Contents

Research Project Title:

Exploring the complexity of dopamine signalling in the C. elegans nervous system

Supervisor name and role:

Iris Hardege

Email

ih287@cam.ac.uk

Project description:

Animal behaviours are crucial for survival and reproductive success, exhibiting remarkable conservation across diverse organisms, regardless of their complexity. The driving force behind these behaviours lies in the flow of information through neural networks. This highly regulated process involves the release of neurotransmitters from presynaptic neurons and the subsequent activation of receptors in postsynaptic neurons, forming the foundation of signal transmission across all organisms. Fast neurotransmission is mediated by ion channel receptors. Typically, we think of neurotransmitters acting via these receptors as being exclusively excitatory or inhibitory. However, discoveries in Drosophila and C. elegans have challenged this binary view, revealing the existence of both excitatory and inhibitory ligand-gated ion channels (LGICs) gated by the same neurotransmitter. Interestingly, despite having just 302 neurons, C. elegans encodes excitatory and inhibitory ion channel receptors for all major neurotransmitters, some within the same neurons. This along with a fully mapped connectome make it an ideal model organism to study this phenomenon. We recently identified both excitatory and inhibitory dopamine-gated LGICs from C. elegans and found that they can be expressed within the same neurons. We also found that some of these receptors have differential expression in male C. elegans. This raises several interesting questions about how a small nervous system utilises this complexity and whether it contributes to sexual dimorphism. In this project you will work to understand the behavioural importance of these two classes of dopamine-gated ion channels in males. To do this you will perform a range of behavioural assays to test the mating efficiency of animals with mutations in dopamine LGICs. You may also use molecular biology techniques to characterise the expression pattern of additional LGICs in male C. elegans.

Student learning outcomes:

This project will provide the student an opportunity to undertake hands on research in a laboratory setting. They will be able to perform independent research, troubleshooting and develop and test their hypothesises.

New skills the student will develop

The student will learn a range of technical laboratory skills including molecular biology (PCR, cloning, mutagenesis), C. elegans handling and behavioural analysis. The student will also develop skills in time management especially in the prioritisation of tasks as well as good record keeping and teamwork.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

You should have an interest in biology, in particular neuroscience or molecular biology. Ideally you will be taking natural sciences with a focus on biology modules. Some technical experience of molecular biology will be a plus, for example gained from undergraduate practicals. Mainly you will be motivated and interested in learning and keen to develop new skills.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

You will be part of the research group based in the main Zoology building and will have access to lab facilities and office space. Supervision will be provided by various group members and overseen by the PI.

Duration of the project (All projects should be between 6 - 10 weeks long.)

10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

a different start date (please provide more detail) 6th or 13th July (the lab will be at a conference on the 29th June) Day to day supervision is likely to be managed by a PhD student in the group who has started this project as a side project and has supervised summer students before. We also have a postdoc and technician so there will always be someone around.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

1-2

Any other comments

Research Project Title:

Establishing design principles for lithiation in anodic battery materials to reduce surface degradation

Supervisor name and role:

Jonathan Van Buskirk

Email

jv477@cam.ac.uk

Project description:

The proposed project involves designing, synthesizing, and testing novel materials for lithium battery applications, with the overarching goal of establishing a framework for understanding when Li+ does or does not intercalate into metal oxide structures. Often when Li does intercalate, the resulting lithiated structure is prone to cracking, which exposes fresh surfaces, necessitates increased SEI formation, and ultimately leads to degradation. Recently, there have been significant advances made by examining single classes of structures such as the Wadsley-Roth crystallographic shear structures. These materials seem to exhibit increased structural rigidity, which might limit their propensity to crack under electrochemical strain. This project attempts to understand the Wadsley-Roth structures as one example of a wider class of crystallographically constrained structures that intercalate Li+. Other types of constrained structures would include structures that exhibit other types of crystallographic shears and structures such as a partially stuffed perovskite. The student will be able to gain experience with solid state synthesis and characterisation as well as electrochemical methods such as constructing and testing Li half-cells. In addition to scientific skills developed, the student will have the opportunity to discuss and present their findings to a vibrant community of scientists.

Student learning outcomes:

- Familiarity with a variety of relevant solid-state structures, techniques, and instrumentation
- Experience with state-of-the-art electrochemical methods
- Development of soft skills such as informal and formal communication of scientific research

New skills the student will develop

The student will become familiar with highly marketable techniques including X-ray diffraction, electrochemical cycling, solid state NMR, and solid state synthesis.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

The successful applicant would be a late stage undergraduate student with familiarity with inorganic chemistry. The ideal candidate would be interested in growing their research experience in a dynamic, stimulating environment.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

The student will have access to a fully equipt lab space and departmental resources.

Duration of the project (All projects should be between 6 - 10 weeks long.)

8-10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

6 July There are a large number of senior graduate students and postdocs working in the lab who could supervise the student for 1 week if necessary

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

One student would be best.

Any other comments

Research Project Title:

A machine-learning method for new estimates of popular literacy in China, 1650-1950

Supervisor name and role:

Christoph A Hess

Email

cah99@cam.ac.uk

Project description:

Were historical European societies uniquely educated? What is the relationship between popular education and long-term economic growth? Was the Chinese script too difficult to learn to allow widespread popular literacy? For this project, I invite students to think about these questions as part of a pilot study that will harness Artificial Intelligence to produce new estimates of popular literacy in China between 1650 and 1950. The source material for the project will be signatures on historical contracts. In recent decades, hundreds of thousands of such contracts have become available, covering ethnic minorities in the deep south, the historical Silk Roads in the north, and many areas in between. Some indicators of literacy on the contracts are easy to identify, such as people who signed with an "X" or an "O" instead of a Chinese character. Others are less straightforward. Many people could write the two to three characters that made up their name, but for a language whose threshold for basic operational literacy lies between 2,000 and 3,000 characters, this by itself is not very revealing. There is, however, a clear variation in calligraphic styles: some signatures are written with a fluent stroke, suggesting a generally competent writer. Others, by contrast, are written more clumsily, from which we may infer that the signatory was a less seasoned writer. It is this variation that the project seeks to exploit. To start with, the student will build a training set by extracting signatures from historical contracts. Together with me, the student will then devise a scheme to rank the perceived confidence of each signature in the training data. The final stage will consist of training a model to automate this assessment of confidence and testing its reliability by using a new set of signatures. Additional sources concerning popular literacy can be made available to interested students. If successful, this project would serve as a pilot study for one of the largest and most long-term surveys of popular literacy anywhere in the non-Western world. It would offer historical evidence on the link between education and living standards and linguistic theories on the relative accessibility of different scripts. Finally, it would allow a reassessment of political narratives on mass education in the early years of the People's Republic of China.

Student learning outcomes:

This project is open to students from a range of backgrounds (see below) and aims to complement their existing strengths while helping them to acquire a degree of competence in a field very much outside their own. A historian, for instance, will be able to draw on their strength in contextualising historical sources, while also learning to carry out basic quantitative analysis. By contrast, a student from a computer science background will have the opportunity to work with challenging historical materials while putting their existing knowledge about machine learning into practice.

New skills the student will develop

I am happy to adapt the project based on the existing skills of the student. Generally, I expect students to (1) develop an understanding of the logic of the Chinese script; (2) learn to carry out basic statistical analysis, or more advanced analysis for students with a strong background in mathematics; (3) build an intuition for the limits of machine learning; (4) understand how to design a database for any purpose, whether qualitative or quantitative.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Competence in Chinese or Japanese in not a requirement for this project, but a successful applicant would display an intellectual curiosity to understand the logic of the Chinese script. An understanding of basic descriptive statistics (e.g. mean vs. median) and their behaviour is however necessary. While advanced mathematical skills are not required, the student should have an interest in quantitative analysis.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Regular supervision by myself, membership of the Cambridge Group for the History of Population and Social Structure with daily research meetings, IT hardware may be provided if needed.

Duration of the project (All projects should be between 6 - 10 weeks long.)

8

Please indicate your preferred start date below, or if you don't have a preference:

29 June I might be absent from August onwards, but my colleagues from the Cambridge Group for the History of Population and Social Structure will offer support

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

up to 3

Any other comments

NA

Research Project Title:

Quantum Machine Learning–Inspired Generative Models for Interpretable Simulation of Quantum Systems

Supervisor name and role:

Kyriakos Flouris

Email

kf318@cam.ac.uk

Project description:

Quantum systems are inherently high-dimensional and probabilistic, governed by non-classical phenomena such as superposition and entanglement. While traditional physics-based approaches—such as Hamiltonian modelling, tensor networks, or analytical approximations—offer interpretability and theoretical grounding, they often become computationally intractable for large or noisy systems. Conversely, modern machine learning methods excel at capturing complex patterns in high-dimensional data but may lack consistency with quantum mechanical principles, limiting interpretability and physical validity. This project explores quantum machine learning–inspired generative models as a principled middle ground. The student will investigate how flexible generative architectures—such as variational autoencoders, diffusion models, or flow-based models—can be augmented with structure-preserving constraints derived from quantum mechanics, including symmetry, conservation laws, or measurement structure. The goal is to build models that are both expressive and physically meaningful. The project will proceed in stages. First, the student will review relevant literature on generative modelling and quantum machine learning, with an emphasis on hybrid quantum–classical and physics-informed approaches. Next, they will implement one or more generative models designed to represent quantum states or measurement data, using simulated datasets to avoid experimental complexity. Physical constraints or priors will be incorporated into the model architecture or training objective to ensure interpretability and fidelity to quantum principles. Finally, the student will evaluate model performance on tasks such as quantum state reconstruction, noise modelling, or simulation of unseen parameter regimes, and analyse learned latent representations for meaningful structure. The project is computational and conceptual in nature, complementing but not overlapping with standard undergraduate physics or machine learning courses. It emphasizes research skills—model design, experimentation, and critical evaluation—rather than formal coursework content. The work is suitable for a summer research project and can be adapted to the student's background, offering a structured yet exploratory research experience at the interface of physics and machine learning

Student learning outcomes:

By the end of the project, the student will understand the principles of generative modelling and their application to quantum systems, gain experience integrating domain knowledge into machine learning models, and develop the ability to critically evaluate model performance and interpretability. The student will also learn how to formulate research questions, implement computational experiments, and communicate technical results clearly in written and oral form.

New skills the student will develop

The student will develop practical skills in scientific programming (Python and machine learning libraries), generative model implementation, and experimental evaluation. They will gain experience working with simulated quantum data, incorporating physical constraints into learning algorithms, and interpreting latent representations. Additional skills include literature review, research documentation, and presenting research findings in an academic context.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

A successful applicant will have a strong interest in physics, mathematics, or computer science, with basic familiarity in linear algebra and probability. Prior exposure to Python programming and introductory machine learning or quantum mechanics is essential. The student should be intellectually curious, comfortable with abstract concepts, and motivated to engage with interdisciplinary research combining physical reasoning and data-driven modelling.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Possibly some Computing Costs

Duration of the project (All projects should be between 6 - 10 weeks long.)

10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

6 July If unvailable for some weeks I will provide online support

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

1

Any other comments

Research Project Title:

Do humans really have the fattest babies? Updating our comparative perspective on mammalian adiposity and/or considering the life and work of Elsie Widdowson.

Supervisor name and role:

Mark Dyble

Email

md479@cam.ac.uk

Project description:

It is often said (at least among biological anthropologists) that humans have fatter babies than any other mammal. However, the usual reference provided to support this claim is a 1998 review article that compiled secondary data from only 19 mammal species. In many cases, the data come from work done in the 1950s by Elsie Widdowson, a Reader in Medicine at Cambridge. I would be interested to supervise a project that did some combination of (1) a systematic literature to provide an updated comparative perspective on human neonatal adiposity, (2) a critical evaluation of the methods used over time (are the 1950s methods robust?), and (3) biographical research into the life and work of Elsie Widdowson, who did pioneering research on nutrition and body composition in the early 20th century which informed rationing policy in the UK and efforts to refeed starved victims of World War II.

Student learning outcomes:

Conducting a systematic literature review in line with open science requirements, understanding of methods used by physiologists to determine body composition, possible archive research.

New skills the student will develop

Conducting a systematic literature review in line with open science requirements, understanding of methods used by physiologists to determine body composition, possible archive research.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Parts (1) and (2) would be best suited to medics or natural scientists. Part (3) could work as a history of science project.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Supervision, inclusion with activities of my research group in Department of Archaeology (although we tend to be quiet over summer)

Duration of the project (All projects should be between 6 - 10 weeks long.)

6 weeks

Please indicate your preferred start date below, or if you don't have a preference:

no preference

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

1

Any other comments

Research Project Title:

Mammalian monogamy in avian context

Supervisor name and role:

Mark Dyble

Email

md479@cam.ac.uk

Project description:

I recently published an article [Dyble, M., 2025. Human monogamy in mammalian context. Proceedings of the Royal Society B: Biological Sciences, 292(2060)] in which I provided comparative perspective on human monogamy by pulling together secondary data on the relative number of full-siblings and half-siblings found in populations of various mammal species. I would like to supervise a project that extends this analysis to birds. The project would involve a systematic literature review of research on the genetic structure of bird populations, and require critical engagement with sampling biases and methods for parentage assignment. It will likely require some computational work to conduct robustness checks.

Student learning outcomes:

Knowledge of bird diversity and mating systems, conducting a systematic literature review in line with open science requirements, coding (possibly).

New skills the student will develop

Knowledge of bird diversity and mating systems, conducting a systematic literature review in line with open science requirements, coding (possibly).

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

The project would be best suited to a student with some knowledge of birds, genetics, statistics, and coding.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Supervision, inclusion in my research group in the Department of Archaeology (though we tend to be quiet over the summer)

Duration of the project (All projects should be between 6 - 10 weeks long.)

6

Please indicate your preferred start date below, or if you don't have a preference:

no preference

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

1

Any other comments

Research Project Title:

Large-Scale Data Analysis of Cybercrime and Online Harms

Supervisor name and role:

Alice Hutchings

Email

ah793@cam.ac.uk

Project description:

The project involves large-scale data analysis relating to cybercrime and online harms. The Centre collects cybercrime-related data at scale and analyses the crime types, actors, platforms, and intervention opportunities. The successful applicant will contribute to ongoing and emerging projects while gaining valuable training in applied data science and cybercrime research. The exact project will depend on the timing of external funding decisions and project priorities at the time. Potential projects include evaluating counterspeech interventions, analysing the transition from forums to chat channels, and analysing stolen data markets or crime-as-a-service business models. All potential projects share a common methodological focus: the analysis of large, complex datasets to better understand patterns of cybercrime, online abuse, fraud, or other harms.

Student learning outcomes:

How to work with large databases of real-world data. How to pose good research questions and develop research skills to learn how to answer these questions effectively. Analytical, critical thinking, project management and communication skills. Depending on the project, the student will also gain insights into natural language processing and tool development, data collection approaches, and exposure to how real-world cybercrime operates.

New skills the student will develop

Skill development includes data science and data processing skills. They will be involved in writing up findings and generating visualisations. Formal research skills will be taught.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

The student should ideally be studying Computer Science, Engineering, or Mathematics and be interested in data science, cybersecurity, and natural language processing/machine learning. Python experience is necessary.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

The successful applicant will be a member of the Cambridge Cybercrime Centre. The research group includes seven postdoctoral researchers and graduate students. There will be day-to-day support, weekly team meetings and regular supervision meetings.

Duration of the project (All projects should be between 6 - 10 weeks long.)

Up to 10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

no preference

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

We can take multiple students

Any other comments

Research Project Title:

Smart your research; Learning to automate data collection at Kings College Meadow

Supervisor name and role:

Olaf Kranse & Tom Thirkell

Email

ok297@cam.ac.uk; tjt35@cam.ac.uk

Project description:

Recent advances in AI are dramatically lowering the barrier of entry to automating software tasks, through LMMs' ability to write python/R code. Simultaneous progress in embedded electronics bring bespoke environmental monitoring systems within reach of the beginner. In this project you will learn how to build a custom continuous monitoring system using the Raspberry Pi Pico as its base platform. Once installed, this system will automatically collect data over time, covering a wide range of environmental dynamics in the meadow. In the first week, you will be provided with an introductory course to data collection using hardware and software. This will be held on the meadow to help familiarise yourself with the experimental grounds. For this project, you will use 'sensor-modules', which contain the required circuitry build-in. You will gain knowledge and experience, working with sensors without the need for a deeper understanding of the electronics. Other facilities such as a MakeSpace and 3D printers are made available at the Crop Science Centre. Project research goals are to automate the monitoring of: 1) Weather on the meadow (image capturing weather station), 2) Water retention of soil in meadow vs grass (water level sensors grid), and 3) Nitrogen, phosphorus, and potassium (NPK) monitoring (NPK-sensors grid)

Student learning outcomes:

The students will gain: 1) Insight in cross-disciplinary collaborations, 2) Real-world use cases for their subject of study, and 3) Insight into real-world application of automation.

New skills the student will develop

The project will cover different disciplines, and therefore the skills developed are dependent on their background. The goal is to build hardware and software to automate the study of the meadow. This includes; electronic engineering (sensors and micro-controllers), software engineering (programming of micro-controllers), biology (study of the meadow). The new skills are either: How to apply automation to research, and/or; Where to apply automation to research.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Any student is welcome regardless of subject of study. No prior skills required. A base understanding of Python, previous experience with Raspberry Pi and/or Arduino are useful, but not required.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Most of the design can be done remotely. Building of device is done at the Crop Science Centre (west Cambridge). Electronics will partially be tested in the lab and in the meadow. Sensors are made available through the lab.

Duration of the project (All projects should be between 6 - 10 weeks long.)

8-10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

29 June Tom will be away for 2 weeks mid way through the project but Olaf will be present throughout the project.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

1-3

Any other comments

Research Project Title:

Insatiable Greed: Medieval Economic Anthropology

Supervisor name and role:

Nick Evans

Email

njbe2@cam.ac.uk

Project description:

During the Insatiable Greed summer project, the student will contribute to the development of a digital corpus of medieval economic ethnographic writing. The research investigates the economic thinking embedded within descriptions of how other society works. It compares ethnographic writing about economic practices and institutions produced in Europe, Byzantium and the Islamic World, ca. 800-1200. The student's work will contribute to a major project currently under review (MedEA, ERC Consolidator Grant, submitted 13 January 2026). The larger project will produce a digital corpus of texts in languages including Greek, Arabic, Latin, Persian, Syriac, Armenian and Old Church Slavonic, with corresponding translations and commentaries. The student will not be expected to know these languages. The student will digitally mark up translations of text extracts (each around 500-100 words in length) for our pilot corpus. Texts are drawn from a wide range of genres, including historiography, geography, imperial and military manuals, legal texts, letter collections and hagiography. So far, we have dealt with topics as diverse as West African currency systems, the supposed 'insatiable greed' of steppe nomads, and miraculous coins in medieval Dublin. The student will mark up extracts, tagging place names, names and dates, along with key concepts and terms for our investigation of medieval economic anthropology, for instance, referring to types of exchange, commodities or currencies. The student will be trained in the TEI XML mark-up schema used by the project. No prior experience of XML mark-up is required. We will choose the texts that the student will work on together with the student, guided by their interests, and any relevant linguistic or subject expertise they may have. The student will contribute to the development of the customised schema, in dialogue with members of the project team, and to the authority lists for tagged terms. The student will help to build bibliography for the commentaries that will accompany the text extracts, and may help draft the commentaries. The student may also wish to suggest texts for inclusion within the corpus. All contributions will be duly acknowledged! In addition to contributing to the corpus, the student will be encouraged to write a blog post at the conclusion of their work. This could take an example from one of the texts the student has worked on to explore how thinking about other societies stimulated broader reflection on economic institutions or practices.

Student learning outcomes:

The student will experience different stages of the research process: they will contribute at different stages of the pipeline for developing the corpus, and will be invited to write up their reflections on the texts, engaging with the broader research questions asked by the project. They will contribute directly to the digital corpus, and will help the project to refine the pipeline, given different levels of linguistic, technical or specialist knowledge that contributors may have. At the same time, the student will gain an authentic experience of project development and collaborative work.

New skills the student will develop

The student will gain training in TEI XML mark-up, and will learn how a customised schema is developed. This will provide valuable broader experience in systematic reading of texts. There may be opportunities to engage with more complex data modelling, if the student is interested. The student will gain experience of research skills such as building bibliography. They will also have an opportunity to develop their writing skills, learning to write in different registers for the commentary and blog post.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

The main requirements are the interest and ability to engage critically, thoughtfully and systematically with texts, and an ability to work collaboratively. A general interest in medieval history would be welcome, although no specialist background knowledge is required. No prior knowledge of TEI XML mark-up is required. No knowledge of the primary text languages (Greek, Arabic, Latin, Persian, Syriac, Armenian and Old Church Slavonic) is required, although if a student did have relevant knowledge, there would be opportunities to contribute to translation work or mark-up on the original source extracts.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

The student will be supervised by Nick Evans, supported by other members of the project team (including Angus Russell and Caroline Goodson at King's). At the start of the project, the student will meet with Nick to agree on texts to be worked on. We hope

Duration of the project (All projects should be between 6 - 10 weeks long.)

6 weeks

Please indicate your preferred start date below, or if you don't have a preference:

a different start date (please provide more detail) 29 June by preference - but other start dates possible I will be available for the six weeks commencing 29 June

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

1-2 students

Any other comments

Research Project Title:

Mapping Brain Circuits using Viral Barcodes

Supervisor name and role:

Marco Tripodi

Email

mt347@cam.ac.uk

Project description:

The project brings together barcoded viral tracing and advanced spatial imaging to visualise neural networks directly within their native tissue environment. By combining viral engineering with approaches inspired by RNA FISH, we aim to decode complex connectivity patterns at single-cell resolution in the mouse brain.

Student learning outcomes:

This is a strong opportunity for students interested in molecular biology, neuroscience and cutting-edge imaging. You will be part of a collaborative team and gain exposure to tools that are shaping the future of connectomics, and we particularly welcome applicants with enthusiasm for biotechnology and some basic laboratory experience.

New skills the student will develop

As a summer student, you will gain hands-on experience across the entire experimental pipeline, from preparing and quality-checking barcoded viral libraries, to working with mouse brain tissue and fluorescence methods to detect viral expression in different regions, and finally contributing to high-resolution microscopy for the detection phase.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

The student will work under the guidance of a postdoctoral fellow and will have full access to the outstanding research facilities at the Laboratory of Molecular Biology.

Duration of the project (All projects should be between 6 - 10 weeks long.)

10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

29 June

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

Any other comments

Research Project Title:

Coral reefs in space and time

Supervisor name and role:

Nile Stephenson

Email

nps36@cam.ac.uk

Project description:

Tropical coral reefs are among the most biodiverse ecosystems on Earth, over 25% of marine life. Coral reefs provide ecosystem services such as tsunami protection, ecotourism, and support for fish stocks. These benefits are a product of complex ecosystem dynamics which generate biodiversity, structural complexity, and complex nutrient regimes. However, coral reefs are currently under threat from climate change; heatwaves are disabling coral's ability to metabolise, leading to mortality via coral "bleaching". Bleaching destabilises reefs and eliminates their ecological benefits. Mortality on coral reefs causes degradation of ecosystem interactions with cascading consequences, leading to the loss of threatened populations reliant upon coral reefs such as sharks and important invertebrate taxa (e.g., sponges, starfish). However, we do not understand how ecological dynamics change throughout bleaching, which is key to understanding how entire coral reef ecosystems collapse and how we can help them to recover. Elucidating coral reef ecosystem dynamics is complicated by changes in ecological interactions across spatial scales. A key property of ecosystems is variability across spatial gradients (e.g., light availability, temperature, water depth), and ecological interactions are often different at the edges of ecosystems versus at the centre. We do not understand how the fine-scale ecological dynamics of coral reefs change with these variables, but by leveraging high-fidelity maps of coral reefs, we can untangle the complex interplay between biotic and abiotic drivers of coral reef community ecology across multiple scales. In this project, the student will contribute to an ongoing research programme seeking to understand the ecological dynamics of coral reefs. The student will contribute directly to a novel coral reef dataset from D'Arros, Seychelles generated via structure-from-motion photogrammetry. In this project, the student will elucidate ecological dynamics using advanced statistical techniques such as spatial point process analysis, and test how these dynamics change across habitat gradients.

Student learning outcomes:

1. Develop an understanding of the variability in ecological dynamics across gradients in depth and temperature of a coral reef. 2. Develop an understanding of the variability in ecological dynamics at the edge and centre of a coral reef. 3. Contribute to our understanding of coral reef ecosystem dynamics and biodiversity at small and large spatial scales.

New skills the student will develop

The student will learn how to collect and process photogrammetry data. The student will develop an understanding of how to use software such as Biigle for image annotation and Agisoft Metashape for photogrammetry processing. The student will develop their skills in statistical modelling and use of statistical software R. Crucially, the student will develop the capacity to plan and execute a research project.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

The applicant will have a good understand of evolution, ecology, and conservation, ideally having completed the Evolution & Behaviour 1A course and the Ecology & Conservation 1B course. This is a data driven project, so some familiarity with R is necessary.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Desk space will be provided in the department of Zoology .

Duration of the project (All projects should be between 6 - 10 weeks long.)

8 weeks (+ 2 week break in July)

Please indicate your preferred start date below, or if you don't have a preference:

29 June I am away for 2 - 3 weeks in July. I will have regular internet access so can contact the student remotely, but I recommend a 2 week break to coincide with my time away.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

1

Any other comments

Research Project Title:

Reading and Book-Ownership in Medieval Yorkshire

Supervisor name and role:

Phil Knox

Email

pk453@cam.ac.uk

Project description:

Who owned books in the Middle Ages? Where did they keep them, how did they use them? These are central questions to literary and cultural history, that have often been answered by using the rich evidence that can be gleaned from surviving medieval manuscripts. But there are other kinds of evidence, too, especially certain legal documents that can reveal who owned books (and who didn't), something about their social and professional background, and, in some cases, where books were stored and presumably used in the household. I'm thinking about preparing some research to look at the evidence of book ownership in medieval England based on some unedited documents. But, to prepare for this, I'd like to get a picture of what kind of evidence can be gleaned from these kinds of materials by doing some preparatory work on a body of documents from late medieval Yorkshire that have been edited and translated (Stell, York Probate Inventories). In the first part of the project (weeks 1-4), we would build a database from this material, to help us understand the kinds of people who possessed books and the kinds of books they owned. It would also include those who didn't own books, which would help us understand the 'density' and distribution of book-ownership. This phase of the work would probably be potentially fiddly but fun, using MS Excel or equivalent to build the database, scouring the Stell edition for evidence of books, and making judgement about how best to record the complex information there in the simplest possible form. If you are interested in having a look at the original medieval documents on which Stell based his research, I can give you some images of these, which will be fun to try to puzzle out. In the second part of the project, weeks 1-3, you would explore in more detail something that you found particularly interesting in your research: a genre of writing or kind of book-object (like prayerbooks, which are very widespread), or a particular author (the Yorkshire mystic Richard Rolle crops up in the records, for instance); or you might think about how books are organised within domestic space, and what this might tell us about how they were used; or you might think about a particular category of book-owner (women, lay-people, city-dwellers, etc.). You would write an essay on this

Student learning outcomes:

The student will produce a database with me, and explore some of its implications; and write an essay / prepare a presentation on a key case-study

New skills the student will develop

Building historical databases and interpreting the evidence (these will be new skills for me too!). Designing a small-scale research project of their own.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

This would suit an English or History UG. No familiarity with medieval Latin / documents / diplomatics / palaeography required. Some familiarity with the cutural history of late medieval England essential. Some basic and probably universal IT skills ideal. Otherwise, it's just about being methodical and curious.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

I would expect to meet with the student about once a week when available (I will be away on holiday/conferences at various points, in which case we could correspond by email or speak on Zoom)

Duration of the project (All projects should be between 6 - 10 weeks long.)

7 weeks

Please indicate your preferred start date below, or if you don't have a preference:

29 June I will be away at a conference w/c 27 July, but can be in touch online. I will also be on holiday w/c 10 Aug and won't have any availability.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

One!

Any other comments

Research Project Title:

The Prison Consensus in Brazil

Supervisor name and role:

Pedro Mendes Loureiro

Email

PML47@cam.ac.uk

Project description:

We are in the second year of a project funded by the Leverhulme Trust and Harry Frank Guggenheim Foundation. In 'The Prison Consensus', we examine the exponential expansion of Brazil's prison system over the last thirty years, growing from as few as 150 prisons to more than 1,500 today. This project hinges on a political puzzle: prisons are widely decried as a failure in the country, but they and the inmate population continually increase. Indeed, while political parties of all inclinations, NGOs, social movements, justices, prison workers, and even organised criminal groups recognise that prisons generate insecurity, do not rehabilitate, and violate human rights, they nonetheless feed calls to build more of them. As the country went from 90,000 to 900,000 prisoners over the last 30 years, we ask: what has led to this rise, what has legitimated it, who profits from it, and how is it being contested? We are an interdisciplinary team of four carrying out extensive field research and document analysis to answer these questions. Specifically for King's Summer Research Programme for the Arts and Humanities, we propose two roles in the wider project. The first and preferred role comprises a historical analysis of the Brazilian prison system by compiling and analysing information present in digital documents. In 1925, José Gabriel Lemos Britto surveyed Brazil's prison system at the request of the Minister of Justice. His findings were published in the three-volume work 'Systemas Penitenciários do Brasil', which contains unstructured but extremely rich data on imprisonment across the country. This includes inmate demographics (gender, race, age, occupation), crimes committed, and the location of prison units. It also contains Lemos Britto's analysis of the system and references to other valuable documents. This represents the most important record of Brazilian imprisonment for the period, unequalled in breadth and depth until the early 1990s, but it has not been properly studied by the academic literature. The researcher would compile and structure these data and produce an exploratory analysis of the content. Reading knowledge of Portuguese and basic data organisation skills are needed for this role. The second option is more loosely defined but does not require knowledge of Portuguese. This would include a literature review and delimited empirical work with secondary data on an aspect of mutual agreement related to the Prison Consensus Project. We have collected extensive information that can be shared for analysis.

Student learning outcomes:

This internship will allow the student to have a brief experience of all cycles of a research project. They will read and summarise the relevant literature, engage with the relevant archival material, collate and organise a database, formulate questions and analyse the data, and write a research report. As such, besides learning about punishment in early 20th century Brazil and the politics of incarceration more broadly, the student will gain transferrable research skills.

New skills the student will develop

Besides the transferable research skills and the specific substantive content indicated above, we would be able to supervise the student on some of the following skills depending on interest: mapping and GIS, data visualisation, basic quantitative analysis.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Tripos: most social sciences and humanities Triposes are appropriate, but preference is given to History and Politics or Human, Social and Political Sciences (HSPS) students. For the main proposed role, the student must have reading knowledge of Portuguese and basic data organisation skills. For the second role, interest in the project's questions and in the political economy of incarceration are sufficient.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

The student will be supervised by the research team, which consists of Dr Pedro Mendes Loureiro (King's), Prof Graham Denyer Willis, Dr Bruna Angotti, and Luiz Antunes. There is space to work from the Alison Richard Building, where the project is located,

Duration of the project (All projects should be between 6 - 10 weeks long.)

Ideally 10 weeks, but shorter internships can be discussed if needed.

Please indicate your preferred start date below, or if you don't have a preference:

29 June No longer periods of absence envisioned, but online supervision is possible if needed.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

Up to 3.

Any other comments

Research Project Title:

Penrose's 8-conic theorem

Supervisor name and role:

Martin Hyland

Email

M.Hyland@dpmms.cam.ac.uk

Project description:

Understand the theorem and give a deeper account of it.

Student learning outcomes:

The theorem. Experience of making use of abstract mathematics.

New skills the student will develop

Thinking for oneself.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Probably they need a feel for abstract algebra and considerable persistence.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Best done in a lively research context.

Duration of the project (All projects should be between 6 - 10 weeks long.)

Open-ended so 10 feels makes sense.

Please indicate your preferred start date below, or if you don't have a preference:

no preference Sadly I do not intend to be away.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

One is fine; probably cap at three.

Any other comments

Very unpredictable but should be very instructive

Research Project Title:

Fermi Problems

Supervisor name and role:

Martin Hyland

Email

M.Hyland@dpmms.cam.ac.uk

Project description:

Create and exemplary collection of such accessible on the basis of school physics.

Student learning outcomes:

Making the estimates for themselves,

New skills the student will develop

Develop judgement about what matters, what are the tricky points.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Enthusiasm for applied mathematics or physics.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Best done in a lively research context.

Duration of the project (All projects should be between 6 - 10 weeks long.)

Open-ended. 10 weeks best but could be shorter.

Please indicate your preferred start date below, or if you don't have a preference:

no preference I do not expect to be away.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

Perhaps cap at two to ensure good working in parallel.

Any other comments

Plenty of ideas online but almost no synoptic vision.

Research Project Title:

Fixed point logic

Supervisor name and role:

Martin Hyland

Email

M.Hyland@dpmms.cam.ac.uk

Project description:

Improve our understanding of Solovay's analysis of provability logic.

Student learning outcomes:

Different aspects of modern logic.

New skills the student will develop

Dealing with an interplay of perspectives. Theory building.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Should already know some logic: propositional calculus. Preparedness to struggle.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Nothing to mention.

Duration of the project (All projects should be between 6 - 10 weeks long.)

Probably needs 10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

no preference I shall not be away over the summer.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

No more than two.

Any other comments

This is a bit of a long shot.

Research Project Title:

Structure of School Mathematics

Supervisor name and role:

Martin Hyland

Email

M.Hyland@dpmms.cam.ac.uk

Project description:

Can the disparate topics be presented as a coherent whole/

Student learning outcomes:

Deeper understanding of mathematics.

New skills the student will develop

Thinking for themselves - not taking things for granted.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Appreciation of and desire to take on a challenge.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Nothing relevant.

Duration of the project (All projects should be between 6 - 10 weeks long.)

Up to 10 weeks.

Please indicate your preferred start date below, or if you don't have a preference:

no preference I shall not be away in the summer.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

Cap at two.

Any other comments

This is more demanding than people will think.

Research Project Title:

Modelling spatial hunting patterns in Nigeria

Supervisor name and role:

Charles Emogor

Email

cae37@cam.ac.uk

Project description:

Hunting is an important source of livelihood for many tropical communities, yet it is also a major driver of biodiversity loss, leaving many tropical forests increasingly “empty”, with wildlife populations depleted or locally extirpated. Defaunation now affects approximately 47% of pantropical forests, including many protected areas, and undermines ecosystem services and resilience by reducing seed dispersal, altering plant community composition and carbon storage, and driving the loss of evolutionarily distinct interactions with potentially irreversible ecosystem consequences. The aim of this project is to determine the spatial patterns, intensity, and drivers of hunting in a tropical forest landscape in Nigeria, with a particular focus on how hunter behaviour interacts with protected areas and surrounding community lands. The project relies on fine-scale hunting data collected from 120 hunters across eight communities surrounding Cross River National Park, Nigeria, with data collection ongoing since June 2025. Following ethics approval from the University of Cambridge and the provision of free, prior, and informed consent, GPS devices were deployed to participating hunters to record movement trajectories during hunting trips, alongside the spatial locations of animal captures. These data provide a rare opportunity to quantify where, when, and how hunting occurs at high spatial and temporal resolution. The dataset includes hunter movement paths, effort metrics (e.g. distance travelled and time spent hunting), and species-specific capture locations, all of which are securely stored after each trip by trained research assistants recruited from the focal communities. While the dataset necessarily includes records of illegal activities, such as the hunting of protected species or incursions into protected areas, all data are collected anonymously and cannot be traced to individuals, ensuring participant confidentiality and ethical integrity. Students working on this project will use spatial analysis and statistical modelling to identify hotspots of hunting activity, examine variation in hunting behaviour across communities and seasons, and assess the degree of spatial overlap between hunting and protected areas. The project offers hands-on experience with GPS movement data, geospatial analysis, and applied conservation questions, while engaging critically with the social–ecological trade-offs inherent in wildlife management. By grounding analysis in real-world data from an active conservation context, the project will equip students with analytical and conceptual skills directly relevant to contemporary conservation science and policy.

Student learning outcomes:

By the end of the project, the student will be able to analyse spatial data to identify patterns of hunting behaviour in a tropical forest landscape, critically interpret human-wildlife interactions within a social-ecological framework, and communicate findings clearly to academic and applied conservation audiences. The student will gain an understanding of ethical considerations in conservation research and develop the ability to link spatial evidence to conservation management and policy-relevant questions. Note that the data are cleaned

monthly, and landscape-level variables have already been extracted (for a complementary research stand), meaning the student can begin analyses as soon as they begin.

New skills the student will develop

The student will develop practical skills in spatial data analysis using GPS movement data. They will gain experience applying statistical and spatial models to real-world conservation datasets, handling sensitive data responsibly, and integrating ecological and social data. The project will also strengthen scientific writing, data visualisation, and the communication of complex results to both technical and non-technical audiences. The student also stands to become a co-author in a publication arising from the work (when data collection is completed).

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

A successful applicant should have an interest in conservation science, with basic familiarity with statistical analysis and GIS or a willingness to learn. Machine learning experience would be suitable for this project, so a computer science student with an interest in environmental issues would also be a good fit. Prior experience in R, Python, or GIS software is essential, while modelling experience is essential (but desirable). The student should be comfortable working with complex datasets, demonstrate good analytical and organisational skills, and show sensitivity to ethical issues in conservation research. Self-motivation and curiosity are essential skill sets.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

The student will receive close academic supervision throughout the project, including weekly meetings to brainstorm and provide feedback on analysis and writing. I have received confirmation from Professor Fletcher (my PI) that the student will be integra

Duration of the project (All projects should be between 6 - 10 weeks long.)

10

Please indicate your preferred start date below, or if you don't have a preference:

29 June I will be available throughout the 10 weeks.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

One

Any other comments

None

Research Project Title:

Unifying patterns in Algebraic Geometry

Supervisor name and role:

Fatemeh Rezaee

Email

fr414@cam.ac.uk

Project description:

In some counting problems in algebraic geometry, one can spot partial patterns and potentially give closed formulas. This summer project aims to work on concrete examples of this type and unify the partial patterns and partial closed formulas. In this project, we are primarily interested in finding patterns in specific integer sequences for which we already have some partial formulas. For example, we consider the sequences of dimensions of the tangent spaces at the singular points of specific Hilbert schemes, which are essential in sheaf-counting enumerative geometry. There are two potential directions: 1)Using ML to unify the partial patterns: in this case, one approach is to use the method introduced by Mishra, Moulik, and Sarkar and to realise the partial formulas in their Conjecture Space. 2)A more theoretical direction is to combinatorially prove some relevant conjectures and use them to unify the formulas without ML.

Student learning outcomes:

Algebraic Geometry, Combinatorics, (potentially) Machine Learning

New skills the student will develop

Algebraic Geometry, Combinatorics, (potentially) Machine Learning

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Since the theoretical direction is expected to be mostly combinatorial, students with excellent combinatorial intuition or those with experience in Mathematics Olympiads/competitions are particularly encouraged to apply. I am seeking highly talented, motivated student(s), and, most importantly, someone committed to collaborative work, to work with me (and potentially an additional data scientist advisor, if the first direction is taken) on this project. If you are eligible to apply and interested in the project, please email me your CV and transcripts before finalising your application.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

If needed, I may have some funding from my grant.

Duration of the project (All projects should be between 6 - 10 weeks long.)

8-10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

29 June

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

I also advertised this project via the department, and I may get more students with their funding.

Any other comments

Research Project Title:

Investigating an engineered PET-degrading enzyme

Supervisor name and role:

Laura Martin

Email

lm2130@cam.ac.uk

Project description:

Enzymatic polymer recycling is currently a major area of research which aims to address the global plastics crisis in a sustainable way. Recently, a novel □/□-hydrolase from Kutzneria buriramensis DSM 45791 (Kubu) has been identified as a best-in-class polyethylene terephthalate (PET)-degrading enzyme, and a rationally engineered mutant achieved the greatest PET depolymerisation rate and degree reported to date. Further opportunities to improve this enzyme exist using machine learning (ML) models. In the lab we have used multiple ML tools to predict an optimal improved variant, KubuMC2, with mutations which simultaneously improve enzyme activity, stability and expression. However, the cause of the improvements observed in this enzyme are not fully understood. This research project will probe the contribution of different mutations to the observed enhanced enzyme activity. A series of mutant reversions, in which the individual mutated amino acid residues are converted back to the native protein, will be constructed and the performance of these individual reversion variants in degrading plastic samples will then be compared to the original wild type Kubu and to the KubuMC2. The aim will be to identify whether each mutation has a positive, negative, or neutral effect on overall enzyme performance, with data obtained being used for future rounds of ML protein design.

Student learning outcomes:

How to structure a lab-based research project, present experimental data effectively, and to think analytically about what experimental results mean and how they support or disprove a theory.

New skills the student will develop

The student will become familiar with a range of experimental molecular biology and biochemistry laboratory techniques, including cloning and DNA purification, protein expression and purification, and protein assay design and set up. They will also receive significant chemistry lab experience in preparing chemical stocks, synthesising plastic nanoparticles, and using high-performance liquid chromatography (HPLC) analysis.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

The student must have some experience of wet lab work in a chemistry or biology setting and an enthusiasm for protein engineering aimed at addressing real world problems. Familiarity with micro/molecular biology and chemistry to an A-Level understanding is desirable.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

The student will be supervised in the laboratory by Dr Laura Martin full time for the first few weeks. They will subsequently be co-supervised by other members of the Hollfelder lab with daily meetings with Dr Martin to address any lab issues. More broa

Duration of the project (All projects should be between 6 - 10 weeks long.)

At least 8 weeks, ideally 10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

no preference There are multiple other postdoctoral and PhD researchers in the lab who will be able to supervise and support the student during any time I am absent.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

One student

Any other comments

Research Project Title:

Does AI make you a good teacher? Comparing expert and novice explanations from an existing study on AI-assisted knowledge transfer

Supervisor name and role:

Umang Bhatt

Email

usb20@cam.ac.uk

Project description:

When individuals learn material with AI assistance and then explain it to others, a critical question arises: how can researchers measure whether the teaching is effective? This project addresses this methodological challenge by analyzing expert explanations to measure teaching quality that predict learning outcomes. This work leverages data from an ongoing study investigating how AI affects interpersonal knowledge transfer. In that study, "Teachers" learn material either through AI chat or PDF documents, then explain topics to "Students" via text chat. Hundreds of these teaching interactions have been recorded, along with Students' comprehension quiz scores. The central question is whether AI-assisted learning impairs teaching quality, but measuring teaching quality at scale requires computational approaches that can process large datasets. The student's project addresses two interconnected challenges: First, what distinguishes expert explanations from novice explanations in measurable, quantifiable ways? Expert explanations for the same topics already exist in the dataset. The student will develop natural language processing (NLP) approaches to systematically extract linguistic features. Second, do these computational measures actually predict learning outcomes? The student will test whether Teachers whose explanations score higher on expert-similarity metrics have Students who perform better on comprehension quizzes. This validation analysis determines whether automated scoring based on expert benchmarks captures what matters for effective teaching. The student's work involves: (1) Developing and implementing NLP pipelines to extract explanation quality features from text data; (2) Comparing distributions of these features between expert and novice explanations to identify discriminative patterns; (3) Building predictive models relating Teacher explanation quality scores to Student quiz performance; (4) Validating whether expert-derived metrics generalize across different knowledge domains and topics. Broader significance: Understanding AI's societal impacts requires measuring how it affects knowledge transmission between people. This project develops validated computational methods for assessing teaching quality at scale, essential for evaluating AI's effects on interpersonal learning.

Student learning outcomes:

Understand how to validate measurement tools by testing whether they predict theoretically relevant outcomes Critically evaluate whether automated approaches capture meaningful constructs (does "expert similarity" actually measure teaching quality?) Interpret complex relationships between text features, expert benchmarks, and learning outcomes Design analyses that answer both theoretical questions (do experts explain differently?) and practical questions (can we measure this automatically?) Communicate findings about what makes

teaching effective and whether computational methods can detect it Think critically about scalability versus validity trade-offs in research measurement

New skills the student will develop

Programming for text analysis: Python or R for processing written explanations, extracting linguistic features, automating measurement Natural language processing: Implementing text preprocessing, feature extraction algorithms, pattern detection in educational discourse Data management: Working with unstructured datasets (chat logs, quiz scores, confidence ratings), joining multiple data sources, handling missing data Version control and documentation: Using Git, writing reproducible code, creating clear technical documentation Research software: Statistical packages (R/Python libraries), text analysis tools, data visualization

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Essential: Strong interest in understanding AI's real-world effects on how people learn, teach, and share knowledge in everyday contexts Willingness to learn computational methods for analyzing text data Comfort working with both quantitative analysis and qualitative interpretation Systematic approach to data analysis and clear documentation Desirable knowledge: Any programming experience (Python, R, or similar) Coursework in computer science, psychology, cognitive science, education, or related fields Curiosity about natural language processing or human-AI interaction research Personal qualities: Motivated by practical questions about AI's societal impacts; enjoys analytical problem-solving; comfortable learning new technical skills

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Supervision: Weekly one-on-one meetings with Dr Umang Bhatt and PhD student that leads this project (Bernardo V) for guidance on research design, NLP methods, and statistical analysis Research community: Membership in the Center for Human-Inspired Artific

Duration of the project (All projects should be between 6 - 10 weeks long.)

10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

6 July Bernardo Villegas (PhD student) will be available if that is the case

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

2

Any other comments

Research Project Title:

Mixing time of random graphs

Supervisor name and role:

Andjela Sarkovic

Email

as2572@cam.ac.uk

Project description:

In this project one would focus on some of the well known interesting random graph models and attempt to bound the mixing time of simple random walk on them. Mixing time is the time it takes for a random walk to approach stationary distribution sufficiently in total variation distance (which is just a metric on all probability distributions on a fixed state space).

Student learning outcomes:

Students would get an experience of mathematics research.

New skills the student will develop

Students will learn how to approach complex problems.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Successful applciant should ideally be a mathematics undergraduate student who has done Markov chains and probability.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Duration of the project (All projects should be between 6 - 10 weeks long.)

8 to 10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

no preference

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

up to 2

Any other comments

Research Project Title:

Directed expanders

Supervisor name and role:

Andjela Sarkovic

Email

as2572@cam.ac.uk

Project description:

Expander graphs are graphs where for any subset of at most one half of all vertices there number of edges connecting that set with a complement is at least a small constant times the number of vertices in this set. One can define directed expanders by asking that on the directed graph number of edges going from any set A towards its complement is at least a small constant times the sum of all outdegrees of A. A graph is called a small set expander, if instead for all sets smaller with less than 1/2 of the vertices the previous property only holds for small enough sets (with less than some delta<1/2 proportion of all vertices). It is known that any small set expander can be split into expanders in case of undirected graphs. It is interesting question if there is an anlogue of this statement for directed graphs.

Student learning outcomes:

The student will get experience of maths research.

New skills the student will develop

The student will learn how to approach maths research and solve complex problems.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Student should be maths undergraduate with interest in combinatorics. If the students has interest in probability there are also related questions they could attempt.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Duration of the project (All projects should be between 6 - 10 weeks long.)

8-10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

no preference

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

up to 2

Any other comments

Research Project Title:

Imaging killer cells of the immune system in action

Supervisor name and role:

Gillian Griffiths

Email

gg305@cam.ac.uk

Project description:

There are five million nascent killer cells in every teaspoon of our blood. Once activated to kill, these CD8 T cells recognise and destroy cancer and virally infected cells with remarkable precision. To understand how these cells work we use high resolution live imaging to identify the dynamic changes that occur as killer cells move in to kill. Using biological probes for different organelles, lipids and proteins we can image many of the key components required for effective killing in live imaging. We also use a new method called “expansion microscopy” to expand the cells ~ twenty times so that we can image details in the cells in 3D in greater detail. Using pan protein, lipid and antibodies to stain these cells we can gain even more information about the changes that happen when killer cells polarize their secretory machinery as they engage their target. The project will follow some of the current questions that we are addressing in the laboratory. For example, how does the nucleus move and how does this control a new burst of transcription that helps killer cells infiltrate clusters of cancer cells.

Student learning outcomes:

Students will learn how to culture primary immune cells and express different biological markers in these cells for imaging. They will be instructed and supervised to use research level microscopes and analyze images.

New skills the student will develop

Cell culture, cell transfection and micorscopy

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

A curiosity-driven student with patience and a careful approach to bench work in the lab.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

The student will join the Griffiths lab in the Cambridge Institute for Medical Research, supervised by Dr Yukako Asano.

Duration of the project (All projects should be between 6 - 10 weeks long.)

8-10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

no preference

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

one, possibly two

Any other comments

Research Project Title:

Heat exchanger correlations for hydrogen aviation

Supervisor name and role:

Zelimhan Raduev

Email

zr289@cam.ac.uk

Project description:

This project is part of a wider group effort in the Whittle Laboratory to develop an advanced hydrogen powered jet engine capable of replacing the traditional kerosene powered engines, paving the way for sustainable aviation. This project is made possible by philanthropic support from Lord Sainsbury and Peter Bennet. These future hydrogen-powered jet engines will require compact and low pressure drop heat exchangers to facilitate new and advanced cycles. Today, many designs are based on correlations for heat transfer and pressure loss from land-based applications. While these correlations are widely used, there is an interest in understanding how well they translate to the conditions of modern aerospace applications, as well as, to further the understanding of the physical mechanisms responsible. This project will therefore investigate heat transfer and pressure drop over microtube banks in crossflow at different conditions and geometric spacings. The work may involve computational modelling, laboratory-based measurements, or a combination of both. On the computational side, the initial focus will be on developing high quality structured meshes and may then progress to using computational fluid dynamics (CFD) to carry out a parametric study over Reynolds number and geometric spacing. The meshing may include automation of mesh generation and simulation workflows using Python. Results will be compared with classical correlations to determine accuracy and assess if two-dimensional models are sufficient to capture the relevant physics. On the experimental side, the student may assist with measurements of new empirical data in a small-scale test rig. The exact scope of this project will be refined based on the student's background and interests, and how the wider project progresses before the summer. Best effort will be made to ensure the work remains achievable within a summer research period while contributing to the ongoing hydrogen aviation research in the laboratory.

Student learning outcomes:

The student will gain an understanding of how fluid flow is studied in an engineering research environment. They will also understand how simplified engineering correlations can be obtained and subsequently, how it can inform the engineering design process for real applications.

New skills the student will develop

The student will develop practical research skills in either computational modelling (such as mesh generation, computational fluid dynamics simulations, and post-processing) or experimental methods (such as basic instrumentation or data acquisition), or a combination of both. They will also gain experience in using engineering and scientific programming software for data analysis and visualisation. These skills will be highly transferable for their future endeavours.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

The successful applicant will have an interest in aerospace or mechanical engineering, with a basic understanding in fluid mechanics. Some experience with programming or numerical methods would be beneficial.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

The student will be a part of the wider Advanced Hydrogen Jet Engine group within the Whittle Laboratory. They would receive frequent supervision from the project supervisor and other members of the research group. Relevant miscellaneous items (such as of

Duration of the project (All projects should be between 6 - 10 weeks long.)

10

Please indicate your preferred start date below, or if you don't have a preference:

29 June Someone from the wider research group will always be available to provide support if I am unavailable for support.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

1

Any other comments

Research Project Title:

The dramas of forgiveness and forgiving

Supervisor name and role:

Stephen Cherry

Email

stephen.cherry@kings.cam.ac.uk

Project description:

An investigation into the way in which forgiveness is portrayed, and the extent to which it happens, in some of Shakespeare's 'post tragic' plays alongside a consideration of similar questions in some contemporary dramas, such as 'Punch' by James Graham (based on the book and true story of Jacob Dunne) and 'Unforgivable'the 2025 TV drama by Jimmy McGovern.

Student learning outcomes:

Deeper knowledge of chosen Shakespeare plays and secondary literature – both contextual and contemporary. A richer appreciation of the relationship between religion and literature/ theatre. Understanding of the current state of play in the study of forgiveness and other reconciliatory practices in different disciplines. Confidence in learning in different modes and engaging in extensive discussion.

New skills the student will develop

Analysis of texts and productions from multiple perspectives. Writing skills - both succinct and accurate summaries and the development of longer reflections. Comparing dramatic writing from different eras. Finding new sources of information, interrogating texts and hopefully conducting interviews. An understanding of the challenges and opportunities of interdisciplinary work. Formulation of valuable questions though individual and collaborative work

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Will probably have studied English Literature to A-level and will definitely have a working knowledge of basic concepts and practices of western Christianity. However they need not be studying Theology or English here. Students from other discipline could be excellent. What is vital is strong curiosity and a desire to grow in understanding of issues that are humanly as well as intellectually challenging. As the contemporary dramas will involve scenarios that are intrinsically disturbing a willingness to be honest about emotional responses and to reach out for support if troubled is vital.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

As this project is so closely connected with the supervisor's major area of research and writing close supervision and support will be given as well as opportunities to pursue ideas that are not yet imagined or formulated. We will do what we can to engage

Duration of the project (All projects should be between 6 - 10 weeks long.)

6 - 8 weeks

Please indicate your preferred start date below, or if you don't have a preference:

Happy to be flexible.

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

1 - 2

Any other comments

If there are two students then there will be opportunities to work collaboratively.

Research Project Title:

Characterising optical tweezers for ultracold atoms

Supervisor name and role:

Tiffany Harte

Email

th558@cam.ac.uk

Project description:

Arrays of atoms in optical tweezers have emerged as one of the main platforms for quantum computing. At the same time, they are alsobecoming outstanding tools to augment quantum simulators based on optical lattices - these quantum simulators can be thought of as analogquantum computers designed to solve specific problems encoded in the geometry and interactions of the system. We are currently building anew hybrid tweezer-lattice setup for ultracold strontium. In this project you will characterise an optical tweezer array combining a spatial lightmodulator (SLM) and/or acousto-optic deflector with high numerical aperture objectives. You will use these devices to shape the laser field tocreate configurable arrays of traps for atoms, and will characterise the optical potentials created after focussing through a high resolutionoptical system. You might also test different approaches to wavefront shaping and modulation of the tweezer potentials.

Student learning outcomes:

You will study advanced theory of optical systems, and will have the opportunity to learn about experimental methods of cooling andmanipulating ultracold gases. You will be a full member of the research group with the opportunity to join group activities such as teammeetings and journal clubs.

New skills the student will develop

You will develop skills in precision optics, with the opportunity for programming (python) and experiment hardware control.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Some knowledge of optics and electromagnetism (at least to 1B physics level), and patience for meticulous experimental work. Some lab experience would be useful but not necessary, we will teach you the necessary lab skills during the project.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Full membership of research group (approx 20 people) and part of the 10-person strontium team. Day to day lab supervision and help fromvarious team members, and training and ongoing (several times weekly) discussions with Tiffany.

Duration of the project (All projects should be between 6 - 10 weeks long.)

8 weeks

Please indicate your preferred start date below, or if you don't have a preference:

29 June

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

1

Any other comments

Research Project Title:

Propulsion systems for eVTOL and eCTOL vehicles

Supervisor name and role:

James Taylor

Email

Jvt24@cam.ac.uk

Project description:

Recent work completed by Masters students at the Whittle Laboratory has uncovered a simple but effective method of achieving transonic andsupersonic flight with commonly available electric motors and drives. The goal of this project is to work with the eVTOL group to demonstrate aprototype engine.

Student learning outcomes:

The students will have hands on experience of a real engine development programme, from initial preliminary work to scope the design to thereal embodiment of the prototype. Knowledge in aerodynamic, electrical and mechanical design will be necessary to begin and will be greatlyimproved by partaking in the project.

New skills the student will develop

Experimental work on rotating test rigs and wind tunnels. Programming low order models and analysis of experimental data. CAD design,machining and 3D printing.

Profile of a successful applicant, including any necessary skills or knowledge the student will need to have.

Students should have an interest in rapid prototyping in all it's forms, a strong emphasis will be placed on using low order models and simpleexperiments to rapidly explore the design space.

Facilities available (e.g. supervision, membership of a research group, support, etc.)

Students will join the eVTOL group at the Whittle Laboratory, a team of several Phds, post docs and two staff members

Duration of the project (All projects should be between 6 - 10 weeks long.)

Flexible 6-10 weeks

Please indicate your preferred start date below, or if you don't have a preference:

no preference

How many students would the project be suitable for? (Please note that all submitted projects should be able to operate with one student only, even if multiple participants would be advantageous.)

1 - 2

Any other comment