

Applied Computer Science and Artificial Intelligence Programme Specification

Academic Year:	2023-24
Degree Awarding Body:	University of Bradford
Final and interim award(s):	Degree of Master of Science Postgraduate Diploma Postgraduate Certificate
Programme accredited by (if appropriate):	N/A
Programme duration:	12 months full time 24 months part time
QAA Subject benchmark statement(s):	Computing Master's (2022)
Date last confirmed and/or minor modification approved by Faculty Board.	May 2023

Introduction

Currently, the UK government and industry are prioritizing the advancement of Computer Science, which encompasses AI, Big data, Cybersecurity, and more, as a means of promoting sustainable growth and establishing international leadership in the digital economy. As a result of this societal shift, the demand for computer science professionals with expertise in AI techniques, software design and development, database technologies, and their practical applications is steadily increasing. This programme is designed to enable students to integrate their existing subject knowledge with practical computing skills, using real-world case studies from around the world, in order to equip graduates with the skills that are currently in high demand in the industry.

The MSc Applied Computer Science and Artificial Intelligence programme builds upon the established academic reputation of the School of Computer Science, AI and Electronics which includes high-quality research, undergraduate and postgraduate teaching. The programme

also draws upon the growing interest in digital skills among faculty members and the wider university community, as well as input from external collaborators and the needs of the digital economy. By integrating their subject knowledge with computer science, students in this programme can develop valuable digital skills that align with national priorities. The programme covers a wide range of practical topics, from digitally-enabled machine learning to ethical and legal considerations surrounding applied computing, AI and data platforms, as well as mobile application design and development and big data visualization. Additionally, students will have the opportunity to collaborate on practical individual dissertations with leading researchers from the School of Computer Science, AI and Electronics and other Schools, such as the School of Management. With a range of optional modules available, students can tailor their programme to their specific career aspirations.

The School of Computer Science, AI and Electronics has extensive academic expertise in delivering various MSc computer science topics through collaboration-based research-informed teaching. This is evidenced by the work of the AI research group, Advanced Automotive Analytics Research Lab, a large number of relevant PhD theses, and our funded research projects. In addition, the School has a proven track record of developing AI and big data systems with major industries such as NASA, ESA, NHS, Cosmetics Europe, EU JRC, Syngenta, and Jaguar LandRover, as well as working with numerous SMEs, including Exa Networks, Rakusen's, Xalient, and National Breakdown.

Programme Aims

The programme is intended to:

1. provide graduates with fundamental knowledge and advanced practical skills in applied computing, artificial intelligence (AI), applied machine learning, and data science through a conversion path.
2. improve students' critical analysis skills and their capacity to combine various backgrounds in discovering, documenting, and disseminating research results. It also seeks to develop students' ability to present practical work and to understand the context within data mining, cybersecurity, and software development.
3. produce graduates who are prepared for the job market, with experience in conceiving, designing, developing, and evaluating solutions to real-world problems using AI tools and techniques.

Programme Learning Outcomes

To be eligible for the award of Postgraduate Certificate at FHEQ level 7, students will be able to:

1. Demonstrate a comprehensive understanding and critical awareness of discipline knowledge in applied computing and artificial intelligence through a systematic approach.
2. Demonstrate knowledge of the latest computing techniques applicable to practical applications and development projects in applied computing, AI and big data topics.
3. Demonstrate originality in collecting and utilizing applied computing principles and knowledge for software design, development, and testing, along with a practical understanding of how novel domain techniques are created.

4. Demonstrate the ability to assess state-of-the-art methodologies and algorithms in applied computer science and propose new methodologies for addressing known practical challenges in applied computer science and AI.
5. Demonstrate the ability to communicate practical work outcomes, evaluation of results, and conclusions within the field of applied computer science and AI to both specialist and non-specialist audiences.
6. Demonstrate transferable skills for making decisions in complex and unpredictable situations in computing-dominant projects.
7. Demonstrate the ability to learn independently, which is necessary for continuing professional development.

Additionally, to be eligible for the award of Postgraduate Diploma at FHEQ level 7, students will be able to:

8. Effectively coordinate and resolve complexity in applied computing projects, encompassing design, development, and documentation phases, utilizing appropriate project management techniques.
9. Demonstrate the ability to work collaboratively within a team, utilizing appropriate communication and planning strategies.
10. Exhibit a comprehensive understanding of computing principles and applied practical skills across a diverse range of computer science subjects, incorporating legal, social, ethical, and professional considerations relevant to AI and database technologies.

Additionally, to be eligible for the award of Degree of Master at FHEQ level 7, students will be able to:

11. Demonstrate the ability to choose, develop, organise, and oversee an independent and self-managed project that focuses on practical applications. This includes the critical analysis and evaluation of relevant material, as well as the application of the latest computing methodologies to create an advanced report.

Curriculum

The programme has two stages: the taught programmes stage which takes place during the first two semesters and the project/dissertation stage. The taught programmes stage is organised on a modular basis. Part time students will take modules over two years, splitting the module load for each semester across each year.

The taught module stages build knowledge, skills, and research techniques within the subject, supporting students with their dissertation as a capstone to their degree.

The programme has two entry points: September and January. Students who enter via the September intake will carry out their studies via the usual semester sequence (1,2,3), whilst those students who enter onto the course in January will study semesters in the sequence 2,3,1. The introductory workshop will be setup in weeks 1-3 for both semester 1 and semester 2, where the study plan for each student will be produced ensuring the learning outcomes are achievable with the various backgrounds and entry levels.

Table 1: Applied Computer Science and Artificial Intelligence core and optional Modules

FHEQ Level	Module Title	Core/ Option/ Elective	Credits	Study Period	Module Code
7	Software Development	C	20	Autumn (Sem 1)	COS7009-B
7	Cloud AI	O	20	Autumn (Sem 1)	COS7054-B
7	Network Security	O	20	Autumn (Sem 1)	COS7055-B
7	Big Data Visualisation	O	20	Autumn (Sem 1)	COS7046-B
7	Mobile Application Development	C	20	Autumn (Sem 1)	COS7025-B
7	Applied Machine learning and Big Data Strategy	O	20	Spring (Sem 2)	OIM7508-B
7	Advanced Machine Learning	C	20	Spring (Sem 2)	COS7045-B
7	Applied Topics in Computer Science	C	20	Spring (Sem 2)	COS7056-B
7	Industrial Big Data Analysis and Mining	O	20	Spring (Sem 2)	COS7050-B
7	Business System Security	O	20	Spring (Sem 2)	COS7035-B
7	Dissertation	C	60	Summer (Sem 3)	COS7004-E
	Introductory Workshop in Weeks 4-5	C		Autumn (Sem 1)/ Spring (Sem 2)	

Students will be eligible to exit with the award of Postgraduate Certificate if they have successfully completed 60 credits and achieved the award learning outcomes.

Students will be eligible to exit with the award of Postgraduate Diploma if they have successfully completed at least 120 credits and achieved the award learning outcomes.

Students will be eligible for the award of Degree of Master if they have successfully completed at least 180 credits and achieved the award learning outcomes.

Learning and Teaching Strategy

The Learning and Teaching Strategy aims to foster an encouraging and supportive environment that enables students to develop into independent learners and problem solvers using applied computer science technology. Various approaches are utilized to support students, including learning in small groups and practical laboratory sessions with embedded discussions and formative feedback. Lecturers, demonstrators, and project supervisors provide academic support and guidance, while seminars and tutorials build communication, teamwork, and strengthen the connections between theory and practice. The student-led University of Bradford Computing Society (PiSoc) offers additional opportunities for students to connect with other Computer Science students at different stages of their study.

On this programme, students will be encouraged to join the student-led communities, such as Applied AI society and PiSoc, in which various interdisciplinary projects will be investigated, such as camera facial identification, city simulation, etc. Students with non-computing background work together with computer science students and research students to complete the projects using the applied skills obtained from this course. They will analyse the user requirement, design the functions, implement the system by coding, test the developed system, and demonstrate the effectiveness in practice.

The programme design embeds the strategic aims of the Universities Learning, Teaching and Student Experience Strategy (LTSES) and Universal Design for Learning (UDL) to achieve a balance between subject knowledge and transferable skills. The student journey has been carefully considered at the programme level, with core modules providing fundamental skills and knowledge in the applied computer science and AI discipline, and optional modules promoting and increasing interest while offering students more choices to meet their personal career goals. Academic skills workshops are also provided to further support students in self-regulation, persistence, and the development of essential skills such as digital literacy.

The course also addresses critical, future-facing subjects such as the ethical and societal impact of increasing use of AI systems. These topics are embedded within many core modules, with optional modules such as applied machine learning and big data strategy offering students the opportunity to study these subjects in greater depth. Additionally, the programme utilizes Amazon Web Services, a tool that meets advanced industry standards, in several modules including the dissertation and project work, as well as the module "Cloud AI" and "Applied Machine Learning and Big Data Strategies" that builds on the Amazon AWS Academy "Cloud Practitioner" learning path.

Students will experience a range of teaching and learning environments. Concepts, principles, and theories are generally explored in formal lectures, demonstrated in laboratory classes, and practised in associated tutorials and seminars.

1. Introductory workshop will support the new starters in both semester weeks 4-5. The course briefing, module overview, assessment and potential learning outcomes will be clarified. Our staff can get familiar to the students' backgrounds and the study plan for each student will be produced ensuring the learning outcomes are achievable with the various backgrounds and entry levels.
2. Formal lectures will facilitate the acquisition of knowledge, understanding, and discipline-specific skills.
3. Laboratory sessions, run in conjunction with the theoretical components, provide students with opportunities to enhance their discipline-specific knowledge, skills, and understanding of topics.
4. Tutorials, seminars, and workshops will develop knowledge, understanding, discipline-specific skills, and personal transferable skills through discussion, presentations, and small-scale project work. These exercises often involve problem-solving and design and are frequently tackled by working in small group.
5. Successful, research-active members of staff make a valuable contribution to the teaching programme, which is a particular strength of this programme.
6. Invited external speakers from various industry sectors, including large corporates such as the BBC, Microsoft, and Sky, as well as SMEs, provide students with additional learning opportunities.
7. Directed study, involving the reading of appropriate texts and the preparation of assessed work, is used to develop learning outcomes. Additionally, students can learn from each other in specifically organized study clubs with their fellow students.

As part of the course requirements, students will conduct a dissertation that involves selecting or creating a research project that requires the development of an application, system prototype, or experimentally tested theoretical hypothesis. A departmental staff member with relevant research expertise will supervise the process, enabling students to develop independent research and implementation skills. Additionally, the dissertation will help students hone their professional communication skills through an assessed viva presentation of their work, key outputs, and conclusions.

The University acknowledges the significance of providing holistic support to students throughout their academic journey. To this end, every student is assigned a personal academic tutor, with whom they can meet regularly for guidance on their learning and personal development. Additionally, the University offers a range of support services to address various student needs, such as disability, counselling, faith advisors and career services.

The University of Bradford prides itself on attracting students from diverse backgrounds, experiences and countries. It actively encourages and supports women in engineering by commemorating events such as International Women in Engineering Day and International Women and Girls in Science Day. The Faculty of Engineering and Digital Technologies has

several STEM ambassadors, including female staff, who promote science and engineering subjects to wider audiences. The University of Bradford's Faculty of Engineering and Digital Technologies has a significant representation of female staff and students. Since 2015, the University has obtained Bronze Athena Swan accreditation, showing its commitment to striving for gender equality. It engages actively with the Women in STEM initiative and other activities within the University. The University of Bradford's ethos, Making Knowledge Work, is ingrained in this programme's philosophy.

The programme's learning and teaching activities integrate equality, diversity, and inclusion (EDI) values. We respect differences and guarantee that all students have an equal opportunity to achieve their desired outcomes. Students are also taught about ethical and professional issues related to big data system development and applications, as well as the associated responsibilities. Students will be encouraged to explore a diverse range of digital technologies and theories and engage constructively with businesses and communities to enrich their understanding of the societal and economic impact of big data science. The programme will instil in students the importance of embracing the values of equality, diversity, and inclusion in their development of data-driven solutions. This approach will equip students with a broad perspective on the relevance of big data science and technology for the betterment of businesses and society.

Assessment Strategy

To evaluate the achievement of learning outcomes, this course employs both module-specific assignments and examinations. The majority of modules use practical coursework exercises to assess students' applied skills, reflecting the emphasis on career-focused progression. Real-world problems and case studies with limited scope increase engagement, creating stronger links between academic subjects, assessment of learning outcomes, and the development of career-ready and transferrable skills. The assessment also includes written or computer-based examinations to measure specific theoretical and knowledge-based aims, which are further evaluated in written reports for many coursework assignments. The dissertation module evaluates research, critical analysis, design, and implementation skills through a major written report and an oral examination.

Assessment Regulations

This Programme conforms to the standard University Regulations which are available at the following link:

<http://www.bradford.ac.uk/aqpo/ordinances-and-regulations/>

Admission Requirements

The University welcomes applications from all potential students and most important in the decision to offer a place is our assessment of a candidate's potential to benefit from their studies and of their ability to succeed on this particular programme. Consideration of applications will be based on a combination of formal academic qualifications and other relevant experience.

To be considered for this course, applicants should have a bachelor's degree from an accredited degree-awarding institution in engineering or other non-computing related field (e.g. accounting, finance) with a result classification of 2:2 or above.

The University of Bradford has always welcomed applications from disabled students, and these will be considered on the same academic grounds as are applied to all applicants. If applicants have some form of disability, they may wish to contact the Disability Service before they apply at www.bradford.ac.uk/disability/before.

Recognition of Prior Learning

If applicants have prior certificated learning or professional experience which may be equivalent to parts of this programme, the University has procedures to evaluate and recognise this learning in order to provide applicants with exemptions from specified modules or parts of the programme.

Applications are welcome from students with non-standard qualifications or mature students (those over 21 years of age on entry) with significant relevant industrial experience, in addition to GCSE English at grade 4 (formerly grade C) or above. International written and spoken English tests passed at grade 6.0 for IELTS or 550 for TOEFL (or 250 for the computer-based test) are accepted for overseas applications.

Minor Modification Schedule

Version Number	Brief description of Modification	Date of Approval (Faculty Board)