Oxford Study Abroad Programme

Online Courses Summer 2022
1 August - 19 August 2022

Course 1 Artificial Intelligence & Machine Learning

Course 2 Data Science

* Oxford Study Abroad Programme runs residential courses at St Antony's College, University of Oxford. The Online Courses are in response to COVID-19 pandemic.

* The Oxford Study Abroad Programmme has received the full Accreditation from the Education Quality Accreditation Commission, and obtained the qualification to issue ECTS credits.

01 Oxford Study Abroad Programme and Online Courses

The Oxford Study Abroad Programmes are held at Oxford colleges all year round. These academic programmes are organised for students from universities all over the world. The programmes allow students to gain knowledge from Oxford University and other world-famous institutions in the UK while experiencing Oxford city and student life during your stay.

OSAP online courses have been organised in response to the COVID-19 pandemic. The goal of these online courses is to minimise the need to gather in large groups and spend prolonged time in close proximity with each other in spaces such as classrooms, dining halls, and residential buildings. This is consistent with the recommendations made by leading health officials on how to limit the spread of COVID-19 and is consistent with similar decisions made by a number of our peer institutions.

Online courses are similar to classroom courses, except that the delivery of learning (lectures, homework, quizzes, readings, etc.) and interaction with students and instructors are all online. The 3-week programme of modules includes intensive online lectures and hands-on practical exercise workshops or group discussions, followed by a period for assignment work. Attendance on the modules is required in order to complete each course.

Most days start with a lecture delivered by the instructor, which is complemented with a seminar for Q&A, discussions, and feedback. Workshops, tutorials, and group work are followed to consolidate the students' learning on the course. Case studies are used to illustrate real-world examples and develop the students' knowledge and understanding of the subject.

A certificate of participation and transcript will be awarded to each participant for their constructive contributions in lectures, seminars, discussions, exercises, and assignments for the duration of the courses. Each course is worth 6 ECTS credits with 150 study hours consisting of 45 teaching hours and the other workload of 105 hours for independent study, project work, and assessment preparation.

Course 1 Artificial Intelligence & Machine Learning

Course Outline
(3 Weeks - 45 Contact Hours)

Part 1 AI and Machine Learning Module
(Week One and Week Three - 30 Contact Hours)
(including online lectures and hands-on practical exercise workshops)

* Model Building
* Unsupervised Learning
* Model Fitting
* Beyond Linear Models: Polynomial and logit fits
* Classic ML Algorithms
* Gaussian Mixture Models
* Natural Language Processing
* Deep Learning
* Reinforcement Learning

Part 2 Interdisciplinary Module
Delivered by Guest Speakers
(Week Two - 15 Contact Hours)
* More detailed information about this module can be found on page 7-9.

Final Assessment
A programming project required by the instructor

Proposed Instructors

Dr Nigel Mehdi

Visiting Lecturer, Software Engineering Programme, Department of Computer Science, University of Oxford

Dr Rob Collins

Dean of Degrees, Fellow, Department of Computer Science, University of Oxford

Prerequisites

Mathematics
Students should develop some skills and familiarity with the mathematical topics below. Knowledge of these topics should be acquired by the students before the course starts.

Matrices
 - What a matrix is: Matrix representation of data-sets
 - Matrix operations: Addition (+), Subtraction (-), Multiplication (.), Transpose (T)
 - The link between algebra and matrices: Expressing systems of algebraic equations in matrix form

Probability
 - What is a 'probability'?
 - Different views of what a probability represents: Bayesian Vs. Frequentist view
 - Operations on probabilities:' AND' and 'OR'
 - Definitions: 'Statistical distribution', 'Sample Space', 'Random Variable'
 - Discreet Vs. Continuous Random Variables and the relationship between them
 - Expectation: Definition and use in valuing options

The course programming language: Python
 - You do not need to be highly skilled at Python before starting the course.
 - The majority of activities will require you to read and replicate existing code, but not write new programmes.

Course 2 Data Science

Course Outline
(3 Weeks - 45 Contact Hours)

Part 1 Data Science Module
(Week One and Week Three - 30 Contact Hours) including online lectures and hands-on practical exercise workshops

Introduction to data analysis
 - Data analysis and its applications. Use of Python.

Statistical methods for data analysis, Part 1
 - Probability and distributions
 Mean and variance. Normal, Poisson and binomial distribution. Bayes's formula. Central limit theorem.

Statistical methods for data analysis, Part 2
 - Regression. Examples.

Statistical methods for data analysis, Part 3
 - Statistical inference. Confidence intervals. Hypothesis testing.

Data cleaning
 - Downloading data. Formats of variables. Missing values.

Data visualisation, Part 1
 - Different types of plots (bar, box, scatter plot).

Data visualisation, Part 2
 - Examples in Python

Machine learning: Part 1
 - Introduction. Examples.

Machine learning: Part 2
 - Regression and machine learning

Machine learning: Part 3
 - Dimension reduction. Principal component analysis.

Part 2 Interdisciplinary Module
Delivered by Guest Speakers
(Week Two - 15 Contact Hours)

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Final Assessment
A programming project required by the instructor

Prerequisites

Mathematics and Statistics

Working knowledge of linear algebra, calculus, basic probability, and statistics

Programming

Familiarity with the basics of Python

Python 3.7 or 3.8 installed as a part of the Anaconda Python distribution of Data Science, or equivalent.

Proposed Instructors

Dr David Kohan Marzagão

Researcher in AI for Polymer Design, Department of Engineering Science, University of Oxford

Dr Paul Duckworth

Postdoctoral Researcher, Oxford Robotic Institute, Oxford

Interdisciplinary Lectures and Sharing Sessions

The interdisciplinary module is meant to give a broader understanding of the work of the individual departments and their interconnections. These courses are usually attended by a large number of students and offer a lively intellectual meeting ground for the entire student body to share insights.

Lectures are co-taught by professors from different departments. These are offered in various combinations and can feature cooperation between professors and students.

Besides the top Oxford Academics, some guest speakers from the VCs and the local government will also be invited to deliver fantastic talks in their fields. Therefore, the students will have the opportunity to explore a wide range of interdependent topics that shape the contemporary world.

Proposed Topics

* Machine Learning, Neural Networks, and Web-Scale Data
* The Secrets of Creativity from Big Data
* Planning for Long-Term Autonomy
* Big Data and Deep Learning

* The Future of Work and Healthcare
* Internet and Fake News
* Online Dating in the Digital Age
* Social Inequality and Mobility

* Innovation and Technology Transfer in Oxford
* Cambridge Technology Innovation
* My Life at Oxford and My Application Experience Delivered by Oxford PhD students
* My Entrepreneur Story Delivered by the Entrepreneur at Oxford

Proposed Guest Speakers (Partial)

Prof. Alex Rogers
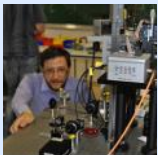Professor of Computer Science, University of Oxford
Professor Rogers is currently the Co-Director of the Autonomous Intelligent Machines and Systems Centre for Doctoral Training (AIMS CDT) and a member of the Cyber Physical Systems research group. His research applies artificial intelligence and machine learning within physical sensor systems to address real-world problems focusing on sustainability.

Prof. Nick Hawes
Associate Professor of Robotics, Oxford Robotics Institute, University of Oxford
Professor Hawes researches Artificial Intelligence (AI) techniques for the creation of intelligent, autonomous robots that can work with or for humans.

Prof. Pietro Liò
Professor at the department of Computer Science and Technology, University of Cambridge
Professor Liò's research interest focuses on developing Artificial Intelligence and Computational Biology models to understand diseases complexity and address personalised and precision medicine. Current focus is on Graph Neural Network modeling.

Dr Jonathan Bright
Associate Professor, Senior Research Fellow at the Oxford Internet Institute, University of Oxford
Dr Jonathan Bright specialises in computational approaches to the social and political sciences. He has two major research interests: exploring the ways in which new digital technologies are changing political participation; and investigating how new forms of data can enable local and national governments to make better decisions

Dr Aaron Reeves
Associate Professor of Evidence-Based Social Intervention and Policy Evaluation, University of Oxford
Aaron is a sociologist with interests in public health, culture, and political economy. His research on the political economy of health has used natural experiments to understand whether poverty reduction policies affect health and alter health inequalities.
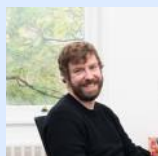
Dr Bruno Lacerda
Senior Researcher in Robotics, Oxford Robotics Institute, University of Oxford
Dr Lacerda's research focuses on the intersection of decision making under uncertainty, formal methods and mobile robotics. In particular, he is interested on the use of a combination of techniques from learning, planning and model checking to synthesise intelligent, robust and verifiable behaviour, both for single and for multi-robot systems.

Prof. David Howard
Associate Professor in Sustainable Urban Development; Fellow of Kellogg College, Oxford
His research relates to historical and contemporary Caribbean societies, with a specific focus on colonial legacies, urban development, and social sustainability. His current research interests focus on access to basic services and shelter in low-income, urban neighbourhoods in Jamaica and the Dominican Republic.
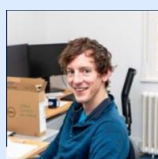
Proposed Guest Speakers (Partial)
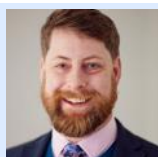
Dr Bernie Hogan
Senior Research Fellow, Oxford Internet Institute
With training in sociology and computer science, Hogan focuses on how social networks and social media can be designed to empower people to build stronger relationships and stronger communities

Dr Paul Duckworth
Postdoctoral Researcher, Oxford Robotic Institute
Dr. Duckworth's current research interests lie in probabilistic machine learning and mobile robotics, and he is also interested in the impact machine learning technologies have on society and the future of human work, and understanding algorithmic (and creative) intelligence.
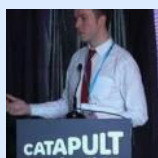
Mr Llewelyn Morgan
Head of Innovation at Oxfordshire County Council
Llewelyn leads a service area within Oxfordshire County Council that leads on Innovation for the Council. The Service has been built up by Llewelyn and colleagues, starting as a small outward focused Research and Innovation team, leading on developing innovative strategies and projects in Transport and Environment it is now broadened its scope to encompass challenges in areas such as Social Care, Education, Public Health and Climate Action supporting these directorates to work collaboratively on innovative solutions to long held or increasing problems.

Mr Guy Wallace
Investment Professional
Guy has spent his entire career involved in startup ecosystems in both operating and investing roles. Prior to Cambridge he was an Investment Associate at a Sydney-based venture capital fund called Reinventure, investing in early stage fintech deals across Asia. He led seed and series-A deals into tech companies in India, Singapore, Indonesia, and Australia. Most recently Guy has consulted on innovation and investment opportunities for larger organizations such as Paris Saint-Germain F.C. and AIG.

Mr Sam Isaacs
Investment Professional, Anamcara Capital
Sam is an Investment Professional at Anamcara Capital, which is a pre-seed/seed stage venture capital fund, investing in B2B technologies that enable the small and medium-sized businesses. He allocates his time between sourcing and investing in early-stage technology companies, and working with Anamcara's current portfolio companies to help them scale their businesses.

Mr Yuanyue Hao
Doctoral Student, Department of Education
Yuanyue's research involves interdisciplinary enquiries into applied linguistics and educational assessment, specifically language testing, adult second language speech, discourse analysis, corpus linguistics, global Englishes, natural language processing, and Rasch measurement.
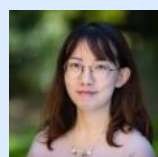
Ms Zhanxin Hao
Doctoral Student, Department of Education, University of Oxford
Zhanxin's research interests include the assessment policy, the predictability and standards of high-stakes tests, assessment for learning and e-assessment.

04 Application Information

♦ **Eligibility**

Undergraduate and graduate students (including MSc students and PhD students), or equivalent

♦ **GPA requirement**

At the time of application, you will normally be able to demonstrate an average grade, or equivalent academic experience, of: 2.5/4.0 GPA or 70/100 Percentage Grade Level or 2:2 (UK scale)

Notes:

First-year undergraduates from some partner universities do not need to submit academic performance proof. For more details, please contact your home institution.

Please note that for some of the courses, there are additional prerequisites. Please see individual course pages for details or contact us at apply@oxfordstudyabroad.org.uk.

♦ **English language requirement**

Proof of English proficiency is not required for applicants whose first language is English, those whose first language is not English but have been involved in a full-time degree-level academic programme at a university where English is the language of instruction, or those who have extensive experience working in a professional English-speaking environment. Otherwise, you will need to demonstrate proficiency by providing us with a recognised qualification.

The majority of modules normally require a level of minimum IELTS 5.5 or equivalent. Please find more details below:
English proficiency
(1) IELTS: minimum 5.5 for an overall average
(2) TOEFL: minimum 80 for the overall score
(3) College English Test (CET)-4: minimum 425 (applicable to Chinese university applicants only)
(4) College English Test (CET)-6: minimum 425 (applicable to Chinese university applicants only)

For applicants who have not taken the above tests by the time of application or have not been in a professional English - speaking environment for years, their English proficiency will be assessed through a virtual interview by the programme officer.

Please note that the selection panel of the programme will consider the overall qualifications of each applicant.

♦ **Scholarships and Awards**

A limited number of scholarships and awards (normally for university students) are available for those participants who demonstrate a competitive performance during the programme and in the home institution.

♦ **Application Procedures:**

Step 1
Complete and submit the application form to the international office of your institution.

Step 2
The successful applicants will receive an acceptance letter with the invoice attached via email.

Step 3
Pay the Tuition Fee. You are admitted to the programme only when the full payment of the fees is received.

Step 4
Prepare for the course with materials provided by the programme officer.

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