THE UNIVERSITY of EDINBURGH
College of Science & Engineering

Proposal for New Degree Programmes

Stage 2

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THE UNIVERSITY OF EDINBURGH

PROGRAMME SPECIFICATION FOR [*INSERT NAME OF PROGRAMME OF STUDY, e.g.* M.A. Honours in Ancient History *or* M.Sc. in Public Health][1]

PROGRAMME SPECIFICATION

Grey text has been added to provide guidance. Please delete as you add your own text, remove italics, and change the font colour to black.

OVERVIEW	
Awarding Institution	University of Edinburgh
Teaching Institution	University of Edinburgh
Programme accredited by	n/a
Final Award	MSc(Res)
Programme Title	MSc(Res) in Biomedical Artificial Intelligence
UCAS Code	n/a
Relevant QAA Subject Benchmarking Group(s)	**n/a**
Postholder with overall responsibility for QA	Director of QA (currently John Longley)
Date of Production/revision	24/10/2018

[1] The information contained in this Programme Specification should be used as a guide to the content of a degree programme and should not be interpreted as a contract.

EXTERNAL SUMMARY

Delivering healthcare that meets the needs of a growing and ageing population is a defining scientific and societal challenge for the twenty-first century. Solutions to this challenge are contingent on our ability to effectively interrogate and model the increasingly larger data sets that biomedical sciences are producing. Artificial intelligence (AI) techniques hold immense promise in this field, but the unique scientific, societal and ethical/ legal dimensions of the biomedical field pose considerable research challenges to the AI community. The proposed MSc by Research programme in Biomedical AI lays the foundations for a research training PhD within the UKRI Centre for Doctoral Training (CDT) in Biomedical AI at Edinburgh.

The programme delivers interdisciplinary training to CDT first year students by blending taught components with individual and group projects. Students will experience a mixture of taught and project work, equipping them with the computational and biomedical foundations, as well as providing a background in the societal/ ethical aspects of research and giving hands-on experience of research at the interface of computational and biomedical sciences.

200-250 Words

- *Background to the discipline and subject, what it is and its place in human endeavour.*
- *What is special about the Edinburgh experience in this degree?*
- *What are the main programme aims (learning outcomes)?*

EDUCATIONAL AIMS OF THE PROGRAMME

The programmed is aimed at students with an already solid computational background who wish to develop their methodological skills within the context of biomedical applications. Students will receive training in AI complementing their existing skills, and will expand their skill set by acquiring knowledge both in biomedical sciences and in the societal aspects of AI research in biomedicine. As part of the CDT bid, we have assembled a large, interdisciplinary faculty of potential project supervisor, leveraging UoE's unique strengths in the area. The principal aims of the programme are to equip students with the research skills that will then be needed during the subsequent, 3-year PhD programme of the CDT.

This section should describe what the University/School aims to achieve through the programme (Programme descriptions may be read by potential applicants)

- *Describe briefly the general area of study and how the programme is placed within it*
- *Mention any distinctive features of the programme at the UoE*
- *List the principal aims of the programme (around 6)*

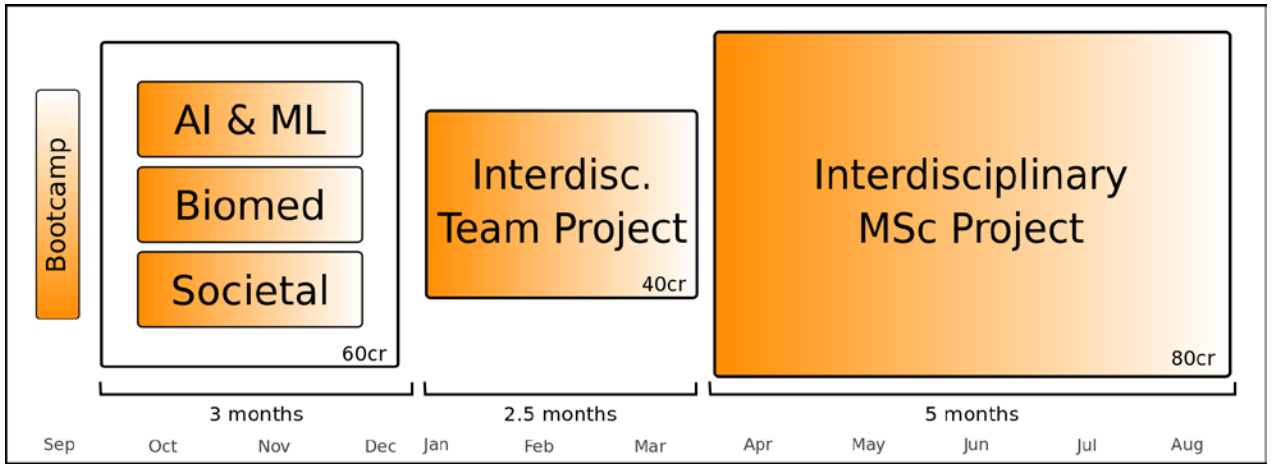
Do not duplicate any information from the External Summary

PROGRAMME OUTCOMES	
Knowledge and Understanding	Students successfully completing the programme will: - have a strong working knowledge of modern AI techniques; - have a broad awareness of the role of AI within biomedical research; - have working experience of applying AI methods on biomedical problems, through completion of two project-based courses; - be able to analyze and anticipate societal and ethical questions arising from the application of AI in a biomedical context. *Entries should describe the acquisition of knowledge as opposed to the ability to do something*
Graduate Attributes: Skills and abilities in Research and Enquiry	Graduates from this course will: - be able to select appropriate AI methods to approach biomedical research questions; - be able to evaluate the societal implications of AI research; - be able to understand and explain state-of-the-art AI research; - be conversant with interdisciplinary research in both computer science and biomedical sciences.

Graduate Attributes: Skills and abilities in Personal and Intellectual Autonomy	Graduates from the course will: - be able to handle large biomedical data sets; - be able to independently implement existing AI methodologies and deploy them on biomedical data sets; - be able to identify biomedically relevant aspects of the results of their research.
Graduate Attributes: Skills and abilities in Communication	Graduates from the programme will: - be able to communicate orally their research to an interdisciplinary audience through presentations; - be able to summarise their research in a scholarly way through project reports; - be able to work effectively as part of an interdisciplinary team;
Graduate Attributes: Skills and abilities in Personal Effectiveness	Graduates will have proven ability to: - acquire knowledge from a variety of sources, including the research literature, peer interaction, online materials, conferences; - work effectively on medium-sized projects, both individually and as part of a team - organize their workload and manage their time, and complete tasks under deadline pressure
Technical/practical skills	Graduates of the programme will be able to: - re-implement existing AI models and modify them to be deployed on novel biomedical questions. - code scientifically in a high-level programming language; - use public and proprietorial biomedical data sets for their work. *Entries should be high-level technical or practical skills developed during the degree programme*

PROGRAMME STRUCTURE AND FEATURES

Programme structure: The programme is designed to give students the required foundations and engage them with biomedical applications through project work. A typical structure of the programme of studies is given in the following figure



Concretely, following an introductory bootcamp week that will involve an assessment of the individual students learning needs, the programme involves 60 credits of taught credits. These will involve a compulsory 20 credits module on Responsible research and innovation (being developed by SSPS) and 40 credits between AI and Biomedical modules (the precise split depending on the needs of the student).

AI and Biomedical courses. A wide offer of courses in statistics, machine learning and AI is already available at levels 9, 10 and 11. Relevant courses include Algorithmic Foundations of Data Science, Artificial Intelligence Present and Future, Bayesian Data Analysis, Biomedical Data Science, Data Mining and Exploration, Introductory Applied Machine Learning, Machine Learning and Pattern Recognition, Probabilistic Modelling and Reasoning, Statistical Programming. Biomedically oriented courses include Bioinformatics 1, Bioinformatics 2, Information Processing in Biological Cells, Mathematical Biology, Next Generation Genomics. Additionally, all students will take a new 10 credits course in Issues in Clinical Data Modelling.

Team project. During the second semester, students will engage in an applied Biomedical AI project in small teams of 2 or 3 on a task set by biomedical research groups. The projects will be jointly supervised by SoI and staff from the other Schools/ institutes within the CDT. The course will account for 40 credits and will be assessed via a report and short presentation.

MSc project. The main MSc project will be worth 80 credits and will require students to tackle in depth an applicative biomedical problem using AI techniques, as well as discussing the responsible research aspects of their project. The project will be assessed using the standard SoI double marking policy, through a substantial report (expected length around 50 pages) which will be expected to contain original material, either methodological, or applicative, or in the analysis of the societal implications of research.

Progression requirements: All courses (including individual project and group project) are assessed through exams or coursework, and a mark is awarded for each course. These marks will be ratified by the MSc Board of Examiners in Informatics. Progression to MSc project will be conditional on students achieving an average of at least 50% on the other courses and having passed with at least 50% the group project.

Exit awards: Students whose marks fall short of the progression requirements will be awarded a PG certificate or a PG diploma.

Mode of study: full time

Language of study: English

This section presents the structure of the programme in relation to the University's Curriculum framework. It must include:

- *SCQF credit points and levels for each constituent course and each year of the programme*
- *Entry requirements, including requirements for second=year entry where applicable*
- *Progression requirements*
- *An explanation of the articulation of learning outcomes and assessment practices*
- *Modes of study*
- *Exit awards available at the completion of specific stages of the programme*

If not provided earlier in the programme specification, information needs to be included on relevant factors from the University's Strategic Plan

TEACHING AND LEARNING METHODS AND STRATEGIES

The courses in the taught component of this programme are taught through lectures (typically around 16 lectures for a 10-point course, and around 32 lectures for a 20-point course). In most cases supporting materials, including notes, slides and sometimes video recordings of the lectures themselves, are made available to students on the web. Lecturers also direct students to recommended reading to supplement the lecture material.

Lectures are often supported by weekly scheduled tutorials, in which students in groups of 10–15 work through set tutorial exercises with the help of a tutor, and have the opportunity to seek assistance with the course material where required. Some courses are supported by scheduled laboratory sessions or supervised drop-in laboratory time, in which they are able to seek help with the practical (e.g. programming) aspects of the course material.

The group project and the individual project (see above) are delivered through a mixture of structured meetings and supervised sessions which are designed to enable students to work independently on a research problem.

TEACHING AND LEARNING WORKLOAD

Please indicate the typical workload for a student on this programme for each year of study

Start Year	Time in scheduled teaching (%)	Time in independent study (%)	Time on placement (%)
1	30	70	0
			Add rows as necessary

ASSESSMENT METHODS AND STRATEGIES

For most courses, the student's achievement is assessed by academic staff via a combination of examinations and coursework assignments. (The balance is typically around 75% for the examination and 25% for coursework, with some variation between courses.) Depending on the course, examinations may be written or online, and assessed assignments may be pen-and-paper or practical programming exercises. Tutorial exercises are not usually assessed directly, but makes an important contribution to preparing students for examinations.

The group and individual projects are assessed via reports on the project work. This is assessed independently by two members of academic staff, typically in the light of a live demonstration of the project work given by the student. The markers then confer to agree on the final mark for the project.

ASSESSMENT METHOD BALANCE

Please indicate the typical assessment methods for a student on this programme for each year of study. Additionally please complete the Assessment matrix.

Assessment Matrix Template.xlsx

Start Year	Assessment by written exams (%)	Assessment by practical exams (%)	Assessment by coursework (%)
Year 1	*70*	*15*	*15*
			Add rows as necessary

CAREER OPPORTUNITIES

It is expected that all students in this programme will progress to undertake a PhD in Biomedical AI as part of the UKRI CDT being proposed. Overall, career opportunities for graduates (both of the PhD and of the MRes) are broad and favourable at the moment**.** Biomedical AI is expected to be a sector of particular growth in the near to medium term, as highlighted in several governmental reports (Industrial Strategy, Life Sciences Industrial Strategy, etc) as well as major industrial players (Association of British Pharma Industry, Glaxo-Smith-Klein strategic report 2018). According to the EU patent office, the Med-Tech sector filed the largest number of new patents in 2017 than any sector. Anecdotal evidence from colleagues working in the field suggests a buoyant job market in both public and private sector with a lively start-up ecosystem. All of these facts point to a high employability for any graduates of the programme, with excellent subsequent career options.

OTHER ITEMS

This section ca include other distinctive features of the programme, e.g.

- *Methods for evaluating and improving the quality and standards of teaching and learning*
- *Opportunities for placement of overseas study*

ABOUT THE PROGRAMME

ADDITIONAL REQUIREMENTS	
PRSB Accreditations (where relevant)	*Please note accreditations awarded or planned*
Admissions requirements **Before completing this section please contact a member of the Recruitment and Admissions team for further guidance.**	These will be in line with the entry requirements for the existing Informatics CDT programmes: A UK 2:1 honours degree, or its international equivalent, in computer science, mathematics, engineering, physics or a related discipline. All applicants must have one of the following qualifications as evidence of their English language ability: • an undergraduate or masters degree, that was taught and assessed in English in a majority English speaking country as defined by UK Visas and Immigration • IELTS Academic: total 6.5 with at least 6.0 in each component • TOEFL-iBT: total 92 with at least 20 in each section • PTE(A): total 61 with at least 56 in each of the Communicative Skills scores • CAE and CPE: total 176 with at least 169 in each paper • Trinity ISE: ISE II with distinctions in all four components

To be completed by R & A Team	*Please select to confirm that a member of the R & A section have consulted on the Admissions requirements.* ☐
Work experience/work based learning opportunities	*Details of organised work experience / work based learning opportunities available during the programme (if applicable)*

CONSULTATION	
Student body	*In addition to the consultation process at Stage 1 please provide a full summary of the consultation undertaken and the impact this has had on the development of the programme*
External Review/Critical Friend	The proposal is currently subject to external peer review as part of the UKRI selection process. We will take into account any comments regarding the programme received from reviewers and during the selection interview.

ADDITIONAL DOCUMENTS	
Memorandum of Agreement (if applicable)	
Award letter (if applicable)	
DPT (please use your current template)	

APPROVAL

Programme Title:	MSc(Res) in Biomedical Artificial Intelligence
Programme Proposer:	Prof Guido Sanguinetti

STAGE 1: SCHOOL BOARD OF STUDIES REVIEW AND APPROVAL

Confirmation of approval of the proposal at the School Board of Studies should be entered below.

Date of BoS:
Convener Name:
Comment and Approval (BoS Minute): *Please provide either a link to the minutes of the Board or a copy of the relevant text from the minutes.*

STAGE 2: HEAD OF SCHOOL REVIEW AND APPROVAL

Head of School: *Please print name*
Comment and Approval:
Signature:

STAGE 3: COLLEGE CURRICULUM APPROVAL BOARD REVIEW AND OUTCOME

Date of CCAB:
Convener Name:

Stage 2 Outcome (please select as appropriate)	
Proposal approved ➡ Proceed to *New Programme Request & DPT creation*	☐
Proposal approved with conditions	☐
Proposal rejected with recommendations	☐
Proposal rejected	☐
Comment:	

DOCUMENT CHECKLIST	
Document	**Completed**
DPT	☐
Memorandum of Agreement (if applicable)	☐
Assessment Matrix	☐
Award letter (if applicable)	☐