**Machine learning and sleep:  Detecting neural replay in sleep with EEG classifiers**

**Description of Research Opportunity:**Memories are spontaneously replayed in sleep, and this replay is critical for their consolidation (strengthening and integration with pre-existing knowledge). Until recently, it has been impossible to detect these replays in humans, but work from our laboratory has devised a method to achieve this using machine learning to analyse EEG data. In this PhD, we will seek to extend this work by improving the detection method and using it to examine many additional aspects of memory replay such as how long it lasts, which phases of sleep it occurs in, and how it impacts on neuroplasticity.

We will first use common machine learning algorithms such as SVM, Logistic Regression, KNN with emphasis in feature extraction and selection. As this is a challenging problem we aim to explore and combine techniques from areas such as time series analysis (dynamic time warping), neuroimaging (representation similarity analysis) and deep learning (LSTM, convolutional NN). We seek a computer science or engineering student with a good background in machine learning and signal processing to take this work forward. An initial paper we’ve written on this is here: <https://www.ncbi.nlm.nih.gov/pubmed/29678758>.

The Neuroscience and Psychology of Sleep (Naps) lab is a thriving community of computer scientists and sleep researchers studying all aspects of how sleep impacts on cognition (see our nascent [web pages](http://www.cardiff.ac.uk/research/explore/research-units/neuroscience-and-psychology-of-sleep-lab-naps).

Cardiff University’s Brain Research Imaging Centre (CUBRIC) opened in Spring 2016, housing a unique combination of facilities and expertise that will further its world-leading research in Neuroimaging, Cognitive Neuroscience and Biological Psychiatry.  Further details of CUBRIC can be found on our web-page: <http://sites.cardiff.ac.uk/cubric>. /

**Award:**

The studentships will commence in 1 October 2019 and will cover your tuition fees (at UK/EU level) as well as a maintenance grant. In 2017-18 the maintenance grant for full-time students was £14,553 per annum. As well as tuition fees and a maintenance grant, all School of Psychology students receive conference and participant money (approx. £2250 for the duration of the studentship).They also receive a computer and office space, additional funding for their research, and access to courses offered by the University’s Doctoral Academy and become members of the University Doctoral Academy.

**Eligibility:**

Full awards (fees plus maintenance stipend) are open to UK Nationals, and EU students.

Send a CV to Penny Lewis: [lewisp8@cardiff.ac.uk](mailto:lewisp8@cardiff.ac.uk) for more info – please title the email ‘Classifier PhD’ by June 25th (you will need to apply through a more official channel after I look at your CV).