THE UNIVERSITY *of* EDINBURGH

Data Science, Technology and Innovation
Postgraduate Online Learning Programme

Enhance your career in Data Science

Join the new generation of data scientists, technologists
and innovators and gain a deeper knowledge of multiple disciplines

BayesCentre

The Programme

Hosted by the Bayes Centre, Data Science, Technology and Innovation (DSTI) is a flexible, modular, part-time online programme designed to fully equip tomorrow's data professionals. With a choice of modular courses from across the University of Edinburgh in the sciences, medicine, arts and humanities.

Choose a single course or more:

♦ MSc in Data Science, Technology and Innovation

♦ Postgraduate Diploma (PG Dip)

♦ Postgraduate Certificate (PG Cert)

♦ Postgraduate Professional Development (PPD)

" *Participation in the DSTI program has significantly expanded my knowledge of data science and latest technologies. This has enabled me to lead an inspiring team and very quickly build an innovative analytics platform which, implements machine learning concepts.* "

Current DSTI MSc student

THE DATA SCIENCE, TECHNOLOGY AND INNOVATION PROGRAMME AT A GLANCE

2016
The programme officially launched in 2016. It welcomed its first cohort of 8 students!

200+
To date the programme has welcomed over 200 students from a range of sectors including technology, medicine and finance.

Our students come from a wide range of countries across the UK, Europe, North and South America, Africa, Asia and Australia.

3
The programme offers courses from schools within all 3 of University of Edinburgh's colleges.

Courses

Advanced Vision

This module aims to build on the introductory computer vision material taught in Introduction to Vision and Robotics. The main aim is to give students an understanding of main concepts in visual processing by constructing or analysing several vision systems during the course of the lecture series and practicals. The 6 systems are for: rigid 2D part recognition, deformable 2D part recognition, rigid 3D part recognition from stereo data, rigid 3D part recognition from range sensing, target detection and tracking in video, and video based behaviour classification.

Engaging with Digital Research

The course will enable students to understand new emerging models of professional practice in business and policy making developing and deploying digital research methods and results. This will include collecting, curating, exchanging and analysing of digitally-derived data, the use of research from digital environments, and the way this is leveraged turning this data into tools for active use and behaviour change. This course will also address the development of transferable insights in managing cross-institutional and citizen collaboration in digital data collection and analysis.

Introduction to Practical Programming with Objects

This module is intended for students who have some previous programming experience, but would like to develop their ability to write complete, practical applications. Students with no programming experience should be able to complete the course, although this will almost certainly be challenging and will require additional time. The course uses an object-oriented approach, based around the Java language, but no previous experience of specific languages or technologies is assumed.

Introduction to Vision and Robotics

Robotics and Vision applies AI techniques to the problems of making devices capable of interacting with the physical world. This includes moving around in the world (mobile robotics), moving things in the world (manipulation robotics), acquiring information by direct sensing of the world (e.g. machine vision) and, importantly, closing the loop by using sensing to control movement.

Introductory Applied Machine Learning

This course is about the principled application of machine learning techniques to extracting information from data. The main area that will be discussed is supervised learning, which is concerned with learning to predict an output, given inputs. A second area of study is unsupervised learning, where we wish to discover the structure in a set of patterns, i.e. there is no output "teacher signal". The primary aim is to provide the student with a set of practical tools that can be applied to solve real - world problems in machine learning, coupled with an appropriate, principled approach to formulating a solution.

Managing Digital Influence

One of the most impactful effects of easier access to a larger proportion of data on an increasing number of phenomena is the use of rankings to assess all aspects of the performance of products and organisations based on customer feedback. The course also offers a tutorial on Using Gephi as a tool for Measuring online Influence.

Medical Informatics

This course provides an introduction to data science in medicine, and more particularly to representing and interpreting data from areas across biomedicine and healthcare. It covers relational databases for medicine and healthcare, medical ontologies, statistical analysis of biomedical data, as well as some advanced topics in medical informatics, such as healthcare workflows and precision medicine.

Message Passing Programming

In the message-passing model the tasks are separate processes that communicate by explicitly sending each other messages. This course uses the de facto standard for message passing, the Message Passing Interface (MPI), which is a library callable from C, C++ or Fortran. Parallel programs written using MPI can run on almost any system from a multicore laptop up to the world's largest supercomputers.

Courses

Natural Computing

This module teaches you about bio-inspired algorithms for optimisation and search problems. The algorithms are based on simulated evolution (including Genetic algorithms and Genetic programming), particle swarm optimisation, ant colony optimisation as well as systems made of membranes or biochemical reactions among molecules.

Neuroimaging: Common Image Processing Techniques 1

This course aims to introduce the student to the major forms of image analysis commonly used in neuroimaging research. This ranges from the 'bread and butter' techniques like qualitative and quantitative assessment of whole brain and subregional brain volumes, simple and complex ways of measuring lesion size, region of interst measurements to assess tissue parameters as might be derived from diffusion-weighted or perfusion images, and simple tractography techniques.

Neuroimaging: Common Image Processing Techniques 2

This course covers generally applicable image processing techniques in Neuroimaging, including DWI basic quantification, Tractography, Retinal image analysis, Registration techniques, Voxel based analysis, and Image segmentation.

Performance Modelling

This course teaches various aspects of computer-aided modelling for performance evaluation of (stochastic) dynamic systems. The main focus is on stochastic modelling of computer systems and communication networks to assess performance characteristics such as throughput, response time etc.; however other dynamic systems such as manufacturing systems may also be considered. The central concept of the course will be that a model is as an abstract representation of a system which can be used as a tool to derive information about dynamic behaviour of the system.

Practical Image Analysis 1

This practical, medical image analysis & processing course introduces MATLAB, an industry-standard operational platform for computational image analysis. Students will also work with related software, which interacts with MATLAB, & become familiar with 2D & 3D image operations, various medical image file formats, image enhancement, image alignment, & registration. Armed with this knowledge, students will tackle different medical image processing & analysis tasks, organised by topic & increasing difficulty as the course progresses.

Practical Image Analysis 2

This practical, medical image analysis & processing course explores advanced MATLAB use & application. The course will help students assimilate & consolidate prior knowledge relating to image processing & analysis. Students will become familiar with 3D & 4D image operations, sophisticated image alignment & registration techniques, threshold-based image segmentation & classification, feature descriptors, machine learning applied to image segmentation & classification, 4D medical image analysis & processing, plus basic analyses of time series of volumetric image data.

Practical Introduction to Data Science

This online course will provide a practical introduction to data science. It will have two broad themes, namely Data Management and Data Analytics. Data Science is an emerging field, which is becoming very important both in research, business and industry. The amount of data that is being generated and stored is greater than it has ever been, and this brings both challenges in terms of how you work with the data and - importantly - rewards in terms of new insight gained from analysing the data.

Practical Introduction to High Performance Computing

The course will cover all the fundamental concepts that underpin modern HPC. The course is practical in the sense that you will explore these topics by running parallel programs on real HPC systems such as the UK national supercomputer ARCHER.

Probability and Statistics

In this course you will learn the fundamentals of probability and statistics - the building blocks for all of data science. Covers both theory and practical aspects using R.

Public Health Informatics

This course provides a broad overview of the field, taking account of classic public health information delivery, core principles of epidemiology, health inequalities and health behaviour change, as well as the implications of massive linked datasets for research and policy, and the value of emerging mobile and social technologies for health surveillance. It will discuss the issues from an international perspective, with reference to global public health needs and the emergence of innovative digital systems and analytics.

Technologies of Civic Participation

The focus of this course is on understanding the current and potential uses of new TCPs by citizens and policy-makers in responding to mundane, everyday threats to social resilience (e.g. street crime, problems with community service delivery, environment, health, etc.), and appreciating how these activities (e.g. monitoring, informing, reporting) are linked to everyday life in the community.

Threaded Programming

This course is a practical introduction to parallel programming using the threading model, which is commonly used on shared memory and multicore hardware. The majority of the course is focused on teaching the use of the industry standard OpenMP API.

The Use and Evolution of Digital Data Analysis and Collection Tools

In this course we will address the opportunities and challenges of a range of traditional and emerging digital research approaches and techniques focusing on the relevance of their applications from a user perspective. It will cover ethical, practical, legal, methodological and economic issues in theory and practice.

Understanding Data Visualisation

In this course, we examine the visual aspects of data analytics and the emerging professional practices of turning numbers into pictures or, more specifically, into screen realities. Hosting contributions from key experts in the field, the course will provide students will skills to critically interpret the most popular data visualisation techniques used by major information provider firms.

Note: Additional courses may be added and some courses may not run every year. Up to date information is available at:
www.datascience.ed.ac.uk/postgraduate

In addition to the courses already offered on the DSTI programme the University also offers a range of related MOOCs (Massive Open Online Courses) which are free, short online courses.

Data Science in Stratified Healthcare and Precision Medicine
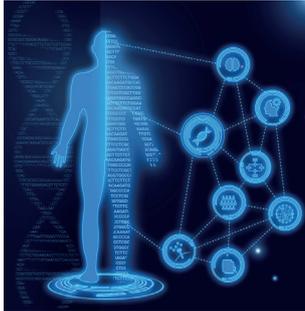
An increasing volume of data is becoming available in biomedicine and healthcare, from genomic data, to electronic patient records and data collected by wearable devices. Recent advances in data science are transforming the life sciences, leading to precision medicine and stratified healthcare.

In this course you will learn about some of the different types of data and computational methods involved in stratified healthcare and precision medicine. You will have a hands-on experience of working with such data. You will learn from leaders in the field about successful case studies.

Topics include: (i) Sequence Processing, (ii) Image Analysis, (iii) Network Modelling, (iv) Probabilistic Modelling, (v) Machine Learning, (vi) Natural Language Processing, (vii) Process Modelling and (viii) Graph Data.

Data Ethics, AI and Responsible Innovation

Our future is here and it relies on data. Predictive policing, medical robots, artificial intelligences, smart homes and cities - we can all think about how any of those could go wrong. Discover how we can build a future where they are done right.

This story-driven course is taught by the leading experts in data science, AI, information law, science and technology studies, and responsible research and innovation. The course is informed by case studies supplied by the digital business frontrunners and tech companies. It looks at real-world controversies and ethical challenges to introduce and critically discuss the social, political, legal and ethical issues surrounding data-driven innovation, including those posed by big data, AI systems, and machine learning systems. It drills down into case studies, structured around core concerns being raised by society, governments and industry, such as bias, fairness, rights, data re-use, data protection and data privacy, discrimination, transparency and accountability. Throughout the course, it will emphasise the importance of being mindful of the realities and complexities of making ethical decisions in a landscape of competing interests.

A full list of MOOCs offered throughout the University of Edinburgh in a number of subject areas is available at:
https://www.ed.ac.uk/studying/online-learning/free-short-courses