting and visualising Big data to help businesses in making the strategic decisions, which will benefit industry and society. It is also emphasised that data science, computational intelligence and machine learning will drive a new wave of innovation required by the modern industry. Successful data and computational intelligence graduates will acquire specialist knowledge and skills, which are greatly demanded on the market. The course will provide the opportunity to individuals to acquire such skills and meet the demand for experts in these areas.

For students in today's competitive employment markets having work experience can significantly enhance employment prospects. For this reason, the course offers students the opportunity to undertake a work placement, extending the main provision to a two-year course. The work placement could be International or UK with a focus, which may be industry or research. Following a selection process within the first semester and subject to securing an approved placement opportunity, students would move onto the two-year course. International students who are interested in a work placement will be supported in completing an application for extending their Tier 4 visa by international student support services. Upon completion of their placement, students will return to complete the course and the final project for the full award.

As part of this course you will undertake a professional development module which is currently accredited by the Chartered Management Institute (CMI). Upon successful completion of the module, you will gain the CMI Level 7 Certificate in Strategic Management and Leadership Practice at no additional cost.

2 Available Award(s) and Modes of Study

Title of Award	Mode of attendance	UCAS Code	FHEQ Level
MSc in Data Science and Computational Intelligence	1 Year FT On-campus 2 years with Work Placement 2 Year PT On-campus		7
PG Diploma in Data Science and Computational Intelligence	Fall-back		6
			5

PG Certificate in Data Science and Computational Intelligence	Fall-back		

3 Awarding Institution/Body	Coventry University
4 Collaboration	
5 Teaching Institution and Location of delivery	Coventry University
6 Internal Approval/Review Dates	Date of approval*/latest review*: 03/2019 Date for next review: 2027/2028
7 Course Accredited by	
8 Accreditation Date and Duration	
9 QAA Subject Benchmark Statement(s) and/or other external factors	Designed is accordance with: The Framework for Higher Education Qualifications Quality Assurance Agency for Higher Education (QAA) subject benchmarking statement for Master's degrees in Computing, which can be accessed at: http://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/sbs-masters-degree-computing.pdf?sfvrsn=c490f681_16
10 Date of Course Specification	February 2021
11 Course Director	Dr Alireza Daneshkhah

12 Outline and Educational Aims of the Course

The MSc in Data Science and Computational Intelligence seeks to provide a post-graduate education covering the main theoretical and practical aspects of the field. The overall aim of the MSc in Data Science and Computational Intelligence is to:

- Deliver advanced theoretical and practical subjects across a range of special areas in data science and computational intelligence which are greatly demanded in a wide range of research and industrial applications;
- Enable students to enhance their analytical, problem solving, critical communication and presentation skills in the context of their taught modules and develop the ability to analyse, evaluate and model complex problems involving large amounts of data;
- Advance the skills and knowledge acquired through previous study and experience into cutting edge research and technologies and to enhance students' transferable and professional skills and, thereby, their employment prospects;
- Provide specialist skills and in-depth knowledge essential for graduates to develop and adapt to the challenges in the field of data science;
- Enable students to analyse and critique the central and current research problems in data science and computational intelligence;

- Enable students to operate as effective independent researchers and/or consultants in their chosen specialised aspect of the course;
- Enhance the awareness of the professional, legal, ethical and social issues along with commercial risk and management in the role of a data science professional.
- Enable students to adapt to future changes in technology in relation to data science and computational intelligence areas.

Additionally, the course would provide a platform for further research at Doctoral level in data science, statistics and machine learning to students with a wide range of undergraduate degrees. Furthermore, the course will provide an opportunity to early- and mid-career practitioners in a wide range of related jobs (including data scientists, data analyst, statistician, etc.) to enhance their knowledge or move into Data science.

13 Course Learning Outcomes

On successful completion of the course a student will be able to:

1. Critically select and use appropriate data analytic approaches for data analysis; interpret the outcome of a statistical analysis and use appropriate algorithms and software as required by the problem;
2. Appraise a wide range of standard and advanced machine learning and artificial neural network methodologies, their associated algorithms and their appropriateness to tackle a wide range of real-world problems;
3. Demonstrate a sound competency of the theoretical and practical issues relevant to Big data analytics and visualisation, and information retrieval techniques;
4. Apply analytical, critical and communication skills in problem solving, information retrieval from various sources, working with others, and the effective use of general IT facilities and specific software's. Develop relevant technical skills in emerging technologies and methodologies to adapt to the challenges in the data science and computational intelligence related field in a global context;
5. Apply professional skills in modelling complex data building analytical solutions in a teamwork environment.
6. Develop the awareness of professional, social, ethical, and legal issues along with commercial risk and management for Data Science and Computational Intelligence. Furthermore, demonstrate knowledge and understanding of management and business practices, their limitations, and how these may be applied in the relevant contexts with the particular specialisation.
7. Develop research skills required for advanced data science and computational intelligence topics selected according to the interests of individual students.
8. Demonstrate a critical awareness of current issues and new technologies and methods in Data Science and Computational Intelligence. Plan self-learning and improve performance, as the foundation for lifelong learning. Monitor and adjust a personal programme of work on an on-going basis. Exercise initiative and personal responsibility, which may be as a team member or leader.
9. Critically evaluate the principles for leading and developing people and equality, diversity and inclusion at a strategic level.

14 Course Structure and Requirements, Levels, Modules, Credits and Awards

Modules within the course, their status, the levels at which they are studied; their credit value and pre/co requisites are identified in the following table.

The course structure reflects its main aims and has been designed to deliver the latest methodologies and technologies; and meet employment trends in the field of data science The modules provide the critical thinking, comprehensive knowledge and Practical and transferable skills of the data science and machine learning fields covered in the course, and as discussed above. The course also provides some specialised technical module such Advanced Machine Learning. The Individual research project will require the students to perform research into and analysis of the most recent Data Science issues and undertake a substantial work in tackling these problems.

A Chartered Management Institute (CMI) module, Leading Diverse Workforces, will involve students working together across disciplines to facilitate an appreciation of how different sectors solve internal issues and how different sectors can learn and adopt or adapt solutions from other fields.

Students who successfully complete the module and meet the CMI learning outcomes will gain a Level 7 Certificate in Strategic Management and Leadership Practice based on the following CMI units: Leading and developing people to optimise performance (unit 702); Strategic approaches to diversity and Inclusion (unit 715).

Students who successfully complete this module will be awarded Foundation Chartered Manager status and be able to use the designation 'fCMgr' after their name.

This is a highly technical course where most modules incorporate substantial practical elements. The course adopts a combination of lectures, lab practical work as well as in-class discussions and presentations. Modules will be delivered as a combination of lectures, computer laboratory sessions, online learning, seminar discussions and tutorials. These are designed and set by the module leaders reflecting the specific topics with the aim of maximising attainment and learning.
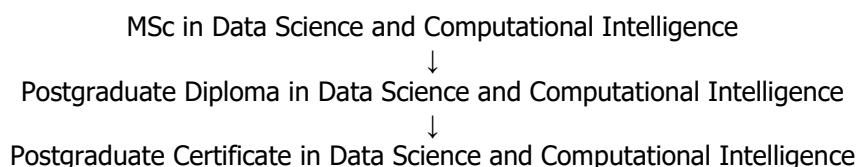
During semester 1, students who have expressed an interest in undertaking a work placement should begin the application process for placement opportunities. Students have the responsibility for securing a placement, but they will be supported throughout the application process by a specialist employer engagement team. The university will work with employers to identify opportunities. Subject to securing a placement, the International Student Support team will work with international students to obtain UK study visa extensions. Visas required to work in other countries will be the responsibility of the student.

The course is structured so that students complete two semesters of taught modules and then spend three semesters on placement. During this time students would be enrolled onto modules 7102CEM Extended Masters Work Placement A, 7103CEM Extended Masters Work Placement B and 7104CEM Extended Masters Work Placement C. The modules are zero credit and do not contribute to the classification or name of the award but must be passed to complete the placement. Upon completion of the work placement, students are expected to return to Coventry to complete the final semester during which time they undertake their project module. Successful completion of the Work Placement is reflected in the final student transcript.

Credit level	Module Code	Title	Credit Value	Mandatory/ Optional	Course Learning Outcomes
Subject to securing an appropriate placement opportunity and fulfilling the selection requirements, students will be transferred to the two-year course and the Work Placement modules listed below are to be taken.					
7	7102CEM	Extended Masters Work Placement A	0	Optional	
7	7103CEM	Extended Masters Work Placement B	0	Optional	
7	7104CEM	Extended Masters Work Placement C	0	Optional	

The work placement is to be taken over three semesters and prior to the final semester of the course.

Cascade of Awards:

MSc in Data Science and Computational Intelligence
↓
Postgraduate Diploma in Data Science and Computational Intelligence
↓
Postgraduate Certificate in Data Science and Computational Intelligence

To achieve the award of Master's degree from study on the course, a student must achieve the minimum credits specified in the University academic regulations.

The requirement for an MSc in Data Science and Computational Intelligence Science is as follows:

1. Achievement of the full curriculum, 180 CATS credits comprising all of the taught modules described in the programme of study

The requirement for a PgDip award in Data Science and Computational Intelligence is as follows:

1. Achievement of 120 credits comprising all of the taught modules described in the programme of study

The requirement for a CertHE award in Data Science and Computational Intelligence is as follows:

1. Achievement of 60 credits comprising any taught modules described in the programme of study

Modules within the course, their status (whether mandatory or options), the levels at which they are studied, and their credit value are identified in the table below.

Please note that this course could be delivered in block format.

Credit Level	Module Code	Title	Credit Value	Course Learning Outcomes	* Semester
7	7072CEM	Machine Learning	15	1, 2, 5, 6	1
7	7086CEM	Data Management Systems	15	3, 4, 5, 6	1
7	7071CEM	Intelligent Information Retrieval	15	3, 4, 5, 6	1
7	7089CEM	Introduction to Statistical Methods for Data Science	15	1, 4	1
7	7153CEM	Big Data Analytics and Data Visualisation	15	3, 4, 5, 6	2
7	7088CEM	Artificial Neural Networks	15	1, 2, 5, 6	2
7	7135CEM	Modelling and Optimisation Under Uncertainty	15	1, 2, 5, 6	2
7	7000CEM	Individual Research Project Preparation	15	4, 6, 7, 8	2
7	7049CRB	Leading Diverse Workforces	10	9	3
7	7048CEM	Computing Individual Research Project	50	1,2,3,4,5, 6, 7, 8	3

* The running order of the modules is subject to change.

15 Criteria for Admission and Selection Procedure

An applicant will normally be expected to possess at least one of the following:

- An honours degree or an equivalent qualification in a relevant subject such as Statistics, Mathematics, Computer Science, Physics or Engineering, etc.
- An unclassified degree in data science or any other relevant fields plus professional experience within the field of data science;

Students whose first language is not English must demonstrate proficiency in the English language equivalent to IELTS 6.5. Alternatively, students may be admitted with IELTS 6.0 if they attend and pass a compulsory five-week pre-sessional English course, operated by Coventry University, before joining their master's course.

Applications involving other UK or overseas qualifications, mature candidates, or candidates with experience are welcome and will be considered on their merit as below:

- Applications from those not possessing the equivalent of an honours degree in a data science or computing related subject will be considered on individual merit and decisions will be based on careful evaluation of the capacity of the applicant to complete the course successfully;
- The course is subject to the general University admission procedures and access policies. A wide range of academic backgrounds is deemed suitable for entry to the course. However, careful monitoring of applications to ensure that applicants are suited to the course takes place. Where necessary and possible, applicants are interviewed, especially those who do not appear to meet standard admissions criteria;
- Accreditation for Prior Learning (APL) is in accordance with University regulations;
- The Accreditation for Prior Experiential Learning (APEL) will only be awarded for achievements equivalent to masters' level.

16 Academic Regulations and Regulations of Assessment

This Course conforms to the standard University Academic Regulations Postgraduate Mode R.

17 Indicators of Quality Enhancement

The Course is managed by the School of Computing, Electronics and Mathematics (CEM) Board of Study of the Faculty of Engineering, Environment and Computing (EEC).

The Programme Assessment Board (PAB) for the EEC Faculty is responsible for considering the progress of all students and making awards in accordance with both the University and course-specific regulations.

The assurance of the quality of modules is the responsibility of the Boards of Study, which contribute modules to the course.

External Examiners have the opportunity to moderate all assessment tasks and a sample of assessed work for each module. They will report annually on the course and/or constituent modules and their views are considered as part of the Course Quality Enhancement Monitoring (CQEM). Details of the CQEM process can be found on the Registry's web site.

Students are represented on the Student Forum, Board of Study and Faculty/School Board, all of which normally meet two or three times per year.

Student views are also sought through module and course evaluation questionnaires.

The QAA's Higher Education Review undertaken in February 2015 confirmed that Coventry University meets the UK expectations regarding the:

- setting and maintenance of the academic standards of awards;
- quality of student learning opportunities;
- quality of the information about learning opportunities;
- enhancement of student learning opportunities

The assurance of the quality of modules is the responsibility of the Board of Study (BoS) which contribute modules to the courses. The SAB and PAB for the Faculty of EEC are responsible for considering the progress of all students and making awards in accordance with both the university and course-specific regulations.

Students are represented on the Student Forum, BoS and Faculty Board, all of which normally meet two or three times per year. Student views are also sought through module evaluation questionnaires.

External Examiners are appointed for all named University awards. The role of the External Examiner at module level is to ensure that academic standards are in line with national norms for the subject. External Examiners report annually on the programme and their views are considered as part of the Course Quality Enhancement Monitoring report (CQEM). Details of the CQEM process can be found on the Registry's web site.

Lecturers, guest speakers, case studies and web materials are used when appropriate to ensure that the content of the MSc course remains valid and contemporaneous, drawing on relevant expertise from within the course team. Research activity and interests, relevant scholarly and consultancy activities will be used to inform the module content within the MSc course.

There is a diverse and active range of research activities influencing programmes in most areas of the Faculty. All staff teaching on the MSc Data Science and Computational Intelligence is actively engaged in research directly related to the content of the module in which they are engaged. The last Research Excellence Framework (REF 2014) resulted in the following ratings for Computer Science & Informatics: 5% World-leading, 37% Internationally Excellent, 55% International Recognition, 3% National Recognition.

There is also a strong and regular industry input to the subject-base of the course. These include the links with employers through the CEM Industry Advisory Board (IAB), industry-focused collaborative research initiatives. Graduate destinations for the course have achieved 100% in 2017-2018.

18 Additional Information

Enrolled students have access to additional, key sources of information about the course and student support including:

- Faculty Student Handbook
- Data Science and Computational Intelligence Course Handbook
- Module Guides
- Aula Postgraduate Course Page and Module Webs
- Module Information Directory

The University and Faculty support is also available via links as follows:

- University library
- Sigma Maths and Stats Support Centre (in the University library), also at: https://www.coventry.ac.uk/study-at-coventry/student-support/academic-support/sigma-maths-and-stats-support/
- Centre of Academic Writing (in the University library), also at: https://www.coventry.ac.uk/study-at-coventry/student-support/academic-support/centre-for-academic-writing/
- EEC Student Web: https://share.coventry.ac.uk/students/EC/Pages/Home.aspx
- Coventry University Student Portal: https://share.coventry.ac.uk/students/Pages/Index.aspx