2022 School of EECMS Summer Internship Application Form

Main Supervisor	Hanieh Bakhshayesh
Is the main supervisor an ECR/MCR?	YES
Other supervisors (if applicable)	Dr Yifei Ren , Siavash Khaksar,
Project Title	An evaluation of mental workload with frontal NIRS
Duration of project (select between 4 and eight weeks)	8 weeks
Project Description	This project aims to examine the feasibility of developing a biomarker of mental workload based on the frontal activities measured by near-infrared spectroscopy (NIRS) Mental workload presents several challenges for the mining industry. Depending on the specific occupation, daily work, or operational setup on any mining site, mining jobs can have a fair amount of labor-intensive tasks mixed with monotonous and repetitive duties. Combined with the long working hours and shift-work schedules of mining work, the prevalence of mental workload in mine workers may seem rather unsurprising. Mining is undoubtedly not alone in facing the challenge of addressing Mental workload. Indeed, many of the characteristics above mirror the similarities of mental workload in other industries, such as health care, aviation, and security. Construct mental workload can be understood as the level of cognitive engagement that directly impacts the effectiveness and quality of awareness. While an optimal level of mental workload facilitates efficient awareness, mental overload could negatively affect task performance and result in more errors. In addition, an overloaded individual may even exhibit psychological symptoms, such as frustration, stress, and depression. Thus, a real-time measure of mental workload can help an individual identify the optimal level of mental workload and enhance one's learning performance. Near-infrared spectroscopy is a non-invasive neuroimaging method that uses light to measure changes in cerebral blood oxygenation associated with brain activity. Compared to other neuroimaging techniques, NIRS has better temporal resolution than fMRI and PET

	and better spatial resolution than MEG and EEG. Furthermore, it uses a safe, low-energy near-infrared light, so it can continuously measure brain activity, unlike other imaging techniques requiring radioisotopes or contrast reagents. We will use a small, wearable, and portable NIRS device to locate eight infrared sensors (8 emitters and two detectors) on the subject's forehead, below the hairline, and above the prefrontal cortex to collect near-infrared data during the different cognitive tasks. One of the main challenges in this method lies in the successful removal of movement artifacts from the collected NIRS signal. In this respect, we will use a multi-channel inertia measurement unit (IMU) containing an accelerometer, gyroscope, and magnetometer to better model movement artifacts than using an accelerometer. As a result, movement artifacts can be more accurately removed. Collected data will examine the potential of Near Infrared Spectroscopy (NIRS) and combine it with novel signal-processing methodologies as real-time quantifiers of cognitive load. The project has an industry collaborator Mitsui & Co. (Australia) Ltd. company details including contact information at www.mitsui.com/au The student will be involved in both data collection and data analysis. In addition, the student will have the opportunity to work with other students who are currently working on similar projects.