

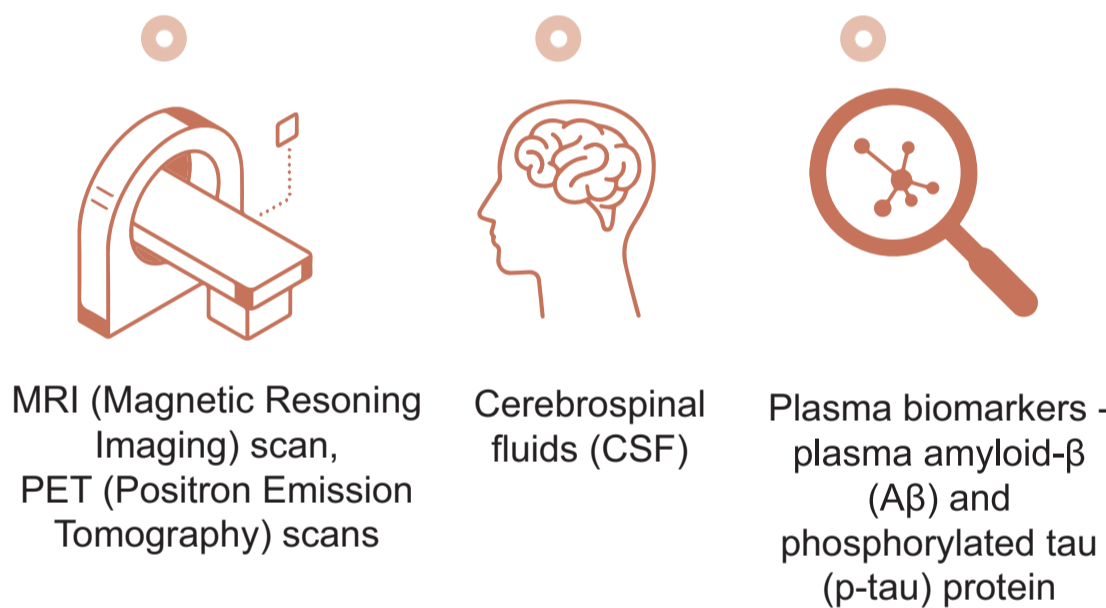
Using Artificial Intelligence (AI) to predict Mild Cognitive Impairment (MCI) in healthy individuals

Ana Cristina Guirola Carias De Newell; Alya Al Rawi; Rayyan Al-Zadjali, Wiktor Stachera, Nehal Hassan, MSc., Sarah Wilson, MSc., Riona McArdle, PhD., Sarah Slight, PhD.
School of Pharmacy, Newcastle University, Newcastle Upon Tyne, UK.

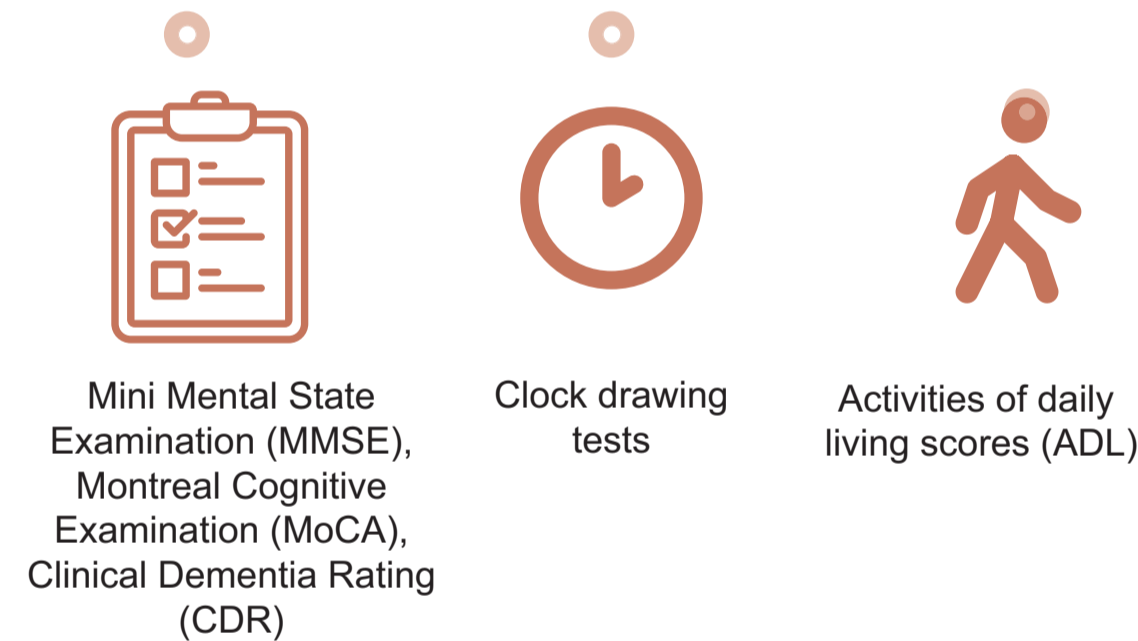
Background

- Alzheimer's disease (AD) is a type of dementia marked by cognitive decline and memory loss, impacting daily life. The pre-clinical phase of AD is mild cognitive impairment (MCI). (1-3).
- By 2050 there will be 139 million people with dementia (4-5). 1 in 3 people born in the UK this year will develop dementia in their lifetime (6).
- Early detection can be beneficial from a cost perspective, as well as providing an early treatment plan for the individual (3).

Invasive methods



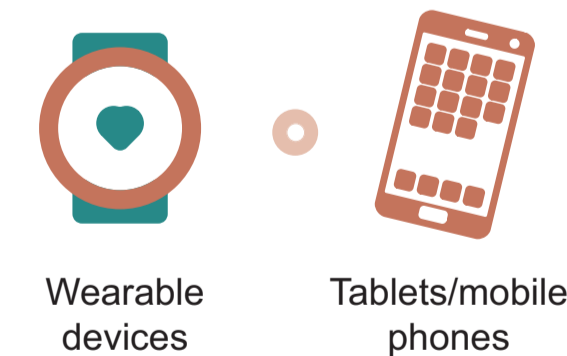
Non-invasive methods



Digital technology can be used to aid in the detection and prediction of MCI and AD, by using artificial intelligence and machine learning algorithms to design passive and/or interactive technological software.

Passive

Monitoring individual's behaviours and patterns without person's direct input.



Interactive

Requires the person's direct input into the device used



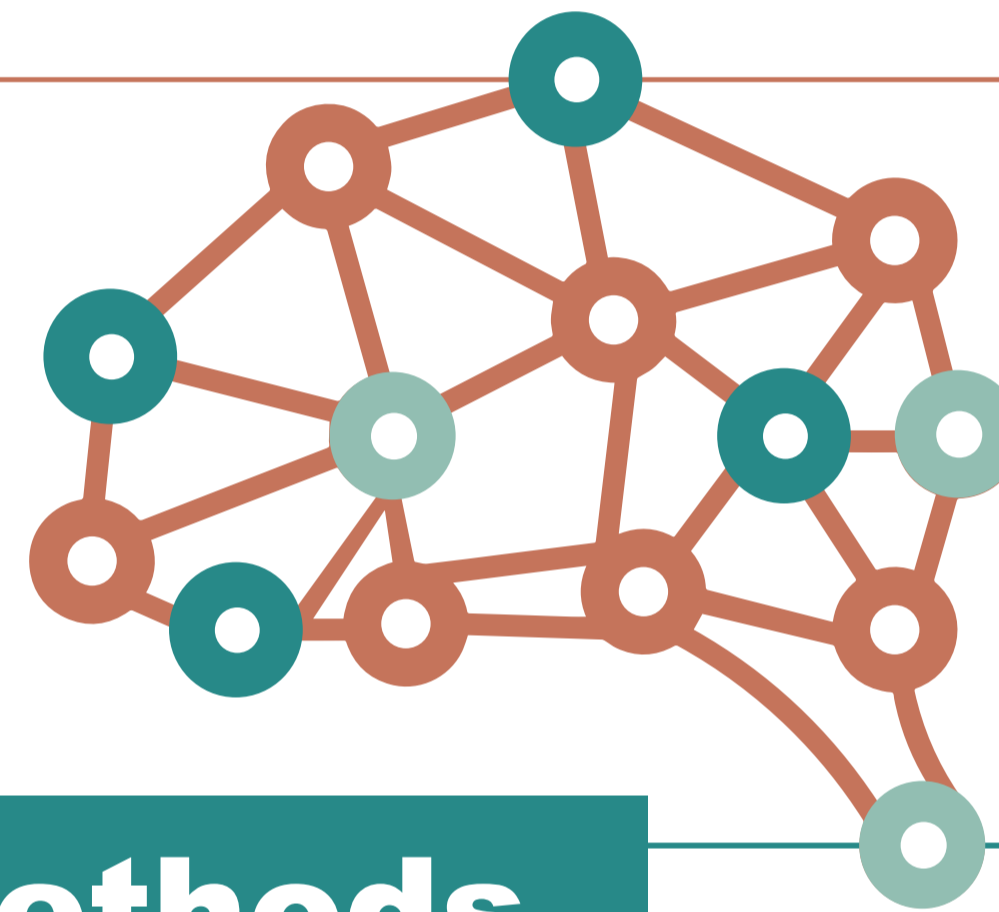
Contact

Ana Cristina Guirola Carias De Newell
B8002336@newcastle.ac.uk



Aims of study

To systematically review the literature of non-invasive predictors that can be used to train machine learning algorithms used to predict onset of MCI in healthy individuals.



Methods

A second screening was carried out of

this systematic review, using Meta-Analysis (PRISMA) and defining inclusion/exclusion criteria. Inclusion criteria included:

- Publications in English language.
- Studies that use machine learning algorithms to predict MCI in healthy individuals.
- Studies that includes individuals without an existing diagnosis of MCI/ who are asymptomatic or cognitively unimpaired.

The databases used and number of papers identified before screening:

- Web of Science (WoS), n = 838
- MEDLINE (via Ovid), n = 203

References

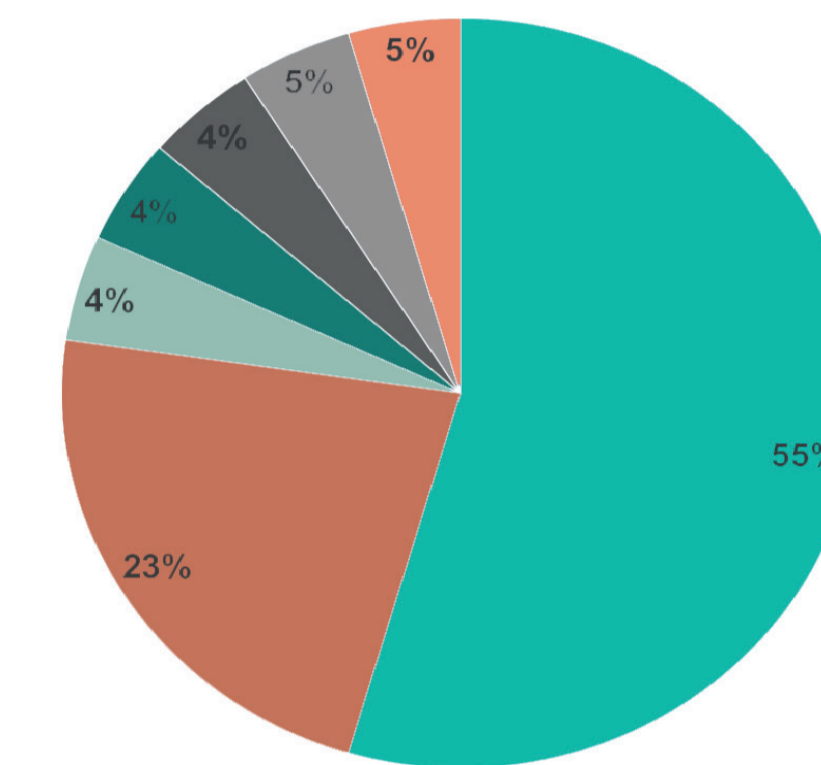


- EMBASE (via Ovid), n = 423
- Cumulative Index of Nursing and Allied Health Literature (CINAHL), n = 79

Results

Our search yielded 1,098 studies, of which 22 met our inclusion criteria.

Validation methods of Machine learning algorithms:



- K-fold cross validation method (n = 12)
- Leave-P out cross validation (n = 5)
- Random subsampling based cross validation (n = 1)
- Randomised cross validation (n = 1)
- Wizard of Oz validation (n = 1)
- No mention of method used but model developed validated (n = 1)
- Study with no validation model (n = 1)

Model performance:

Studies used different methods to determine performance, which gives an indication of how reliable this can be when predicting which individuals are at risk of developing MCI.

Performance measure	Average	Minimum	Maximum
Sensitivity	74.22% ± 35	30%	100%
Specificity	80.99% ± 18	64%	100%
Accuracy	78.69% ± 30.34	36%	96.67%
Positive predictive value	90.1% ± 14.3	71.40%	100%
Negative predictive value	75.19% ± 37	25%	100%

From these studies:

- 8 studies aimed to predict MCI in cognitively healthy individuals (7-14).
- 14 studies focused on detecting MCI in cognitively healthy individuals and classifying healthy individuals from MCI (15-28).

All studies used interactive and/or passive devices, which can be woven into everyday life for patients, such as the use of games, and the use of recognition tools, tracking activities from the comfort of their own home.

Conclusion

- The findings demonstrate machine learning algorithms have 90% accurate prediction and 96.67% and 86.2% accurate detection of MCI.
- In the near future, this might aid in the diagnosis of MCI in healthy individuals.