Imperial College London

Artificial Intelligence Showcase

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Imperial Global Science
Policy Forum

30 October 2018

#ImperialAI

The Imperial Global Science Policy Forum

The Imperial Global Science Policy Forum is a high-profile network connecting Imperial academics with senior international science and technology advisers and diplomats, UK government policymakers, industry experts and other relevant stakeholders.

The programme of events focuses on some of the most important global challenges – from smart cities and future health to artificial intelligence – and showcases Imperial's creative, international and multidisciplinary scientific research and technological innovation.

Artificial Intelligence

Imperial College London is a world leading centre in artificial intelligence (AI) and machine learning with more than 600 people working with and developing AI. Our AI ecosystem brings together fundamental discovery-led research in AI, machine learning and data science with academics from healthcare, engineering, and business who are leading breakthroughs across a wide range of application domains.

Programme

15.45
Registration opens

16.15 – 17.15
AI at Imperial Showcase
Dyson School of Design Engineering

Reception to showcase the latest techniques and applications of cutting edge AI research at Imperial College London

Introduction and welcome:

Professor Maggie Dallman OBE,
Vice-President (International),
Associate Provost (Academic Partnerships)
and Professor of Immunology

Professor Nick Jennings CB FREng,
Vice-Provost (Research and Enterprise),
Professor of Artificial Intelligence, Departments
of Computing and Electrical Engineering

Presentations:

Biomedical imaging
Dr Ben Glocker,
Senior Lecturer in Medical Image Computing,
Department of Computing

Neurotechnology
Dr A. Aldo Faisal,
Reader in Neurotechnology and AI,
Departments of Bioengineering and Computing

Machine analysis of human behaviour
Professor Maja Pantic,
Professor of Affective and Behavioural
Computing, Department of Computing

17.30 – 18.40
Keynote talks and presentations
Room 200, City and Guilds Building

AI at Imperial
Professor Nick Jennings CB FREng,
Vice-Provost (Research and Enterprise),
Professor of Artificial Intelligence, Departments
of Computing and Electrical Engineering

**How the UK government supports the AI
Sector – and how AI can support the UK
government and economy**
Professor John Aston,
Chief Scientific Advisor to the Home Office

The application of AI technology in the UK
Professor Andrew Blake,
Chair, Samsung AI Centre

Professor Chris Bishop,
Director, Microsoft Research Lab

Chair: **Professor Maja Pantic**,
Professor of Affective and Behavioural
Computing, Department of Computing

18.40 – 19.30
Drinks reception and AI exhibition
College Main Entrance

Meet Imperial researchers and learn more about the new AI technologies and tools being developed at the College.

- Get your face 3D scanned by machine learning experts and plastic surgeons aiming to improve facial reconstruction operations.

- Test your mental skills with an AI tool for neuroscientists investigating how our brains are wired.

- Meet the machines teaching themselves to spot the signs of heart complications.

- Detect and uncover fake news using algorithms based on geometric deep learning.

- Observe computer vision technology for autonomous vehicles that aims to capture the full complexity of human behaviour in urban environments.

Biographies

Professor Maggie Dallman OBE

Professor Maggie Dallman, OBE, is Vice-President (International), Associate Provost (Academic Partnerships) and Professor of Immunology at Imperial College London. In her Vice-President and Associate Provost roles, Professor Dallman is the academic lead on the College's International Relations and Societal Engagement Strategies respectively. Continuing to lead research into immunology and inflammation, Professor Dallman was awarded an OBE for services to bioscience in 2016, and in 2018 was named Imperial's first Vice-President (International).

Professor Nick Jennings CB, FREng

Professor Nick Jennings CB, FREng is Vice-Provost (Research and Enterprise) at Imperial College London. Professor Jennings is Professor of Artificial Intelligence in the Departments of Computing and Electrical and Electronic Engineering. Before joining Imperial, he was the Regius Professor of Computer Science at the University of Southampton and the UK Government's Chief Scientific Advisor for National Security. Professor Jennings is an internationally recognised authority in the areas of artificial intelligence, autonomous systems, cybersecurity and agent-based computing.

Dr Ben Glocker

Dr Ben Glocker is a Senior Lecturer in Medical Image Computing and one of three academics leading the Biomedical Image Analysis Group at Imperial College London. He is also Adviser – Medical Image Analysis at HeartFlow and leads the London-based HeartFlow-Imperial Research Team. Dr Glocker works as scientific adviser for Definiens and Kheiron Medical Technologies. His research is at the intersection of medical image analysis and artificial intelligence aiming to build computational tools for improving diagnosis, therapy and intervention.

Dr A. Aldo Faisal

Dr Aldo Faisal is the Director of the Behaviour Analytics Lab at the Data Science Institute and Reader in Neurotechnology and AI in the Departments of Bioengineering and Computing at Imperial College London. He is an Associate Group Head at the MRC London Institute of Medical Sciences and an honorary senior fellow of the FMRIB Center at the University of Oxford. Dr Faisal's lab combines cross-disciplinary computational and experimental approaches to investigate how the brain learns and controls goal-directed movements, and how to restore them in disease.

Professor Maja Pantic

Professor Maja Pantic is Professor of Affective and Behavioural Computing and leader of the Intelligent Behaviour Understanding Group (iBug) group at Imperial College London, where she is working on machine analysis of human non-verbal behaviour and its applications to human-computer, human-robot, and computer-mediated human-human interaction. Professor Pantic's current research addresses the problem of sensing and understanding human non-verbal interactive actions and intentions.

Professor John Aston

John Aston is Professor of Statistics at the University of Cambridge and has been on secondment as Chief Scientific Adviser to the Home Office since September 2017. His research interests include all areas of Applied Statistics, but particularly Statistical Neuroimaging and Statistical Linguistics. Professor Aston sits on the Board of the Economic and Social Research Council, and until recently was a trustee of the Alan Turing Institute. He has previously held academic positions at the University of Warwick and at Academia Sinica, Taiwan.

Professor Andrew Blake

Professor Andrew Blake, PhD, FREng, FRS, is a pioneer in the development of the theory and algorithms that make it possible for computers to behave as seeing machines. His interests are primarily in image processing and segmentation as optimisation, on visual tracking as probabilistic inference, and on real-time, 3D vision. Currently Professor Blake is a consultant in AI and is the Chairman of Samsung's AI Research Center in Cambridge. He is also a consultant and Scientific Adviser to the FiveAI autonomous driving company and serves as an adviser to Siemens.

Professor Christopher Bishop

Professor Christopher Bishop is a Microsoft Technical Fellow and Director of the Microsoft Research Lab in Cambridge. He is also Professor of Computer Science at the University of Edinburgh, and a Fellow of Darwin College, Cambridge. At Microsoft Research, Professor Bishop oversees a world leading portfolio of industrial research and development, with a strong focus on machine learning and AI, and creating breakthrough technologies in cloud infrastructure, security, workplace productivity, computational biology, and healthcare.

AI exhibition

AI for healthcare

The Brain and Behaviour Lab at Imperial College London focuses on digital healthcare for neurological and neurodegenerative disorders by developing objective measures of disease progression from full-body motion data collected using wearables in daily life.

The development and approval of disease-modifying treatments are often slowed down by the fact that it takes a long time to determine if a treatment works well or not for a group of patients.

Many gold-standard methods for tracking disease progression rely on judgements 'by eye' in the clinic. We give patients wearable sensors which capture their arm and leg movement 24/7. This movement data is analysed by our AI technology. This is a bit like having a personal neurologist looking after you day and night, day after day, who can notice even subtle changes in movement ability.

This novel approach will significantly improve the accuracy and reduce the time it takes to detect disease progression, potentially reducing the duration of future clinical trials and the cost of treatment development. Currently, we are working on clinical trials alongside our clinical partners to develop novel digital biomarkers for Duchenne muscular dystrophy, stroke and traumatic brain injury.

Exhibitors:
Dr Aldo Faisal
Dr Balasundaram Kadirvelu

Human brain insights with AI

The brain is the most complex and fascinating organ in the human body. Trying to understand how the brain works throughout its various stages of development is an exciting area of research. The Biomedical Image Analysis Group at Imperial is using advanced AI technologies to better understand healthy brain development, and to help doctors by automatically detecting neurological disorders and diseases in medical scans.

We will present some of our interdisciplinary research on how we use AI to create the first four-dimensional brain map of early life as part of our EU-funded 'Developing Human Connectome Project'. We will also demonstrate how an AI algorithm can be trained to find brain tumours, traumatic injuries and stroke lesions and extract clinically useful information from complex MRI scans. This algorithm is currently tested on the world's largest collection of brain scans from patients with brain injuries as part of a large European project CENTER-TBI involving more than 30 academic, industrial and clinical partners aiming to improve the care for patients with traumatic brain injury. We believe in the tremendous positive impact that AI can have on healthcare, and we work closely with hospitals and doctors to help translate our research into clinical practice.

Exhibitors:
Dr Ben Glocker
Dr Ahmed Fetit
Konstantinos Kamnitsas

Using machine learning to understand heart failure

Cardiac function is a complex trait and its disturbance underlies a global pandemic of heart failure – yet its genetic architecture is poorly understood predicting outcomes relies on simple parameters that are insensitive to the dynamic physiology of heart disease. Our team is approaching understanding of cardiac function from a radically different perspective by developing machine learning computer vision algorithms, prediction networks and statistical genomics approaches to discover how genetic and environmental factors regulate the three-dimensional function of the heart and can be used to make patient-specific predictions of future events.

Machine learning offers a significant advance in developing integrative approaches to modelling heart disease and is well suited to a variety of classification and prediction tasks that exploit complex input data. Our team is developing state-of-the-art approaches for inference and prediction using rich 3D models of cardiac motion taken from MR imaging which integrate functional, genetic and biochemical biomarkers of disease. Our aim is to develop efficient and automated tools for predicting time-to-events, classifying patients and identifying causative mechanisms in heart disease through joint analysis of imaging and biological data – accelerating the discovery of new therapies.

This work is strongly interdisciplinary with innovative collaborations across the domains of computer vision, functional genetics, molecular cardiology, pharmacology and time-to-event statistics using data from diverse patient populations, as well as the UK Biobank.

digital-heart.org

Exhibitors:
Dr Declan O'Regan
Dr Jinming Duan
Carlo Biffi
Dr Ghalib Bello

Fabula AI – solving fake news, for good

Fake news has already undermined democracy, enabled large-scale fraud, and incited violence. It also violates the fundamental human right to free choice, as it denies informed decision-making. Governments and the public are becoming increasingly concerned – and pressure is being applied to the biggest names in technology for a solution. Presently, fake news is detected primarily by human review - slow, error prone, and staggeringly expensive.

To solve fake news, Fabula AI developed and patented Geometric Deep Learning, a novel class of machine learning algorithms able to learn on social network data. Our AI models are trained to deliver unbiased authenticity scores for any piece of news, in any language. Our initial model has already proven its ability to quickly and accurately spot fake news on Twitter.

At Fabula AI, we strive to deliver a better way to maintain trust in the world's news: an independent, automated clearing house. To achieve this, we have assembled a world class team of data scientists at the forefront of AI, together with successful entrepreneurs and seasoned technology leadership. We have secured seed funding to scale our model and add APIs, allowing any platform or app to validate news – quickly, objectively and cost-effectively.

Exhibitors:
Professor Michael Bronstein
Federico Monti
Fabrizio Frasca
Damon Mannion

Synthesis of 3D faces for all realities

The iBug group focuses on technology that will be used in every piece of software that interacts with or generates human faces from the real world, to augmented and virtual realities.

The group aims to tackle problems in automatic face analysis, including but not limited to 2D/3D face reconstruction and tracking, face and facial expression recognition, facial motion capture, etc. The technology of the group currently includes the most anatomically accurate statistical model of a 3D face, as well as a very accurate statistical model of 3D facial expressions. The face recognition algorithms have been tested in international competitions and have found to be amongst the best in the world with accuracy levels of greater than 98%.

Proprietary data within the group includes over 2.5 million high resolution scans of faces of all ethnicities, age groups and genders with various facial expressions. With this technology we are able to create and animate highly realistic 3D faces which avoid the dangers of the "uncanny valley".

Exhibitors:
Dr Stefanos Zafeiriou
Stylianos Ploumpis
Alexander Lattas

Humanising Autonomy

Humanising Autonomy improves the safety and efficiency of autonomous mobility systems through developing a better understanding of human behaviour across cities.

Autonomous systems are unable to understand the complexities of human behaviour, which creates one of the primary obstacles in the development of automated vehicles in cities. Current solutions do not consider the full range of human behaviour at street level. This lack of perceptive abilities and understanding makes vehicles unsafe around people, and slows down the technology's adoption rate and efficiency in navigating urban environments.

Humanising Autonomy has built a human intent prediction application that is able to recognise and predict human behaviour from visual camera footage. Its main application is in automated vehicles as it allows the vehicle to make better decisions in terms of vehicle path planning and pedestrian interactions to improve the safety, societal acceptance, and deployment of level 2+ automated vehicles. The human intent recognition and prediction platform is based on patent pending technology informed by both behavioural psychology and novel AI models.

Humanising Autonomy's technology has been tested and validated with multiple mobility partners, including Daimler Mercedes Benz. New collaborations include other mobility customers in aviation and aerospace, including Airbus. The human intent prediction platform will be licensed to automotive OEM's and Tier 1 suppliers and can be extended to applications across multiple industry verticals such as warehouse automation, drone interactions, delivery bots, and collaborative robots.

Exhibitors:
Raunaq Bose, CTO
Leslie Nooteboom, CDO

Autonomous Urban Mobility for the elderly

Autonomous navigation is actively evolving in cars, but urban mobility for wheelchairs needs addressing. Control mechanisms in powered wheelchairs cannot adapt to people with severe disabilities. And the ageing population must also be taken into account. Human-in-the-loop approach combined with AI systems allow subjects to navigate their wheelchair without the need to interact with a 'user interface'.

We have developed an autonomous wheelchair fitted with sensors and a universal motor driver. Lidar sensors installed on the wheelchair can reconstruct the environment in real time, and recognise objects in the proximity of the user using AI algorithms. This allows the wheelchair to be contextually aware, and to identify static and dynamic obstacles. Upon destination definition, the path can be computed and executed autonomously by the wheelchair by accounting for the obstacles and pre-identified conditions. Our urban platform enables maximum independence and makes urban continuum possible for wheelchair users. This platform will learn from the frequently mapped environment (home) and will be able to adjust to new urban environments. Such mapped environments can be shared over a common network of autonomous wheelchairs.

Exhibitors:
Dr Aldo Faisal
Mahendran Subramanian

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