Oxford Study Abroad Programme
Online Courses Winter 2023
26 January- 8 February 2023

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

Course 1 Artificial Intelligence & Machine Learning

Course 2 Robotics and Artificial Intelligence

Course 3 Future Cities and Public Policy

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

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 2-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
(2 Weeks - 45 Contact Hours)

Part 1 AI and Machine Learning Module
(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 Lectures
Delivered by Guest Speakers
(15 Contact Hours)

Final Assessment
A programming project required by the instructor at the end of this course

Proposed Instructors

Dr Nigel Mehdi

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

Dr Rob Collins

Lecturer, 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
 - Intermediately 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 Robotics and Artificial Intelligence

Course Outline
(45 Contact Hours)

Part 1 Robotics and AI Module
(30 Contact Hours)
Including online lectures and hands-on practical exercise workshops
Lecture 1: Robot Kinematics
- Frames of reference, rigid body transformations
- Forward and Inverse Kinematics
Session 2: Computer Vision
- Image formation and pinhole camera model
- Image Filtering
- Feature extraction and Description
Session 3: Robot Control
- Principles of robot control
Session 4: Localization
- Iterative Closest Point Matching
- Bayesian Filtering
Session 5: Robot Planning
- Path planning in robotics
- Popular algorithms for path planning
Session 6: Introduction to Machine Learning
- Introduce the terms Machine Learning, Deep Learning and Artificial Intelligence
- Different kinds of learning schemes
- Introduce Regression
Session 7: Introduction to Deep Learning
- Biological Neuron vs Artificial Neuron
- Building a neural network with an example
- How to train a neural network – back propagation, gradient descent
Session 8: Convolutional Neural Networks (CNNs)
- Introduction to CNNs
- How CNNs are used for Computer Vision
- Popular CNN architectures and their applications – Autonomous Driving
Session 9: Reinforcement Learning
- Fundamentals of Reinforcement Learning
- Markov Decision Process
- Value function and Q-value functions
- Q-Learning and Deep Q-Learning
Session 10: Case studies and discussion
- State of the art applications

Part 2 Interdisciplinary Lectures
Delivered by Guest Speakers
(15 Contact Hours)
* More detailed information about this module can be found on page 6-7.

Final Assessment
A group programming project required by the instructor at the end of this course

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.

Main Instructor
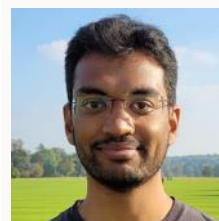
Dr Sundara Tejaswi Digumarti
Researcher at the Oxford Robotics Institute, University of Oxford

Tejaswi is a researcher at the Oxford Robotics Institute. He works with the Dynamic Robot Systems Group on topics related to robot navigation and mapping. The focus of his research is on utilizing semantics and structure to segment 3D navigation maps, extract meaning and enable long term scene understanding.

Course 3 Future Cities and Public Policy

Course Outline

(45 Contact Hours)

Part 1 Future Cities and Public Policy Module (30 Contact Hours)

Sustainable Urban Development Module
* Why Cities Exist
* Resilience, Urbanism, and City - Building in the Age of COVID - 19
* Urban and Regional Growth
* Designing Resilient Cities in East Asia
* Social Science Research Methods: Design, Data Collection, and Data Analysis

Sustainability and Leadership Module
* Leadership, Management, and Strategy for Net Zero, Sustainable Development
* Navigating Complexity: Surviving and Thriving in Turbulent, Uncertain, Novel and Ambiguous times
* Mental and Physical Health in Future Cities
* Sustainability and Corporate Social Responsibility

Part 2 Interdisciplinary Lectures
    Delivered by Guest Speakers
    (10 Contact Hours)
* More detailed information about this module can be found on page 6-7.

Part 3: Social Science Research Methods Workshop (5 Contact Hours)

Final Assessment
* A group presentation on a city plan project

Proposed Instructors

Dr Vlad Mykhnenko

Associate Professor of Sustainable Urban Development; Fellow of St Peter's College, University of Oxford

Dr Laurence Wainwright

Departmental Lecturer and Course Director, MSc Sustainability, Enterprise and the Environment, University of 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

* Performing transdisciplinary creativity: Making-with Arts and Sciences
* 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

Proposed Guest Speakers (Partial)

Prof. Alex Rogers
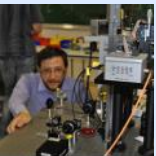Professor of Computer Science, University of Oxford
Professor Rogers is currently the Co-Director of the Autonomous Intelligent Machines and Systems Centre for Doctoral Training (AIMS CDT) and a member of the Cyber Physical Systems research group. His research applies artificial intelligence and machine 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, 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.
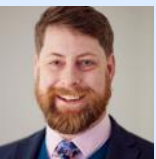
Dr Bernie Hogan
Senior Research Fellow, Oxford Internet Institute
With training in sociology and computer science, Hogan focuses on how social networks and social media can be designed to empower people to build stronger relationships and stronger communities
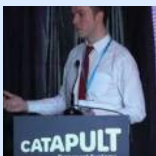
Mr Llewelyn Morgan
Head of Innovation at Oxfordshire County Council
Llewelyn leads a service area within Oxfordshire County Council that leads on Innovation for the Council. The Service has been built up by Llewelyn and colleagues, starting as a small outward focused Research and Innovation team, leading 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.

Prof. Pamela Burnard
Professor of Arts, Creativities and Educations, Faculty of Education, University of Cambridge
Pamela holds degrees in Music Performance, Music Education, Education and Philosophy. Her primary interest is creativities research for which she is internationally recognised.

Dr Debbie Hopkins
Associate Professor in Human Geography, University of Oxford
Debbie is a human geographer and environmental social scientist. Her research is broadly concerned with the social dimensions of climate change, socio-technical transitions, and the mobility of people, goods and 'waste', with a focus on cities and processes of urbanisation.

04 Application Information

♦ **Eligibility**

Undergraduate and graduate 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:
* China Grading System: minimum 2.5/4.0 GPA or average percentage score of 70%
* UK Grading System: minimum 2:2 Class or average percentage score of 50%

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 primary 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.

♦ **Additional Tuition Fee Reductions**

Partner University Student Discount of GBP 100

Each applicant from the partner universities is offered a favourable discount of £100 off the original tuition fee of £1, 250.

Additional Tuition Fee Reduction of GBP 100

Any participant with a minimum cumulative weighted GPA of 3.5/4.0, or equivalent, e.g., and an A+, A or A- (about 30%-35% of all participants) on the final assessment of the course will be eligible for a tuition fee reduction of GBP 100.

♦ **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.

Oxford Study Abroad Programme
Belsyre Court, First Floor, 57 Woodstock Road
Oxford, OX2 6HJ, United Kingdom
www.oxfordstudyabroad.org.uk
P: +44 (0) 1865 521959
E: info@oxfordstudyabroad.org.uk