Dementia Diagnosis in Patients Using Machine Learning: Recent Progress

Teesside University: School of computing and Digital Technologies
Edwin Joseph | W9524201 | Research Methods, CIS4011-N

Research Purpose

The primary goal of this study is to discover new advances in machine learning for dementia diagnosis. Since dementia is classified into different types, studies on the most prevalent kind of dementia, such as Alzheimer's disease, have received more attention. Following the completion of this study, I'd like to explore a variety of developments that may aid in the more accurate identification of various varieties of dementia.

Research Question:

How do recent advances in machine learning benefit the diagnosis of dementia in patients?

Background Context

Dementia, disease or damage to the brain that causes a persistent and gradual loss of cognitive function, is becoming more widespread as the population ages. The World Health Organization (WHO) estimates that roughly 47 million people suffer from dementia, with this figure anticipated to rise to 82 million by 2030 and 150 million by 2050.. Diagnosing dementia accurately and early is a huge challenge. It will be easier in the near future with the aid of machine learning and AI.

Fig1. Artificial Intelligence may diagnose dementia in a day

Research Methodology

Initially, we can collect clinical datasets from the hospital and care home records. We can perform a comprehensive analysis of research in which machine learning was used to predict whether individuals with moderate cognitive impairment will acquire dementia or stay stable using neuroimaging data. We can screen data for qualitative analysis after deleting duplicates.

Evaluation Methodology

Collection of Data
The datasets can be obtained from a variety of sources. There are numerous clinical datasets available now.

Data Pre-processing
Most machine learning methods are hampered by missing or noisy entries in the data. A series of guidelines was followed to remedy this issue in order to replace or recover several missing values as feasible.

Feature Selection
The goal of feature selection is to remove redundant or irrelevant features while retaining important information. This reduces complexity and increases comprehension.

Methods
Following feature selection, multiple supervised machine learning algorithms can be used to simulate the characteristics of dementia patients. We compare the performance of decision tree-based methods such as random forest, XGBoost, and ensemble methods under bagging to other different methods, including logistic regression and support vector machine.

Interpretable Decision Trees
Using computational tools to derive insights from data can assist clinicians in making vital decisions. To do so, the doctor must first comprehend and trust the fundamental machine learning approach. As an outcome, decision trees that can explain the outcome of the models in a set of regulations are constructed. Clinicians may utilize these trees to discover the combinations of risk variables that may influence the growth of dementia and give accurate prognostics.
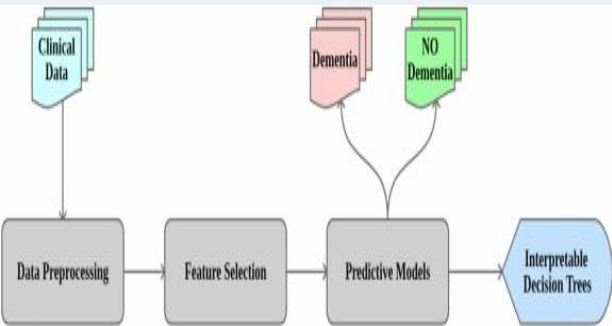
Fig2. Methodology

Schedule and publishing

Schedule	Activity
Week 1-2	Deciding a Research Topic
Week 3 -5	Background and significance of the research
Week 6	Methodology
Week 7-9	Reviewing literature
Week 10-12	legal and ethical concerns
Week 13	Submission

Professional, Legal and Ethical Issues

All recommended standards, particularly those concerning consent, anonymity, confidentiality, and originality, will be followed by the study. While Digital Transformation applications such as Machine Learning, Artificial Intelligence, and Deep Learning have very promising applications, users must overcome some of the data privacy and related ethical issues. The lack of quality clinical datasets is another ethical issue.
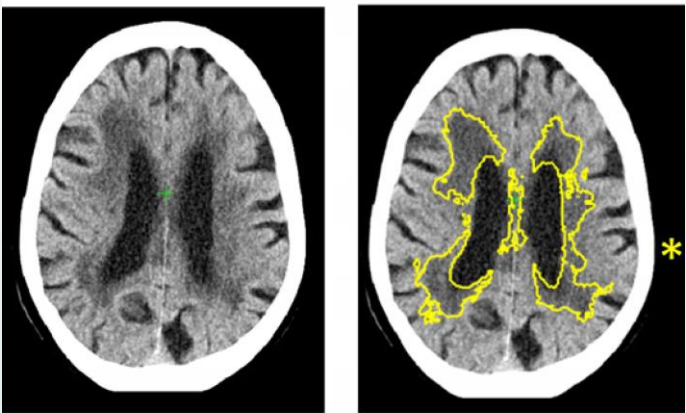
Fig3. Machine learning has detecting causes of dementia in brain scans (CT)

References

1. BBC News. 2022. *Artificial Intelligence may diagnose dementia in a day*. [online] Available at: <https://www.bbc.co.uk/news/health-57934589> [Accessed 10 May 2022].
2. Yang, H. and Bath, P., 2020. The Use of Data Mining Methods for the Prediction of Dementia: Evidence From the English Longitudinal Study of Aging. *IEEE Journal of Biomedical and Health Informatics*, 24(2), pp.345-353.
3. Tsang, G., Xie, X. and Zhou, S., 2020. Harnessing the Power of Machine Learning in Dementia Informatics Research: Issues, Opportunities, and Challenges. *IEEE Reviews in Biomedical Engineering*, 13, pp.113-129.
4. Myers, M. and Campus, S., 2022. *Artificial Intelligence improves stroke and dementia diagnosis in brain scans | Imperial News | Imperial College London*. [online] Imperial News. Available at: <https://www.imperial.ac.uk/news/186108/artificial-intelligence-improves-stroke-dementia-diagnosis/> [Accessed 10 May 2022].