

## Summer Institute 2019



### 2019 Summer Institute at Oriel College Oxford

#### --- Artificial Intelligence Programme

#### I. Introduction & Background

##### **Oriel College**

Oriel College is the fifth oldest of the University of Oxford's constituent colleges, founded in 1326. Situated in the heart of Oxford, Oriel is home to around 300 undergraduate and 200 postgraduate students, as well as around 100 members of academic staff. The majority of Oriel's buildings date from the 17th century onwards and include the Chapel, Pantin Library, Senior Library, and Hall. The College prides itself on being a welcoming academic community, home to world-class teaching, learning and research.

##### **Summer Institute at Oriel College Oxford**

Summer Institute at Oriel College Oxford (OSI) is an exclusive study abroad programme offered by Oriel College (University of Oxford, UK). It offers courses on a wide range of subjects like Earth Science, Artificial Intelligence, Biochemistry, International Law, PPE, English Literature and Learning Skills. OSI works with an outstanding faculty that is comprised of current professors, lecturers, researchers and tutors from the University of Oxford and the University of Cambridge.

## **II. Artificial Intelligence Programme Introduction**

This exclusive four-week Artificial Intelligence programme is part of the Summer Institute of Oriel College Oxford. It is designed by Prof Bernardo Cuenca Grau from Department of Computer Science, University of Oxford and taught together with his students team. Through attending lectures delivered by faculty members from the University of Oxford and the University of Cambridge, delegates will gain an understanding of the various fields within the science spectrum. Each week, Delegates will participate in one course with an examination at the end of the week. Cultural activities will be offered as well so that delegates can have the closest experience of Oxford life within a short time.

**Programme Dates: 4 August to 31 August 2019**

### **Course Description**

The following two course subjects were suggested by experienced teaching fellows. But Oriel College would be happy to offer other course subjects upon the request from Northwest University.

#### **I. Artificial Intelligence with a Focus on Search Part I**

This course provides an introduction to the field of Artificial Intelligence. The main focus of the course is the problem of search, which is presented as the fundamental technique used by an AI to solve problems. We will study the key search algorithms and their applications to areas as diverse as planning, constraint satisfaction problems, and exploration with partial knowledge and non-determinism..

Delegates taking this course will gain an overview of Artificial Intelligence and the use of search by AI to solve various problems. Delegates will be familiarized with the various techniques of search, including basic search algorithms and dealing with unknown environments..

#### **II. Artificial Intelligence with a Focus on Search Part II**

This course focuses on the topic of search in Artificial Intelligence and compliments the course 'Artificial Intelligence with a Focus on Search Part I,' which can be taken together or separately.

This course covers the foundations of search-based AI, and explores the various applications of search, including in robot motion problems and games.

## Summer Institute 2019

Delegates will gain an overview of search-based Artificial Intelligence, including informed search, AI search with heuristics, and local search. Delegates will also gain a firm grasp of how search can be applied as AI techniques in real life, including in games.

### III. Artificial Intelligence - Logic, Knowledge Representation and Ontologies

Knowledge Representation is at the heart of the great challenge of Artificial Intelligence: to understand the nature of intelligence and cognition so that computers can exhibit human-like abilities. Pioneers of the field such as John McCarthy believed that (artificial) intelligence could be formalised as symbolic reasoning with explicit representations of human knowledge given in some form of Logic. In this setting, the key challenge is to effectively represent knowledge in computers and to exploit it algorithmically to perform tasks in an intelligent way.

As the course is self-contained and assumes no prior knowledge, delegates will gain foundational knowledge of the concepts and questions related to knowledge representation and artificial intelligence including Classical Logic, Theorem Proving, and Computational Complexity. The student will learn specialised logic-based languages and how they are implemented in modern applications.

### IV. Numerical Analysis & Image Processing and Ontologies

Numerical Analysis is the study of algorithms for solving the problems of continuous science. By "algorithm" we mean a sequence of calculations, typically performed on a computer. This is a broad and exciting subject. This course will introduce (or review, depending on your background) some basic areas of numerical analysis.

#### Course Goals

- Develop existing knowledge of differential equations, calculus, and basic linear algebra
- Give an introduction to numerical function approximation, differentiation and integration.
- Demonstrate how to implement the above in software such as Matlab or GNU Octave
- Prepare students for image processing and surface computing courses

### III. Faculty

The 4-week Artificial Intelligence Programme is designed by Prof Bernardo Cuenca Grau from Department of Computer Science, University of Oxford and accomplished together with his students in Oxford.



**Prof Bernardo Cuenca Grau**

Professor of Computer Science

Royal Society Research Fellow

Department of Computer Science, University of Oxford

**Dr Andrew Krause**, Postdoctoral Research Assistant, Mathematical Institute, University of Oxford

**David Tena Cucala**, Doctoral Student, Hertford College, University of Oxford

**Alessandro Ronca**, Doctoral Student, Oriel College, University of Oxford

### IV. Additional Course Features

**1. Excursion:** During students' time off, there are planned trips to top attractions and landmarks around the United Kingdom. Locations delegates can choose from include Bath, Cotswolds and London.

**2. Cultural Activities in Oxford:** Throughout the programme, delegates will have the opportunity to get to know the city of Oxford through a variety of activities

- Welcome Reception
- The Ashmolean Museum
- Oxford Castle Tour
- Oxford Walking Tour
- Oriel College Tours
- Traditional Punting
- Oxford University Botanic Garden
- River Cruise
- Croquet Tournament
- Film Nights

in partnership with:

## Summer Institute 2019

- Pub Tour
- Evening talks
- Formal Hall and Farewell Dinner
- ...

### V. Certificate, Academic Transcript, and Accreditation

Each week, one course will be taught. Combining lecture time, preparation, study time, and tests, each week is designed to be equivalent to 2 - 3 ECTS credits or 1 - 1.5 US credits. Delegates are invited to participate in one examination each course.

Summer Institute at Oriel College Oxford is a certificate programme that may be accountable for optional credits depending on the requirements of the home institution/school/university.

A certificate of attendance will be issued by Oriel College. An Academic Transcript will also be issued by Oriel College and will show the courses attended by each delegate. It will indicate the workload of each course as well the results of exams and assignments.

### VI. Tuition and Fees

<b>Tuition fee (per 4-week session)</b>	<b>4,070 GBP</b>
<b>For FUDAN Universities</b>	<b>2,560 GBP</b>

The tuition fee includes all lectures, lecture materials, leisure activities, and planned weekend excursions.

<b>Accommodation and Food (per 4-week session)</b>	<b>2, 650 GBP</b>
--	-------------------

The Summer Institute offers the opportunity to stay in one of the colleges of the University of Oxford (UK). All rooms are single rooms with shared bathroom facilities. Breakfast, lunch and dinner will be offered by the college from Monday to Friday. On weekends only breakfast will be served.