**Project title:** Automated identification of early Alzheimer’s disease in medical images

**Project supervisors:** Prof. Huiyu Zhou and Dr. Reza Zare

**Highlights:**

- To investigate possible solutions of detecting early AD in medical images using neural networks.
- To automate early AD detection and reduce additional costs to the NHS.
- To generalise the developed artificial intelligence technologies to other diseases if possible.

1. **Introduction**

Alzheimer’s disease (AD) is a degenerative neurological disease and the main cause of dementia. The symptoms of AD include memory loss and difficulties in thinking, problem-solving or language, which largely influence the daily life of patients [1]. In the early stage of AD, patients may demonstrate symptoms of Mild Cognitive Impairment (MCI). Early diagnosis of AD and MCI helps people to make suitable treatment plans in addition to the preparation for financial and legal matters [2]. It also helps the patients and their families to collect further information, advice and guidance.

A number of computer-aided approaches have been established to address automated diagnosis of AD and MCI in recent years. These non-invasive neuroimaging tools have been used to explore potential solutions to the early diagnosis problem of AD and MCI, including support vector machine [3], Gaussian process [4] and deep neural networks [5]. However, evidence has shown that the developed approaches do not hold sufficient robustness and consistency to heterogeneity of images [6]. As a consequence, we need to come up with new proposals for developing a robust and generalised framework to deal with various challenges in AD and MCI.

2. **Methodology and expected outcomes**

The proposed method will consist of the following aspects:

- To collect rich literature for reviewing the recent technology development in the field.
- To develop novel deep learning based technologies to detect hippocampal formation in the brain.
- To identify the growth of hippocampal formation over time using U-Net image segmentation technologies.
- To comprehensively evaluate the proposed approaches over publicly accessible datasets.

2-3 IEEE Transactions papers will be submitted during the Ph.D. lifetime. 2-3 major conference papers will be published in addition to a demonstrable software kit.

3. **Critical skills, training and development**

The applicant is expected to be academically excellent and hold strong software programming skills. S/he should also have excellent communication skills with team spirits. During the Ph.D., the student will have opportunities to attend academic conferences and training course for enhancing research conduct and project management skills.

**References:**


