

PROJECT RISK ASSESSMENT FORM



DEPARTMENT / UNIT / GROUP: MEDICAL PHYSICS AND BIOMEDICAL ENGINEERING
Quantitative Imaging Group

WORK / PROJECT TITLE: Self-supervised deep learning to improve quantification of blood-brain barrier permeability from MRI data

LOCATION(S): The UCL Centre for Medical Image Computing (CMIC)

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DESCRIPTION OF WORK: Description: The blood-brain barrier (BBB) provides a protective layer between blood vessels and brain tissues, preventing any blood borne toxins from entering the brain. Damage to the BBB affects this seal around the blood vessels so that they become "leaky," meaning that toxins are able to cross into the brain. The rate of water exchange across the BBB is emerging as one of the most promising MRI biomarkers for quantifying its permeability, but current acquisition protocols suffer from low image quality. This means that standard parameter estimation techniques using non-linear least squares approaches using this low-quality data suffer from noise and biases. Deep learning, in particular self-supervised learning, has been shown to improve parameter estimation by reducing these biases, whilst also providing significant gains in speed.

In this project, the student will implement a self-supervised deep neural network to improve the quantification of BBB permeability. Improvements in parameter estimation will first be evaluated using simulations; the technique will then be applied to a pilot data set of healthy volunteers. This project would suit a student with an interest in machine learning and numerical modelling. Good mathematical and programming skills are required, and experience with Python is desirable.

PERSONS INVOLVED: Elizabeth Power, Gabe Yawitch, Geoff Parker, Snigdha Sen

HAZARD IDENTIFICATION *(state the hazards involved in the work)*

1. Computer work
2. Long reading hours

RISK ASSESSMENT *(make an assessment of the risks involved in the work and where possible state high, medium or low risk)*

1. Computer work could result in back pain (medium risk), eye strain (medium risk), repetitive strain injury (low risk)
2. Long reading hours could result in eye strain (medium risk)

CONTROL MEASURES *(state the control measures that are in place to protect staff and others from the above risks. Put in place adequate control measures for any risks that have been identified as uncontrolled.)*

1. To prevent injuries due to computer use, frequent breaks must be taken and good posture maintained at a suitable computer setup.

2. To prevent eye strain from long reading hours, ensure that reading is occurring in sufficient light and frequent breaks are taken.

DECLARATION

I the undersigned have assessed the work, titled above, and declare that there is no significant risk / the risks will be controlled by the methods stated on this form (*delete as applicable*) and that the work will be carried out in accordance with Departmental codes of practice.

Name.....**Gabe Yawitch**.....

Signed..........

Date.....**31/10/23**.....