MINI PROJECT TITLE –

MACHINE LEARNING FOR CEREBROVASCULAR DISORDERS

LITERATURE REVIEW

S.NO.	AUTHOR/ YEAR	TITLE	DESCRIPTION
1.	Yu, Yannan Chen, David Yen Ting [1]/2023	Machine Learning for Cerebrovascular Disorders	Cerebrovascular disease refers to a group of conditions that affect blood flow and the blood vessels in the brain. It is one of the leading causes of mortality and disability worldwide, imposing a significant socioeconomic burden to society. Research on cerebrovascular diseases has been rapidly progressing leading to improvement in the diagnosis and management of patients nowadays. Machine learning holds many promises for further improving clinical care of these disorders. In this chapter, we will briefly introduce general information regarding cerebrovascular disorders and summarize some of the most promising fields in which machine learning shall be valuable to improve research and patient care.
2.	Dumitrascu, Oana M. Koronyo-Hamaoui, Maya [2]/2020	Retinal vessel changes in cerebrovascular disease	Purpose of reviewThe retina is growingly recognized as a window into cerebrovascular and systemic vascular conditions. The utility of noninvasive retinal vessel biomarkers in cerebrovascular risk assessment has expanded due to advances in retinal imaging techniques and machine learning-based digital analysis. The purpose of this review is to underscore the latest evidence linking retinal vascular abnormalities with stroke and vascular-related cognitive disorders; to highlight modern developments in retinal vascular imaging modalities and software-based vasculopathy quantification.Recent findingsLongitudinal studies undertaken for extended periods indicate that retinal vascular changes can predict cerebrovascular disorders (CVD). Cerebrovascular ties to dementia provoked recent explorations of retinal vessel imaging tools for conceivable early cognitive decline detection. Innovative biomedical engineering technologies and advanced dynamic and functional retinal vascular imaging methods

			have recently been added to the armamentarium, allowing an unbiased and comprehensive analysis of the retinal vasculature.
3.	Liu, Chaofan[3]/2023	An enhanced stroke prediction model based on data class balance and machine learning	Stroke is an acute cerebrovascular disorder that can be either ischemic or hemorrhagic. Stroke is distinguished by its high rates of morbidity, death, disability, and recurrence. In order to successfully limit the occurrence of stroke, early knowledge of the risk of onset and control of risk variables via science are essential. In this work, we integrate numerous machine learning techniques for prediction with the kmeans smote data oversampling technique. The experimental results demonstrate that the XGBoost model performs rather well, with an accuracy rate of 97%, a recall rate of 92%, and an AUC of 0.955. This model outperforms its contemporaries.
4.	Gao, Mengxia Lam, Charlene L.M. ,eta [4]/2021	Preoperative brain connectome predicts postoperative changes in processing speed in moyamoya disease	Moyamoya disease is a rare cerebrovascular disorder associated with cognitive dysfunction. It is usually treated by surgical revascularization, but research on the neurocognitive outcomes of revascularization surgery is controversial. Given that neurocognitive impairment could affect the daily activities of patients with moyamoya disease, early detection of postoperative neurocognitive outcomes has the potential to improve patient management. In this study, we applied a well-established connectome-based predictive modelling approach to develop machine learning models that used preoperative resting-state functional connectivity to predict postoperative changes in processing speed in patients with moyamoya disease. Twelve adult patients with moyamoya disease (age range: 23–49 years; female/male: 9/3) were recruited prior to surgery and underwent follow-up at 1 and 6 months after surgery. Twenty healthy controls (age range: 24–54 years; female/male: 14/6) were recruited and completed the behavioural test at baseline, 1-month follow-up and 6-month follow-up. Behavioural results indicated that the behavioural changes in processing speed at 1 and 6 months after surgery compared with

			baseline were not significant.
5.	Sahriar, Saad eta [5]/2024	Unlocking stroke prediction: Harnessing projection-based statistical feature extraction with ML algorithms	Non-communicable diseases, such as cardiovascular disease, cancer, chronic respiratory diseases, and diabetes, are responsible for approximately 71% of all deaths worldwide. Stroke, a cerebrovascular disorder, is one of the leading contributors to this burden among the top three causes of death. Early recognition of symptoms can encourage a balanced lifestyle and provide essential information for stroke prediction. To identify a stroke patient and risk factors, machine learning (ML) is a key tool for physicians. Due to different data measurement scales and their probability distributional assumptions, ML-based algorithms struggle to detect risk factors. Furthermore, when dealing with risk factors with high-dimensional features, learning algorithms struggle with complexity. In this study, rigorous statistical tests are used to identify risk factors, and PCA-FA (Integration of Principal Components and Factors) and FPCA (Factor Based PCA) approaches are proposed for projecting suitable feature representations for improving learning algorithm performances. The study dataset consists of different clinical, lifestyle, and genetic attributes, allowing for a comprehensive analysis of potential risk factors associated with stroke, which contains 5110 patient records. Using significant test (*P*-value <0.05), chi-square and independent sample *t*-test identified age, heart_disease, hypertension, work_type, ever_married, bmi, and smoking_status as risk factors for stroke. To develop the predicting model with proposed feature extraction techniques, random forests approach provides the best results when utilizing the PCA-FA method.

REFERENCES

1. Yu, Y., Chen, D.YT. (2023). Machine Learning for Cerebrovascular Disorders. In: Colliot, O. (eds) Machine Learning for Brain Disorders.

Neuromethods, vol 197. Humana, New York, NY. https://doi.org/10.1007/978-1-0716-3195-9_29

2. Dumitrascu, Oana M.a; Koronyo-Hamaoui, Mayab. Retinal vessel changes in cerebrovascular disease. Current Opinion in Neurology 33(1):p 87-92, February 2020. | DOI: 10.1097/WCO.0000000000000779
3. C. Liu, "An enhanced stroke prediction model based on data class balance and machine learning," *2023 IEEE 9th International Conference on Cloud Computing and Intelligent Systems (CCIS)*, Dali, China, 2023, pp. 469-473, doi: 10.1109/CCIS59572.2023.10263235.
4. Mengxia Gao, Charlene L M Lam, Wai M Lui, Kui Kai Lau, Tatia M C Lee, Preoperative brain connectome predicts postoperative changes in processing speed in moyamoya disease, *Brain Communications*, Volume 4, Issue 5, 2022, fcac213, https://doi.org/10.1093/braincomms/fcac213
5. Sahriar, Saad Akther, Sanjida Mauya, Jannatul Amin, Ruhul Mia, Md Shahajada Ruhi, Sabba Reza, Md Shamim,Unlocking stroke prediction: Harnessing projection-based statistical feature extraction with ML algorithms ,2024 doi: 10.1016/j.heliyon.2024.e27411 DO - 10.1016/j.heliyon.2024.e27411