

AI meets MD: Combining Machine learning algorithms and medical expert's diagnosis (MD) for new beginnings in the prediction of Alzheimer's disease progression

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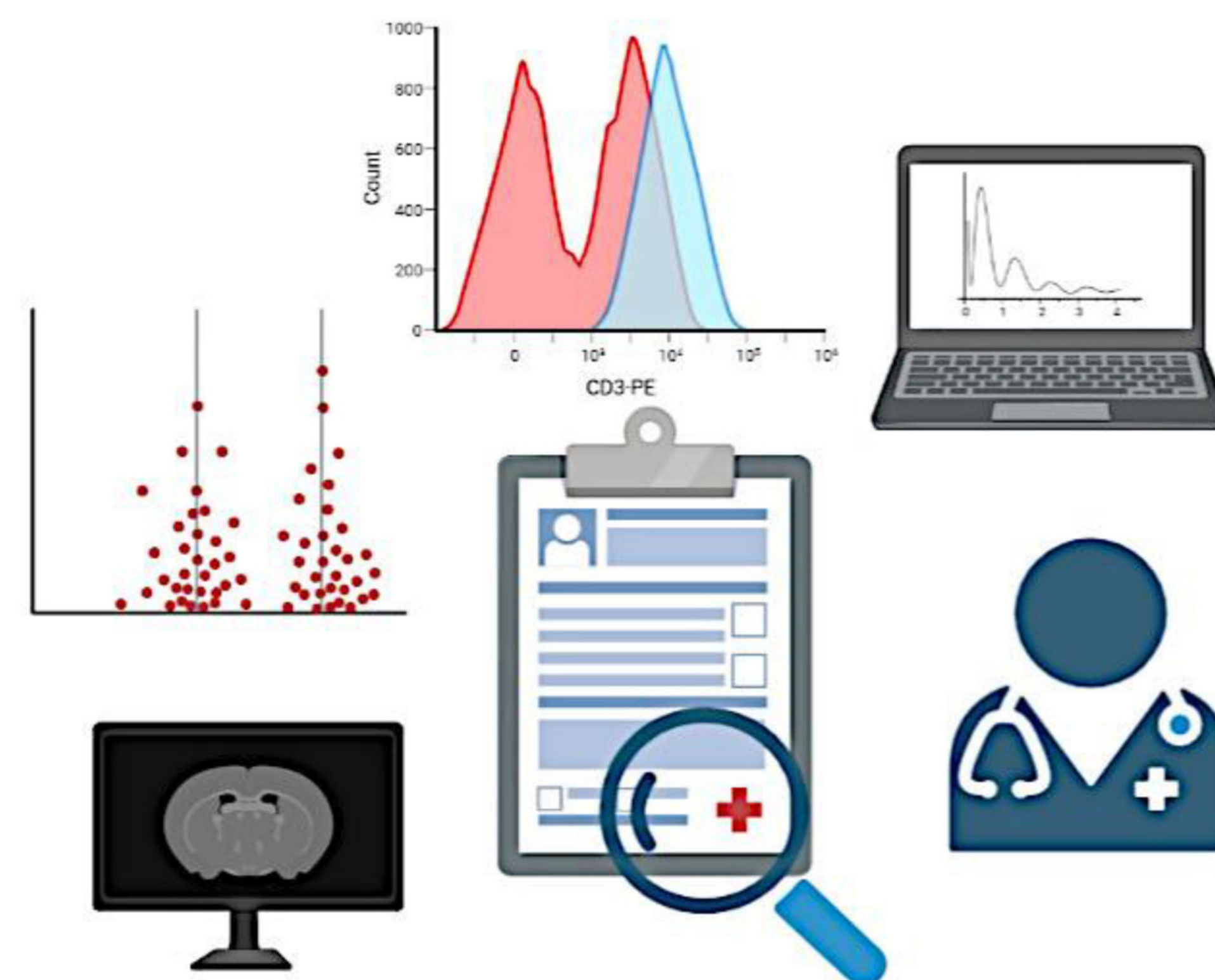
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Background

The conventional medical diagnoses based on human expertise and intuition are prone to substantial error rates (Abimanyi-Ochom et al., 2019; Edmonds et al., 2016).

The availability of large amounts of data in the health sector (Bennett & Hauser, 2013) enables machine learning (ML) algorithms to enhance diagnostic accuracy (Kohli & Arora, 2018; Richens, Lee, & Johri, 2020).

However, due to the limited availability of longitudinal biomarker data for fast progressing (high risk) groups, the algorithms suffer from a data imbalance problem in the diagnosis of Alzheimer's disease (AD) progression (Andrade Leon, Bruton, & Jafri, 2021). This project proposed a hybrid of algorithmic and clinical expertise-based prediction to address this issue.

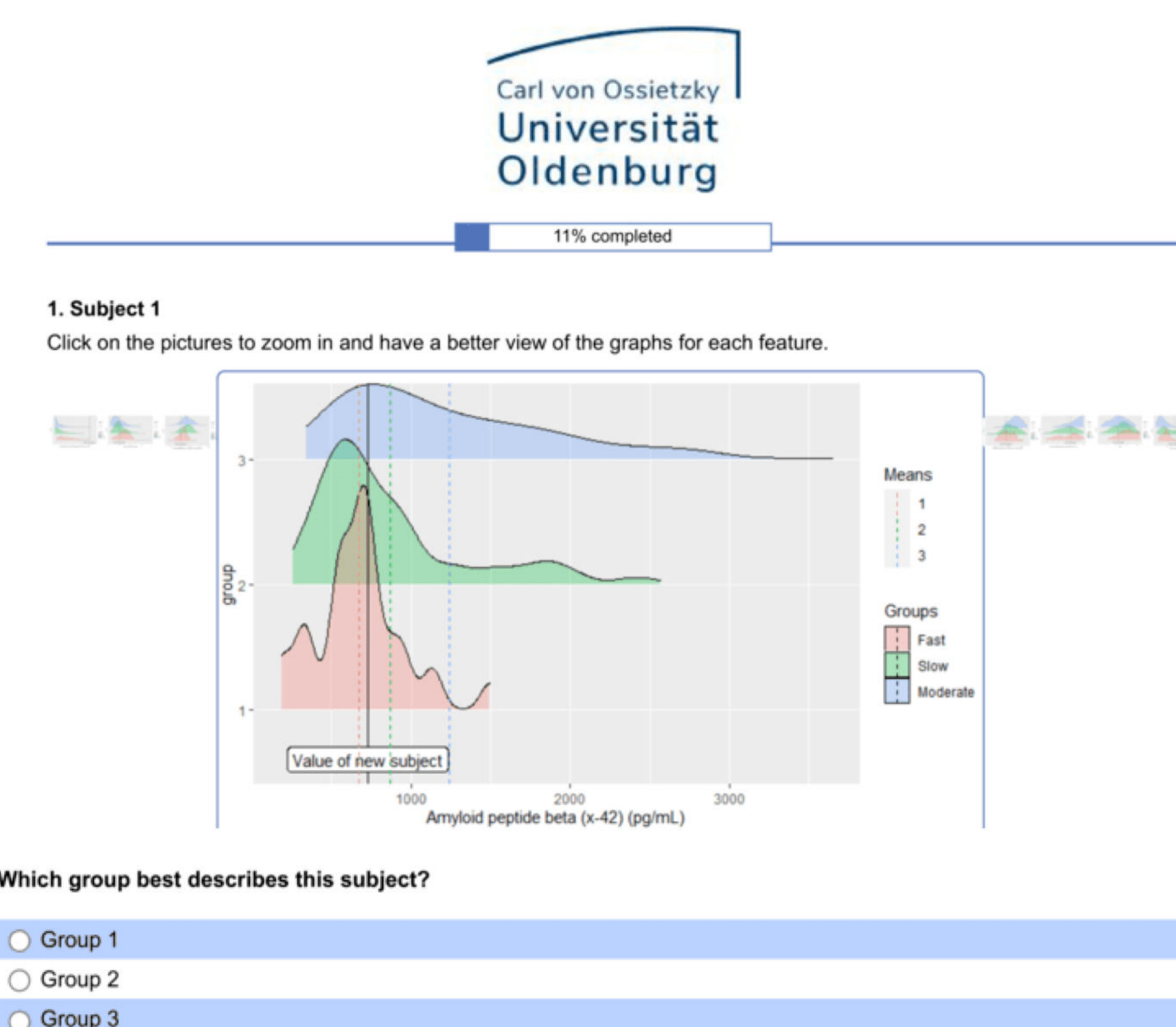


Methods

Aim: Investigate the agreement between the assessment of AD progression predictors by experienced clinicians and ML algorithms.

Instrument: A Survey including the sampling distributions of the 10 most relevant predictors (e.g., brain volume) for the three progression groups (slow, intermediate, and fast). 30 patients were located and marked within these distributions.

Procedure: We contacted 9 clinicians from the domains of neuropsychology, geriatrics, psychiatry and neurosurgery (Germany & Mexico). They were asked to assign each patient to either of the three progression groups based on the plots.



Results

None of the contacted experts fully completed the survey. However, one clinician provided detailed feedback:

- He pointed out, that it may be important to consider the time of disease onset.
- Furthermore, he cited evidence indicating the potential irrelevance of certain predictors (medio-basal temporal lobe atrophy and β -amyloid).
- He also emphasised the practical inutility of MRI-based diagnostics (lack of widespread availability).
- Lastly, he questioned the applicability of the features for predicting single cases. According to his experience, severity of AD may be differentially compensated (e.g., a more severely affected patient might still be able to live at home with adequate support).

Discussion & outlook

The present study represents a preliminary assessment of the acceptance and adaptability of ML algorithms in the field of dementia diagnostics.

The outcome is interpreted as reflecting the previously described scepticism of clinical professionals towards the consideration of clinical decision support systems (CDSS; Berner & La Lande, 2007; Kilsdonk, Peute, & Jaspers, 2017).

Thus, future studies should address potential biases of clinicians and provide the latter with detailed information regarding both strengths and limitations of ML-based feature prediction.

