

Proposed Changes to MSc. by Research DPT for the UKRI CDT in Biomedical AI (PRMSCBIOAI1F)

Background

Having now been through the majority of the first year of the CDT programme, an MSc.(R) year, we have sought extensive 1:1 feedback with the student cohort and had a series of discussions amongst members of the CDT executive to assess the appropriateness of the existing MSc.(R) DPT to fit the needs of the programme and prepare the cohorts to undertake their Doctoral studies.

The primary objectives of the DPT are:

- i. Expose students to foundational RRI principles to equip them with the skills and base knowledge to apply these principles in their future research
- ii. Allow students to fill skills/knowledge gaps before entering their PhD studies; essential as we draw from a diverse inter-disciplinary background
- iii. Give them experience of team-working in a research setting
- iv. Give them experience of undertaking a substantial piece of independent research work.

The DPT as originally designed addresses all of these points but suffers from two key problems as identified by both students, PTs and Exec members (Appendix 1 – Current DPT).

- i. There are not enough credits available for students to fill skills gaps in optional courses (currently only 30C available)
- ii. Having two assessed RRI courses is not currently a practical and effective way to imbue RRI practice and experience in the cohort.
- iii. The selection of optional courses in the current DPT is too restrictive, missing key learning opportunities and training needs relevant to the CDT research programme and future career prospects of the students.

To address this, we propose to make three changes to the DPT (Appendix 2 – Proposed DPT).

- i. Remove the compulsory Semester 2 course RRI Living Lab (PGSP11532) from the DPT. This is a CDT only course so the change will have no effect on other DPTs.
- ii. Reduce the Group Project (Biomedical AI) (INFR11196) from 40C to 20C with a commensurate reduction in hours from 400h to 200h.
- iii. Change the list of courses available in the optional course menu for the DPT to better reflect the interests and key skills gaps experienced through our initial cohort intake. This will also allow us to adopt some new courses that are relevant to the CDT.

The effect of these changes will be to provide 60C of optional course choice to students whilst still satisfying the original learning intentions of the original CDT.

Rationale for Changes

We briefly provide a more detailed motivation and rationale for these three changes below

i. Expanding optional credits from 30 to 60 credits

Members of our existing and incoming cohorts come from extremely diverse backgrounds including quantitative subjects such as Mathematics, Physics, Computer Science, & Engineering, but also less quantitative ones such as Biology, Neuroscience, Psychology, Clinical Practice, Social Science, & Business Studies. These students therefore have diverse needs. A commonality as already reflected in the DPT is learning centred around machine learning courses and exposure to elements of biomedical and clinical science, but most students cannot take the necessary complement of courses with the available credit budget in the DPT. The result in the first cohort was a large number of audited courses, where learning is un-assessed making it very difficult for students or supervisory teams to understand whether skills gaps have been closed. Crucially it also risks students taking on far too much. This adjustment will give the PT and student the space to develop a bespoke training programme for each individual student based on their needs, taking advantage of the wide range of Computer, Data, Biomedical and Clinical Science courses available.

ii. Redesigning RRI delivery in the CDT programme

The delivery of RRI has been extraordinarily challenging in the first year. The design of the Semester 2 course in particular was incompatible with the timing of the individual research projects and as a result had to be re-factored at very short notice to integrate with the group research projects. At least in part this led to a lot of confusion and stress for the students which was further compounded by UCU strike action and then COVID-19. In combination student feedback on the two RRI courses was very poor with serious structural, organisational and delivery problems. This was always going to be difficult; engaging the cohort with this topic is essential and following discussion we feel that the best solution is for course organisers to put all of their efforts into redesigning Foundations in RRI (PGSP11534) to equip the students with core base knowledge and for further RRI development within the CDT programme to occur using other means. This is most likely to include a cross-cohort programme of events and activities that persists throughout the year and across years. That role will not be fulfilled by an assessed course.

iii. Expanding optional course choices

In the first cohort PTs had to submit large numbers of concession requests following 1:1 PT and Exec member discussions with students designed to help them to fill skills gaps. The menu of courses needs to be updated as a result of this and due to some courses not being offered next year. We have compiled a list of courses that we would like to include in a revised DPT in Appendix 2.

Commensurate changes to the parallel 2-year MSc.(R) DPT (PRMSCBIOAI2F) can be found in Appendix 3.

Appendix 1 - Current DPT Structure (PRMSCBIOAI1F)

Compulsory Courses (150C)

- 10C - Issues in Clinical Data Modelling INFR11195 (S1)
- 10C - Foundations in Responsible Research & Innovation PGSP11534 (S1)
- 10C - Responsible Research & Innovation Living Lab PGSP11532 (S2)
- 40C - Group Research Project (Biomedical AI) INFR11196 (S2)
- 80C - Individual Research Project (Biomedical AI) INFR11197 (Spring/Summer)

Optional Courses (30C)

Group A

Semester 1

Select between 0 and 30 credits of the following courses

[Machine Learning and Pattern Recognition](#) INFR1113020

[Algorithmic Foundations of Data Science](#) INFR1115610

[Bioinformatics 1](#) INFR1116010

[Neural Computation](#) INFR1116210

[Introductory Applied Machine Learning](#) INFR1118220

[Mathematical Biology](#) MATH1001310

[Statistical Programming](#) MATH1117610

[Bayesian Theory](#) MATH1117710

[Incomplete Data Analysis](#) MATH1118510

[Information Processing in Biological Cells](#) PGBI1105110

and

Semester 2

Select between 0 and 20 credits of the following courses

[Next Generation Genomics](#) BILG1100410

[Bioinformatics 2](#) INFR1100510

[Data Mining and Exploration](#) INFR1100710

[Probabilistic Modelling and Reasoning](#) INFR1113420

[Artificial Intelligence, Present and Future](#) INFR1118010

[Biomedical Data Science](#) MATH1117410

[Bayesian Data Analysis](#) MATH1117510

Appendix 2 - Proposed DPT Structure (PRMSCBIOAI1F)

Year 1

Compulsory Courses

[Issues in Clinical Data Modelling](#) INFR11195 10C (S1)

[Foundations in Responsible Research & Innovation](#) PGSP11534 10C (S1)

[Group Research Project \(Biomedical AI\)](#) INFR11196 20C (S2)

[Individual Research Project \(Biomedical AI\)](#) INFR11197 80C (Spring/Summer)

Optional Courses

All Year - Select between 0 and 40 credits of the following courses

[Machine Learning Practical](#) INFR11132 20C YR

[Text Technologies for Data Science](#) INFR11145 20C YR

AND

Semester 1 - Select between 0 and 40 credits of the following courses

[Accelerated Natural Language Processing](#) INFR11125 20C

[Introductory Applied Machine Learning](#) INFR11182 20C

[Machine Learning and Pattern Recognition](#) INFR1113020 20C

[Algorithmic Foundations of Data Science](#) INFR11156 10C

[Bayesian Theory](#) MATH11177 10C

[Bioinformatics 1](#) INFR11160 10C

[Incomplete Data Analysis](#) MATH11185 10C

[Information Processing in Biological Cells](#) PGBI11051 10C

[Mathematical Biology](#) MATH10013 10C

[Neural Computation](#) INFR11162 10C

[Social and Technological Networks](#) INFR11124 10C

[Statistical Programming](#) MATH11176 10C

AND

Semester 2 - Select between 0 and 40 credits of the following courses

[Probabilistic Modelling and Reasoning](#) INFR11134 20C

[Advanced Databases](#) INFR11011 10C

[Artificial Intelligence, Present and Future](#) INFR11180 10C

[Bayesian Data Analysis](#) MATH11175 10C

[Bioinformatics Algorithms](#) PGBI11057 10C

[Biomedical Data Science](#) MATH11174 10C

[Computational Cognitive Neuroscience](#) INFR11036 10C

[Data Analytics with High Performance Computing](#) INFR11171 10C

[Data Mining and Exploration](#) INFR11007 10C

[Data Visualisation](#) INFR11190 10C

[Next Generation Genomics](#) BILG11004 10C

[Reinforcement Learning](#) INFR11010 10C

[Software Development](#) INFR11172 10C

Appendix 3 - Proposed DPT Structure for 2-year DDT (PRMSCBIOAI2F)

Year 1

Compulsory Courses

You must take these courses

[Group Research Project \(Biomedical AI\)](#) INFR11196 20C (S2)

Compulsory Courses - Select between 10 and 20 credits of the following courses

All of these courses must have been taken by the end of year 2

[Issues in Clinical Data Modelling](#) INFR11195 10C (S1)

[Foundations in Responsible Research & Innovation](#) PGSP11534 10C (S1)

Optional Courses

All Year - Select between 0 and 20 credits of the following courses

[Machine Learning Practical](#) INFR11132 20C YR

[Text Technologies for Data Science](#) INFR11145 20C YR

Semester 1 - Select between 0 and 20 credits of the following courses

[Accelerated Natural Language Processing](#) INFR11125 20C

[Introductory Applied Machine Learning](#) INFR11182 20C

[Machine Learning and Pattern Recognition](#) INFR1113020 20C

[Algorithmic Foundations of Data Science](#) INFR11156 10C

[Bayesian Theory](#) MATH11177 10C

[Bioinformatics 1](#) INFR11160 10C

[Incomplete Data Analysis](#) MATH11185 10C

[Information Processing in Biological Cells](#) PGBI11051 10C

[Mathematical Biology](#) MATH10013 10C

[Neural Computation](#) INFR11162 10C

[Social and Technological Networks](#) INFR11124 10C

[Statistical Programming](#) MATH11176 10C

Semester 2 - Select between 0 and 20 credits of the following courses

[Probabilistic Modelling and Reasoning](#) INFR11134 20C

[Advanced Databases](#) INFR11011 10C

[Artificial Intelligence, Present and Future](#) INFR11180 10C

[Bayesian Data Analysis](#) MATH11175 10C

[Bioinformatics Algorithms](#) PGBI11057 10C

[Biomedical Data Science](#) MATH11174 10C

[Computational Cognitive Neuroscience](#) INFR11036 10C

[Data Analytics with High Performance Computing](#) INFR11171 10C

[Data Mining and Exploration](#) INFR11007 10C

[Data Visualisation](#) INFR11190 10C

[Next Generation Genomics](#) BILG11004 10C

[Reinforcement Learning](#) INFR11010 10C

[Software Development](#) INFR11172 10C

Year 2

Compulsory Courses

You must take these courses

[Individual Research Project \(Biomedical AI\)](#) INFR11197 80C (Spring/Summer)

Compulsory Courses - Select between 0 and 10 credits of the following courses

All of these courses must have been taken by the end of year 2

[Issues in Clinical Data Modelling](#) INFR11195 10C (S1)

[Foundations in Responsible Research & Innovation](#) PGSP11534 10C (S1)

Optional Courses

All Year - Select between 0 and 20 credits of the following courses

[Machine Learning Practical](#) INFR11132 20C YR

[Text Technologies for Data Science](#) INFR11145 20C YR

Semester 1 - Select between 0 and 20 credits of the following courses

[Accelerated Natural Language Processing](#) INFR11125 20C

[Introductory Applied Machine Learning](#) INFR11182 20C

[Machine Learning and Pattern Recognition](#) INFR1113020 20C

[Algorithmic Foundations of Data Science](#) INFR11156 10C

[Bayesian Theory](#) MATH11177 10C

[Bioinformatics 1](#) INFR11160 10C

[Incomplete Data Analysis](#) MATH11185 10C

[Information Processing in Biological Cells](#) PGBI11051 10C

[Mathematical Biology](#) MATH10013 10C

[Neural Computation](#) INFR11162 10C

[Social and Technological Networks](#) INFR11124 10C

[Statistical Programming](#) MATH11176 10C

Semester 2 - Select between 0 and 20 credits of the following courses

[Probabilistic Modelling and Reasoning](#) INFR11134 20C

[Advanced Databases](#) INFR11011 10C

[Artificial Intelligence, Present and Future](#) INFR11180 10C

[Bayesian Data Analysis](#) MATH11175 10C

[Bioinformatics Algorithms](#) PGBI11057 10C

[Biomedical Data Science](#) MATH11174 10C

[Computational Cognitive Neuroscience](#) INFR11036 10C

[Data Analytics with High Performance Computing](#) INFR11171 10C

[Data Mining and Exploration](#) INFR11007 10C

[Data Visualisation](#) INFR11190 10C

[Next Generation Genomics](#) BILG11004 10C

[Reinforcement Learning](#) INFR11010 10C

[Software Development](#) INFR11172 10C