

# En introduksjon til kunstig intelligens og dets rolle i medisinsk forskning

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Esten H. Leonardsen

26.10.23



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1. Historikk
2. Hva er egentlig kunstig intelligens (og maskinlæring)?
3. Kunstig intelligens i hjerneforskning
4. Kunstig intelligens i kreftforskning



Turing  
(1950)



Alan Turing

Turing  
(1950)

MIND  
A QUARTERLY REVIEW  
OF  
PSYCHOLOGY AND PHILOSOPHY

I.—COMPUTING MACHINERY AND  
INTELLIGENCE

By A. M. TURING

1. *The Imitation Game.*

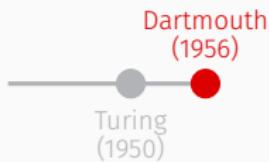
I PROPOSE to consider the question, ‘Can machines think?’ This should begin with definitions of the meaning of the terms ‘machine’ and ‘think’. The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words ‘machine’ and ‘think’ are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning and the answer to the question, ‘Can machines think?’ is to be sought in a statistical survey such as a Gallup poll. But this is absurd. Instead of attempting such a definition I shall replace the question by another, which is closely related to it and is expressed in relatively unambiguous words.





Turing  
(1950)

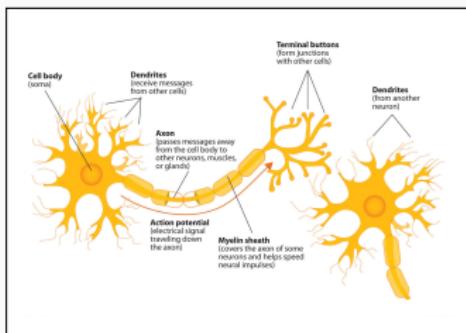
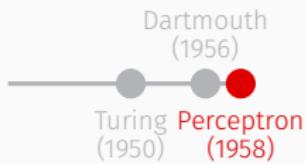




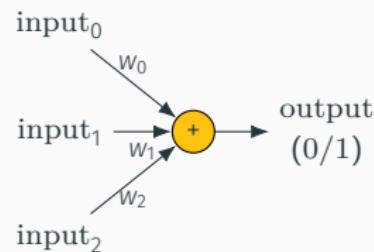
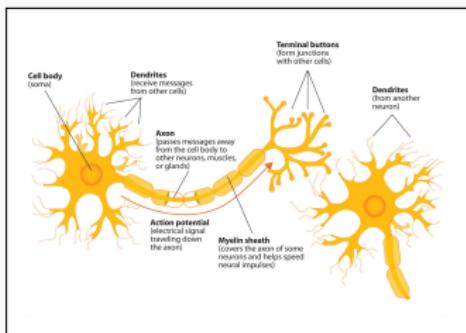
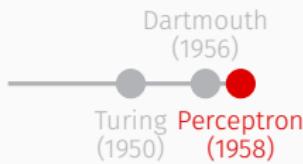
"We propose that a 2-month, 10-man study of artificial intelligence be carried out [...]. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in [...] a summer."

- Proposal, Dartmouth summer school (1956)

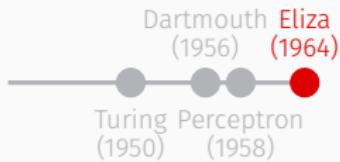
# Historikk



# Historikk



# Historikk



Talk to Eliza by typing your questions and answers in the input box.

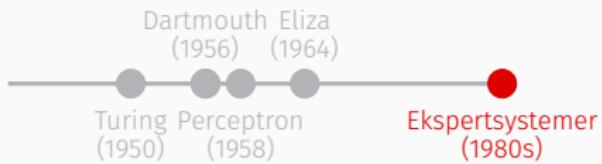
```
* I'm feeling kind of sad today
> Do you believe it is normal to be feeling kind of sad today?
* No, I would prefer to be happy
> Are you sure?
* Yes
> Are you sure about that?
* Yes
> Okay, now you're repeating yourself. That is not moving us forward.
* You started
> Oh... Let's move on to something else for a bit. started?
```

TYPE HERE

<https://web.njit.edu/~fonkowit/eliza.html>



# Historikk



1) Patient's name: (first-last)  
\*\* FRED BRAUN

2) Sex:  
\*\* M

3) Age:  
\*\* 55

4) Are there any cultures for Fred Braun which may be related to the present illness, and from which organisms have been grown successfully in the microbiology laboratory?  
\*\* y

{background patient data}

-----CULTURE-1-----

5) From what site was the specimen for CULTURE-1 taken?  
\*\* BLOOD

\*BLOOD

6) Please give the date and time when CULTURE-1 was obtained. (mo/day/year time)  
\*\* JUN 20, 1977

The first organism isolated from the blood culture of 20-JUN-77 (CULTURE-1) will be referred to as:

-----ORGANISM-1-----

7) Enter the laboratory-reported identity of ORGANISM-1:  
\*\* UNKNOWN

8) The stain (Gram or Ziehl-Neelsen acid-fast) of ORGANISM-1:  
\*\* NEG

9) Is ORGANISM-1 a rod or coccus (etc.):  
\*\* ROD

10) What is the form of the individual organisms (e.g. Lancelet-shaped for cocci, fusiform for rods, etc.)?  
\*\* FUSIFORM

{typically identity is not yet known}

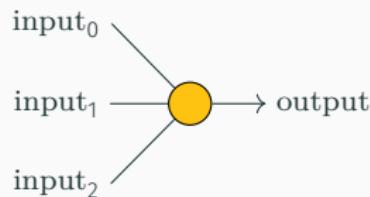
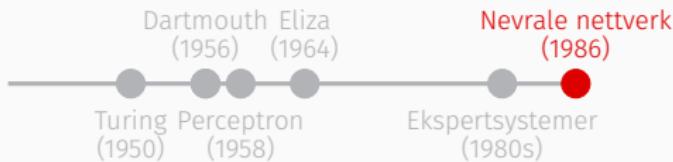
{preliminary lab results give some clues}

{...more questions follow in order to gather sufficient information to infer the identity and significance of the infecting organisms...}

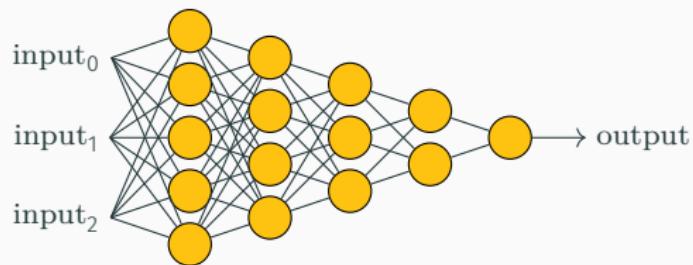
MYCIN (1972)

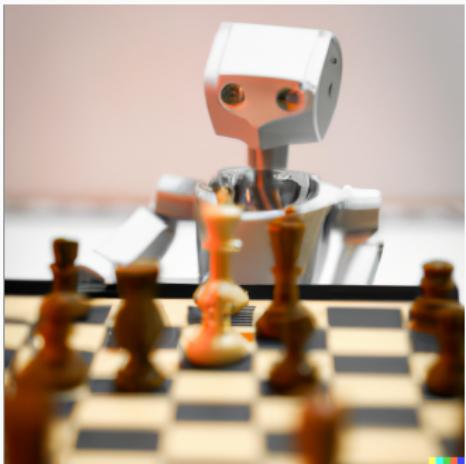
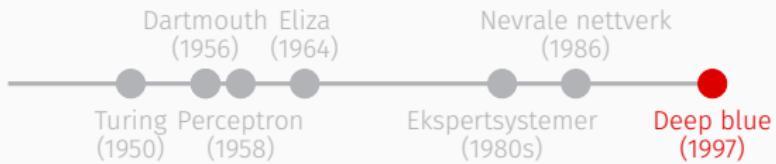


# Historikk



# Historikk





DALL-E: "A robot playing chess"

- IBMs Deep Blue ble den første datamaskinen som slo sittende verdensmester i sjakk.
- Deep blue vant med  $3\frac{1}{2}$  poeng mot Garry Kasparovs  $2\frac{1}{2}$  etter seks spill.
- Kasparov har uttalt at "Deep Blue was intelligent the way your programmable alarm clock is intelligent."
- Avanserte søkealgoritmer og preprogrammert kunnskap fra sjakkekspertene.

# Historikk



Katt



# Historikk



Solsikke



Marihøne



Katt



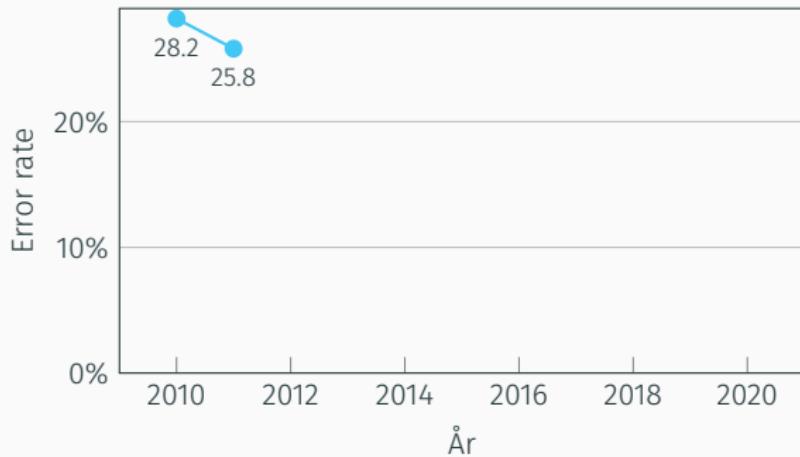
Fly



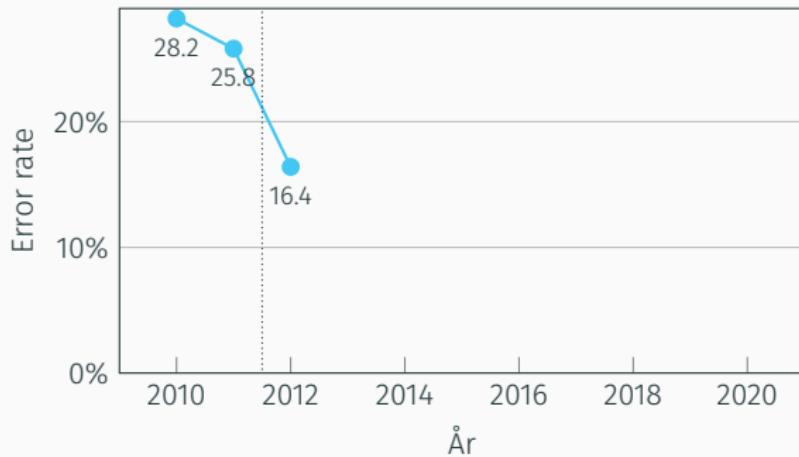
Hvithai

ImageNet: ~14m bilder fra ~22k kategorier

# Historikk



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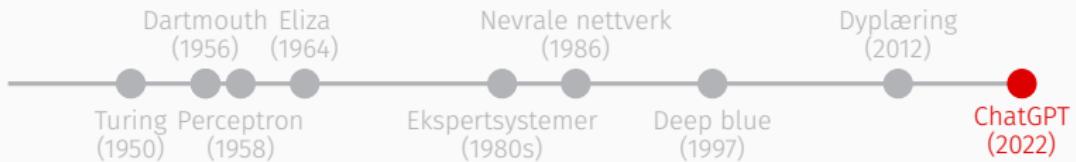


# Historikk



# Historikk





You  
Can you help me describe some high-level commonalities between the usage of AI in cognitive neuroscience and cancer research?

ChatGPT  
Absolutely, the use of Artificial Intelligence (AI) in both cognitive neuroscience and cancer research, though applied in distinct fields, shares several high-level commonalities:

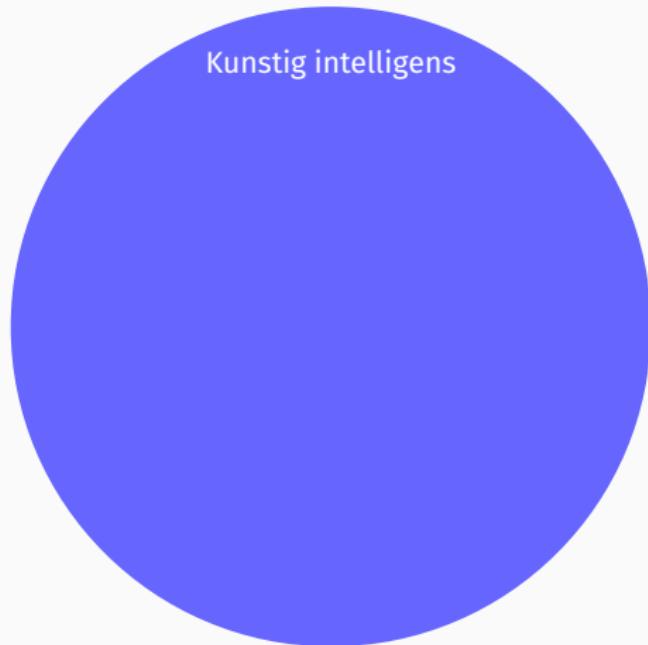
- Data Analysis and Pattern Recognition:** Both fields generate massive amounts of complex data. In cognitive neuroscience, this might be functional MRI scans or EEG data, while in cancer research, it could be genomic sequences or cell imaging data. AI excels in identifying patterns and correlations within these large datasets, which might be too subtle or complex for traditional analysis methods.
- Predictive Modeling:** AI is used to develop models that can predict outcomes. In cognitive neuroscience, this might involve predicting cognitive abilities or the progression of neurological diseases based on brain imaging data. In cancer research, AI models predict disease progression, response to therapies, or patient prognosis based on genetic, cellular, or clinical data.
- Personalized Medicine:** Both fields benefit from AI's ability to tailor medical approaches to individual patients. In cognitive neuroscience, this could mean personalized treatment plans for neurological disorders. In cancer research, it facilitates the development of personalized therapy regimens based on the specific genetic makeup of a patient's tumor.
- Improving Diagnostic Accuracy:** AI algorithms can augment the diagnostic process by providing more accurate interpretations of medical imaging or laboratory results, whether it's identifying subtle changes in brain scans that might signal the onset of a disorder or detecting early signs of cancer in imaging or biopsy data.

## Hva er egentlig kunstig intelligens (og maskinlæring)?



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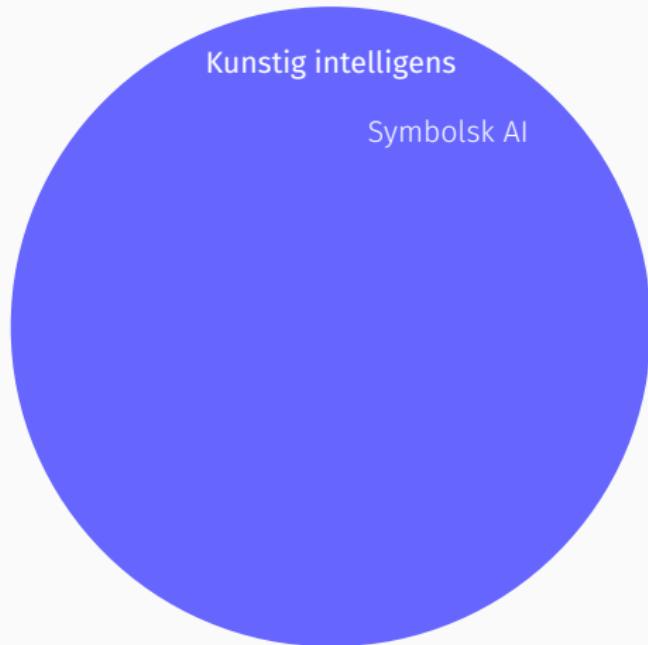
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**Kunstig intelligens (AI):**  
Maskiner som løser problemer  
som krever intelligens



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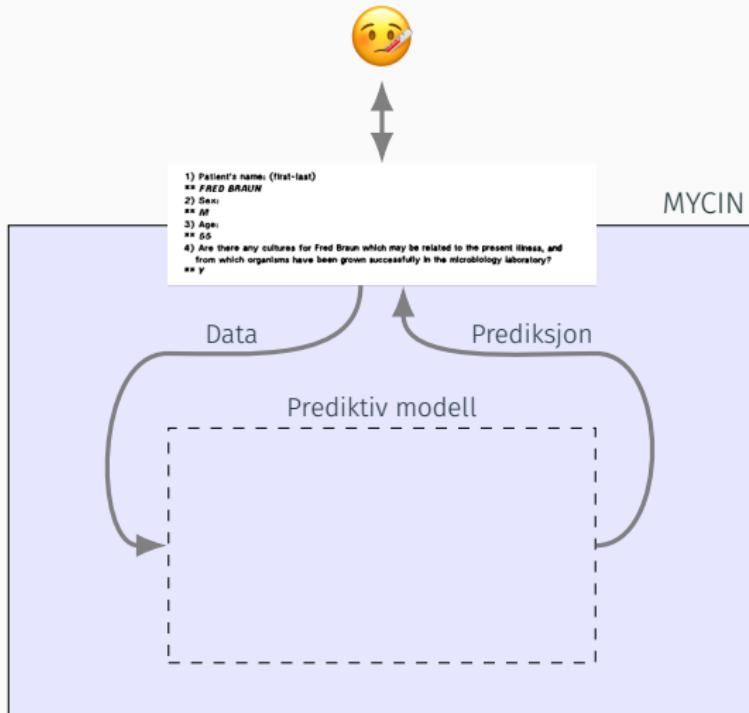


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\*\* FRED BRAUN  
2) Sex:  
\*\* M  
3) Age:  
\*\* 65  
4) Are there any cultures for Fred Braun which may be related to the present illness, and from which organisms have been grown successfully in the microbiology laboratory?  
\*\* Y

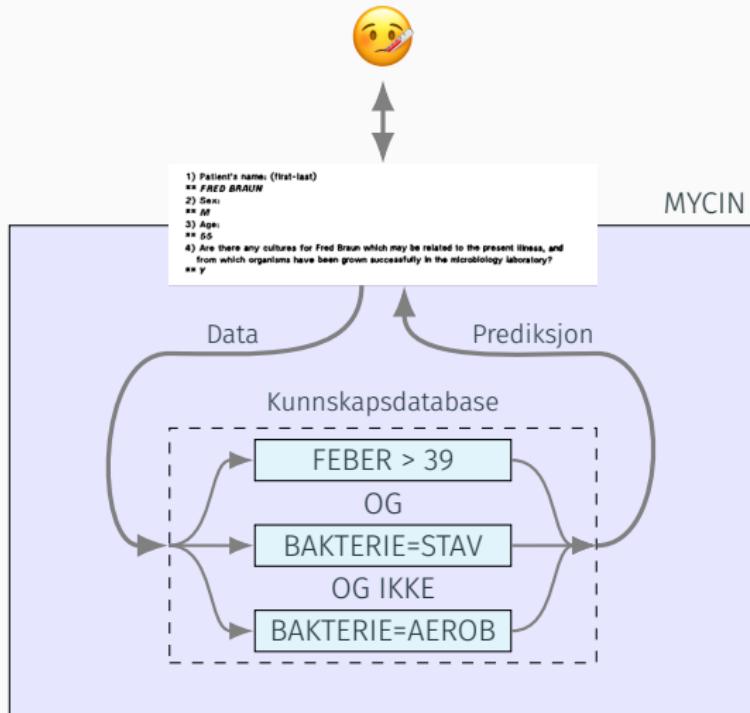
MYCIN



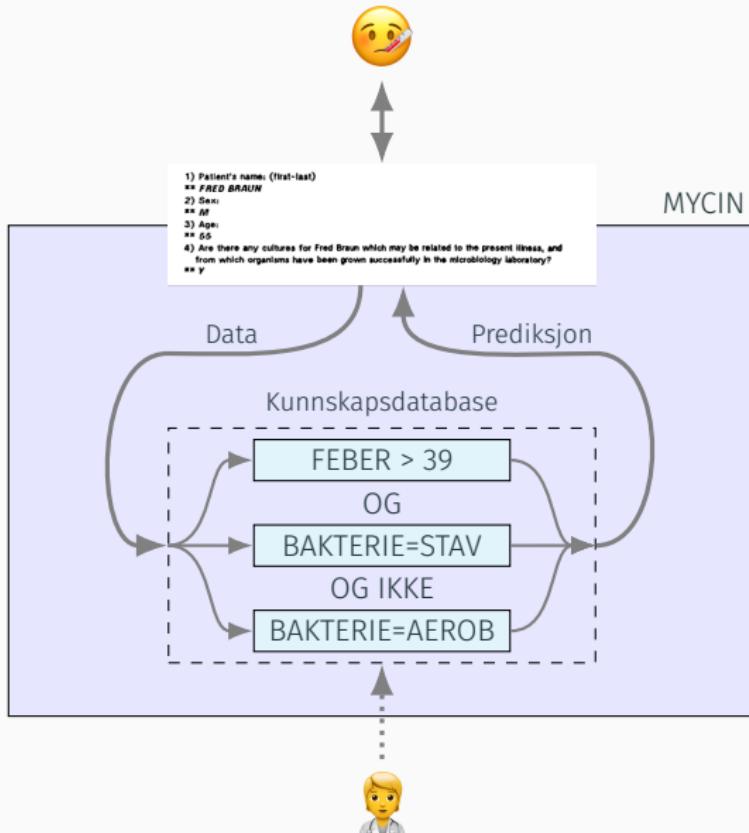
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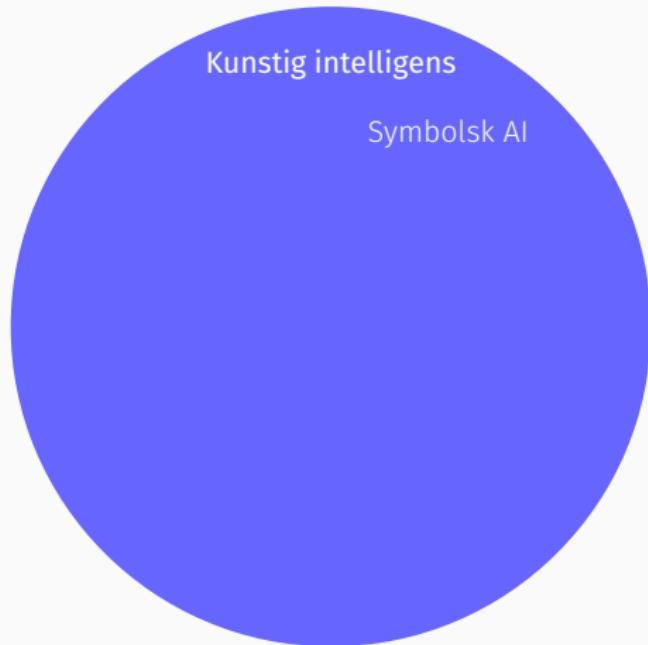
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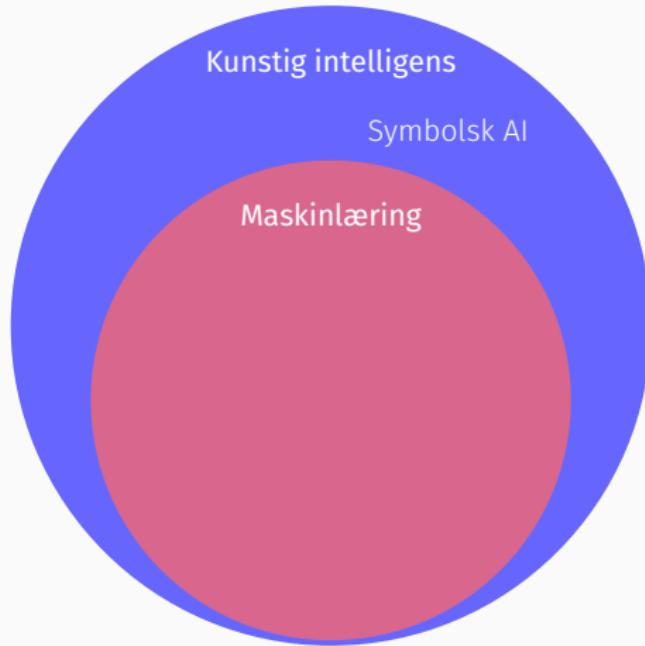
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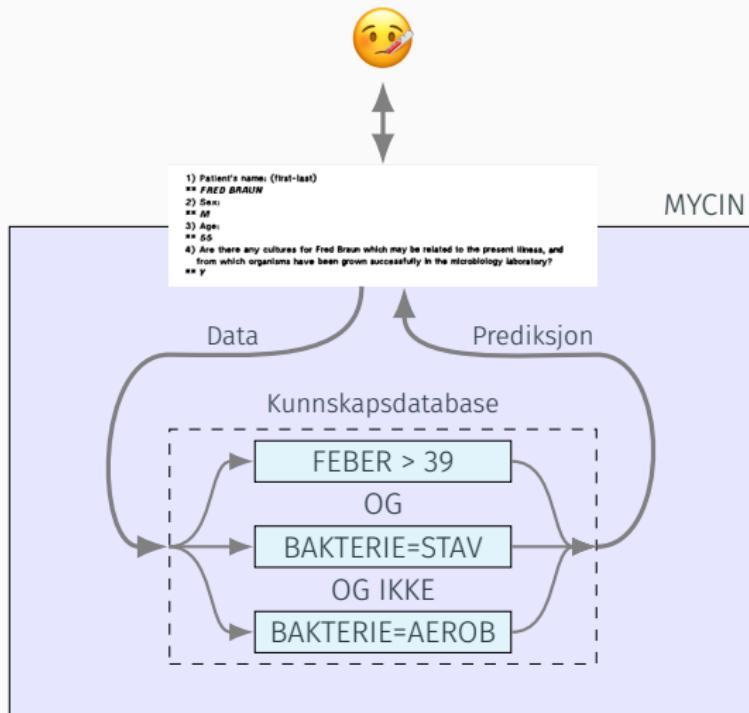


**Kunstig intelligens (AI):**  
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**Maskinlæring:**  
Maskiner som lærer å løse problemer gjennom å finne mønster i data



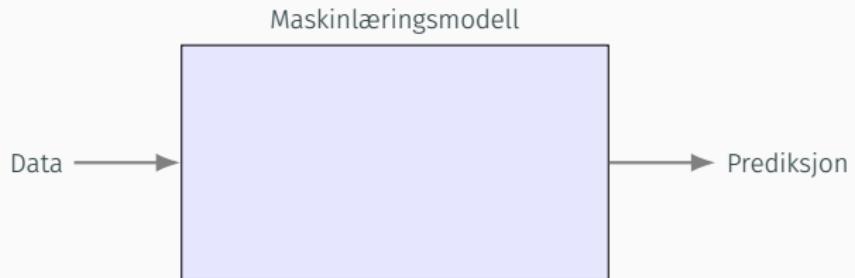
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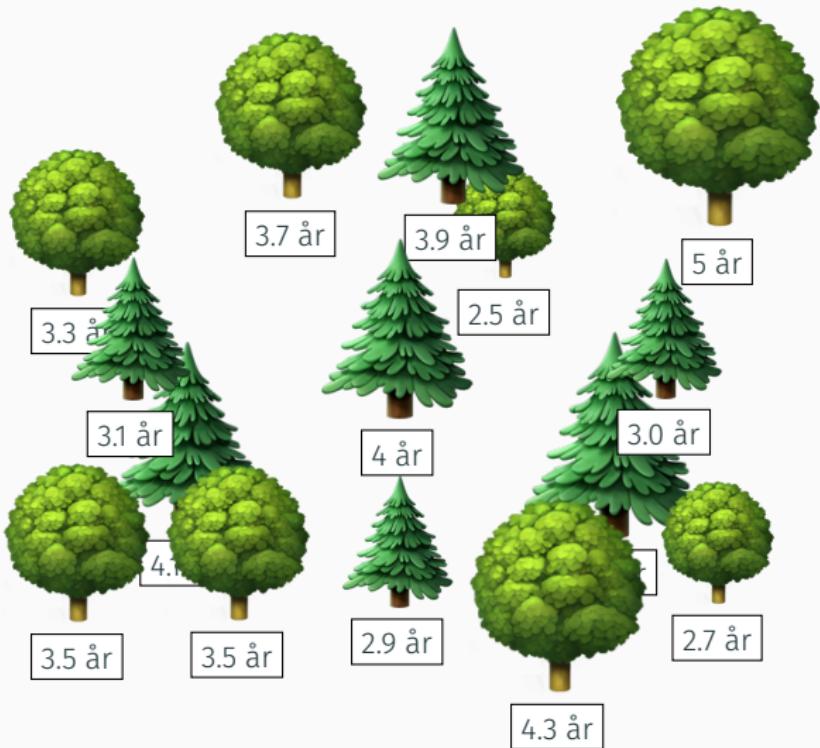
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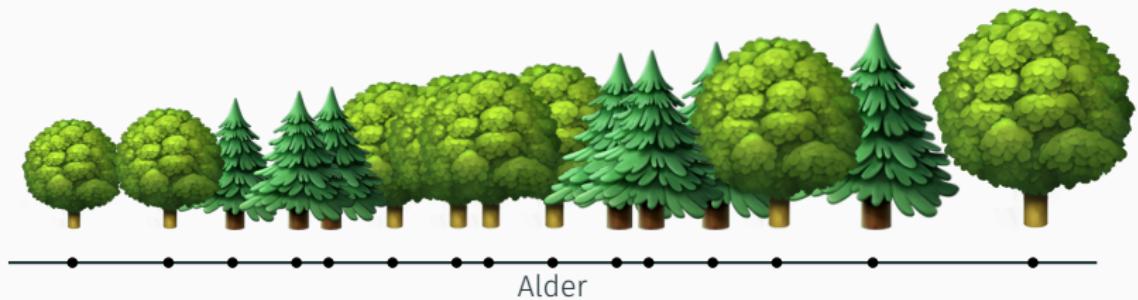
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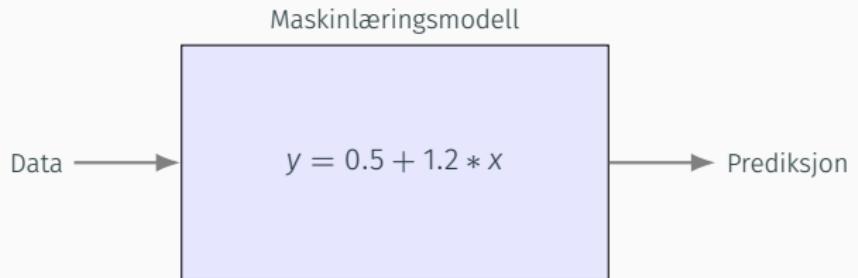
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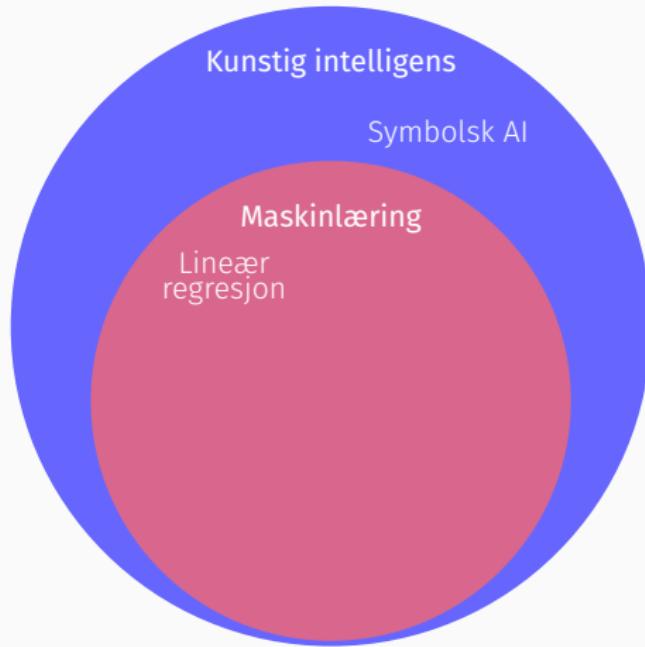
$$høyde = 0.5 + 1.2 \cdot alder$$



# Hva er kunstig intelligens?



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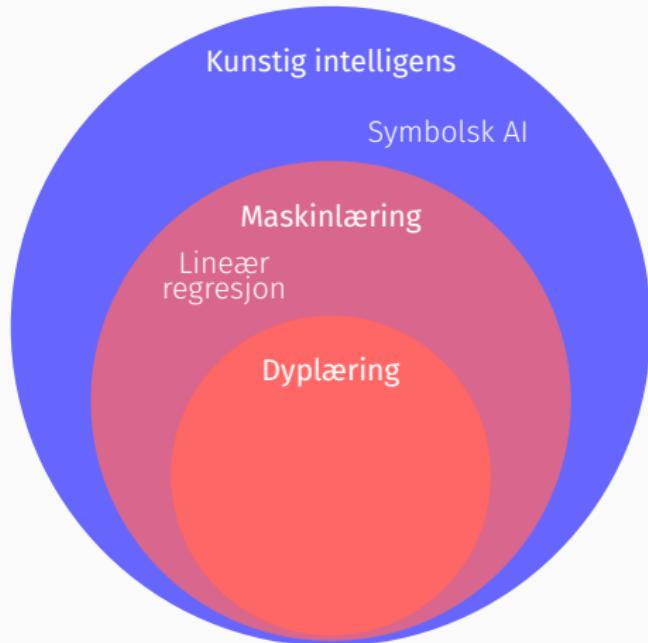


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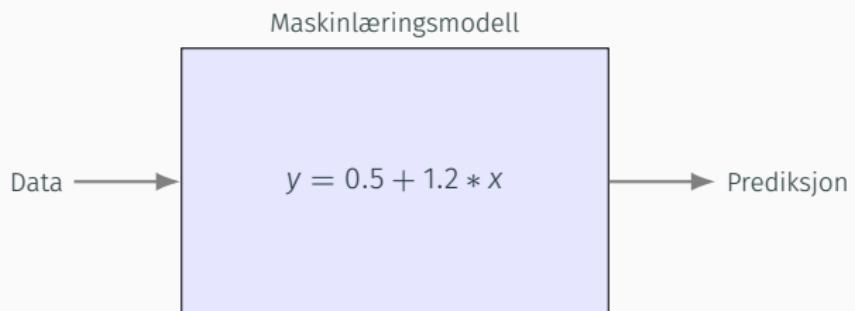
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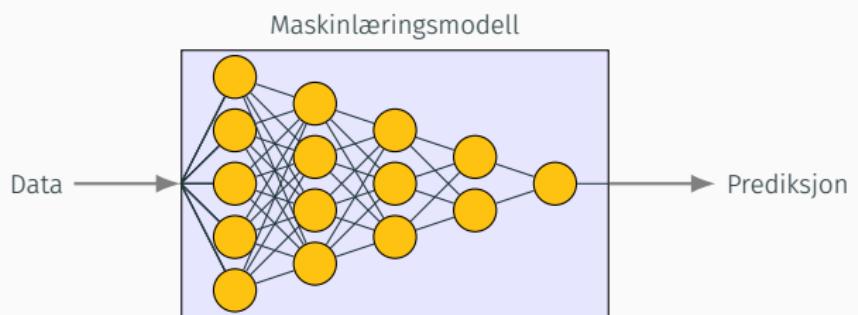
**Dyplæring:**  
Maskinlæringsmodeller som er hierarkisk organisert ( $\approx$  dype nevrale nettverk), inspirert av hjernens struktur



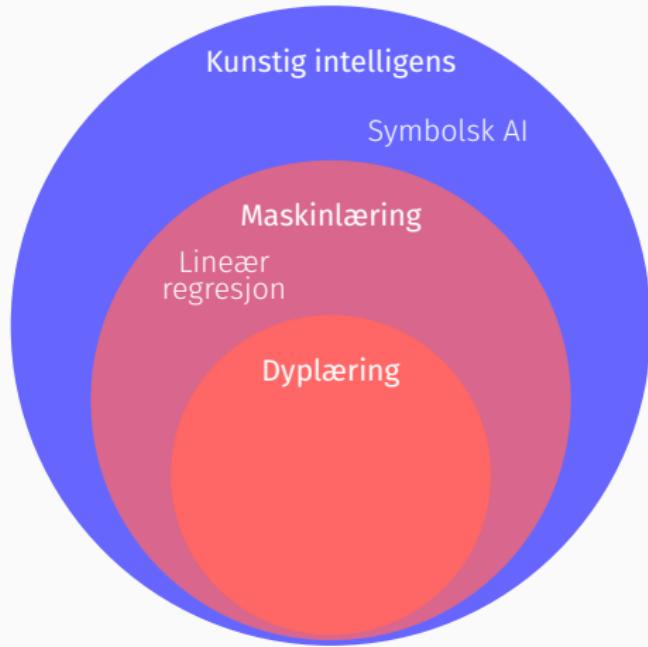
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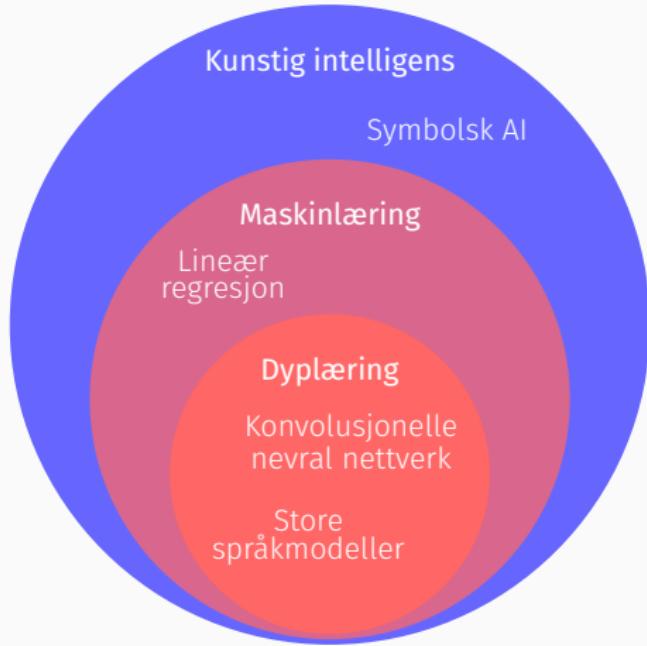


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**Konvolusjonelle nevrale nettverk:**  
Nevrale nettverk for prosessering av bildedata

**Store språkmodeller:**  
(Store) nevrale nettverk for språkprosessering (ChatGPT)



# Terminologi: Veiledet vs ikke-veiledet læring

Veiledet læring  
(Supervised learning)



→ Katt



→ Hund

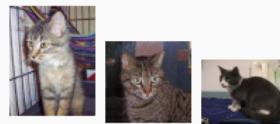


→ Katt



→ Hund

Ikke-veiledet læring  
(Unsupervised learning)



# Kunstig intelligens i medisinsk forskning

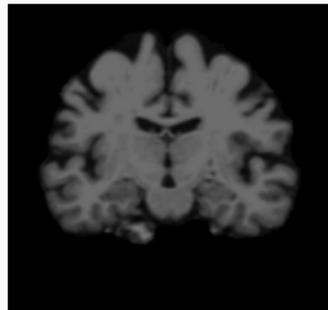
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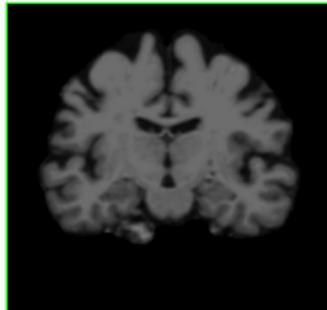
# AI i hjernehjerneforskning: Presisjonsdiagnostikk



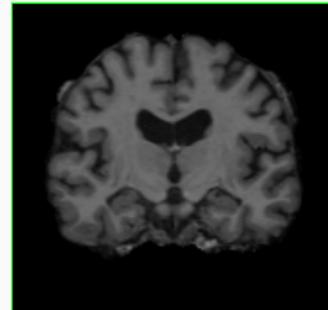
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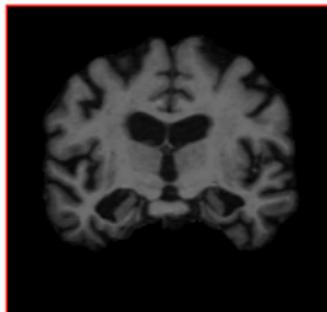
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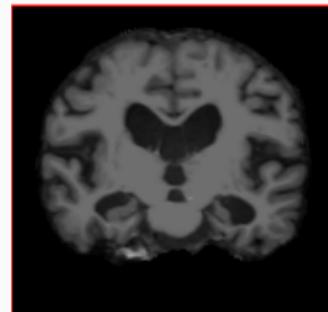
Frisk



Frisk



Pasient

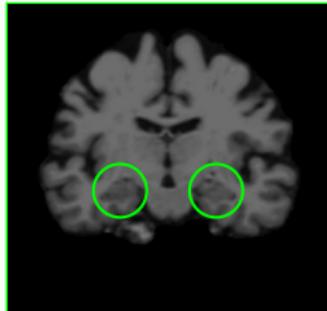


Pasient

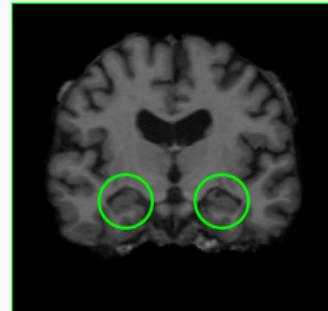
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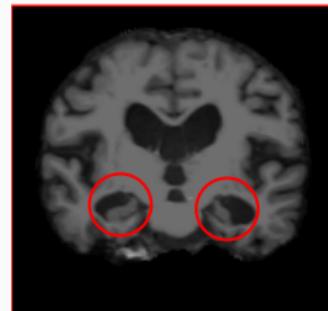
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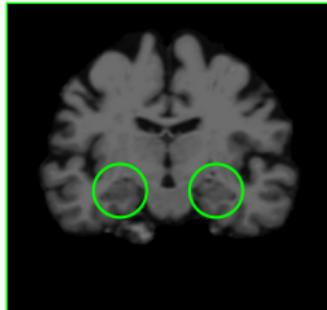


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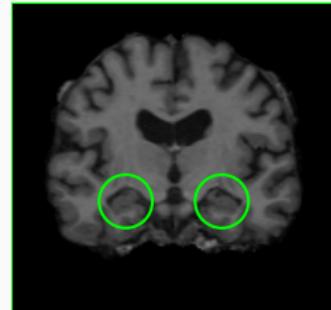
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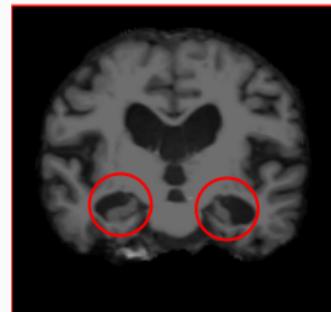
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Frisk



Ikke effektiv  
Talevansker  
Pasient

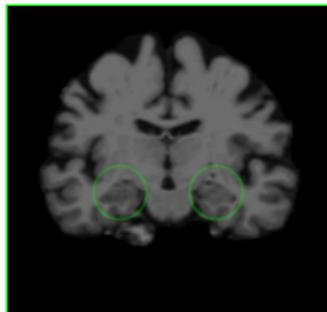


Effektiv  
Hukommelsessvikt  
Pasient

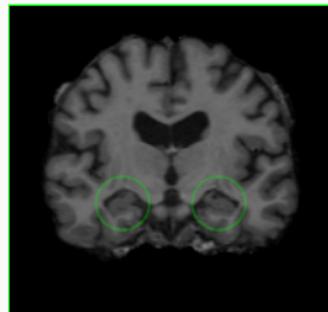
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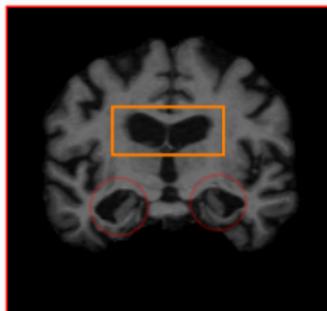
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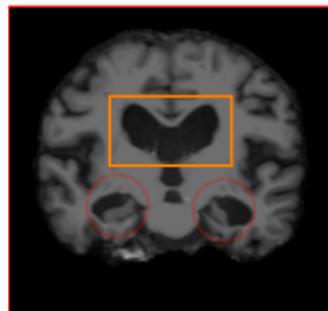
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Frisk



Ikke effektivt  
Talevansker  
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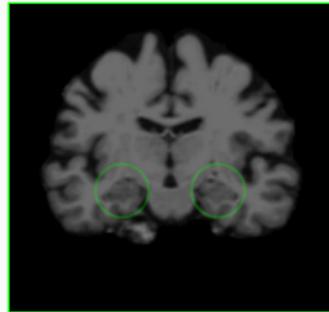


Effektiv  
Hukommelsesssvikt  
Pasient

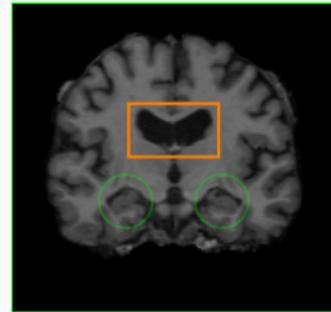
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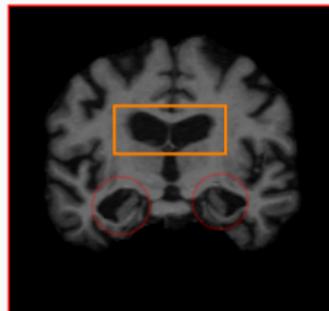
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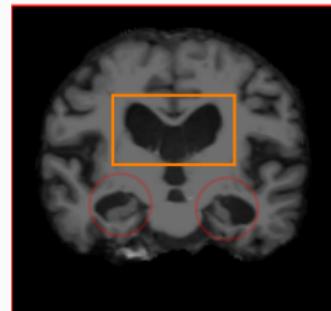
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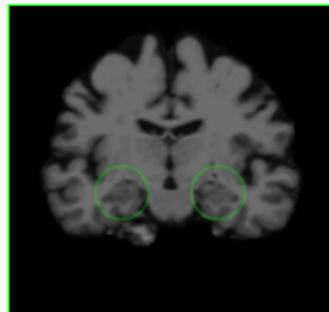


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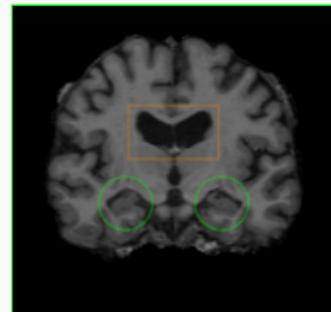
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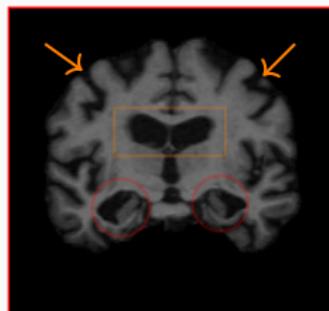
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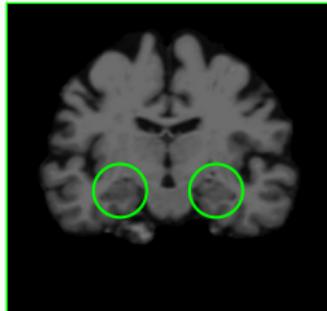


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Hukommelsessvikt  
Pasient

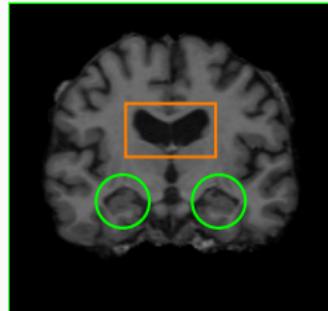
Data fra Open Access Series of Imaging Studies 3 (OASIS-3)



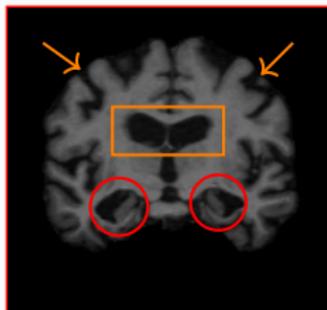
# AI i hjernehjerneforskning: Presisjonsdiagnostikk



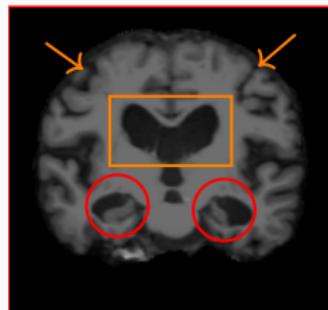
74 år  
Kvinne  
Frisk



75 år  
Mann  
Frisk



84 år  
Mann  
Ikke effektivt  
Talevansker  
Pasient

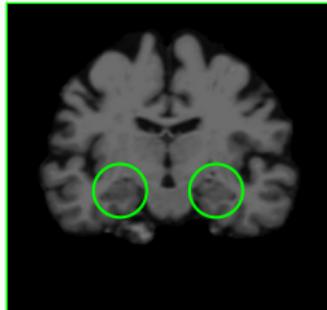


81 år  
Kvinne  
Effektivt  
Hukommelsessvikt  
Pasient

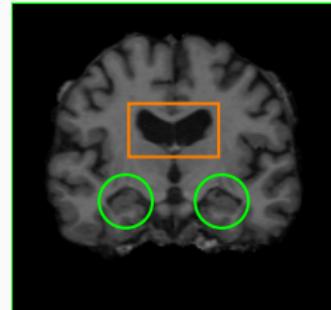
Data fra Open Access Series of Imaging Studies 3 (OASIS-3)



# AI i hjernehjerneforskning: Presisjonsdiagnostikk



74 år  
Kvinne  
Frisk



75 år  
Mann  
Frisk



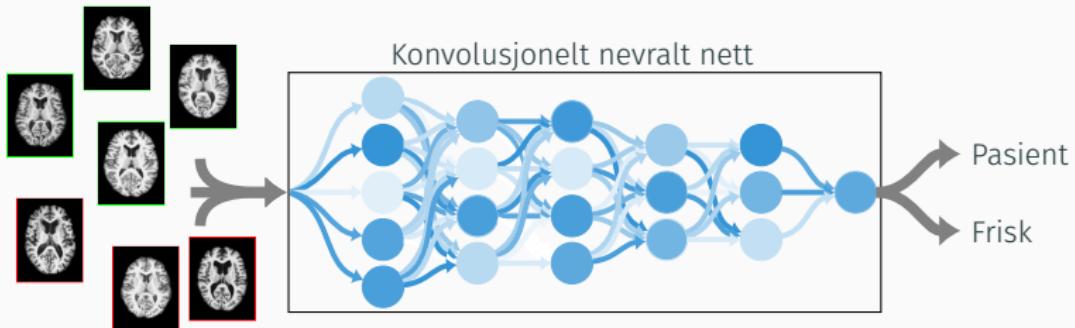
84 år  
Mann  
Ikke effektivt  
Talevansker  
Pasient

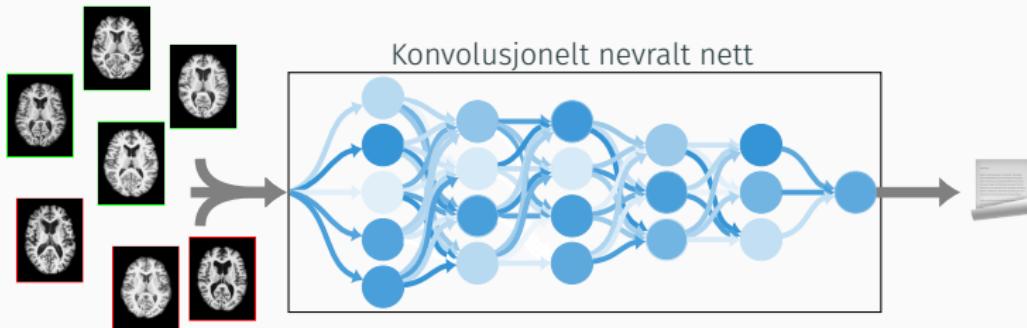


81 år  
Kvinne  
Effektivt  
Hukommelsessvikt  
Pasient

Data fra Open Access Series of Imaging Studies 3 (OASIS-3)

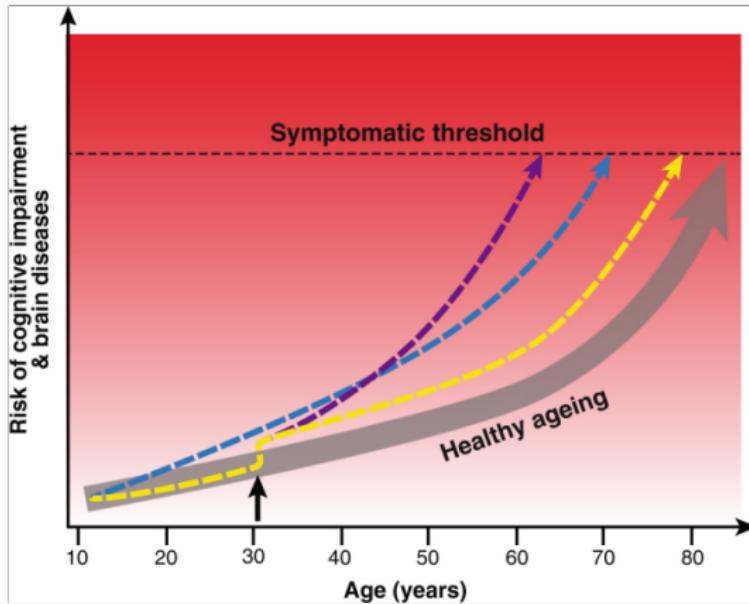








# AI i hjernehforskning: Hjernealder

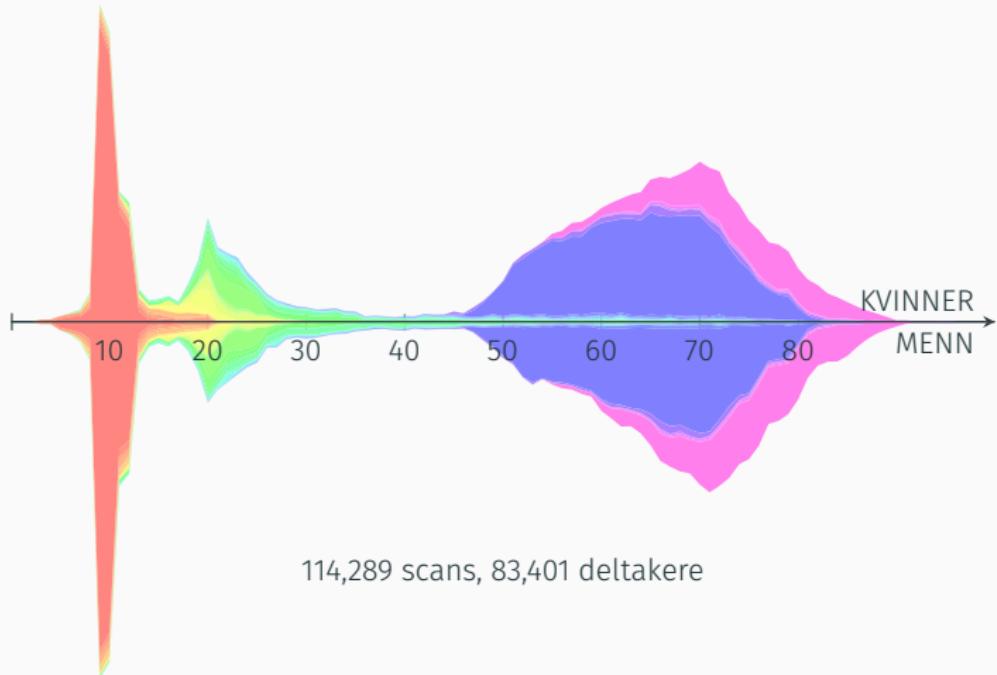


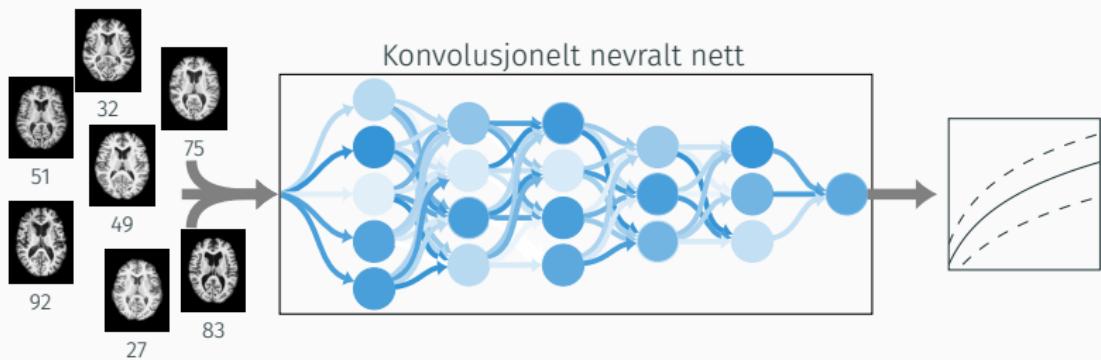
Brain age and other bodily 'ages': implications for neuropsychiatry

Cole et al., *Molecular Psychiatry* (2019)

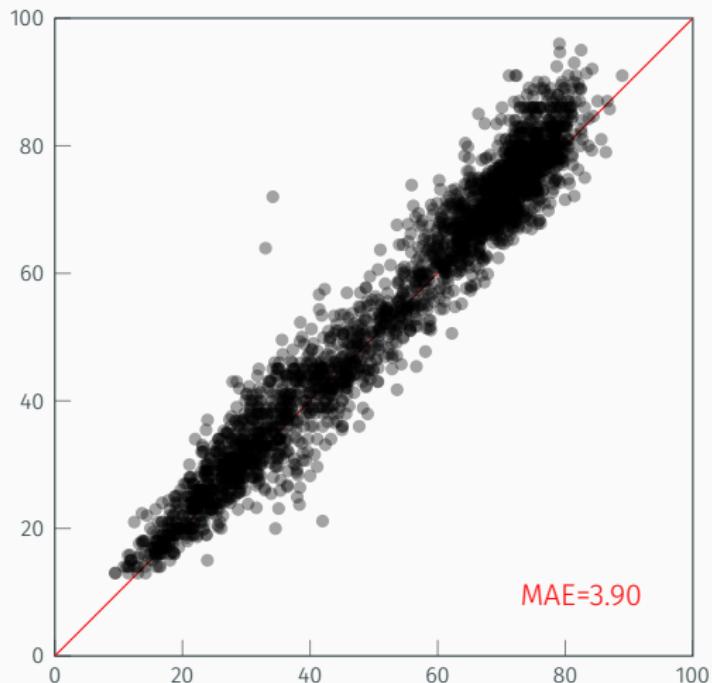


# AI i hjernehforskning: Hjernealder

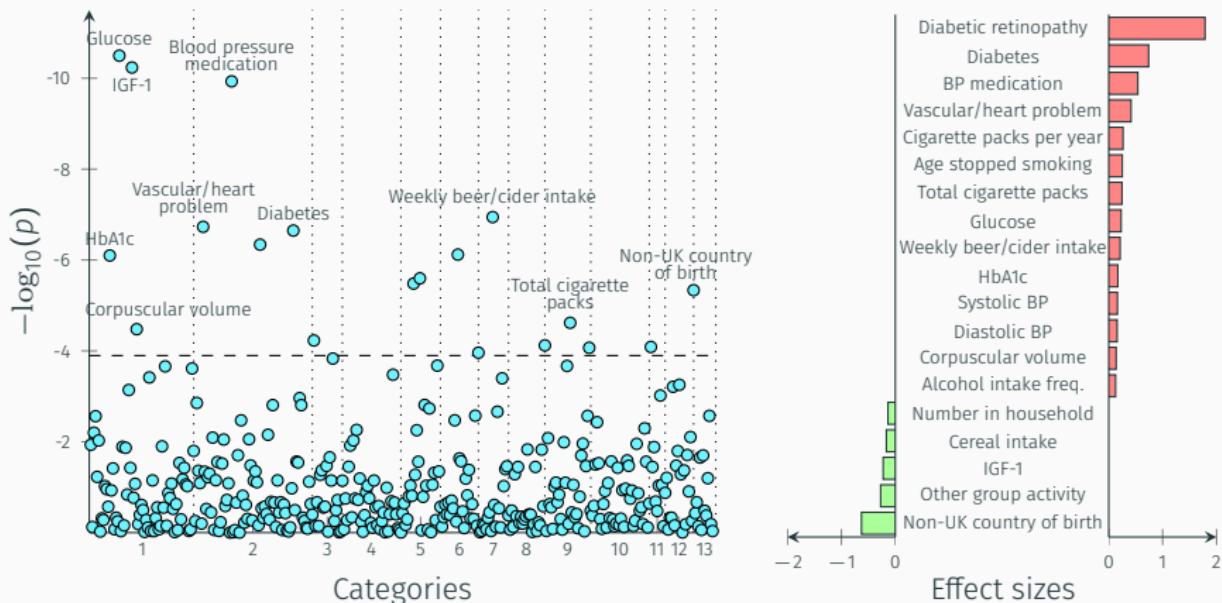




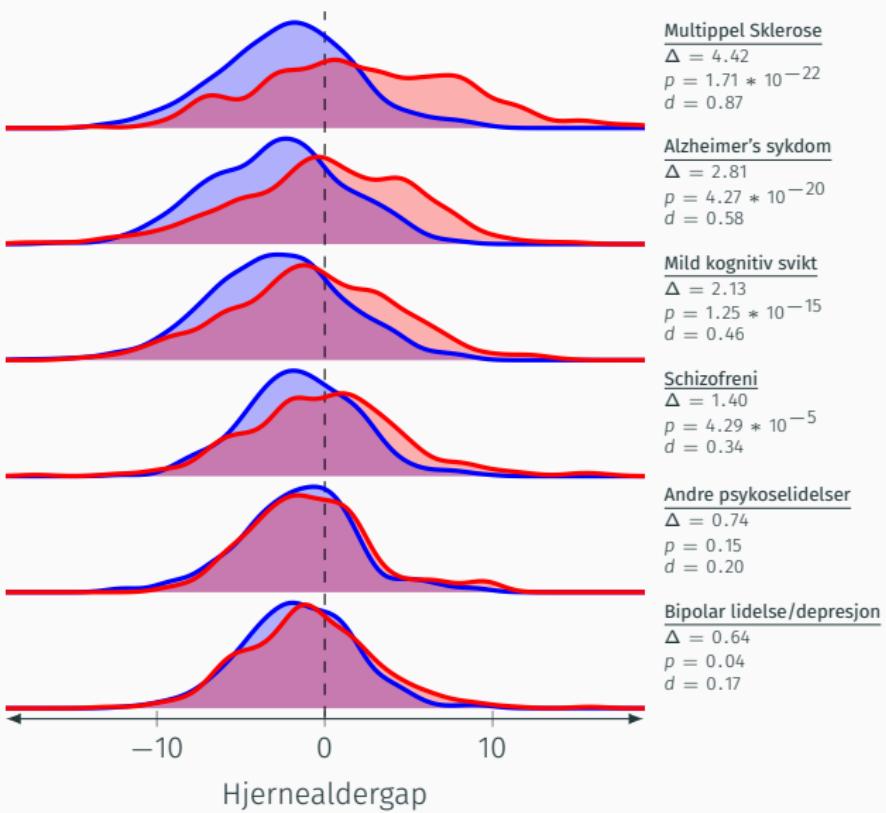
# AI i hjernehforskning: Hjernealder



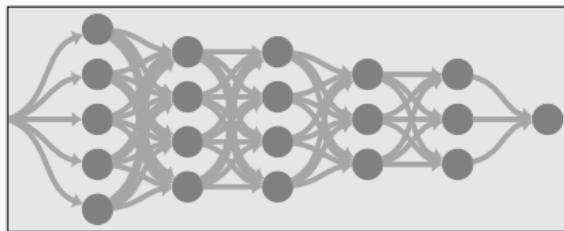
# AI i hjernehalskning: Hjernealder



# AI i hjernehelseforskning: Hjernealder

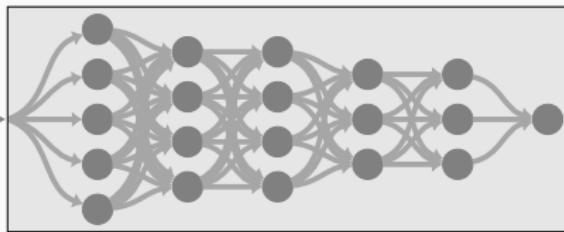


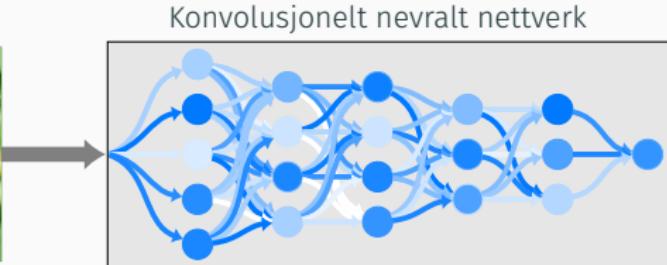
Konvolusjonelt nevralgt nettverk

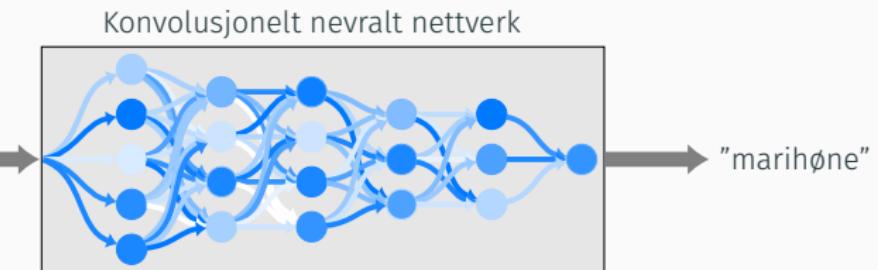


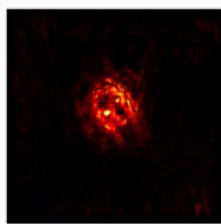


Konvolusjonelt nevralgt nettverk

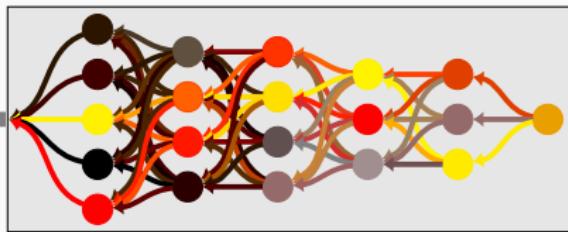






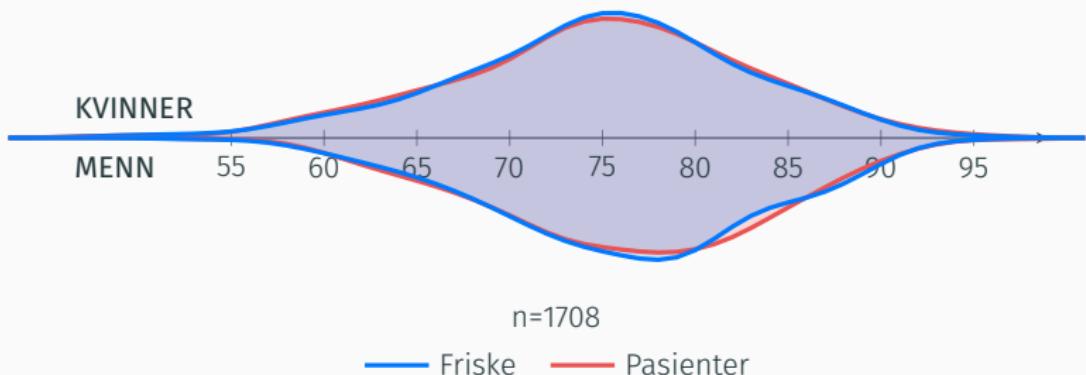


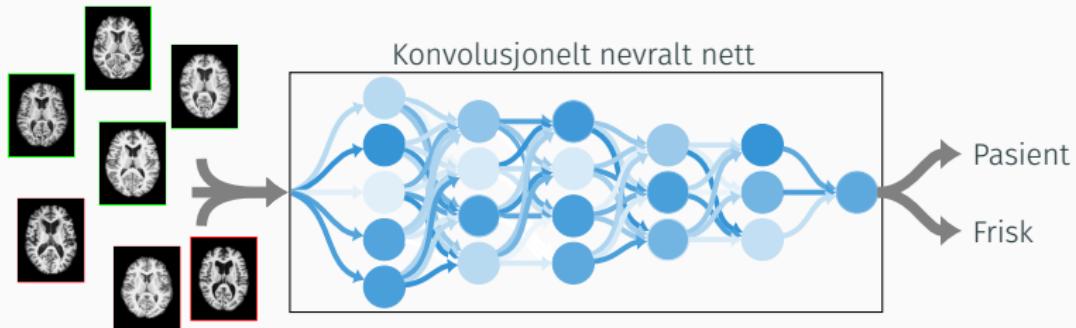
Konvolusjonelt nevralgt nettverk



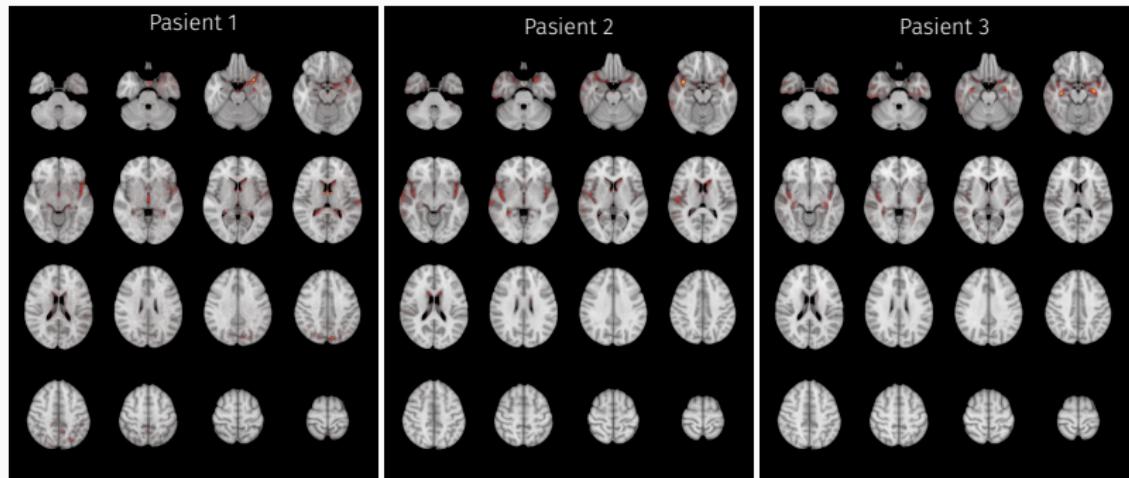
"marihøne"

# AI i hjernehforskning: Forklarbarhet

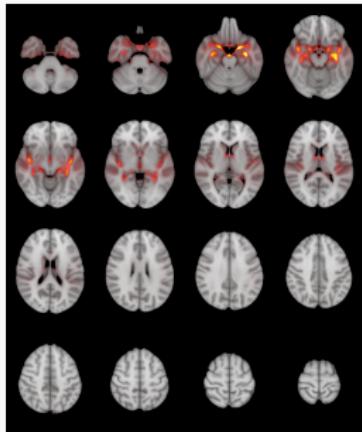




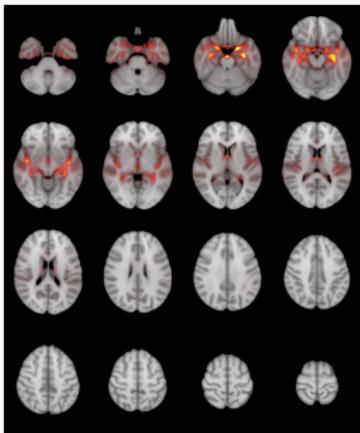
# AI i hjernehjerneforskning: Forklarbarhet



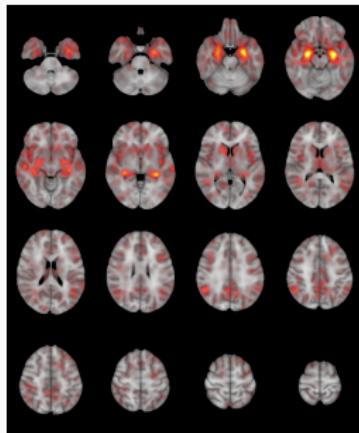
# AI i hjernehorskning: Forklarbarhet



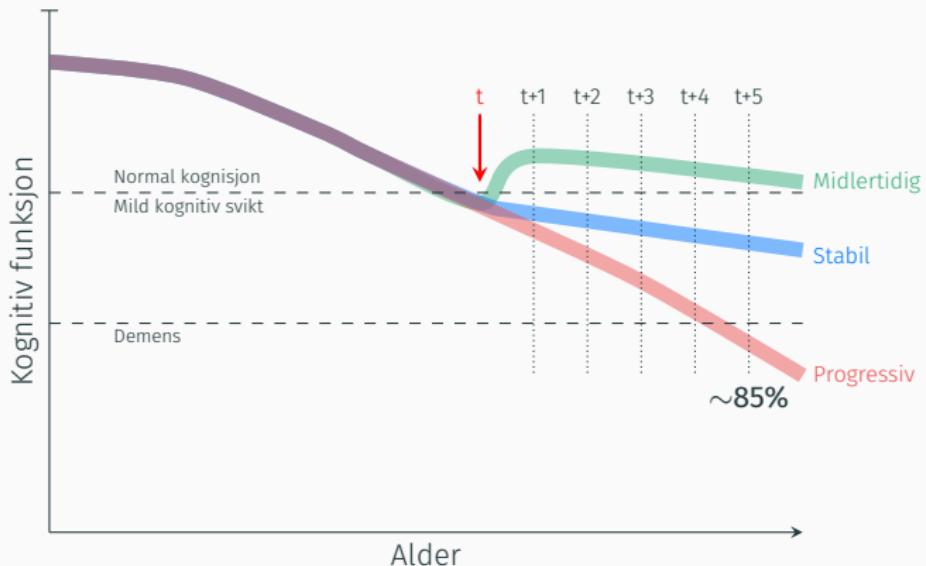
AI



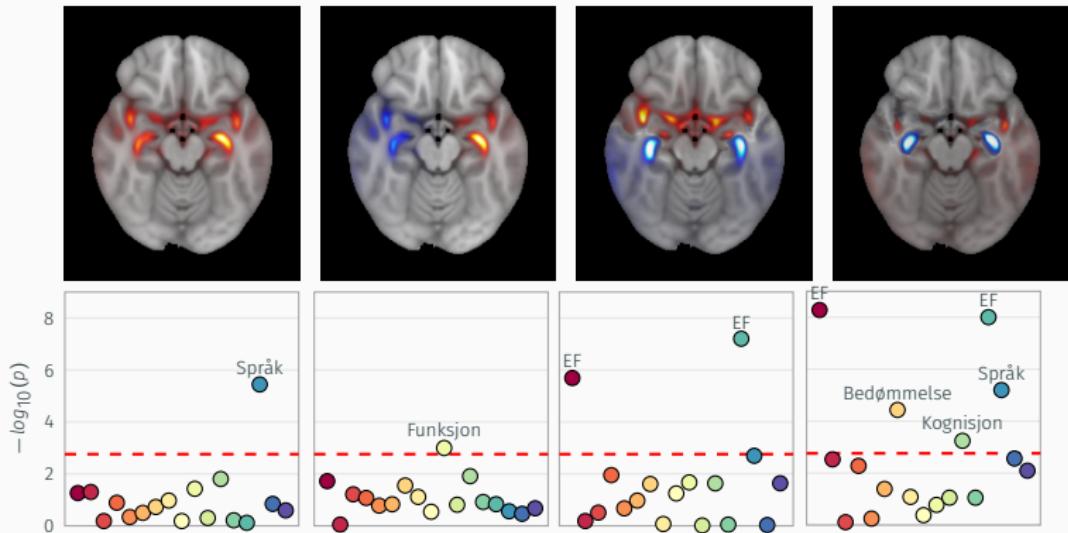
Mennesker

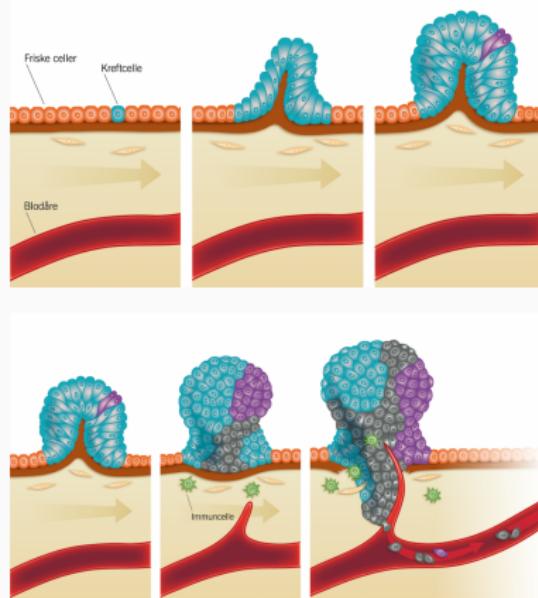


# AI i hjernehjerneforskning: Forklarbarhet



# AI i hjernehorskning: Forklarbarhet



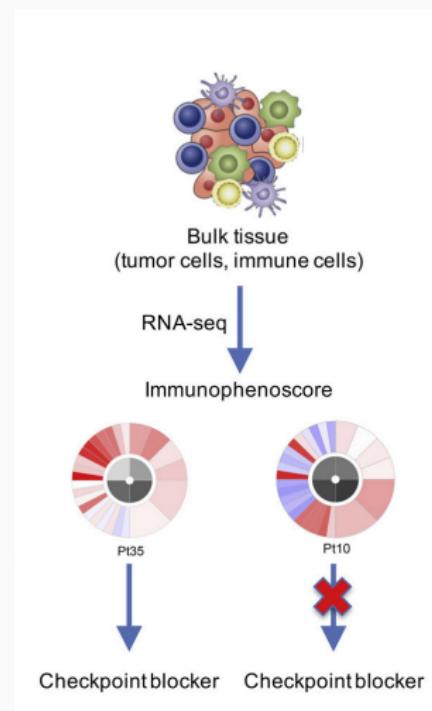


[www.kreftforeningen.no](http://www.kreftforeningen.no)

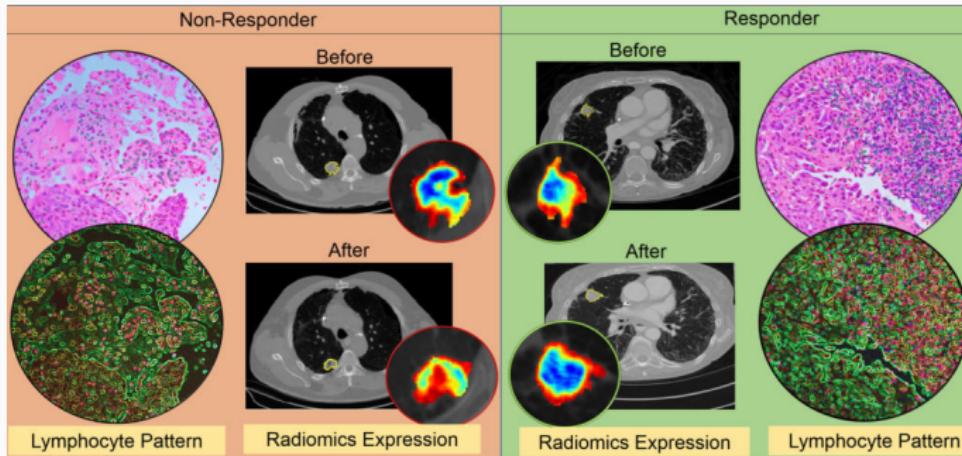


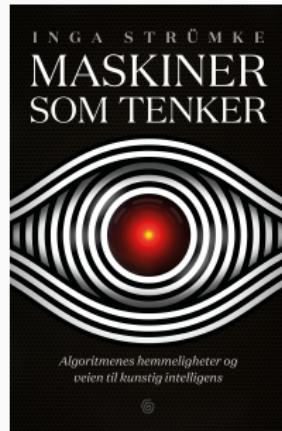
## MASAI-studien (Sverige, 2023)

- Screening av 80,000 mammografier
- AI-støtte med hjelp fra Transpara (CE-merket, FDA-godkjent)
- 20% flere svulster oppdaget med hjelp fra AI
- 45% færre undersøkelser med hjelp fra AI



# AI i kreftforskning: Presisjonsdiagnostikk





Takk for meg!

