Undergraduate Research Projects

School of Engineering

Undegraduate Student Research

Students within the School of Engineering regularly get the opportunity to take part in research projects that related to their fields of study.

A project can be carried out as part of your degree or even something you may take on as a summer project, it can be a great opportunity to put your theory into practice.

The topics of these projects can vary, covering any discipline of engineering depending on what you are studying – it could range from researching robotic technologies or creating new energy opportunities to discovering civil engineering solutions and many more.

Umama Bendaoud

Research Project:
New Generation of Liquid Crystalline Energy Harvesters

Describe the scope of your research project?
I have investigated the potential of new organic materials to harvest and store light energy, which could be converted into electrical current in a further stage. These new materials will nurture the development of innovative photovoltaic devices and will promote more efficient technologies for energy harvesting and storage, contribute to the University's ambitions to drive the energy transition locally and internationally and help achieve national and global decarbonisation targets.

How did you undertake your research?
The project was mainly experimental and analytical. I have applied impedance spectroscopy to different materials such as polymers, by the application of alternating electrical field at different frequencies, under various temperature programmes. I then evaluated the effect of UV-irradiation on the conductivity. Hence, I have analysed the obtained measurements using Excel and Origin software, to calculate the conductivity and thermal-activation energies of the processes.

Throughout the project I was supported by my Supervisor Dr Alfonso Martinez-felipe who was a great helper, mentor and motivator. Dr Alf's ex-PhD student Daniel Zaton was also very helpful throughout the duration of the project.

What did you enjoy most about this research project?
Overall, this project was an invaluable personal and professional opportunity that enabled me to conduct useful research in developing new liquid crystalline energy harvesters. The project represented an excellent first research experience, working with academics, technicians, and PhD students, and has allowed me to broaden my prospects and knowledge.

Jokubas Kuprys

Research Project:
Optimizing Grasping Neural Network Performance with Small Size Grasping Data Set for Bin Picking

Describe the scope of your research project?
The project was focused on machine vision in robotics i.e. how can we make robots recognize and manipulate the environment robot is situated in. The project was based on physical system consisting of a robotic arm and depth camera. The decision was taken to base the project on the state-of-the-art system 'Self-supervised Learning for Precise Pick-and-place without Object Model' which utilises such hardware. This system uses the aforementioned cameras in combination with machine learning techniques (Neural Network Model governing the grasping) to move the robot hand to try and grasp never-seen objects from the cluttered bin, with the goal of placing them into the bin nearby.

However, for this summer research project, it was chosen to focus on the system grasping performance. Therefore, the scope of the project was split into two parts: The first part being, setting up the robotic system, the second part being experimenting and trying to optimise the Neural Network Model governing the system grasps. i.e. trying to raise the efficiency of how successful the system 'brain' is on determining which of the objects to grasp from the unforeseen environment.

What did you enjoy most about this research project?
The most enjoyable part of such software-hardware-oriented projects is seeing the hardware come to life, it can be a robot starting to move for the first time, or a camera starting to show 3D images, or components working in harmony. Such moments make the hard work feel more rewarding. During the project, I have learned a lot about the field of robotics and machine learning, both of these fields I have not had experience in before. Having this knowledge, now lets me have a broader perspective when looking for the right work or post-graduate studies after graduating from the undergraduate degree. Furthermore, this summer research project gave me a great opportunity to see how research work is done. I have started to appreciate and understand how difficult but rewarding research in such fields can be. Moreover, I have improved my computer programming skills in C++ and Python programming languages. Both of these languages are popular and valued in both Academia and Electronics/Computer Science fields.

Niamh Ellis

Research Project Name:
Classification of Holographic Images

Describe the scope of your research project?
This project aimed to classify the images of plankton produced by the weeHoloCam developed by the University in conjunction with Defence & Security Accelerator (DASA) which is a part of the MoD. This is important as the images produced by this state of the art camera can be used to tell marine biologists studying marine life about the numbers and types of plankton present in the sea. Plankton is an important source of food in the marine ecosystem.

How did you undertake your research?
I started researching different methods of image classification networks based on the numbers or available images of labelled plankton. I then developed my own code for identifying straight lines in the images to aim to classify phytoplankton before using transfer learning with a subset of the image classification dataset ImageNet to train my own classification network on my laptop. I was aided in this project by Dr. Thangavel Thevar who was a part of the research group who designed the weeHoloCam and Dr. Pascal Meissner. I was also able to discuss my project with a fellow undergraduate student who was undertaking a similar project.

What did you enjoy most about this research project?
I really enjoyed getting to learn about something new that was not covered as a part of the university course but is particularly interesting to me. It is also in an area I hope to explore as a future career path and has led to me undertaking a similar project for my dissertation. The project gave me a real insight into the process of performing a research project and prepared me for the research and work needed to go into completing my dissertation. It also gave me a chance to practically apply skills I have learnt in my courses.

Kleon Papadimitriou

Research Project Name:
Evolutionary Algorithms for the Optimisation of Switching Control in a Two-wheeled Self-balancing Robot

Describe the scope of your research project?
This research project is based on previous work done by an Aberdeen University engineering student. It attempts to identify the most effective parameters for the control of a two-wheeled self-balancing robot through evolutionary algorithms. This is an important tool as with growing demand for mobile robots their optimisation becomes more complex and time consuming. Having effective simulations that can quickly develop the desired control modes can be invaluable to this growing field. As well as developing the evolutionary algorithms, the research improves and addresses stability problems during the switching of different control modes in the previous work.

How did you undertake your research?
The research began with a good understanding of different evolutionary algorithms, to see which would be the most ideal for such a simulation. Using CoppeliaSim and MATLAB the little robot's behaviour was simulated and evolved over generations. As it was a purely computing project, I could do all my work from home, which was compatible with the Covid restrictions in place then.

What did you enjoy most about this research project?
I enjoyed reading the literature, and being able to really dive into a subject area very in depth with an actual, practical problem to then address. I enjoy being able to say that I now know a lot about this small niche in evolutionary robotics. Furthermore seeing my research and implementation begin to take shape and do the things we want it to do was a very rewarding feeling. It has changed my approach to engineering as it was the first real problem that I could not immediately tackle or imagine its solution intuitively. Instead the methodology relied on previous work, research papers and the help and guidance from my supervisors.