



# Real-world applications of Artificial Intelligence in pre-dementia diagnostics and treatment administration



Esten H. Leonardsen

Chief Scientific Officer, baba.vision

Post-doc at the Department of  
Psychology, Universitet i Oslo



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# Background

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## Deep neural networks learn general and clinically relevant representations of the ageing brain

*Deep neural networks learn general and clinically relevant representations of the ageing brain*, Leonardsen et al., 2022. *NeuroImage*, 256, 119210

linked to cognitive performance in multiple domains. While further validations in clinical contexts are needed, our XAI pipeline for dementia demonstrates how advanced predictive technology can be employed by clinicians to monitor and characterize disease development for individual patients.

*Constructing personalized characterizations of structural brain aberrations in patients with dementia using explainable artificial intelligence*,  
Leonardsen et al., 2024. *npj Digital Medicine*, 7(1), 110

# Background

 estenhl Merge pull request #26 from estenhl/packaging ··· 7671d00 · 4 months ago 123 Commits

 citations	Finished READMEs for now	9 months ago
 docker	Updated docker containers, small linting fixes, fixed bug ...	9 months ago
 notebooks	Updated docker containers, small linting fixes, fixed bug ...	9 months ago
 preprocessing	Finished models, pre/postprocessing and example from ...	10 months ago
 pyment	Tried moving data folder (although I don't want to)	5 months ago
 scripts	Updated docker containers, small linting fixes, fixed bug ...	9 months ago
 tests	Removed redundant data folder	5 months ago
 .gitignore	More tests and comments, modified README	9 months ago
 CHANGELOG.md	More tests and comments, modified README	9 months ago
 LICENSE.md	Added license and citation	2 years ago
 README.md	Finished READMEs for now	9 months ago
 requirements.txt	Fixed docker containers	10 months ago
 setup.py	Tried moving data folder (although I don't want to)	5 months ago

No description, website, or topics provided.

 Readme  
 View license  
 Activity  
 33 stars  
 2 watching  
 15 forks  
Report repository

**Releases** 2

 v2.0.0 (Latest) on Feb 17, 2023 + 1 release

**Packages**  
No packages published

**Languages**

•  jupyter Notebook 99.5% •  Other 0.5%

 README  License

This is a repository containing pretrained models for neuroimaging data used in various scientific publications. The publications are listed [here](#), and all the models are listed [here](#). After version 3.0.0 the nature of this repo changed, a description of which can be found in the [changelog](#). The models posted here try to mimic the behaviour and interface of the [pretrained models in the Keras applications package](#). Besides the possibility of importing this library in Python and interacting with the models as Python-objects, we demonstrate three use cases for interaction here:

- [Jupyter notebooks](#)
- [Command-line scripts](#)
- [Docker containers](#)

<https://github.com/estenhl/pyment-public>

# Background

1. Showcase the **general efficacy** of artificial intelligence for demonstrative clinical use-cases

## Background

1. Showcase the **general efficacy** of artificial intelligence for demonstrative clinical use-cases
2. Build predictive models to solve specific **real-world clinical problems** using **commercially available data**
3. Ensure the **robustness and utility** of the models through extensive validation
4. Collaborate with clinicians to package the models in **user-friendly interfaces** integrating smoothly into **standardized clinical workflows**

# Background

Per

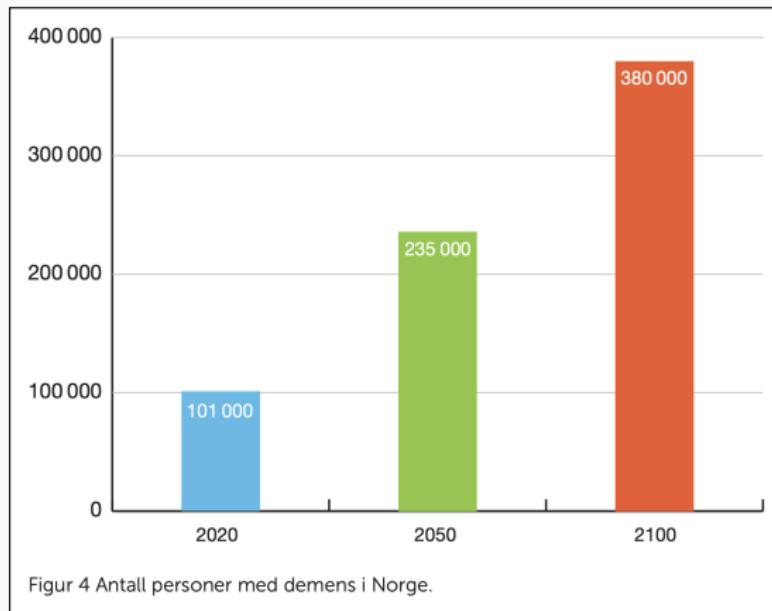
# Background

Per

# Decision support for neuroradiological examinations in dementia pre-diagnosis

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# Neuroradiological decision support



# Neuroradiological decision support

Radiology time spent

# Neuroradiological decision support

	1	2	3	4	5
1	38	273	17	4	0
2	0	92	144	12	0
3	0	6	89	31	2
4	0	0	3	19	5
5	0	0	0	0	5

Neuroradiological decision support

This screenshot shows a medical AI interface for a brain scan analysis. The top navigation bar includes 'Subject: "Bibi"', 'MRI-Scans' (selected), 'Reports', and 'Individuals'. The date '2024-09-16 MRI T1' is displayed along with a 'Generate draft report with AI' button.

The left sidebar has sections for 'Navigator', 'MRI-scans' (selected), 'Reports', and 'Individuals'. Below this are three thumbnail images of previous scans: '2024-09-16 MRI T1', '2024-09-16 MRI T2', and '2024-09-16 MRI PD'.

The main area features an 'Overview' section with four key metrics:

- Brain Age: 75 (+11.01%)
- Dementia index: 7/10 (-0.03%)\*
- Microhemorrhages: 5 (+15.03%)
- Total volume change (ml): 2,318 (+6.08%)

Below the overview are three grayscale brain scan images showing specific regions highlighted in red, green, and blue. Each highlight is accompanied by a circular slider control.

The 'Score' section lists various dementia risk factors with corresponding sliders:

- MTA: Low risk (red)
- CGA: Moderate risk (grey)
- Fazekas: Low risk (red)
- PSMD: Moderate risk (grey)
- CAA: Low risk (red)

The 'Differential diagnosis' section lists conditions with sliders indicating risk levels:

- Vascular dementia: High risk (red)
- Levy body dementia: Moderate risk (grey)
- Alzheimer: High risk (red)
- Huntington: Low risk (red)

The 'XAI Image highlights' section shows three specific findings with colored dots:

- Highlight 1: Red dot (vascular dementia)
- Highlight 2: Blue dot (Levy body dementia)
- Highlight 3: Green dot (Alzheimer)

The right side of the interface displays 'Subject data' (Age: 75, Sex: M) and an 'Image history' section listing previous scans and a PET scan.

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Neuroradiological decision support

The screenshot displays a dashboard for a medical AI system. At the top, it shows the subject as "Bibi" and the date as "2024-09-16 MRI T1". It includes a "Generate draft report with AI" button and a "Subject data" section with fields for Age (75), Sex (M), and Image history (MRI scans from today, Step 4, and Feb 2, 2024, along with a PET scan from Feb 2, 2024).

**Overview**

Brian Age	Dementia index	Microhemorrhages	Total volume change (mL)
75 +11.01%	7/10 -0.03% *	5 +15.03%	2,318 +6.08% *

**Image History**

- MRI scan (T1, T2, PD) Today, 11:59 AM
- MRI scan (T1, T2, PD) Step 4, 2024
- MRI scan (T1, T2, PD) Feb 2, 2024
- PET scan Feb 2, 2024

**Score**

Score	MTA	CSA	Fazekas	PSMD	CAA
● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●

**Differential diagnosis**

Vascular dementia	Levy body dementia	Alzheimer	Huntington
● ● ●	● ● ●	● ● ●	● ● ●

**XAI Image highlights**

Highlight 1	Highlight 2	Highlight 3
●	●	●

**Individuals**

- Individuals

**Reports**

- Reports

**MRI-scans**

- MRI-scans

**Navigator**

- Navigator

**Subject: "Bibi"**

**2024-09-16 MRI T1**

**2024-09-16 MRI T2**

**2024-09-16 MRI PD**

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# Treatment response prediction and monitoring of patients on anti-amyloid therapies

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# Treatment response and monitoring

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Home > News > Leqembi recommended for treatment of early Alzheimer's disease



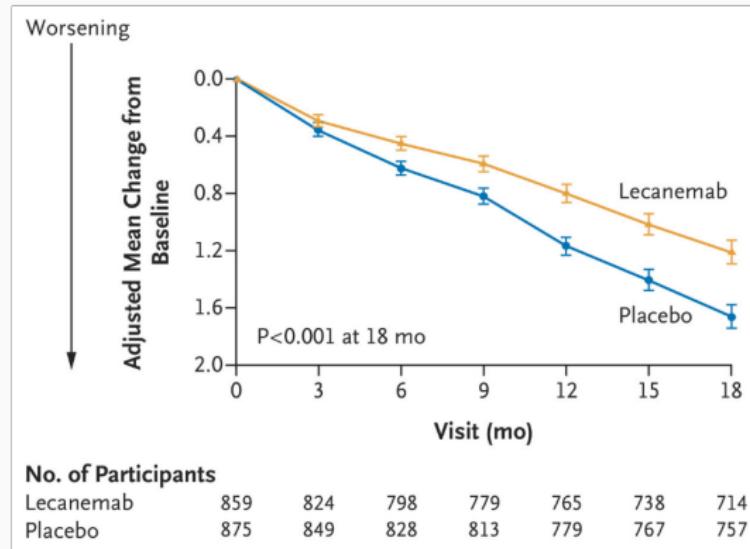
**Leqembi recommended for treatment of early Alzheimer's disease**

14 November 2024

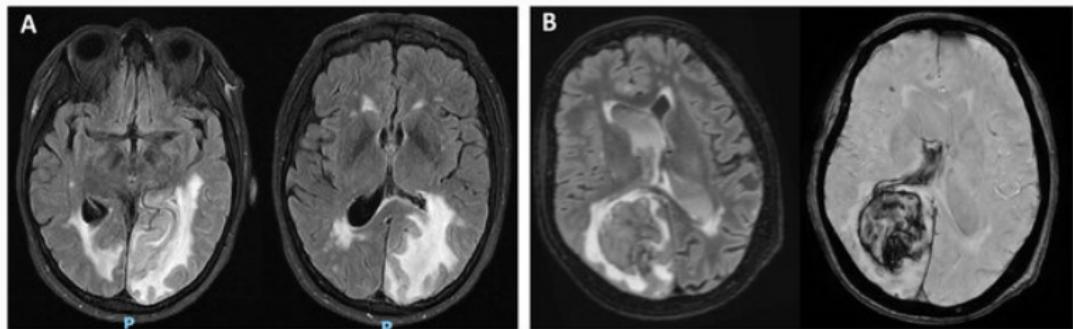
Re-examination concludes that benefits outweigh risks in a restricted patient population

**News** **Human** **Medicines**

# Treatment response and monitoring



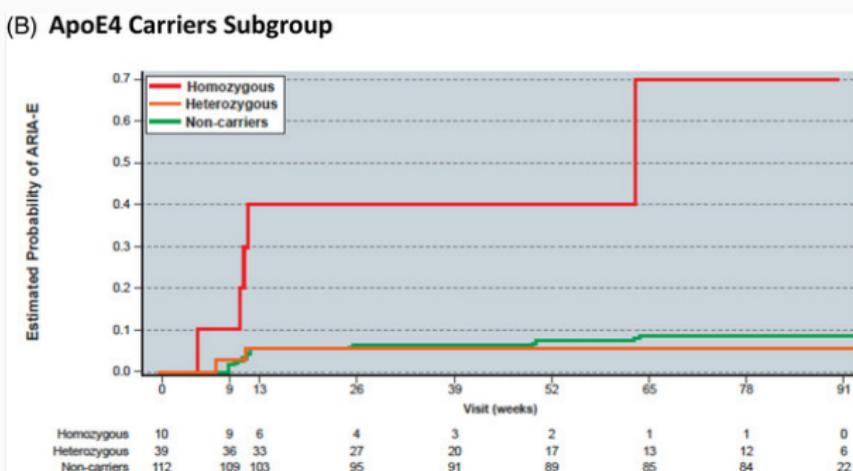
# Treatment response and monitoring



Villain, N., Planche, V., & Levy, R. (2022). High-clearance anti-amyloid immunotherapies in Alzheimer's disease. Part 1: Meta-analysis and review of efficacy and safety data, and medico-economical aspects. *Revue neurologique*, 178(10), 1011-1030.

# Treatment response and monitoring

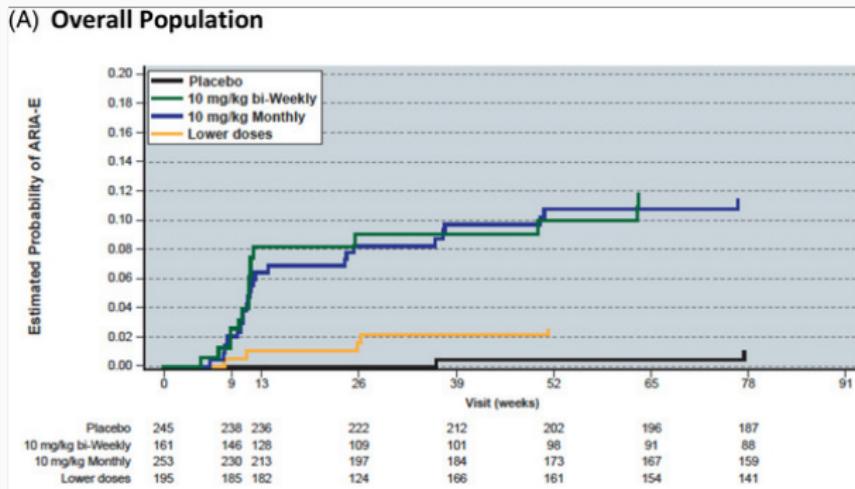
## (B) ApoE4 Carriers Subgroup



Honig, L. S., Barakos, J., Dhadda, S., Kanekiyo, M., Reyderman, L., Irizarry, M., ... & Sabbagh, M. (2023). ARIA in patients treated with lecanemab (BAN2401) in a phase 2 study in early Alzheimer's disease.

*Alzheimer's & Dementia: Translational Research & Clinical Interventions*, 9(1), e12377.

# Treatment response and monitoring



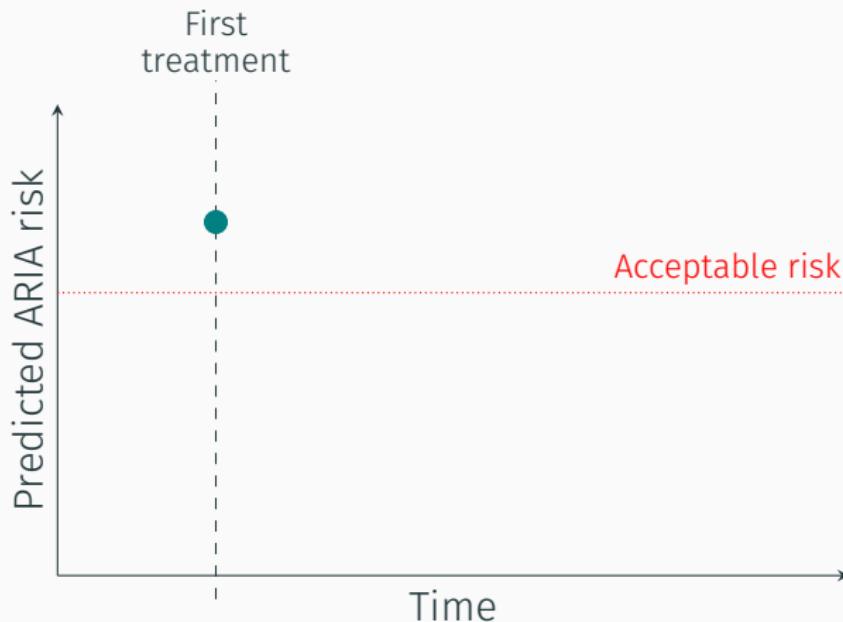
Honig, L. S., Barakos, J., Dhadda, S., Kanekiyo, M., Reyderman, L., Irizarry, M., ... & Sabbagh, M. (2023). ARIA in patients treated with lecanemab (BAN2401) in a phase 2 study in early Alzheimer's disease.

*Alzheimer's & Dementia: Translational Research & Clinical Interventions*, 9(1), e12377.

# Treatment response and monitoring

"MRI-based exclusion criteria of the lecanemab phase 3 (CLARITY AD) study included a history of any CNS macrohemorrhage >10 mm in diameter, more than 4 microhemorrhages (<10 mm in diameter), evidence of superficial siderosis, evidence of brain vasogenic edema, significant white matter hyperintensities, multiple lacunar strokes, or any cerebral strokes involving a major vascular territory. Evidence of cerebral contusion, encephalomalacia, brain aneurysms or other vascular malformations, central nervous system (CNS) infection, and brain tumors other than meningioma or arachnoid cysts excluded patients from phase 3 trial participation. **These same restrictions should apply when considering patients for treatment with lecanemab.** MRI evidence of underlying CAA-ri/ABRA or other conditions placing patients at risk for ARIA as well as more serious forms of ARIA should exclude patients as treatment candidates."

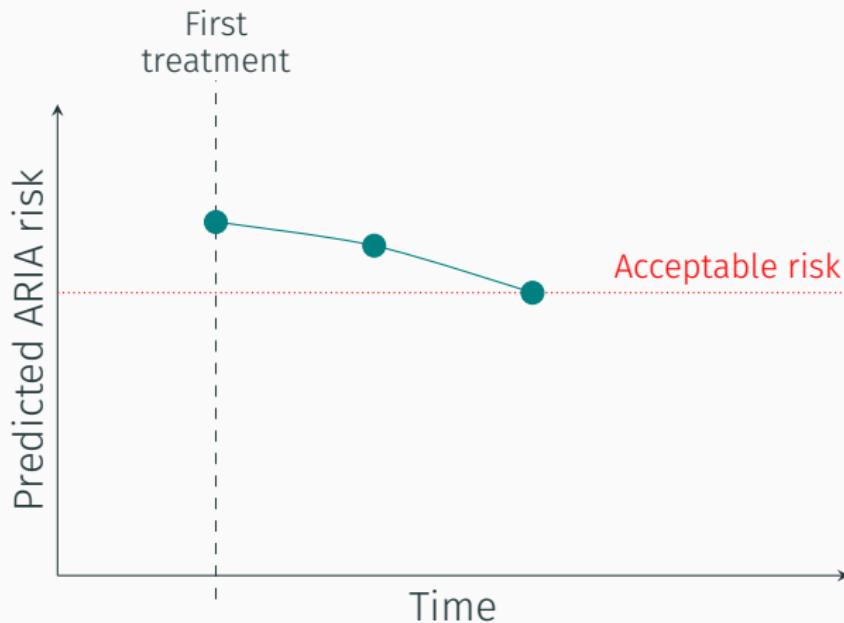
# Treatment response and monitoring



# Treatment response and monitoring

"We recommend obtaining MRIs after the **5th, 7th, and 14th infusions** as outlined in the PI. We recommend an additional week 52 (i.e., before the 26th infusion) MRI scan, especially for APOE4 carriers and those with evidence of ARIA on earlier MRIs."

# Treatment response and monitoring



# Treatment response and monitoring

**SAMPLE**  
**ARIA-H Report**

icobrain aria by icometrix

DATE OF BIRTH: 1952-01-01 STUDY DATES: 2018-02-06 - 2018-11-21 ID: ICO ID:

STATUS: Intermediate REMARKS: Not for clinical use.

**Microhemorrhages**

NEW COUNT	EVALUATED SEVERITY
6	Moderate

	Left (count)	Right (count)
Frontal Lobe	0	0
Parietal Lobe	0	0
Occipital Lobe	0	0
Temporal Lobe	0 + 6	0
Total (count)	0	0
Cerebellum	0	0
Other	0	0
Whole Brain	0 + 6	0

Note: In benchmark tests, automated measurements for patients with evaluated MODERATE or SEVERE Microhemorrhages. Severely had, on average, the following errors: 4.6 missed new microhemorrhages, and 5.1 false positive new microhemorrhages.

**Severity**

- No new incidents
- Less than 5 new incidents
- 5 to 9 new incidents
- 10 or more new incidents
- New incidents

**Superficial Siderosis**

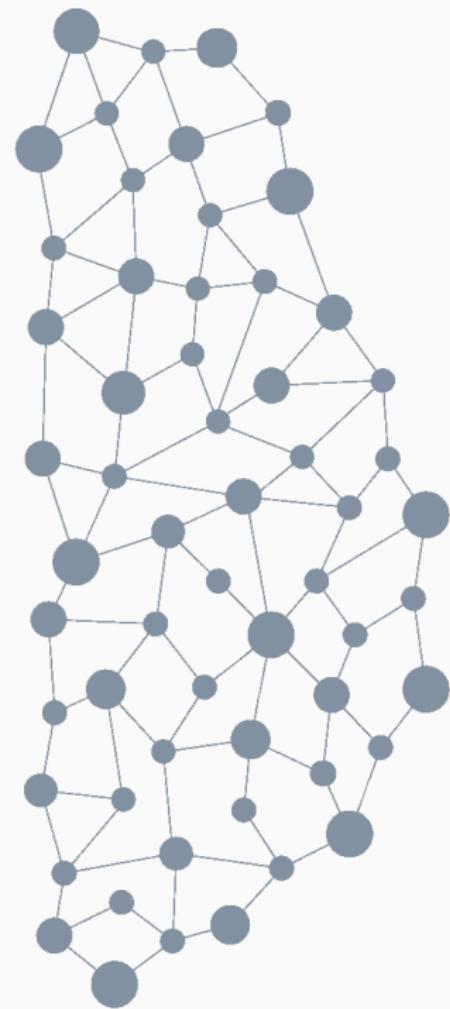
NEW COUNT	EVALUATED SEVERITY
0	None

	Left (count)	Right (count)
Frontal Lobe	0	0
Parietal Lobe	0	0
Occipital Lobe	0	0
Temporal Lobe	0	0
Total (count)	0	0
Cerebellum	0	0
Other	0	0
Whole Brain	0	0

Note: In benchmark tests, automated measurements for patients with evaluated NONE. Superficial Siderosis. Severely had, on average, the following errors: 1.2 missed sites, and 0.0 false positive new superficial siderosis sites.

**Severity**

- No new areas
- 1 new area
- 2 new areas
- More than 2 new areas
- New incidents



Thank you for your attention!  
[esten@baba-vision.com](mailto:esten@baba-vision.com)