AI-verktyg som hjälpmedel vid analys av grundvatten och relaterade områden – möjligheter och fördelar

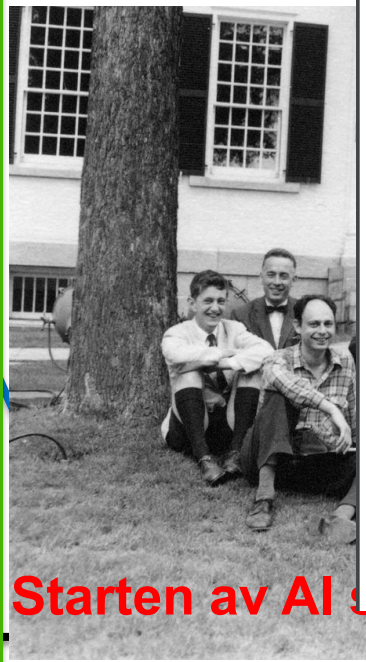
Fredrik Frisk – Högskolan Kristianstad

AI historia

Popularitet

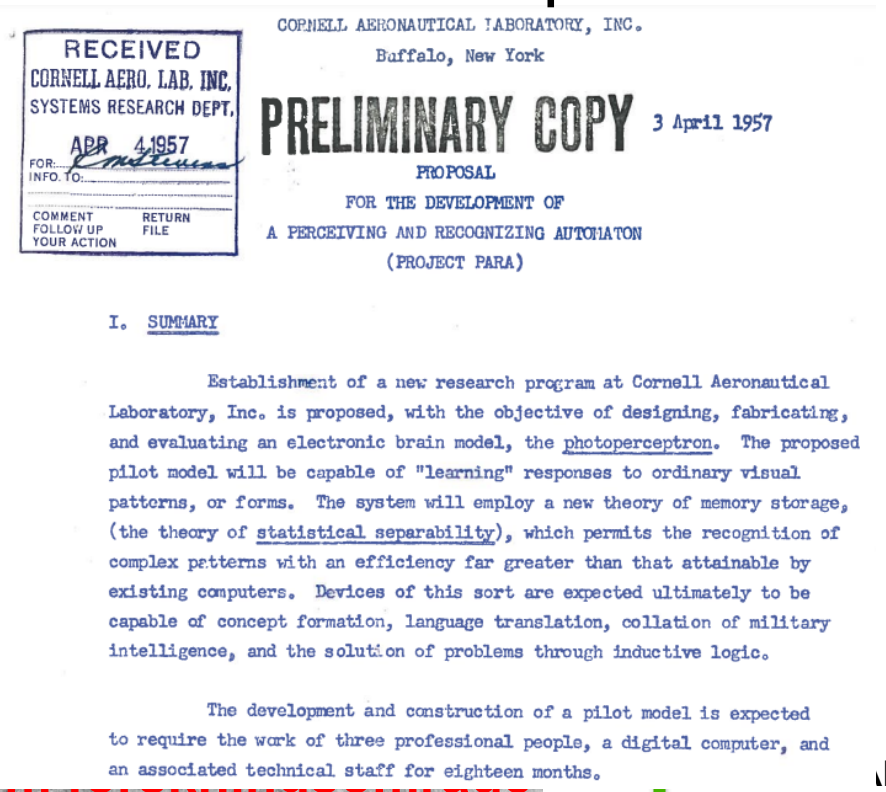
1956

Dartmout



Starten av AI

Rosenblatt Perceptron 1957



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CORNELL AERO. LAB. INC.
SYSTEMS RESEARCH DEPT.
APR 4 1957
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CORNELL AERONAUTICAL LABORATORY, INC.
Buffalo, New York

PRELIMINARY COPY 3 April 1957

PROPOSAL
FOR THE DEVELOPMENT OF
A PERCEIVING AND RECOGNIZING AUTOMATON
(PROJECT PARA)

I. SUMMARY

Establishment of a new research program at Cornell Aeronautical Laboratory, Inc. is proposed, with the objective of designing, fabricating, and evaluating an electronic brain model, the photoperceptron. The proposed pilot model will be capable of "learning" responses to ordinary visual patterns, or forms. The system will employ a new theory of memory storage, (the theory of statistical separability), which permits the recognition of complex patterns with an efficiency far greater than that attainable by existing computers. Devices of this sort are expected ultimately to be capable of concept formation, language translation, collation of military intelligence, and the solution of problems through inductive logic.

The development and construction of a pilot model is expected to require the work of three professional people, a digital computer, and an associated technical staff for eighteen months.

From: https://spectrum.ieee.org/dartmouth-ai-workshop

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AI historia

Popularitet

1956 1974 1980

Expertsystem

60- och 70-talet Industrirobotar

Flerlagers neuralt nätverk

Signal – Feedforward Neural Network

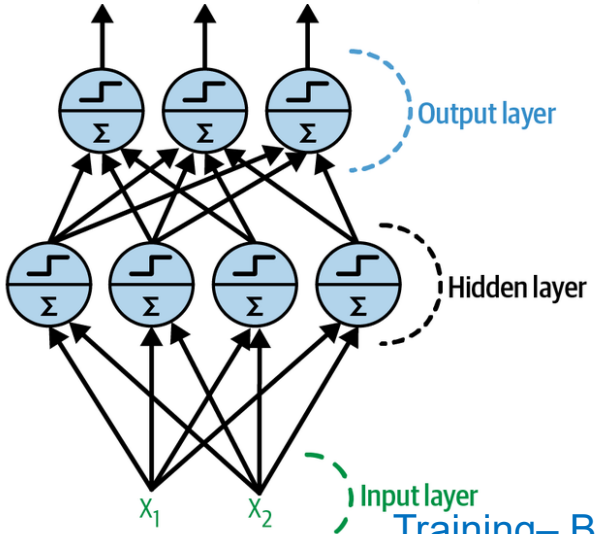
Regelb

Ex

Om pat

a influensa.

Non-expert user



Training– Backpropagation

expert

From:

Från https://boxofnotes.com/expert-system-in-artificial-intelligence/

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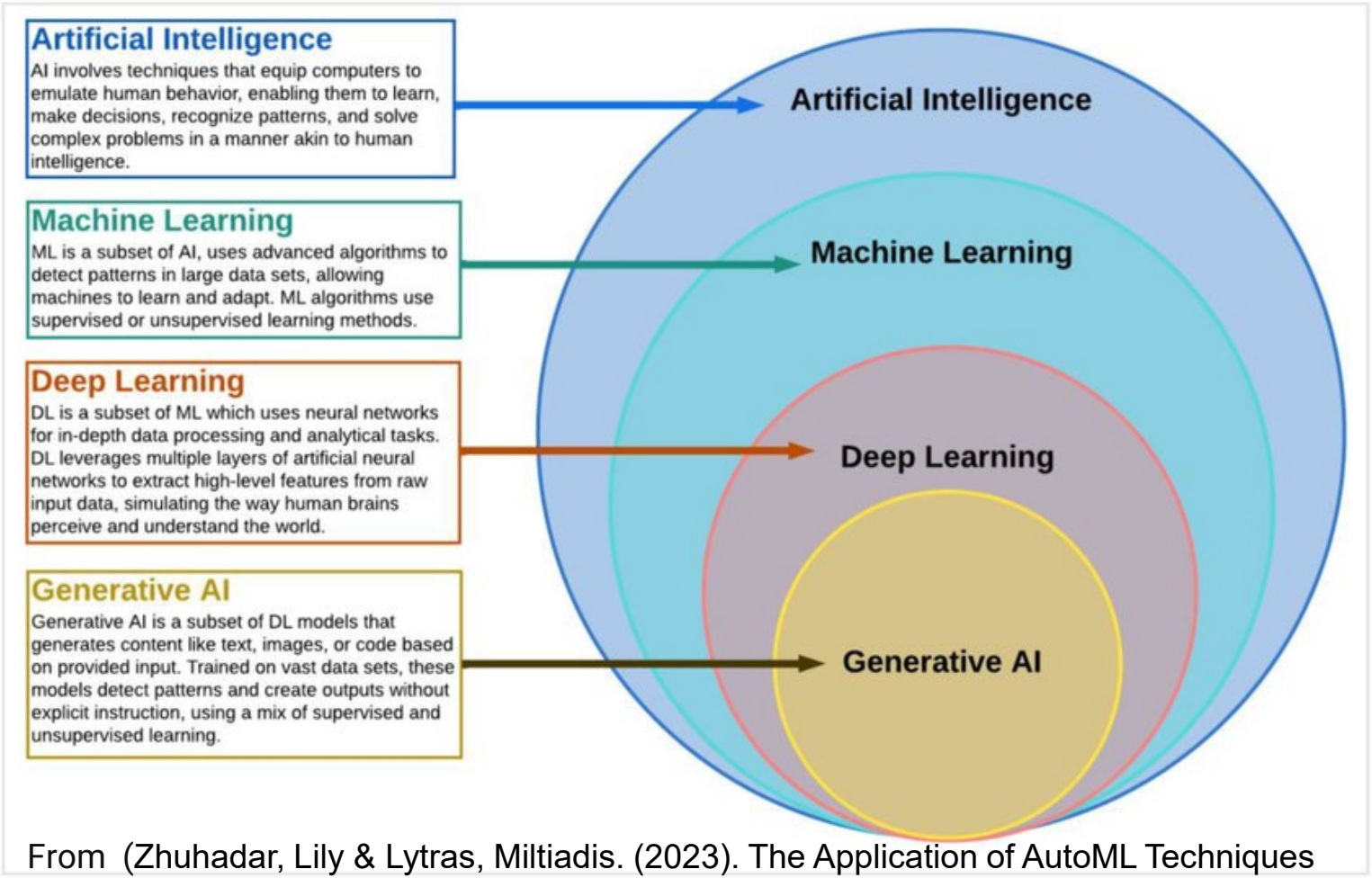
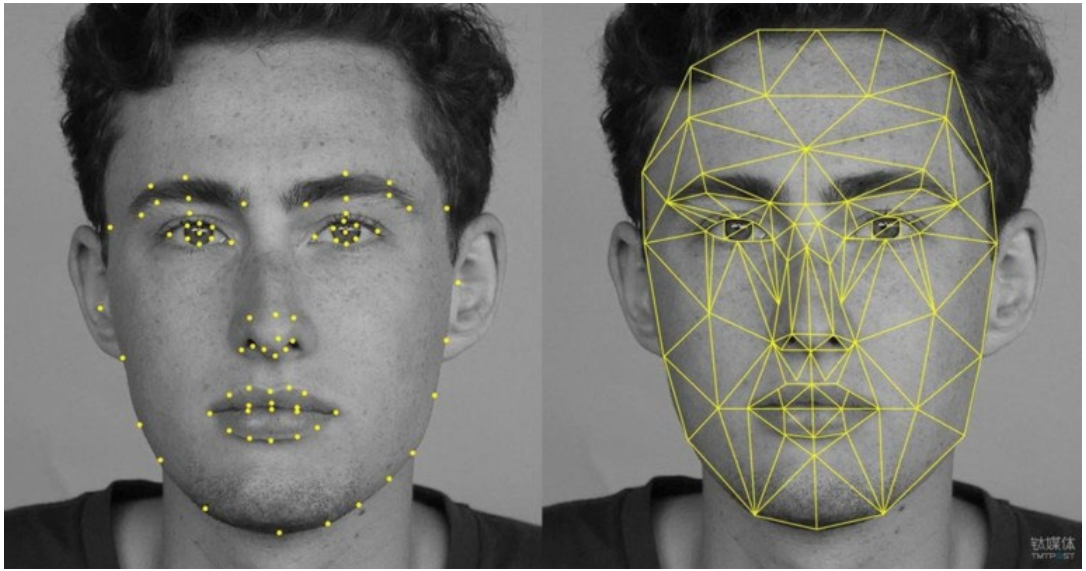


From (Zhuhadar, Lily & Lytras, Miltiadis. (2023). The Application of AutoML Techniques in Diabetes Diagnosis: Current Approaches, Performance, and Future Directions. Sustainability. 15. 13484. 10.3390/su151813484.

Ansiktsigenkänning

- Identifiera ett ansikte



Egenskaper:

Struktur i ansiktet,
t.ex. ögonplacering,
storlek mun

Detta är komplext

DeepFace - 2014

2014 IEEE Conference on Computer Vision and Pattern Recognition

DeepFace: Closing the Gap to Human-Level Performance in Face Verification

Yaniv Taigman Ming Yang Marc'Aurelio Ranzato Lior Wolf

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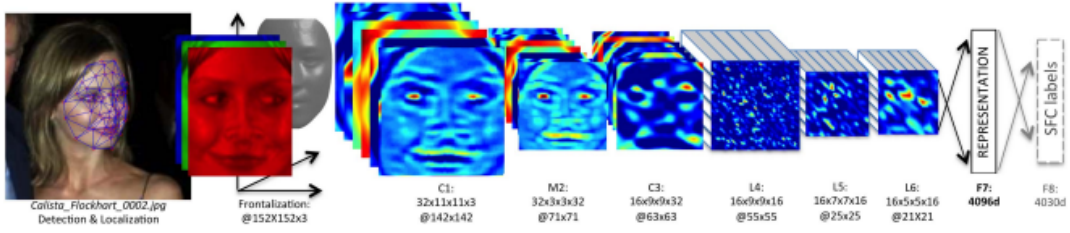

Figure 2. **Outline of the *DeepFace* architecture**. A front-end of a single convolution-pooling-convolution filtering on the rectified input, followed by three locally-connected layers and two fully-connected layers. Colors illustrate feature maps produced at each layer. The net includes more than 120 million parameters, where more than 95% come from the local and fully connected layers.

DeepFace:

120 miljoner träningsbara vikter/kopplingar

Träningsmängd:

4 miljoner bilder på 4000 olika personer

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Chihuahau eller Muffin ?

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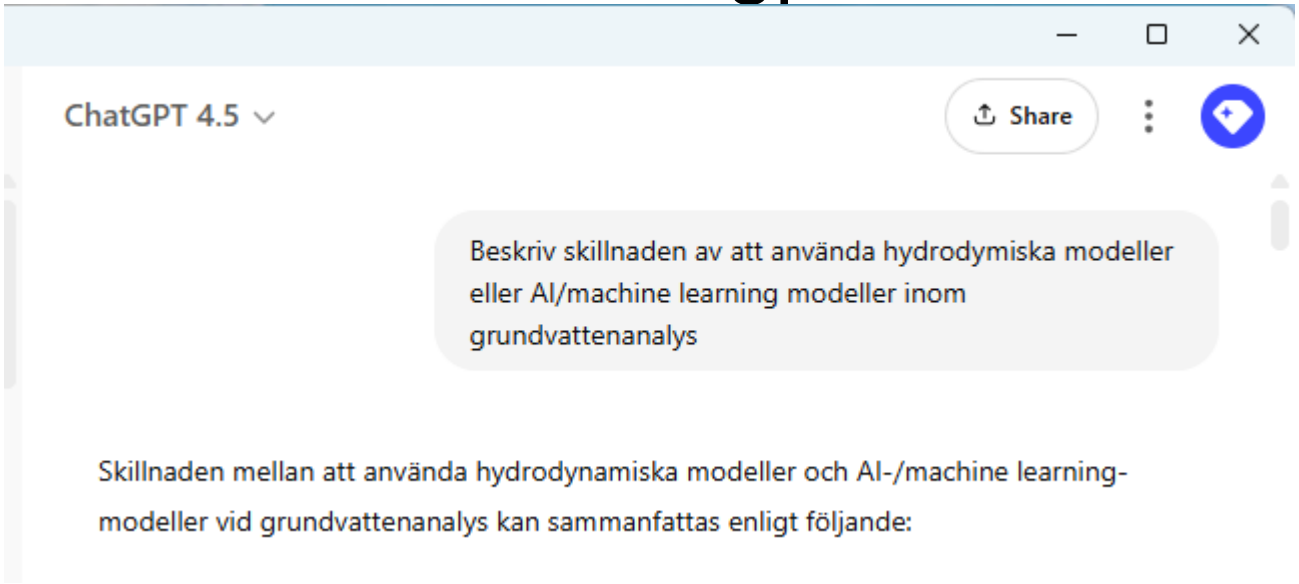
LLM – Large Language Models

- Ett känt exempel chatgpt
- Senaste versionen gpt – 4.5



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GPT – 4.5

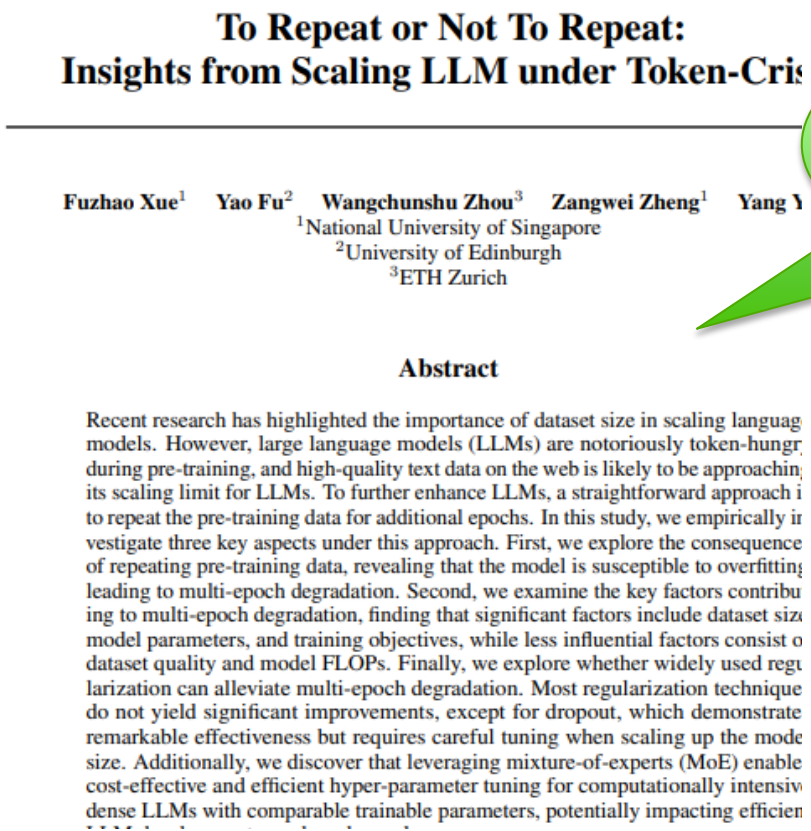
- 1.8 biljoner kopplingar/vikter
  - 1 800 000 000 000

Träningsmängd:

- 15 biljoner tokens (ord)

Mänskliga hjärnan
86 biljoner kopplingar

Möjligheter



To Repeat or Not To Repeat:
Insights from Scaling LLM under Token-Cris

Fuzhao Xue[1] Yao Fu[2] Wangchunshu Zhou[3] Zangwei Zheng[1] Yang Y
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[2]University of Edinburgh
[3]ETH Zurich

Abstract

Recent research has highlighted the importance of dataset size in scaling languag
models. However, large language models (LLMs) are notoriously token-hungr
during pre-training, and high-quality text data on the web is likely to be approachin
its scaling limit for LLMs. To further enhance LLMs, a straightforward approach i
to repeat the pre-training data for additional epochs. In this study, we empirically ir
vestigate three key aspects under this approach. First, we explore the consequence
of repeating pre-training data, revealing that the model is susceptible to overfittin
leading to multi-epoch degradation. Second, we examine the key factors contribu
ing to multi-epoch degradation, finding that significant factors include dataset siz
model parameters, and training objectives, while less influential factors consist o
dataset quality and model FLOPs. Finally, we explore whether widely used regu
larization can alleviate multi-epoch degradation. Most regularization technique
do not yield significant improvements, except for dropout, which demonstrate
remarkable effectiveness but requires careful tuning when scaling up the mode
size. Additionally, we discover that leveraging mixture-of-experts (MoE) enable
cost-effective and efficient hyper-parameter tuning for computationally intensiv
dense LLMs with comparable trainable parameters, potentially impacting efficien

5 oktober 2023
Börjar bli svårt att skapa större träningsmängd

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Två vägar att analysera

t.ex. vattenflöden eller grundvattennivåer

Hydrodynamiska modeller

- Bygger på fysikaliska lagar
- Förutsätter att systemets fysiska egenskaper är kända.

AI/Maskininlärnings-modeller

- “Black box” modell
  - Kräver inga fysikaliska samband
- Mönsterigenkänning
  - statistisk analys

Svårigheter

Hydrodynamiska modeller

- Kräver explicit beskrivning av hydrogeologiska parametrar
  - Permeabilitet
  - Porositet

AI/Maskininlärnings-modeller

- Kräver stora mängder data för att lära sig samband mellan in och utdata
- Kan ej extrapolera data
  - extremväder

Fördelar

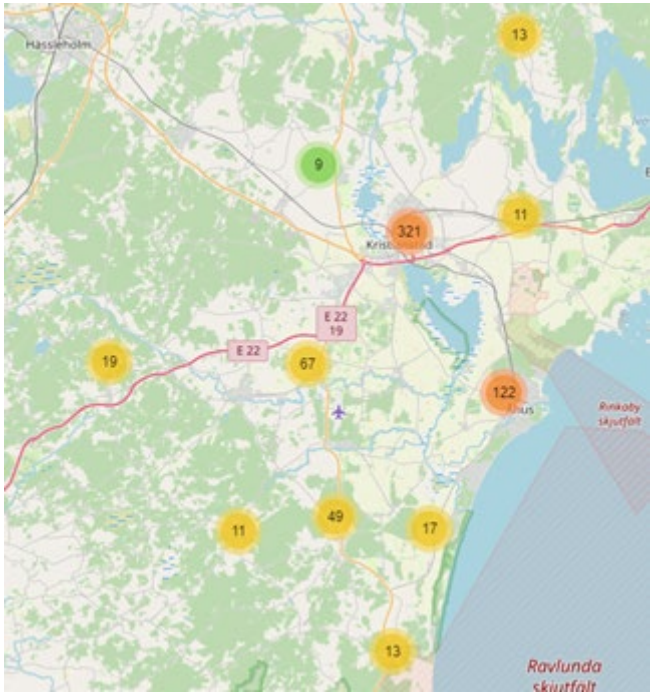
Hydrodynamiska modeller

- Kräver explicit beskrivning av hydrogeologiska parametrar
  - Permeabilitet
  - Porositet
- Kan analyser extremhändelser
  - Kräver att modellen har byggts för det

AI/Maskininlärnings-modeller

- Kan hitta komplexa samband mellan in och utdata
- Flexibilitet att flytta modeller till närliggande områden

SmartVA - Kristianstad



- 672 utplacerade mätare
- Dagvattennivåer
- Regnmängder
- Grundvattennivåer
- Vattennivåer
- …

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Simulering av vattenflöde

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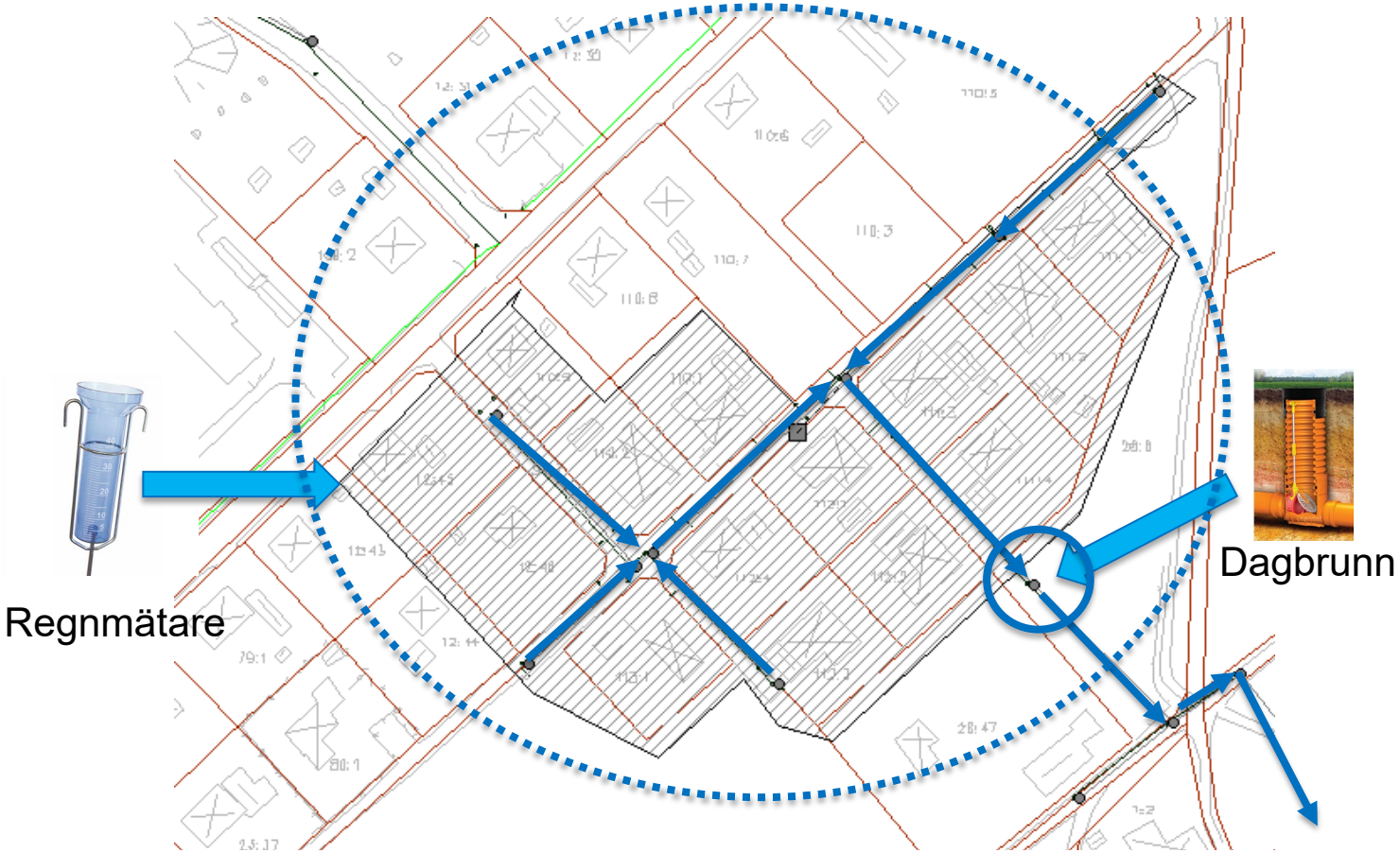

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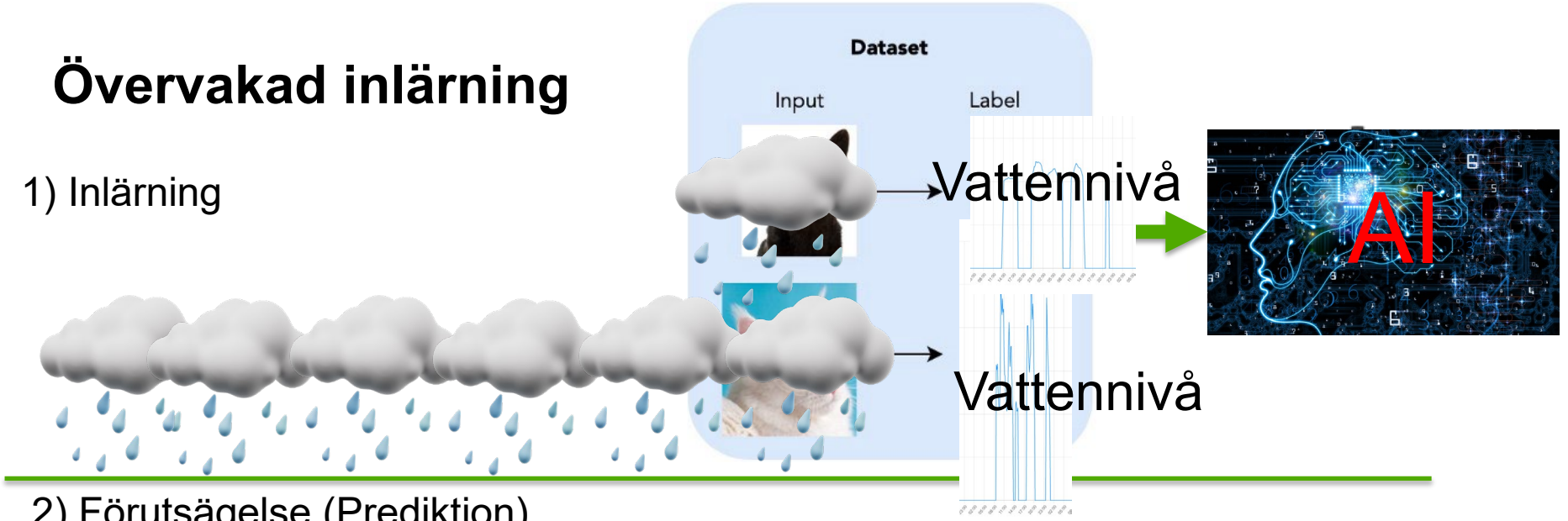
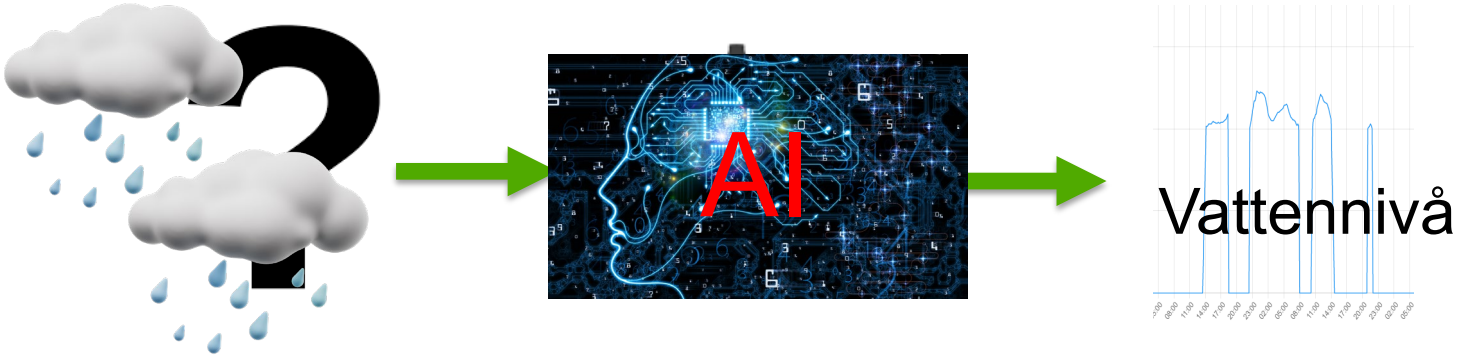
Övervakad inlärning

1) Inlärning



2) Förutsägelse (Prediktion)



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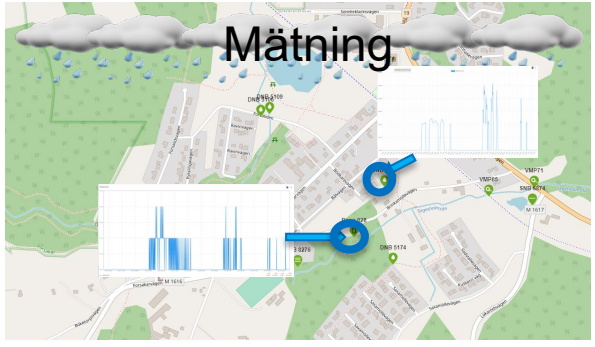
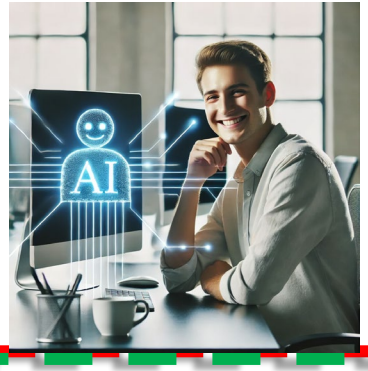
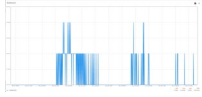
AI vs. Fysikaliska modeller



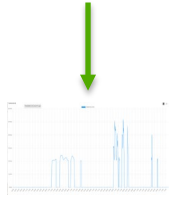
Träning

AI -modell

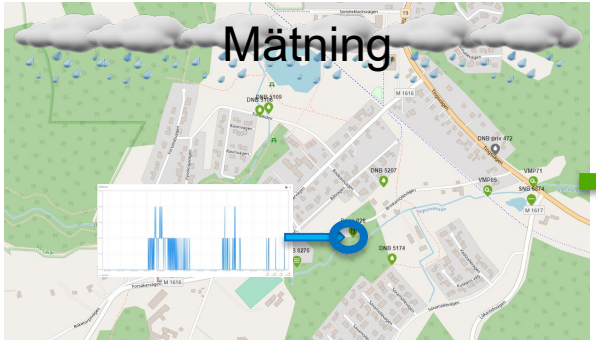




Regn

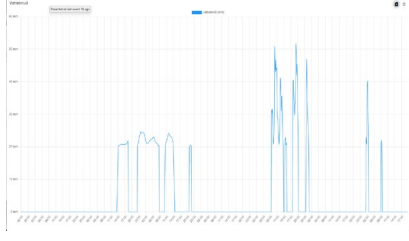


Vatten-djup



Fysikalisk modell

Vattendjup



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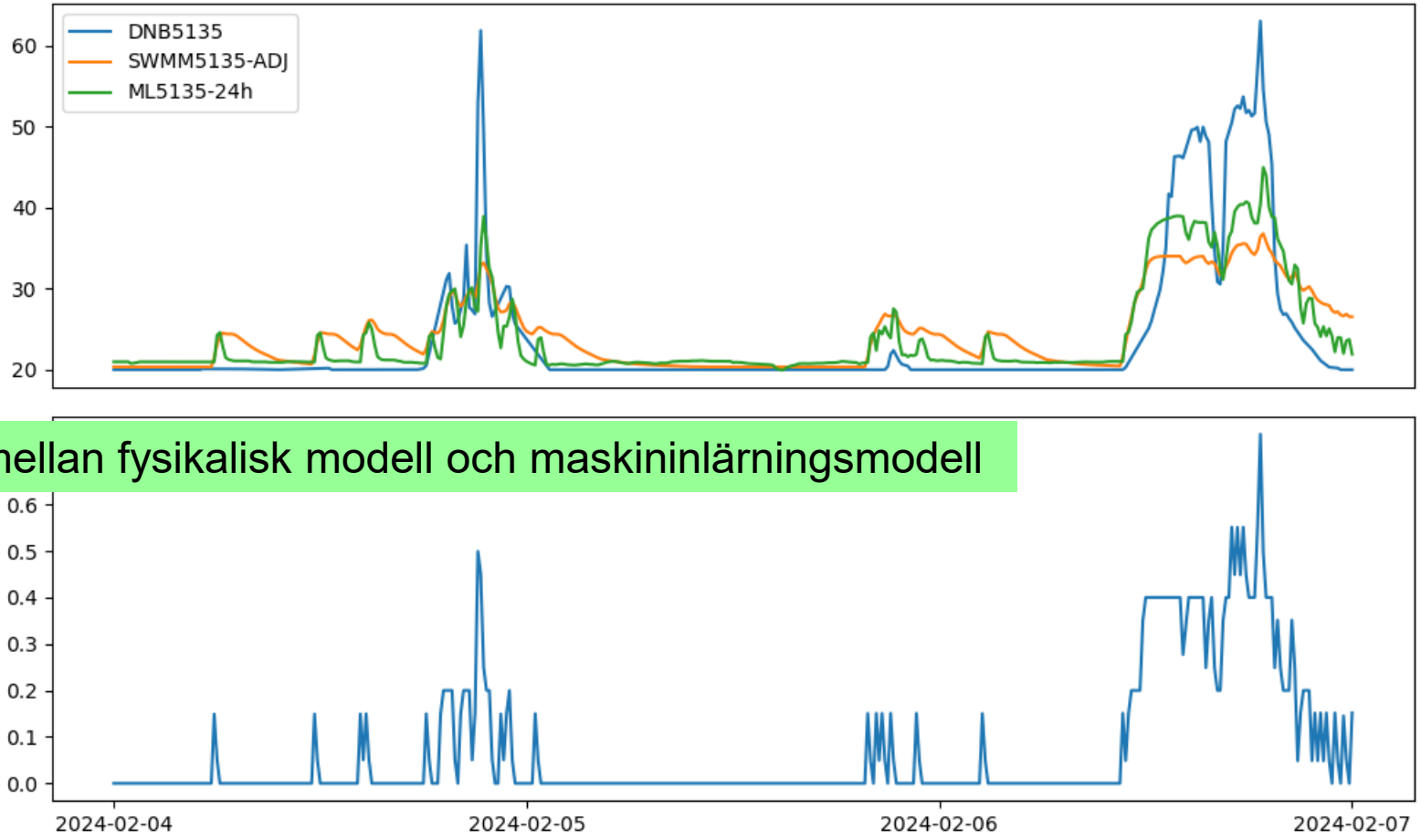

Jämförelse mellan fysikalisk modell och maskininlärningsmodell

MALMÖ UNIVERSITET

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Kristianstad University Sweden

Tack för att ni lyssnade!

Kristianstad University Sweden