**2020 Summer Winter Research Project Description**

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| **Project title:** | **Characterising top-down modulation of working memory using eye movements and electroencephalography** |
| **Positions available:** | **1** |
| **Project duration and delivery** | * 20–30 hours per week * 10 weeks, based in the Queensland Brain Institute |
| **Description:** | It can be argued that any choice behaviour requires combining of the current sensory input, past experience and the task at hand. Working memory is thought to be a cognitive function that combines these three and gives rise to a single behavioural choice. The main goal of this project is to characterise how different task rules modulate working memory maintenance. The data have already been collected, and now require analysis. In the experiment we asked participants to perform two different working memory tasks. In one task, participants had to remember the location of visual stimuli on a computer display (i.e., spatial memory), whereas in another task participants had to remember the orientation of the stimuli (i.e., feature memory). Eye movements and brain electrical activity were recorded while participants performed the tasks.  This project will focus on analysing the collected data using machine learning algorithms to characterise working memory processes in different tasks. The main aim is to decode either the location or the orientation of the memorized stimuli and to compare the decoding accuracy between different tasks. A further aim is to determine the degree to which different tasks modulate the correlations between eye movements and the brain activity. Addressing these two aims is of both theoretical and methodological significance. First, we will learn about the nature of working memory representations under different task rules, and second, we will learn whether eye movements can be used as an index of brain activity. |
| **Expected outcomes and deliverables:** | The work will involve preliminary data inspection and organisation, programming and data analyses, and interpreting the results. The candidate will be invited to present a summary of the findings in a lab-meeting format at the end of the 10 weeks.  Scholars will gain hands-on experience with analysing different behavioural and physiological measures, using R and Python programming languages, the most popular tools in data sciences, which will increase their competitiveness in the job market. The planned analyses will rely on cutting-edge multivariate data analysis methods which are broadly applicable in a variety of contexts. Scholars will also experience day-to-day work in a cognitive neuroscience lab. They will have an opportunity to interact with neuroscientists at different career stages from PhD students to lab heads. These experiences could help scholars when formulating their own plans for the future. |
| **Suitable for:** | This project would most suit a student with a background in mathematics, computer science, programming, engineering, etc. Applications from technically minded students with a background in psychology, neuroscience, etc., will also be considered. |
| **Primary Supervisor:** | Jason B Mattingley and Dragan Rangelov |
| **Further info:** | Please address any questions about the project to **Dragan Rangelov** at [d.rangelov@uq.edu.au](mailto:d.rangelov@uq.edu.au) |