# Imperial Data Science Winter School

**21st January to 7th February 2024 at Imperial College London**



**IMPERIAL COLLEGE LONDON AND THE DATA SCIENCE INSTITUTE**

Consistently rated amongst the world's best universities (3rd in Europe and 6th in World, QS World University Rankings 2023), Imperial College London is a science-based institution with an international reputation for excellence in teaching and research. Imperial attracts over 22,000 students and 8,000 staff of the highest international quality from over 126 different countries.

Since its foundation in 1907, Imperial's contributions to society have included the discovery of penicillin, the development of holography and the foundations of fibre optics. This commitment to the application of research for the benefit of all continues today, with current areas of focus including interdisciplinary collaborations to improve global health, tackle climate change, develop sustainable sources of energy, address security challenges, develop data management and analysis technologies for supporting data driven research, and tackling problems at molecular scale.

Imperial's Centre for Continuing Professional Development had extensive experience in developing and running a range of winter and winter schools for undergraduate students. We draw on Imperial's education pedagogy to design and deliver programmes that provide an engaging learning experience for students, incorporating group projects that are designed to assess students' learning outcomes.

The **Data Science Institute** (DSI) is a major Imperial College London initiative that brings together Imperial's existing data science activities and expertise and provides a focus and a catalyst for new partnerships.

The DSI supports multidisciplinary collaborations between the College's academic experts in many disciplines such as healthcare, financial services, climate science, and city infrastructure to create solutions to complex problems. Alongside research, the Institute fosters the next generation of data scientists and engineers by developing a range of postgraduate and executive courses.

The DSI includes 7 Academic Labs, has attracted over £50m in funding for data science research, technology and infrastructure and has published over 300 papers.

The Institute's Data Observatory (DO) was one of the first and largest visualisation suites in Europe. It provides a multi-dimensional and immersive environment to analyse large and complex data sets and to work collaboratively.

Thanks to its many research collaborations both across College and with a variety of external academic and industrial partners, the DSI is establishing its role as an international hub in data science.

## WINTER SCHOOL OVERVIEW

Data Science is successfully adding value to all business models using statistics and deep learning tools to make better decisions. A growing number of companies are now hiring data scientists to crunch data and predict possible situations and risk for businesses.

This winter school is designed for students studying IT, computing or any engineering degrees at a well-recognised university, with an interest in data science. Students will be introduced to the concept, develop an understanding of data science, hear from experts on data science applications and work in teams towards a technical project.

**Team-based learning through group project:**

Students will be working in small teams on a group project as outlined below:

Gliomas are the most common malignant brain tumours causing significant mortality and morbidity around the world. Accurate detection of brain tumours has always been a real-world challenge with great clinical importance. Imaging tests like MRI scans are commonly used for checking an abnormal brain area that is likely to be gliomas. Examining an MRI scan is a time-consuming and tedious task for clinicians. In this technical project, students will develop an accurate and automated AI framework

that is able to detect and segment brain tumours in MRI scans. This framework not only has the potential for improving efficiency in healthcare systems, but also for extracting imaging biomarkers for assessing the disease progression and evaluating the outcome of the treatments.

Supervised by Imperial academics throughout the programme, students will present the project to a panel of experts on the last day of the programme.

**Learning objectives:**

On completion of this winter school, students will be able to:

- Understand the basic concepts of Data Science;
- Develop an understanding of exploratory data analysis, natural language processing, data science for computer vision and machine learning for data science;
- Establish an understanding of data visualisation and see how this is presented in the state-of- the-art 360 observatory;
- Understand the real-world applications in data science and how data science can transform the future of healthcare;
- Establish an understanding of data entrepreneurship and blockchain technology;
- Understand the importance of data privacy and ethics;
- Gain a unique insight into advances in data science through Imperial's researchers in data science;
- Develop valuable professional skills in teamwork, communication and presentation;
- Experience team-based learning through a technical data science project;
- Practice and improve their English language.

In addition, students will have an opportunity to make new friends, get to know student ambassadors from Imperial College London through social activities and discuss opportunities for future study and experience what it is like to study in a world class university.

**Visit to the Data Science Institute**
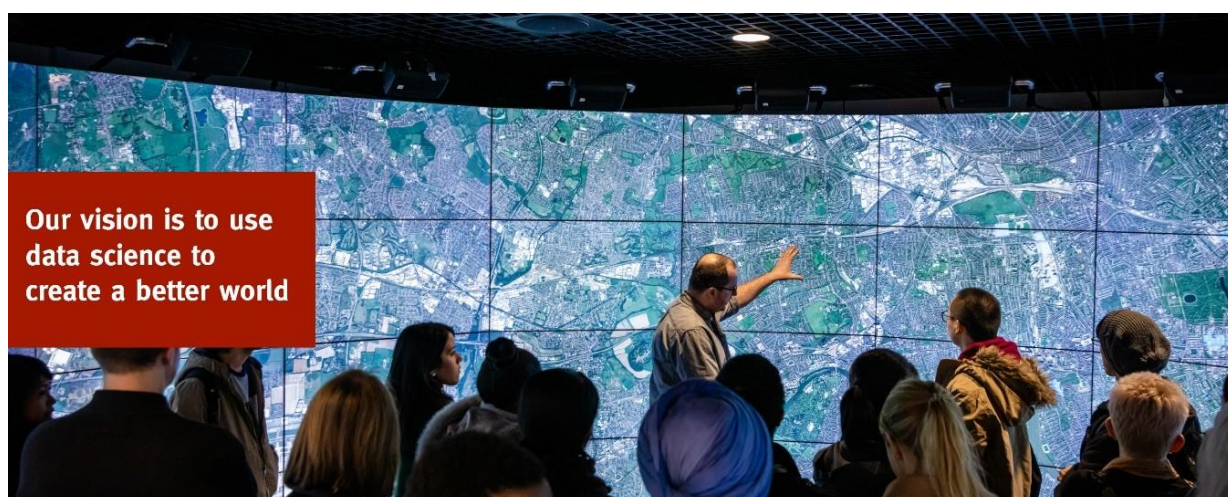


As part of this winter school, students will have a unique opportunity to visit the state-of-the-art 360 Observatory at the Data Science Institute, one of the seven Global Institute at Imperial College London, and see demonstrations of cutting edge data science research.

## PROGRAMME STRUCTURE AND FORMAT

59 contact hours spread over 2 weeks covering lectures, workshops, tutorials, project work and visits. Classes will be delivered on weekdays.

Students will be allocated in small groups for Project work which will be done through team- based learning with supervision. Final project will be presented in groups to a panel of experts on the last day of the programme. A prize will be awarded to the team with the best project.

The entire programme will be taught in English.

## CERTIFICATION

Students will receive a verified Imperial College London certificate on successful completion of the winter school and a prize will be awarded to the best project team. Each student will also receive a transcript for their project marks.

## ENTRY REQUIREMENTS

All students are expected to be studying an undergraduate degree, preferably in the final two years of their undergraduate studies, in any engineering discipline, IT or computing degree at a well-recognised university.

*English requirements:*

All students are required to have a good command of English, and if it is not their first language, they will need to satisfy the College requirement as follows:
- a minimum score of IELTS (Academic Test) 6.5 overall (with no less than 6.0 in any element) or equivalent.
- TOEFL (iBT) 92 overall (minimum 20 in all elements)
- CET- 4 (China) minimum score of 550
- CET- 6 (China) minimum score of 520

*Technical requirements:*

As the project has a strong technical element, students are expected to have the following technical knowledge and interest:
- Interested in computer visualisation / natural language processing;
- Have at least intermediate level at one of the common programming language (Python, Java, C ++, etc.);
- Have mathematical foundation (probability theory, linear algebra, etc.);
- Have understanding of the Linux environment;
- Knowledge of Machine Learning with experience in using PyTorch / Tensorflow / Keras.

Students will be asked to bring along their computer pre-installed with Python for project work.

**COST**

The cost of the winter School is **£5280**. The fee includes all tuition which covers:

- Lectures, project work, supporting materials, project mark and Imperial College certificate of attendance,
- Campus tour, visits and social activities in the programme schedule,
- Lunches and refreshments on weekdays from 23$^{rd}$ January to 5$^{th}$ February,
- Accommodation fee for 17 nights.
- Overseas insurance expenses;
- A London Transport card with a top-up value of £5;
- An airport shuttle service on a fixed schedule.

Please note you are eligible to apply for the scholarship up to £600 and get a tuition fee deduction.

**APPLICATION**

● Step 1: Please complete the application form: https://imperial.mikecrm.com/k8Y6q2l

● Step 2: You will need to send *a copy of your university transcript* and *evidence of English language proficiency* to the email: icdsi.programme@gmail.com. It is important that the transcript includes your full name. (If this document is not in English, please provide a brief translation.)

*The English qualification certificate is waived for the student undertake high education (undergraduate or postgraduate) studies in English. If you have difficulty providing the above evidence, you will be required to attend an online interview.

The deadline of winter school application is **23:59 30$^{th}$ November (UK time)**.
*To prevent potential disappointment, we highly recommend that you submit your application at your earliest convenience. Our admissions process operates on a **rolling system**, meaning applications are assessed and decisions are made on a first-come, first-served basis. Applying earlier grants you access to a larger pool of available places to offer for evaluation.

**SCHOLARSHIP APPLICATION**

 A scholarship of **up to £600** will be provided by *Global University Online*.

To apply, please click the link below, complete an online application form and upload your personal statement (within 500 words) and CV/resume:
http://www.globaluniversityonline.org/hqdx.php/scholarship/detail/26.html?lang=en

The deadline of scholarship application is **23:59 20$^{th}$ October (UK time)**.
*In order to ensure the prompt and efficient processing of your scholarship applications, **it is imperative that you submit your scholarship application on the same day as your application materials.**

**PROVISIONAL SCHEDULE (subject to change)**

## Data Science Winter School
**21st January to 7th February 2024 at Imperial College London, UK**

### Sunday 21 January

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|---|---|
| 10:30 | Arrive in the UK |
| 14:00 | Ice-breaking Session (depending on the arrival time of students) |
| 16:30 | End of day |

### Monday 22 January

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|---|---|
| 10:30 | Orientation |
| 14:00 | Academic English Skills |
| 16:30 | End of day |

### Tuesday 23 January

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|---|---|
| 09:00 | Programme Registration |
| 09:15 | **Welcome, Housekeeping and Introduction to Imperial** |
| 09:30 | **Programme Overview and Icebreaker** |
| 10:00 | **Introduction to Data Science** |
| 12:30 | **Group Photo** |
| 13:00 | **Welcome lunch with student ambassadors** |
| | **Followed by campus tour** |
| 14:00 | **Team building and leadership** |
| 16:30 | End of day |

### Wednesday 24 January

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|---|---|
| 09:15 | **Exploratory Data Analysis** |
| 10:45 | **Break** |
| 11:00 | **Introduction to Natural Language Processing** |
| 12:30 | Lunch |
| 13:30 | **Group Project Introduction and Briefing** |
| 15:30 | **Data preparation** |
| 16:30 | End of day |

### Thursday 25 January

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| 09:30 | **Coach pickup from Imperial** |
| | **Study visit to Bletchley Park** |
| 16:30 | End of day |

### Friday 26 January

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|---|---|
| 09:15 | **Computer Vision and Applications** |
| 10:45 | **Break** |
| 11:00 | **Machine Learning for Data Science** |
| 12:30 | Lunch |
| 13:30 | **Project tutorials Q & A** |
| 14:30 | Teams work on group project |
| 16:30 | End of day |

**Saturday & Sunday, 27 & 28 January**

Free time to explore London

**Monday 29 January**

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|---|---|
| 09:15 | **Data Science Entrepreneurship** |
| 10:45 | Break |
| 11:00 | **Transforming the future of healthcare with data science** |
| 12:30 | Lunch |
| 13:30 | **Project tutorials Q & A** |
| 14:30 | Teams work on group project |
| 15:30 | End of day |

**Tuesday 30 January**

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|---|---|
| 09:15 | **Data Visualization** |
| 10:45 | Break |
| 11:00 | **Effective Communication for Presentation Workshop** |
| 12:30 | Lunch |
| 13:30 | **Social activity - British Cultural Quiz** |
| 14:30 | **Project tutorials Q & A** |
| 15:30 | Teams work on group project |
| 16:30 | End of day |

**Wednesday 31 January**

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|---|---|
| 09:30 | **Visit to DSI 360 observatory for Groups 1, 2, 3, 4** |
| 10:30 | **Visit to DSI 360 observatory for Groups 5, 6, 7, 8** |
| 11:30 | **Visit to DSI 360 observatory for Groups 9, 10, 11** |
| | Teams work on group project during non-visit period |
| 12:30 | Lunch |
| 13:30 | **Social activity - Visit to The Design Museum** |
| | Approximately 25 minutes walk from Imperial |
| 16:30 | End of day |

**Thursday 1 February**

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|---|---|
| 09:15 | **Introduction to Blockchain Technology** |
| 10:45 | Break |
| 11:00 | **Data Privacy and Ethics** |
| 12:30 | Lunch |
| 13:30 | **Project tutorials Q & A** |
| 14:30 | Teams work on group project |
| 16:30 | End of day |

**Friday 2 February**

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|---|---|
| 09:30 | **Advances in Data Science - Research showcase** |
| 12:30 | Lunch |
| 13:30 | **Opportunities for International Students** |
| 14:00 | **Project tutorials Q & A** |
| 15:30 | Teams work on group project |
| 16:30 | End of day |

**Saturday & Sunday, 3 & 4 February**

Free time to explore London

**Monday 5 February**

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|---|---|
| 08:00 | **Students arrive to upload project presentations** |
| 08:15 | **Group 1** |
| 08:30 | **Group 2** |
| 08:45 | **Group 3** |
| 09:00 | **Group 4** |
| 09:15 | **Group 5** |
| 09:30 | Break |
| 09:45 | **Group 6** |
| 10:00 | **Group 7** |
| 10:15 | **Group 8** |
| 10:30 | **Group 9** |
| 10:45 | **Group 10** |
| 11:00 | **End of presentation** |
| | **Students to complete feedback form** |
| 11:15 | Lunch |
| 12:00 | **Announcement of winning teams** |
| | **and Certificate Ceremony** |
| 13:00 | End of winter school |

**Tuesday 6 February**

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| 10:30 | Workshop: Alumni Experience Sharing |
| | (Master's and PhD/ Career opportunities) |
| 13:30 | London Visit |

**Wednesday 7 February**

**London Visit / Departure Day**

**TEACHING FACULTY**

The winter school is founded by Professor Yike Guo and co-directed by Dr Kai Sun and Huang Ping and taught by a multi-disciplinary teaching faculty from the Data Science Institute and other departments of Imperial College London.

**LOCATION**

The winter school will take place at Imperial College London's South Kensington Campus, located amongst many famous attractions in London.

The culture triangle: neighbour to three of London's most prestigious (and free) museums. Right next door, the Science Museum. Across the road, the Victoria & Albert Museum, and around the corner? The Natural History Museum. From Neolithic to the latest scientific breakthroughs, experience it all just minutes from Imperial's doorstep.

The campus is also next to the famous Royal Albert Hall, one of London's most iconic music venues, established in 1871, host to the BBC Proms and countless world-famous international artists.

In addition, the beautiful Hyde Park and the famous Harrods Department Store are just a short walk from the campus.

**VIDEOS OF 2023 SUMMER SCHOOL**

Please visit the following link for the vlog and students' feedback videos of 2023 Imperial Data Science Summer School:

https://s5r1icy7rr.feishu.cn/drive/folder/TPkmfbxtKlerWVdaO71ctp0snyk

**PHOTOS OF 2023 SUMMER SCHOOL**

**FEEDBACK FROM 2022 COHORT**

*"I really have learned a lot through the programme. Thanks to all professors and supervisors"*

- student from Shanghai Jiaotong University

*"High quality teaching, useful knowledge and full support"*

- student from Shanghai Jiaotong University

*"Wonderful. It enhanced my understanding of data science. It was also wonderful to listen and discuss opinions with the professors"*

- student from Zhejiang University

*"It's indeed a wonderful experience, learning knowledge and coming across with so many excellent teachers and classmates"*

- student from Zhejiang University

*"This programme opens a door to the world of data science for me! Brilliant!"*

- student from Zhejiang University

*"The project gave me the opportunity to meet many great students and professors. I learned how to use artificial intelligence to improve everyday tasks, including but not limited to the computer vision and natural language projects in the program. This has greatly broadened my horizons and expanded my knowledge beyond my undergraduate studies. "*

- student from Xi'an Jiaotong-Liverpool University

*"Many thanks for this valuable experience. I have benefited greatly from being exposed to cutting-edge data science knowledge and trying to work on a project with students from different schools and disciplines. I will always cherish this memory. "*

- student from Nanjing Audit University

*"It's a fantastic opportunity to experience the research atmosphere at Imperial College London. It is exhilarating to meet so many outstanding staff and professors talking like friends to us. It was also a valuable experience working with my teammates, who doesn't actually know each other before, but come together tighter after this programme. And my passion towards IC has never become so high like now. "*

- student from University of Nottingham Ningbo China