

## Examples of NRP descriptions

Placement subject	Project title	Project description
Computing	Classification of research organisations based on extracted main characteristics	<p><i>Objectives:</i></p> <ul style="list-style-type: none"> <li>• The student will be given web documents describing organisations and the first task will consist in extracting relevant information about them</li> <li>• The student will learn to translate relevant information about organisations into main features (including audience, size, funding, scope, domain) to create categories in which to classify the organisations</li> <li>• The student will produce a spreadsheet containing the classification of organisations according to meaningful features</li> </ul> <p><i>Aim:</i> The aim of this work is to produce a qualitative analysis from a web survey about research organisations. Given a list of institutions performing research activities, the final result of this assignment is a document representing various categories and different ways of grouping them according to criteria including -but not limited to- audience, size, funding, scope, domain of activity. The researcher will be encouraged to extend the list of criteria.</p> <p><i>Methodology:</i> Desk research surveys</p>
Computing	Human Emotion Recognition System Placement	<p>Facial expression is one of the most effective means for human beings to indicate emotions, feelings and intentions. Literature shows that facial expression contributed to about 55% effect of overall emotion expression during social interactions. Therefore, significant progress in facial emotion recognition has been witnessed in cognitive, neuroscience and computational intelligence fields. On top of that EEG base emotion detection has also shown promising performance in real-time emotion recognition (B. Nakisa et al. 2018). The combination of EEG and vision-based emotion will provide an emotion recognition system that is robust to variations, such as illumination, rotation and pose. Although many applications employ geometric-based, appearance-based or hybrid methods for automatic facial expression recognition, it is still a difficult and challenging task to recognize facial expressions with high accuracy because of the subtlety and variability of facial expressions, especially during the natural human- computer interaction. Another challenging task is to model the recognised emotions in appropriate intentions and apply them respectively. In general, this project aims to provide flexible, cost-effective, robust and accurate intent detection system based on EEG and vision-based emotion recognition to model an automatic cognitive behavioural therapy (CBT) for drug rehabilitation. The two novel aspects of this project are as follows: · Combination of EEG signals and computer vision for automatic facial emotion recognition. · Integrating intention detection with automatic CBT for drug rehabilitation. CBT is a talking therapy that can help to manage problems by changing the way of thinking and behaviour (E. E. Devito et al. 2018). CBT has also shown very effective in treating various mental disorders such as panic disorder, obsessive-compulsive disorder, depression, anxiety and drug addiction. The practical side of the project will involve the application of state-of-the-art machine learning and signal processing techniques for intent detection and emotion recognition in a real-life scenario.</p>
Earth Sciences	Determining whether graveyard soils are contaminated grounds and can be posed as a risk	<p>The successful detection of unmarked human burials, either clandestine graves of murder victims, or indeed unmarked graves in cemeteries and graveyards, have proven problematic. Various techniques have been employed, including geomorphology, near-surface geophysics, ground probing (not recommended!) and surveying to limited success (see Pringel et al. 2012). The evolution of more digital surveying techniques, particularly low cost drones and ground-based LiDAR, have allowed the rapid and accurate mapping of areas a lot more accurately than was previously possible. This project will use existing surveying equipment to assess the use of these for both clandestine and unmarked graves. Research publication should result for the participating students, as a minimum in an affiliated natural sciences journal.</p>
Environmental	Wildlife on the verge: mapping protected species along the road network of the East Midlands	<p>The accuracy of environmental assessment and report writing is a key part of what we do to safeguard protected wildlife and precious habitats found alongside the Strategic Road Network of the East Midlands. As part of our 'Minimum Standard for Environmental Assessment', we undertake historical searches for biological records which inform our ecological surveys. It's a key part of what we do within our Environment Team, with the results of these data searches combined with what we find in our field based surveys packaged up in our environmental assessments for a diverse range of highways schemes. It's surprising to learn what lives by the side of some of our busiest roads – everything from bustling badgers to dozy dormice to wandering water voles! This intriguing</p>

		placement is targeted at anyone who has a keen interest in ecology, environmental science, computing and/or geography. It is a desk-based role where you will be trained to use our Quantum Geographical Information System (QGIS) software. QGIS is environmental mapping software which we use to produce digital maps to visually illustrate and interrogate spatial information on protected and invasive wildlife species from desktop and field assessments. You will then oversee the creation of some QGIS 'layers' to hold more recent biological records captured in the field by our intrepid team. You will also be asked to produce a summary report of what you have found for not only our benefit, but also for our major client. So if you have an interest in British wildlife, why not join us for this fascinating placement? You will have access to our databases and work with staff to learn all about how ecological and environmental impacts are managed in the huge range of civil engineering projects we work on.
Environmental	Pollinators on the Toon	The global insect pollinator decline has been well documented in recent years and has gathered public attention. The drivers behind it are complex, but include: pesticides, land-use changes and urbanisation. However, cities have been identified as possible areas of pollinator refugia or conservation. Recent work have found that gardens, allotments and churchyards can all contain remarkable pollinator diversity. Even small planters can influence biodiversity and abundance. On this placement, you will join a team to investigate pollinator use of urban habitats in Newcastle-upon-Tyne. Centered around an experimental installation outside of Theatre Royal you will conduct field pollinator surveys and trapping exercises. This field ecology will be supported by your investigation of the pollen content of city centre honey samples supplied by our network of beekeepers.
Engineering/ manufacturing	Aerodynamic and noise performance of drones	Flying drones is becoming very popular, for recreational purposes and enterprise, including parcel delivery, aerial photograph, live video streaming, police surveillance, building inspection, built equipment inspection (bridges, radio masts, chimneys, electricity pylons), search and rescue, and many more. One concern with the expansion of this sector is acoustic noise pollution. The aim of this project is to set up a test rig in the hemi-anechoic chamber for testing the acoustic signature of propellers for drones and, time permitting, of drones in hover. For safety reasons, the propellers will be tested on a fixed (static) rig and any drone will be motion restricted by a tether to the ground. Thrust will be measured using a three-component force balance, in Cell 1. Time permitting, the effect of a cross-wind on thrust will be simulated by using the DERA wind tunnel, Thermodynamics Laboratory, school of engineering, which is also equipped by an identical three-component force balance. The selected student will assume the main responsibility for the acoustic measurements and data post-processing. The candidate will be paired with a second student whose main responsibility will be setting up the thrust balance and acquiring the relevant aerodynamic data. Both students will share the same laboratory space and will work as a team.
Engineering/ manufacturing	Comparing the corrosion and wear properties of coated and uncoated aluminium alloys.	Aluminium alloys are widely used in the aerospace and automotive industries where weight saving is critical for fuel efficiency and performance. To improve its corrosion resistance, aluminium is often treated via electrolytic processes to grow oxide coatings at the metal surface. These coatings act as an environmental barrier. In this project, the student will investigate the difference in performance between coated and uncoated aluminium. This will involved comparing the corrosion resistance of coated and uncoated samples as well as investigating the wear resistance and mechanical properties of the oxide coatings
Mathematics	Predicting bat carcass locations	Wind turbines can cause great problems for surrounding bat populations. However, the cause of these problems is currently unknown. Moreover, trying to find the bodies of dead bats in order to investigate the turbine influence is difficult, as the tiny bodies are thrown over a large area. This project will involve using a mathematical model to predict the likely locations of where the bat carcasses will land. The student will learn how to simulate simple equations for movement under gravity and produce randomised simulations, which will produce aggregated data, which can then be compared with the current field work observations.
Mathematics	An introduction to: imaginary numbers, matrices and Markov chains and their application to weather prediction	We will first look at a basic introduction to two different (but equally interesting) concepts in mathematics. The first - 'imaginary numbers' - have a controversial history and unexpected applications in the real world. The second - 'Markov chains' - have the power to predict the future... Based on your preferred interest after the introductions we will explore one of two paths. In the first case we will explore imaginary numbers. Where did they come from and how are they possibly useful? We will learn how they work and discover some surprising applications in the real world. In fact, the mathematical theories on which the weather forecast models are based rely on imaginary numbers. In the second case we will experiment with some simple probability experiments and compare the results with our intuition. Exploring these ideas deeper, we will discover some connections between the intuition we all have about probability and the underlying mathematics. This will lead us to discover so-called 'Markov chains' which, surprisingly, can be used as a basic model

		for weather prediction! Necessary for the understanding of Markov chains will be matrices - we will learn what these are and how they work. Finally, if there is time, we will explore matrix powers and learn why they have the power to predict future events..."
Psychology	Subvocalisation in silent reading of tongue twister sentences (eye tracking)	Silent reading is not actually "silent". In reading, written words are converted into "sounds" before the meaning can be accessed. For instance, readers typically slow down during silent reading of tongue twister sentences (e.g., she sells seashells by the sea shore). How can your tongue be twisted in silent reading? One hypothesis is that readers read these sentences out loud in their heads. This project tests this hypothesis by investigating the role of subvocalisation in silent reading of tongue twister sentences. We will experimentally suppress subvocalisation (by repeatedly saying "aluminium" out loud) and examine its effects on eye movements during reading.
Statistics / Data Science	Outreach Data Analysis	Over 500 young people take part in a summer school with XXX Outreach Team each year, getting a taste of university life and first-hand experience of studying a STEM degree subject. This project will look at the widening participation data and evaluation feedback we have collected since 2016 to analyse trends and outcomes. You will produce a report summarising your findings and to help us identify topics for further investigation. The project will involve working with the Outreach Data & Evaluation Team to conduct data analysis and produce graphs, tables and graphics for your report. You will also work with the activities team to gather feedback on the ground from summer school participants.
Statistics / Data Science	Using data to understand environmental processes	Currently, scientists that interact with non-scientists often feel that their contributions are ignored, while the latter complain that available scientific information is not tailored to their specific needs. Traditionally, the scientific community has used explanatory graphics and images to support scientific communication such as publications or conference talks; however, these figures are typically designed for audiences that are, to some extent, familiar with the underlying data or graphical form. Today, data visualisations are ubiquitous, appearing in various technical (e.g., information visualisation, scientific visualisation and geographic visualisation) and functional (e.g., statistical graphics, information graphics and data journalism) orientations. The aim of this project is to make the student part of current research, applying numerical tools to understand environmental processes. The student will work with different datasets, focusing on understand the causality of environmental hazards, such as forest fires. The datasets to analyse and represent are environmental and socio-economic factors in "small areas". The main duties will be to develop descriptive analysis and work on the representation of the different variables. Analysis and images will be part of a scientific publication of which the student will be co-author. At the end of the project, the student will be able to understand the scientific principle, from the initial question to communication of the results. Also, the student will be able to understand the basics of descriptive analysis and successfully carry out data visualisation, not only from a commercial software, but also from a widely-used open source statistical software, R.