Predicting post-stroke epilepsy development from DECT images using Machine Learning techniques

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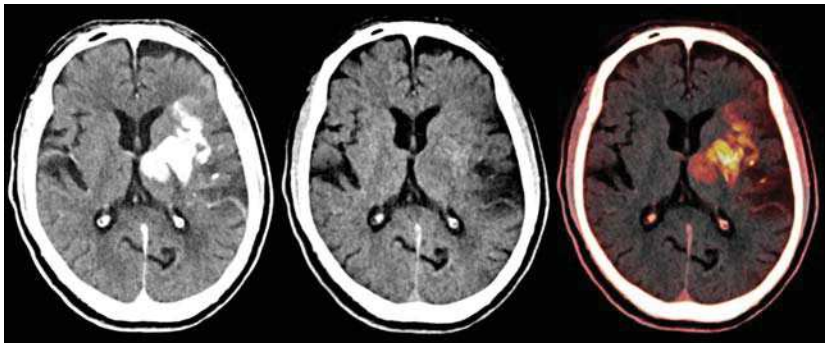
Background: Stroke is the most frequent cause of epilepsy in the elderly population, and the incidence of post-stroke epilepsy (PSE) increases every year. PSE is a major clinical problem for these patients because it relates to a worse functional outcome, a decrease in quality of life, and a higher mortality rate. Despite the frequent occurrence of PSE and its serious consequences, it is still unknown which underlying mechanisms cause epilepsy after stroke. This makes it hard to predict which patient will or will not develop epilepsy after stroke and makes targeted (prophylactic) treatment of specific patients at risk challenging. The most investigated and validated way of predicting the likelihood of developing PSE is based on clinical stroke characteristics. However, it has been shown that not only clinical features, but also pre-existing underlying pathophysiological factors, might play a role in the development of epilepsy after stroke. Therefore, to obtain a more accurate prediction, also an alternative strategy to predict PSE should be considered.

One of the potential biomarkers for the early identification of patients at high risk for PSE development is dysfunction of the blood-brain barrier (BBB). The BBB separates the circulating blood from the brain parenchyma, protecting the brain from neurotoxic substances in the blood and maintaining the microclimate within the brain tissue. Preclinical studies suggest that BBB dysfunction may play a key role in the development of epilepsy after stroke, as an imbalance in neurochemical compounds can contribute to triggering seizures. One way to assess BBB dysfunction is by quantifying iodine leakage on Dual-Energy CT (DECT) images.



Student Task Description: We have acquired DECT data and obtained clinical characteristics and post-stroke epilepsy status from ±450 stroke patients. The aim of this project is;

1) Pre-process the DECT images into iodine leakage maps
2) Set up a Machine/Deep Learning pipeline for the prediction of developing PSE after stroke using these images and clinical characteristics.

Useful knowledge/skills:

- Machine learning knowledge or willingness to learn about this.
- Programming experience in Matlab and/or Python