

# S A I R E

Smart devices en AI voor Revalidatie

Seminarie

11 oktober 2021

[www.saire.be](http://www.saire.be)

# Agenda

- 13:00 Introductie Seminarie SAIRE
- 13:05 Introductie AI
- 13:20 AI in de zorg
- 13:35 Smart Walker
- 13:55 Q&A



**SAIRE**  
Seminarie  
11 oktober | 13u

## SMART WALKER: WAAR ELEKTRONICA EN ZORG ELKAAR ONTMOETEN

De gezondheidszorg komt steeds meer onder druk te staan. Door een tekort aan personeel en verhoging van het aantal zorgbehoevenden dienen zorgprofessionals steeds meer prestaties te leveren en hebben ze vaak te weinig tijd per zorgvrager. **Smart devices** en **Artificiële Intelligentie (AI)** reiken hier een mogelijke oplossing aan.

In dit seminarie beginnen we met een algemene introductie van Artificiële Intelligentie binnen de zorg aan de hand van enkele concrete voorbeelden. Daarna gaan we dieper in op de 1<sup>ste</sup> ontwikkelingsfase van onze eigen **Smart Walker**: een intelligente rollator die het gangpatroon bij zelfstandig gebruik verbetert aan de hand van audiovisuele feedback.

**Praktisch**  
Plaats: online  
Datum: 11 oktober 2021 van 13u tot 14u  
Kostprijs:  
 · Leden van de begeleidingsgroep van SAIRE: gratis  
 · Studenten en leden van EhB, Odisee en VUB: gratis  
 · Externen: 30 euro per persoon, over te schrijven naar REKENINGNUMMER EHB + GEGEVENS EHB, met vermelding 'Seminarie SAIRE 11 okt'.

**Op voorhand inschrijven is verplicht (deadline 8 oktober) via**  
<https://www.saire.be/2021/09/16/seminarie-smart-walker-11-10-2021-13u-14u/>



Introductie

# SAIRE - Smart devices en AI voor Revalidatie

- TETRA Project
- Praktisch onderzoek
- Samenwerking bedrijven, universiteiten en hoge scholen
- Verschillende projecten binnen SAIRE
  - Smart Brace
  - Smart Walker
  - Smart Infuushouder
- Disseminatie kennis



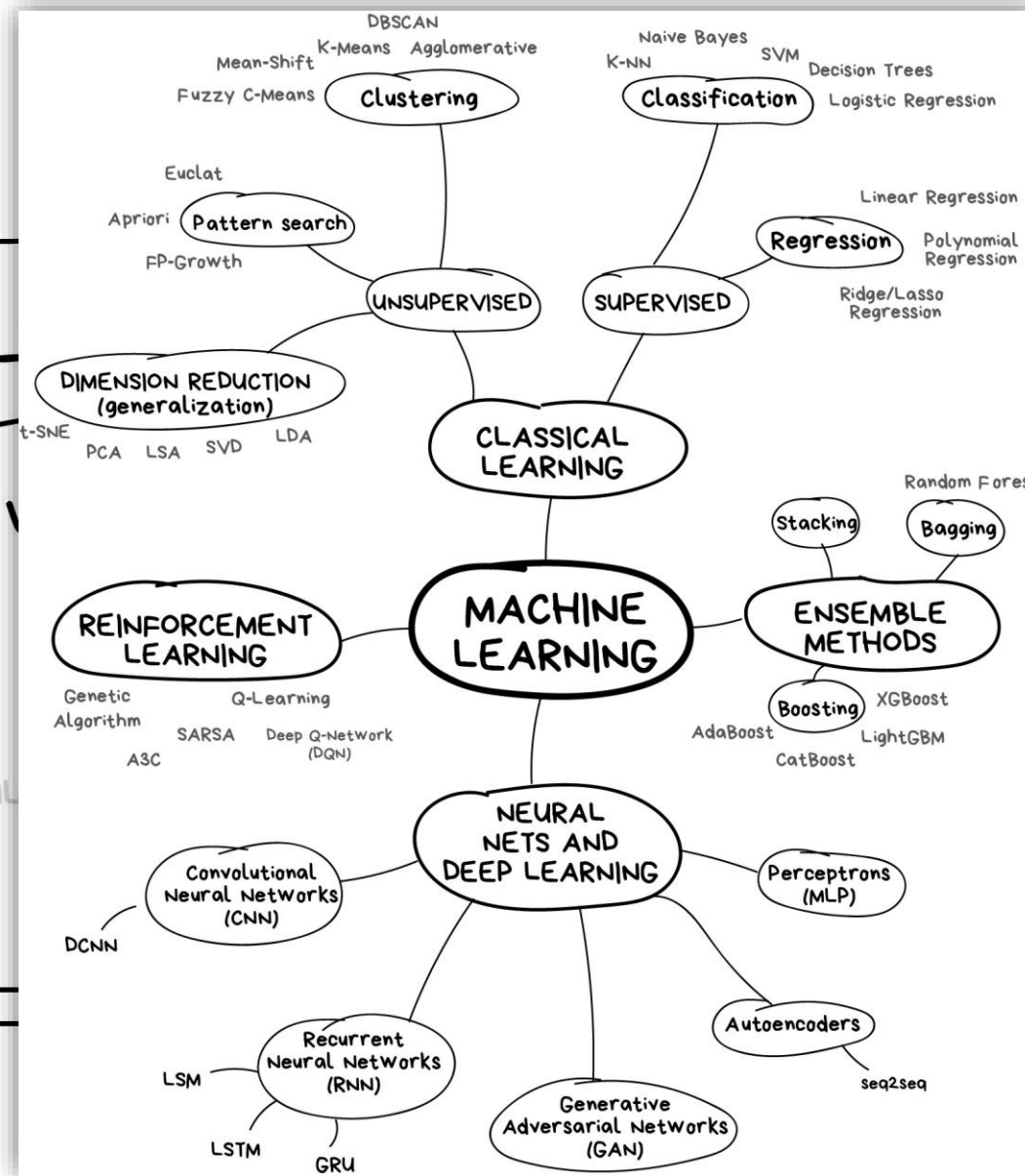
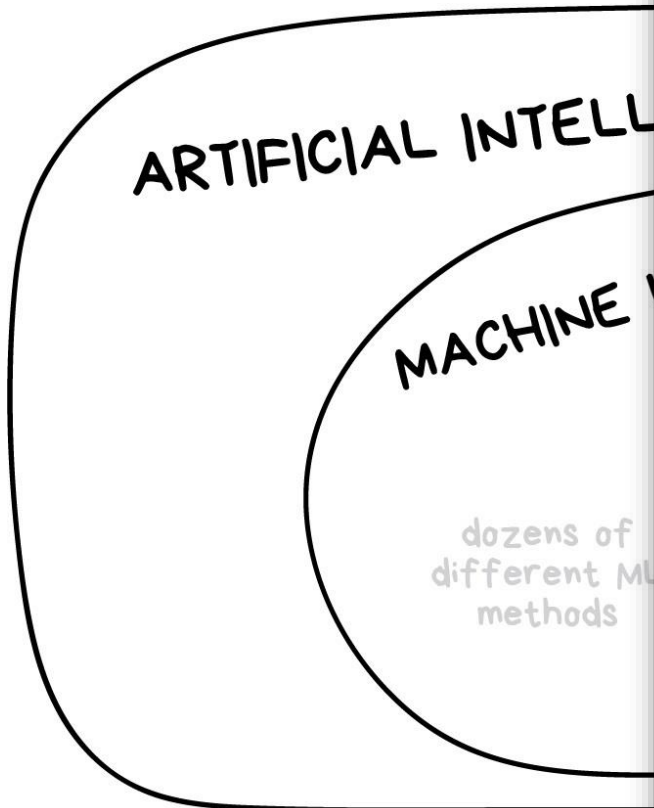
Introductie AI

# AI - Artificiële Intelligentie

- Wat is AI
- Klassieke Machine Learning modellen
- Neurale netwerken
- Deep Learning
- Overzicht machine learning toepassingen
  - Object herkenning
  - Object lokalisatie
  - Object segmentatie
  - Generative Adversarial Networks
  - Natural Language Processing
  - Reinforcement learning

Introductie AI

# Wat is AI



system able to perform tasks that require human intelligence, such as perception, speech recognition, decision-making, and machine translation between languages.”

Machine learning is the general term for algorithms that learn from data.

Deep learning is a subfield of machine learning that uses complex neural network structures algorithms in an "artificial neural network" that can learn and make decisions on its own.

Introductie AI

# Machine Learning - Klassieke modellen



## CLASSICAL MACHINE LEARNING

Data is pre-categorized or numerical

Data is not labeled in any way

### SUPERVISED

### UNSUPERVISED

Predict a category  
**CLASSIFICATION**  
«Divide the socks by color»

Divide by similarity  
**CLUSTERING**  
«Split up similar clothing into stacks»

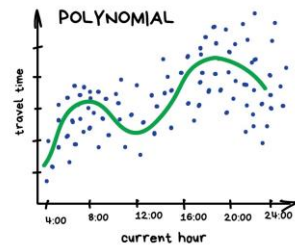
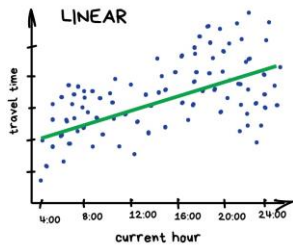
Predict a number  
**REGRESSION**  
«Divide the ties by length»

Identify sequences  
Find hidden dependencies  
**ASSOCIATION**  
«Find what clothes I often wear together»

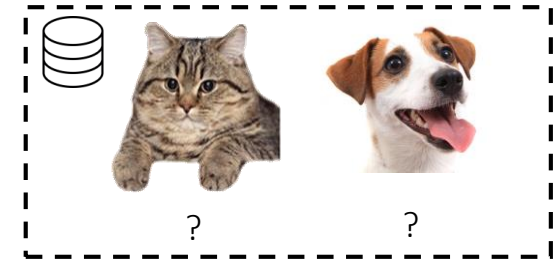
**DIMENSION REDUCTION (generalization)**  
«Make the best outfits from the given clothes»



PREDICT TRAFFIC JAMS



REGRESSION

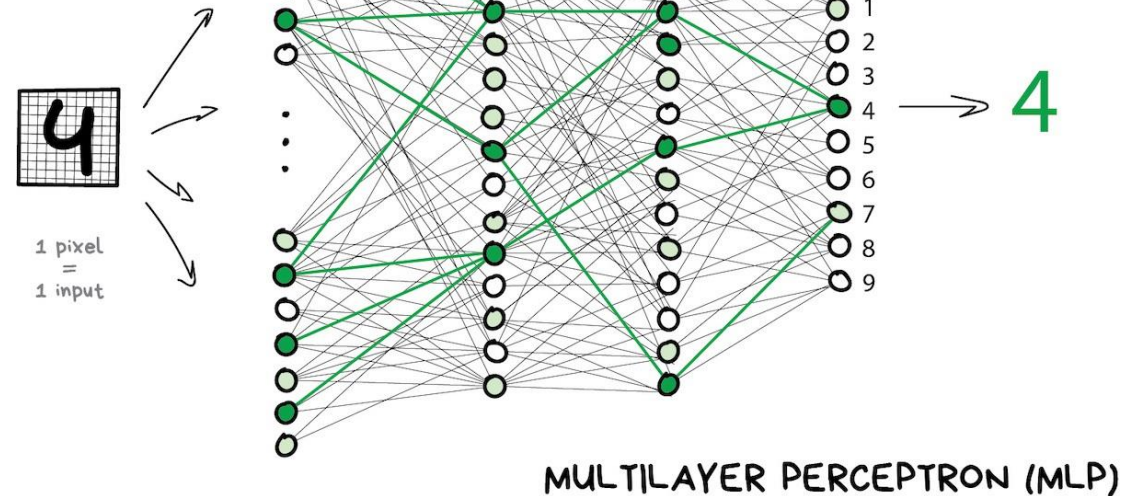
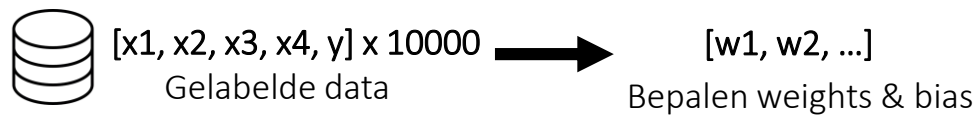
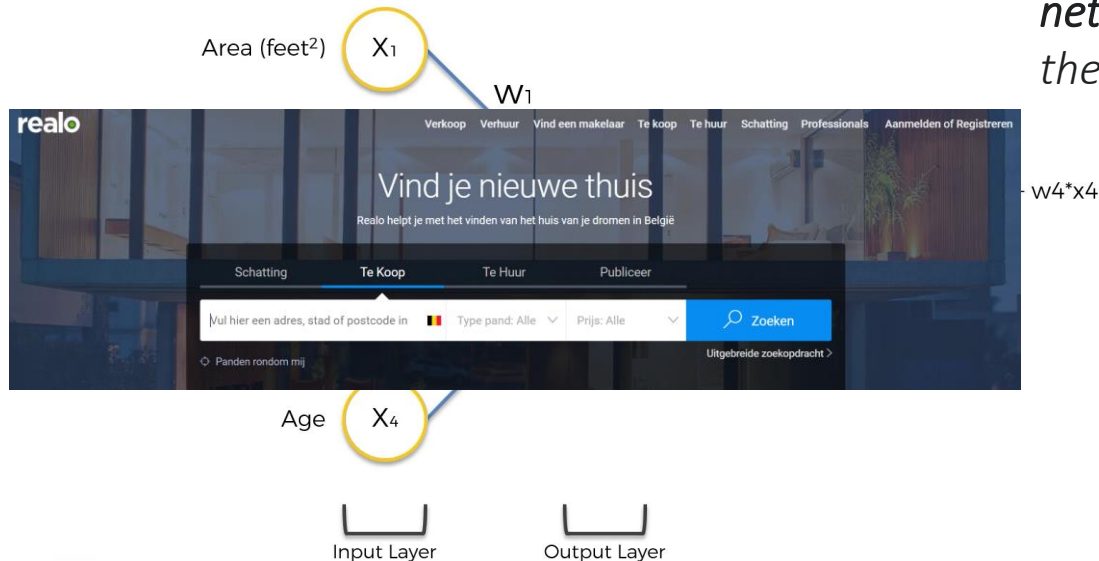


Hoe kunnen we de data groeperen?  
Wat maakt een kat een kat?

Introductie AI

# Machine Learning – Neuraal netwerk

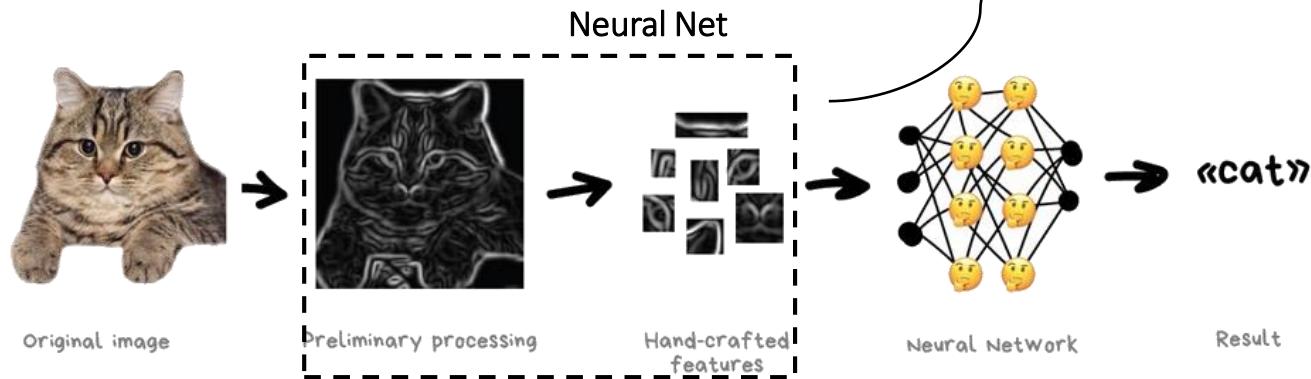
“Artificial neural networks (ANNs), usually simply called neural networks (NNs), are computing systems inspired by the biological neural networks that constitute animal brains.”



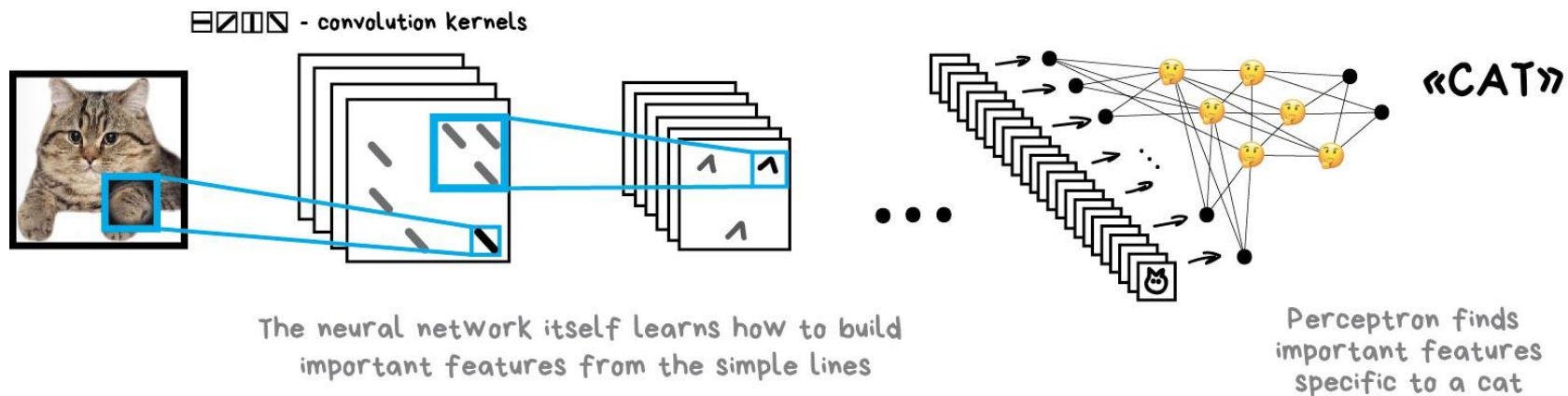
# Machine Learning – Deep Learning



Selecteren features → Welke?  
 Extraheren features → Hoe?



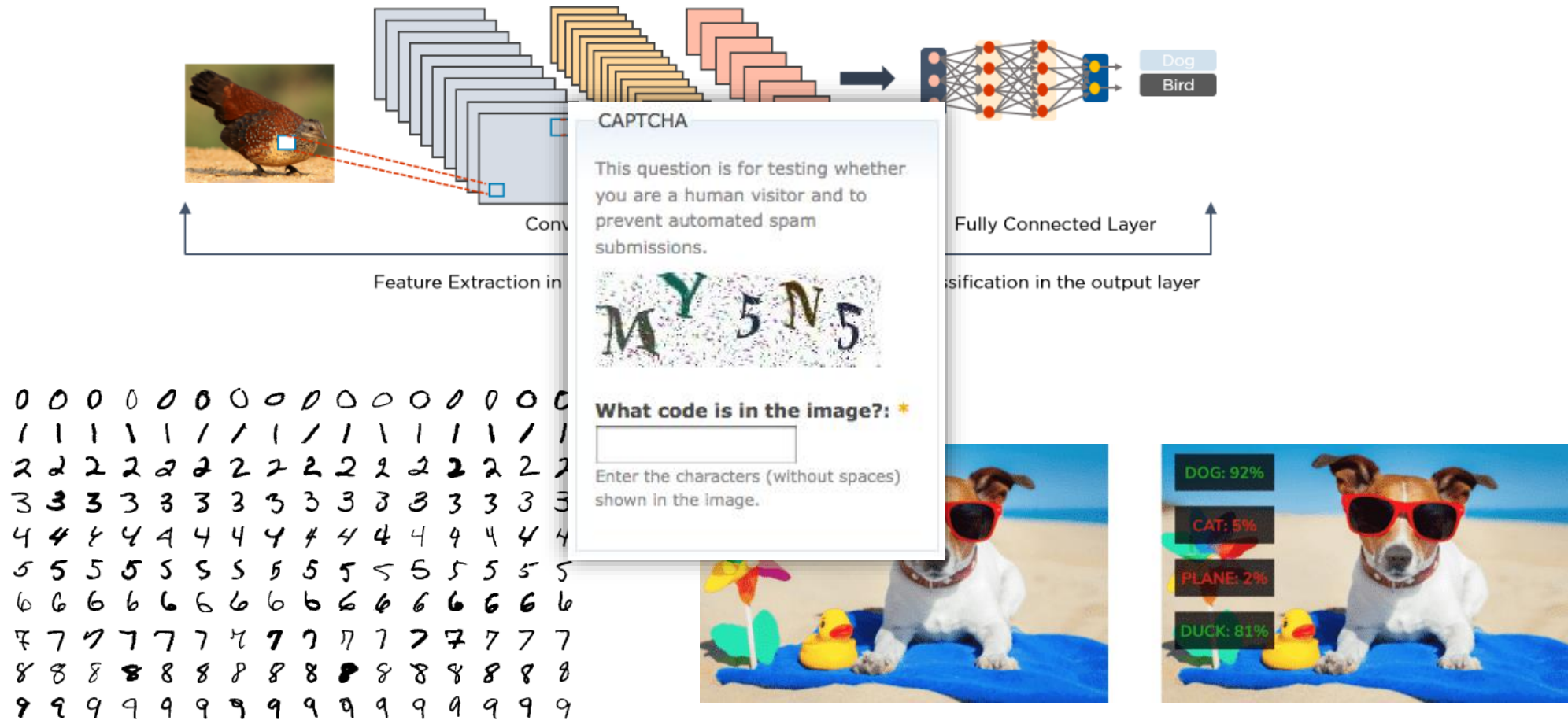
## Deep Neural Net





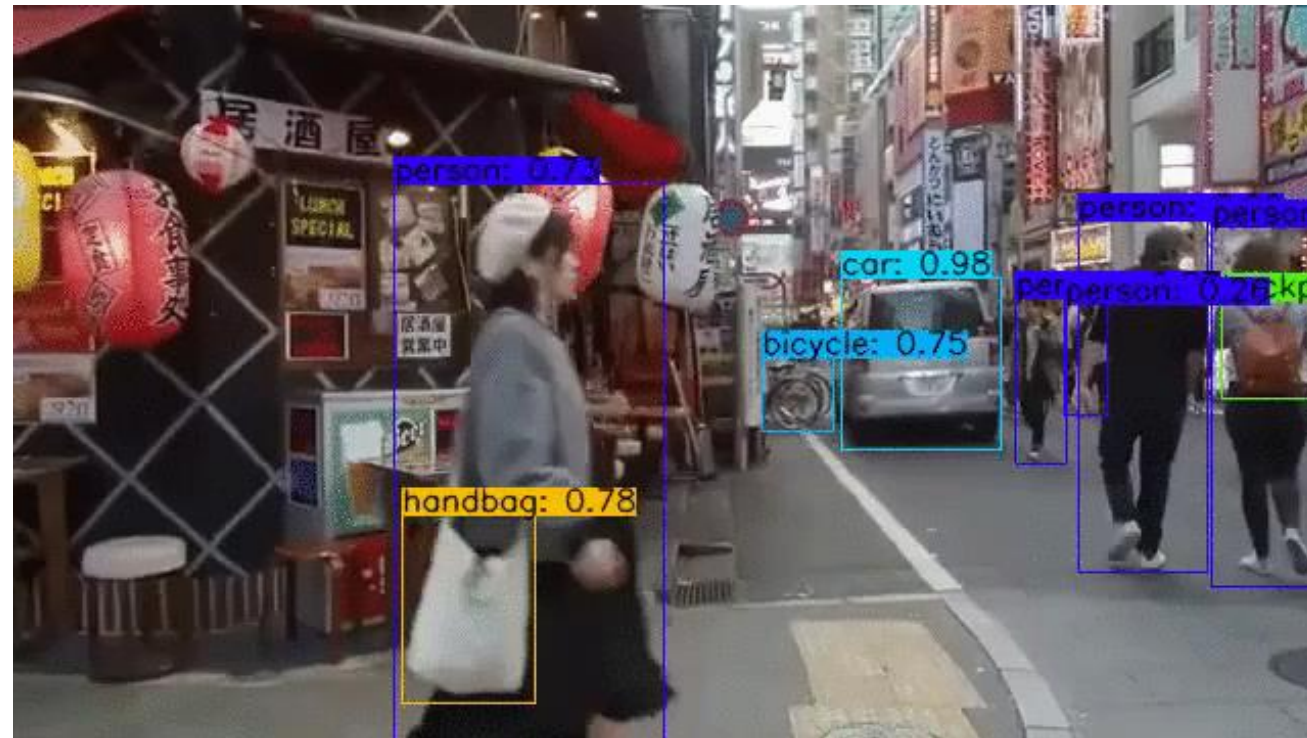
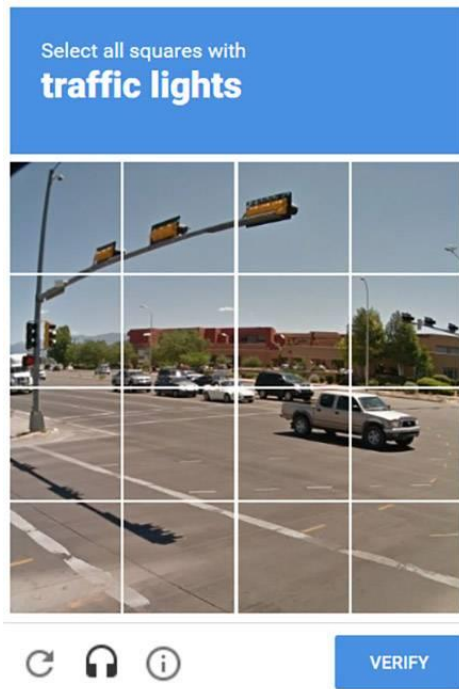
Introductie AI

# AI – Object Herkenning

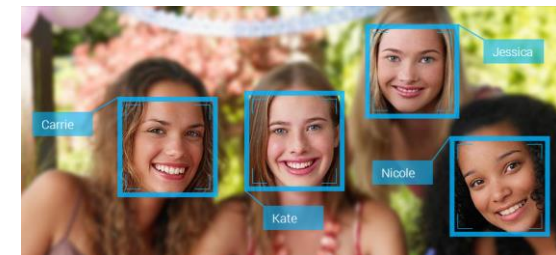
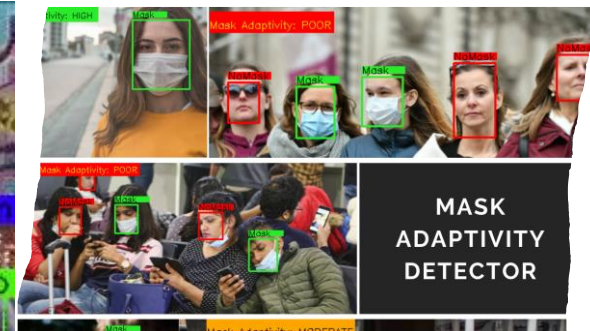


Introductie AI

# AI – Object Lokalisatie

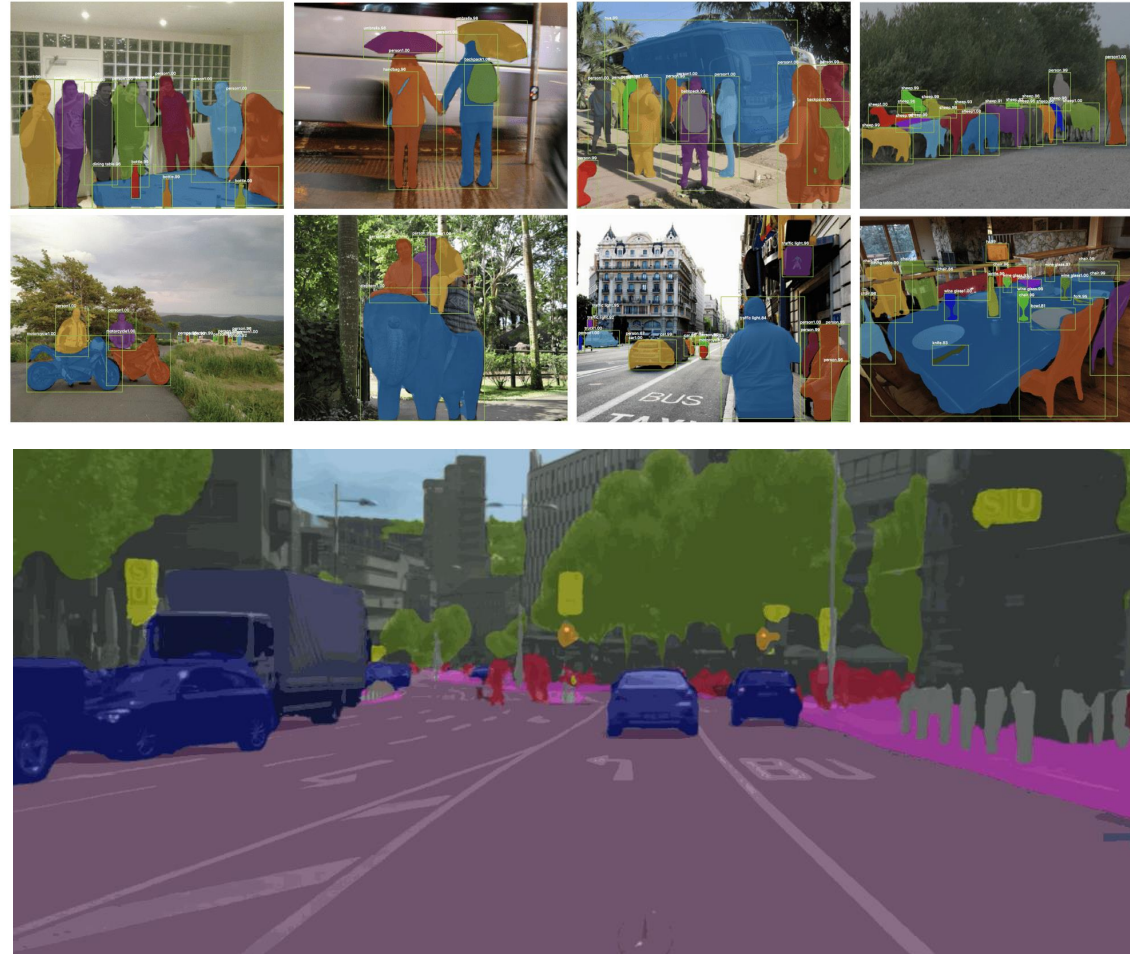


YOLO - You Only Look Once



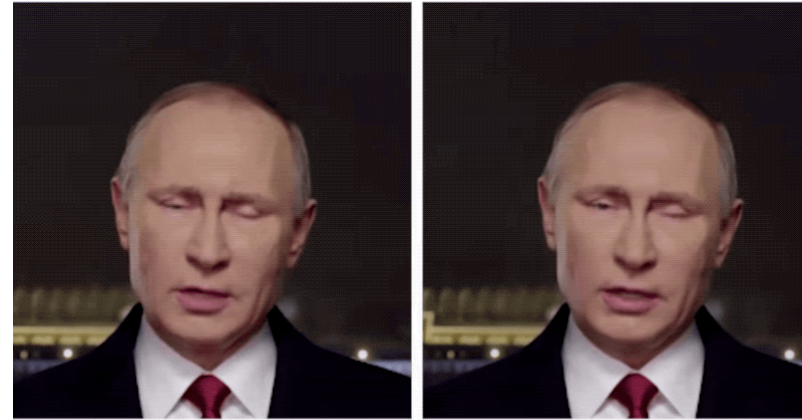
Introductie AI

# AI – Object Segmentatie



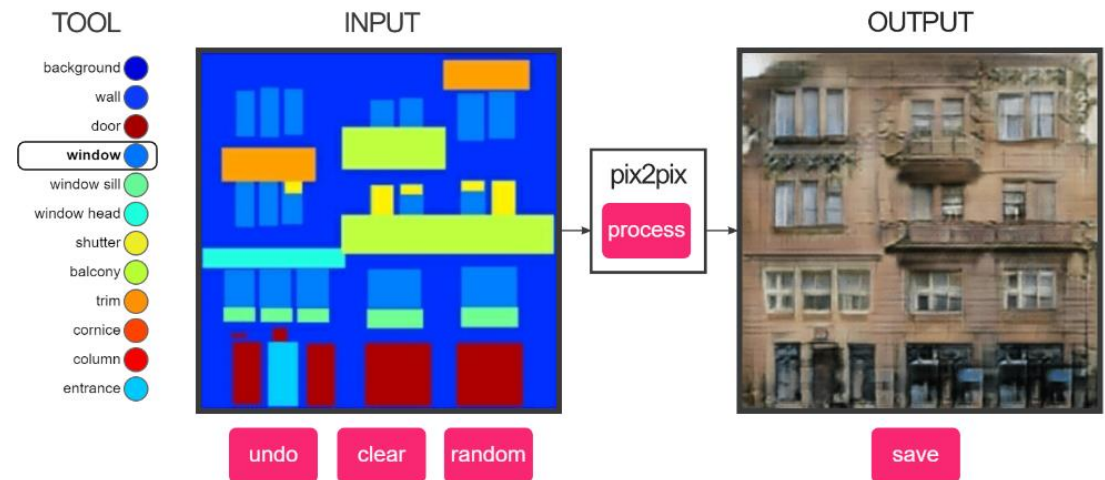
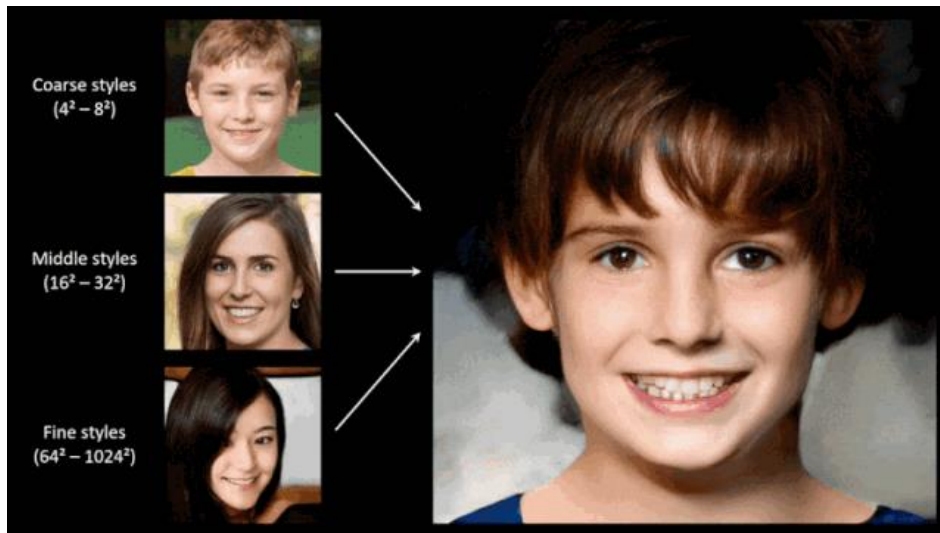
Introductie AI

# AI – Generative Adversarial Networks (GAN)



Real

DeepFake



<https://affinelayer.com/pixsrv/>

Introductie AI

# AI – Natural Language Processing



Speech to text



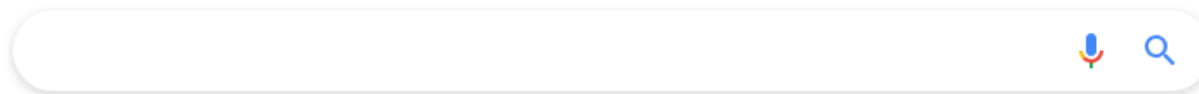
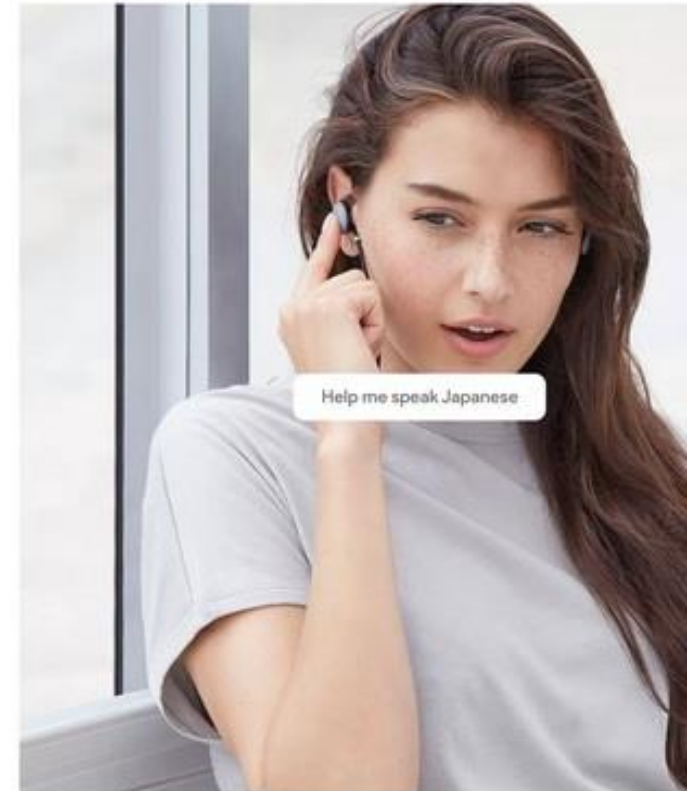
Text to speech

Google Pixel Buds  
+ Google Assistant  
+ Google Translator

Talk to more people in more places with Google Translate.

Get real-time translation with Google Translate. Just touch and hold the right earbud to activate the Google Assistant on your Pixel.<sup>1</sup>

Interpreteren van tekst



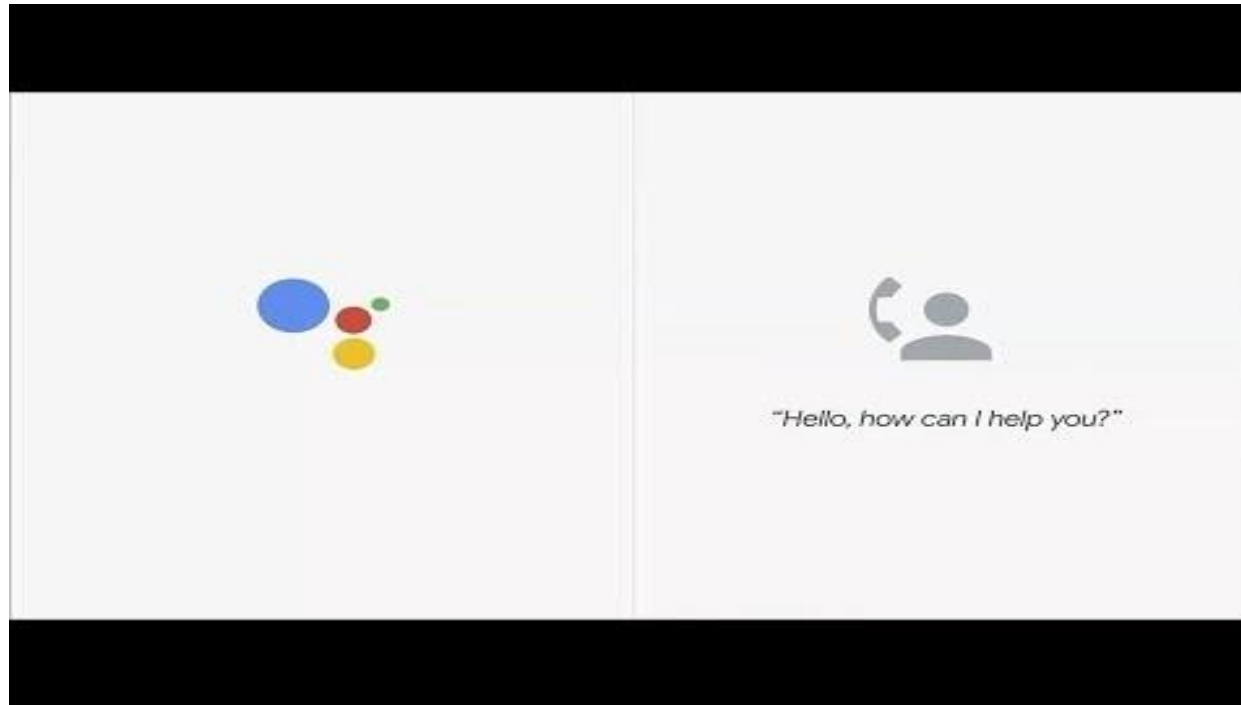
Tekst generator: <https://deepai.org/machine-learning-model/text-generator>

WaveNet: <https://deepmind.com/blog/article/wavenet-generative-model-raw-audio>

AI SongContest: <https://www.aisongcontest.com/>

Introductie AI

# AI – Natural Language Processing



Tekst generator: <https://deepai.org/machine-learning-model/text-generator>

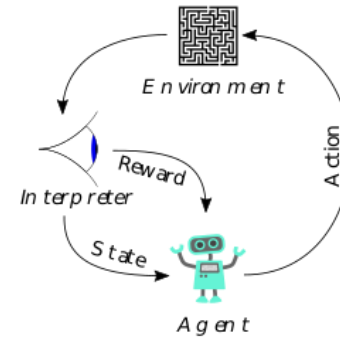
WaveNet: <https://deepmind.com/blog/article/wavenet-generative-model-raw-audio>

AI SongContest: <https://www.aisongcontest.com/>

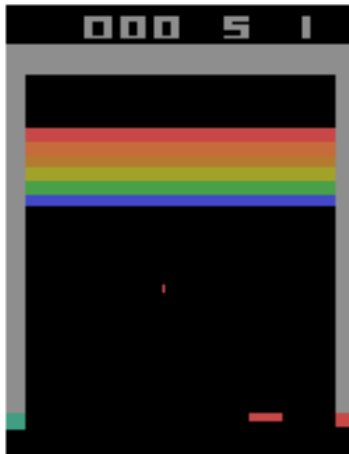
Introductie AI

# AI - Reinforcement Learning

*"Throw a robot into a maze and let it find an exit"*



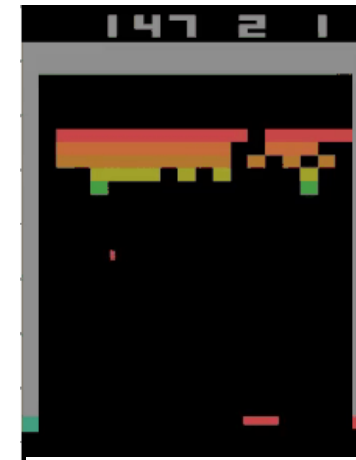
1. Definieer de mogelijke acties
2. Definieer de "reward" functie
3. Laat model zichzelf optimaliseren



<10min training



120min training



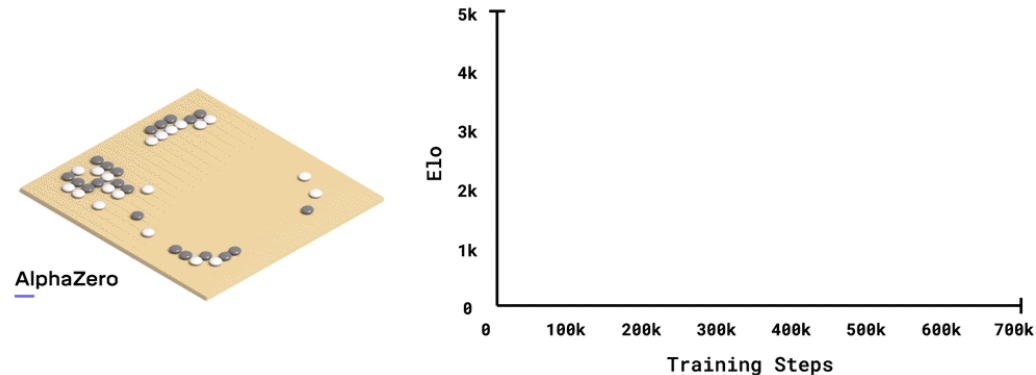
240min training

Introductie AI

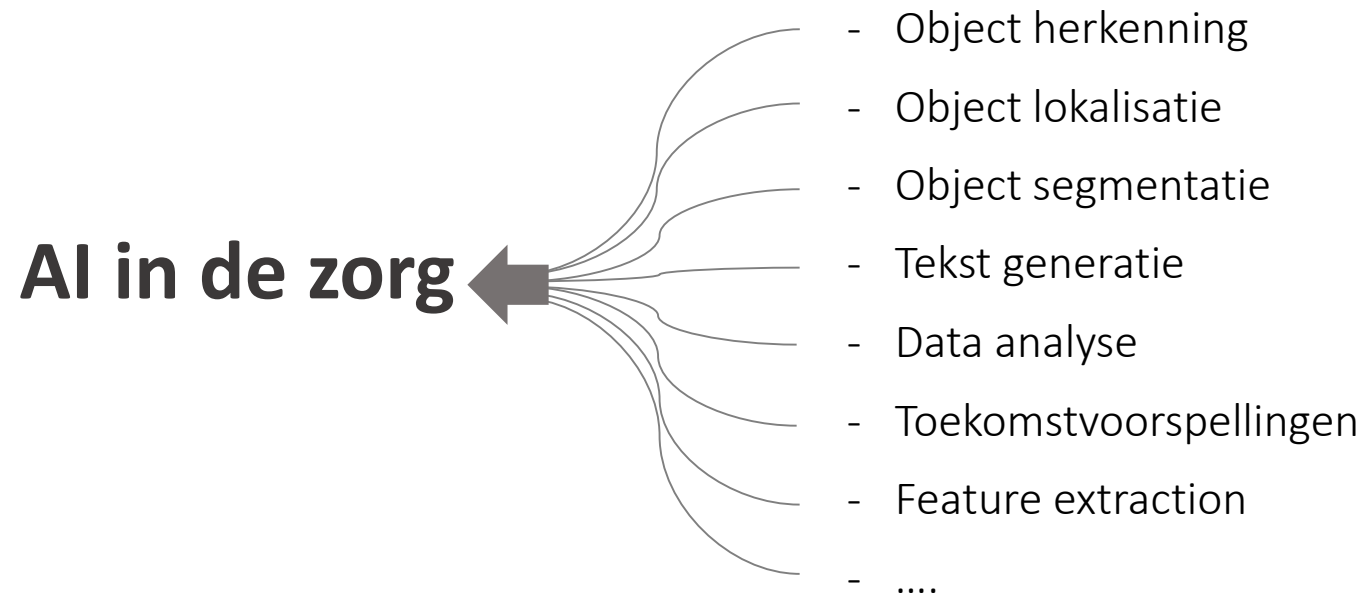
# AI – Reinforcement Learning - AlphaZero

## AlphaZero: Creative player

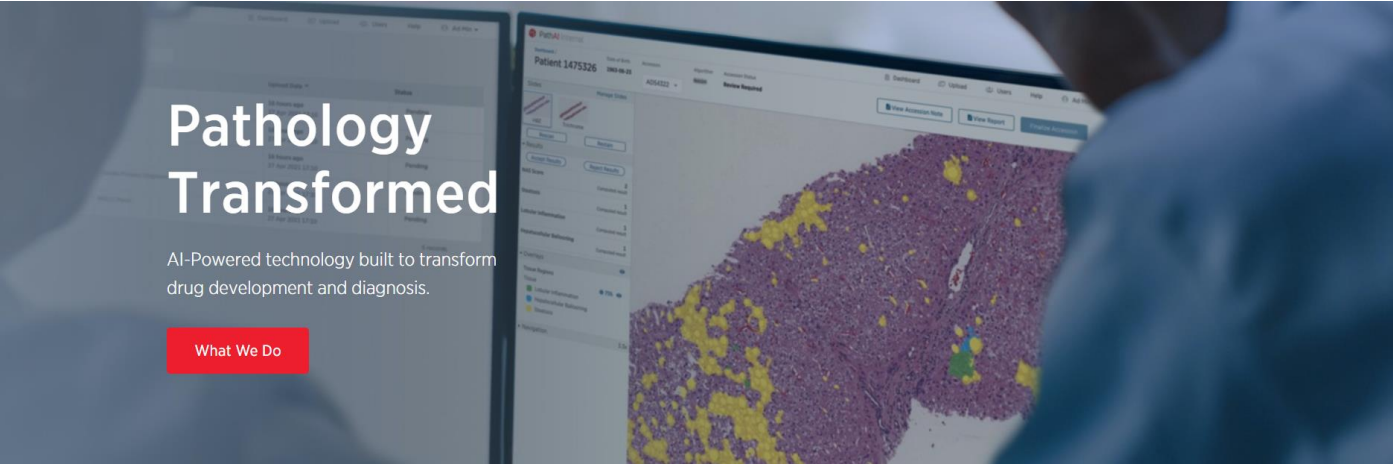
In late 2017, we introduced AlphaZero, a single system that taught itself from scratch how to master the games of chess, shogi, and Go, beating a world-champion computer program in each case.







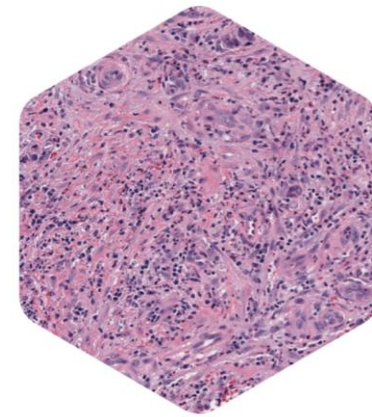
AI in de zorg  
**PathAI**



**Pathology Transformed**

AI-Powered technology built to transform drug development and diagnosis.

What We Do



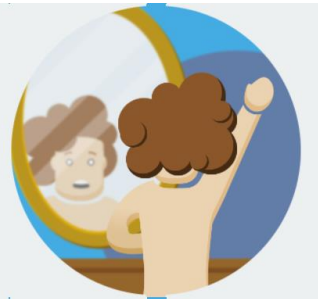
PARTNER WITH US  
**Transform Pathology, Together**

At PathAI we are transforming diagnosis and treatment of disease by enhancing each stage of the drug development process with AI-powered technology.

Contact Us

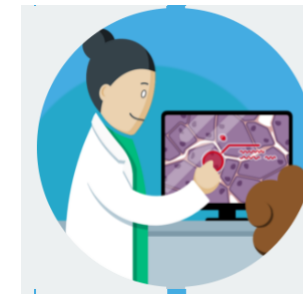
Imagine...

Elise is a 40-year-old mother who, one day, discovers a lump on her breast. Her clinician takes a tissue sample and sends it to a pathologist.



Imagine viewing a satellite photo of Boston and trying to find blue cars.

Pathologists do this with tissue from hundreds of patients every day, looking for cancerous cells in each.



PathAI is developing technology that assists pathologists in making rapid and accurate diagnoses for every patient, every time. That way patients like Elise can receive the best possible treatment and live the best possible life.



**The Pathologist's Role**

Upon reviewing Elise's tissue sample, her pathologist will essentially define her future with their diagnosis, determining whether or not she has cancer.

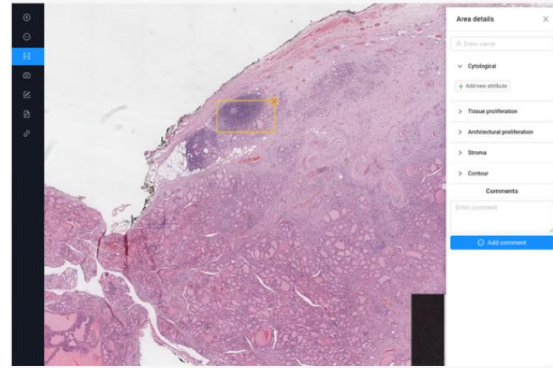
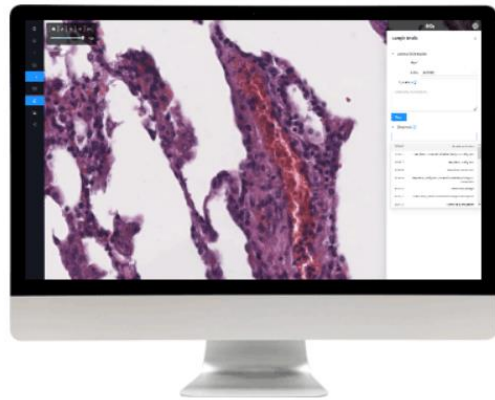
AI in de zorg

# Cancer Center

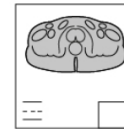
## AI AND DEEP LEARNING IN CANCER DIAGNOSIS



Medical Image + Deep Learning Algorithm = Faster Cancer Diagnosis with Better Efficacy



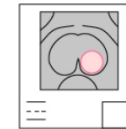
1. Firstly, acquire medical images



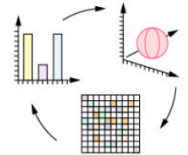
2. Secondly, store your data safely in the cloud



3. Next, use the software to find region of interests



4. Finally, run algorithms for characterization



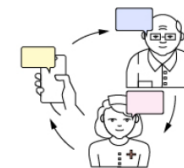
5. Use the power of deep learning



6. After that, double check your diagnosis & staging



7. Collaborate with other experts from all over the world



8. Lastly, generate reliable and accurate reports



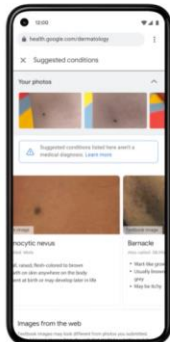
# AI in de zorg

# Google Health

Google Health Overview For everyone For clinicians Research Partners

Imaging & Diagnostics Genomics Publications

## AI-enabled imaging and diagnostics previously thought impossible

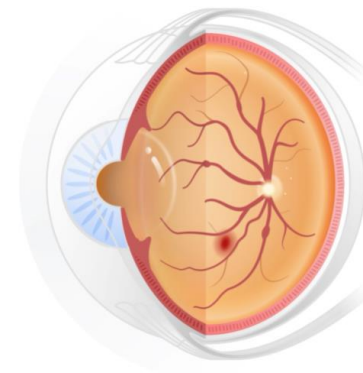


### Improving access to skin disease information

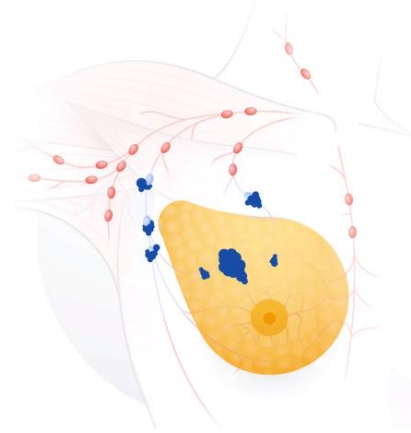
Through computer vision AI and image search capabilities, we are developing a tool to help individuals better research & identify their skin, hair, and nail conditions. The tool supports hundreds of conditions, including more than 80% of the conditions seen in clinics and more than 90% of the most commonly searched conditions. The work was highlighted in both [Nature Medicine](#) and [JAMA Network Open](#). [Read the post](#)

### Helping doctors prevent blindness

Our Automated Retinal Disease Assessment, in use in clinics in India and Thailand, shows how an AI can help doctors quickly spot diabetic retinopathy, a leading cause of blindness. With widespread adoption, perhaps millions of patients with diabetes could keep their vision in part to Automated Retinal Disease Assessment assisting doctors. This research was published in [JAMA](#) and [Ophthalmology](#). Additional research, published in [Lancet Digital Health](#), showed that we can predict whether patients will develop diabetic retinopathy in the future, which can help doctors customize both treatment and eye screening frequencies for their patients. [Learn more](#)



SAIRE

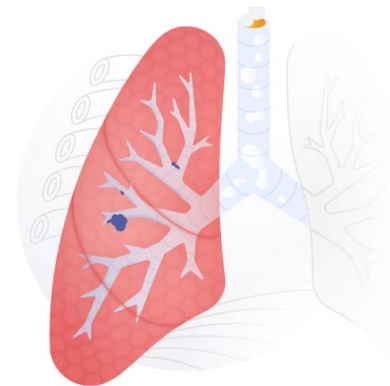


### Studying how AI can help breast cancer screening in clinical practice

Breast cancer screening helps detect cancer earlier, but diagnosing breast cancer accurately and consistently remains a challenge, with half of all women experiencing a false-positive over a 10-year period. In [Nature](#), we demonstrated the potential of our AI model to analyze de-identified retrospectively collected screening mammograms with similar or better accuracy than clinicians. Now, we're collaborating on an investigative device research study to understand how the model can help in clinical practice to reduce the time from screening mammography to diagnosis, narrowing the assessment gap and improving the patient experience. [Read the post](#)

### A promising step forward for predicting lung cancer

Lung cancer leads to over 1.8 million deaths per year world wide, accounting for almost one in five cancer deaths, and is the largest cause of cancer mortality. Our research, published in [Nature Medicine](#), shows that deep learning may eventually help physicians more accurately screen for lung cancer and identify the disease even in incidental lung cancer detection workflows. [Read the post](#)



AI in de zorg

## FACE2GENE



READ THE BLOG

CONTACT US

SIGN IN

REGISTER

It's free



FDNA TELEHEALTH

CLINIC

LABS

RESEARCH

PUBLICATIONS

HOW IT WORKS

ABOUT FDNA



## CLINIC

Enhanced Patient Evaluation with Deep Phenotyping

LEARN MORE &gt;

DATA PRIVACY  
COMPLIANT

## Deep Learning and Computer Vision

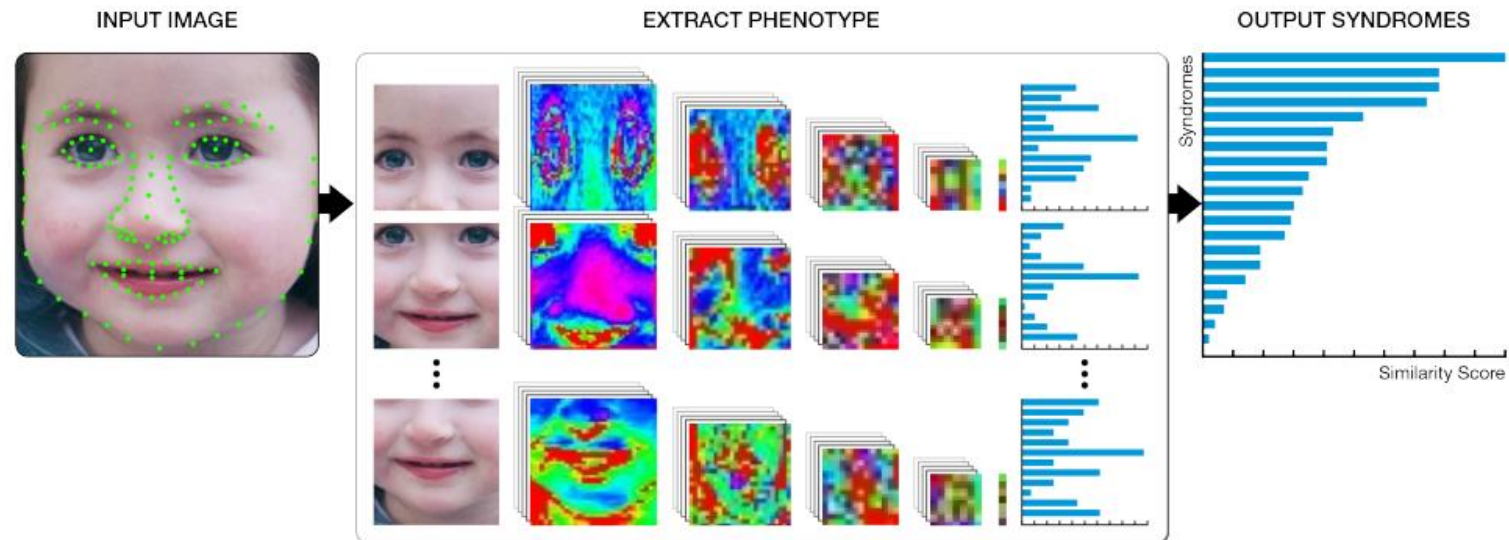
Deep learning algorithms build syndrome-specific computational-based classifiers (syndrome gestalts) Proprietary technology converts a patient photo into de-identified mathematical facial descriptors (facial descriptors) The patient's facial descriptor is compared to syndrome gestalts to quantify similarity (gestalt scores) resulting in a prioritized list of syndromes with similar morphology Artificial intelligence suggests likely phenotypic traits and genes to assist in feature annotation and syndrome prioritization. Please read more [in this Nature Medicine publication](#).

## Real World Phenotype Data

Crowd-sourced by expert genetics professionals, labs & bioinformaticians from real patients Millions of comprehensive, precise & accurate data points Learning system uses expansive data for unique health insights and genomics discoveries

# DeepGestalt - Identifying Rare Genetic Syndromes Using Deep Learning

Yaron Gurovich<sup>1</sup>, Yair Hanani<sup>1</sup>, Omri Bar<sup>1</sup>, Nicole Fleischer<sup>1</sup>, Dekel Gelbman<sup>1</sup>, Lina Basel-Salmon<sup>2,3</sup>, Peter Krawitz<sup>4</sup>, Susanne B Kamphausen<sup>5</sup>, Martin Zenker<sup>5</sup>, Lynne M. Bird<sup>6,7</sup>, Karen W. Gripp<sup>8</sup>

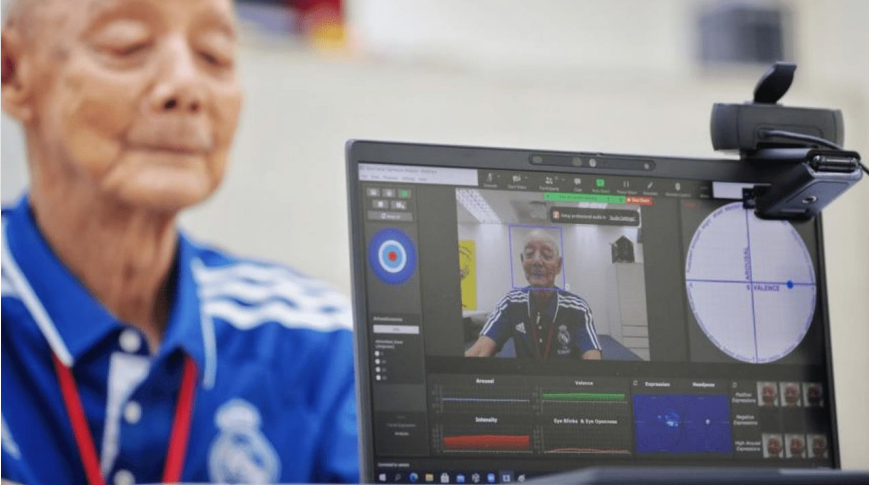




**AI-powered emotion analysis technology to help diagnose mental health conditions in seniors in Singapore**

[Home](#) ▶ [Products](#) ▶ [SenseCare – Health Prediction](#)

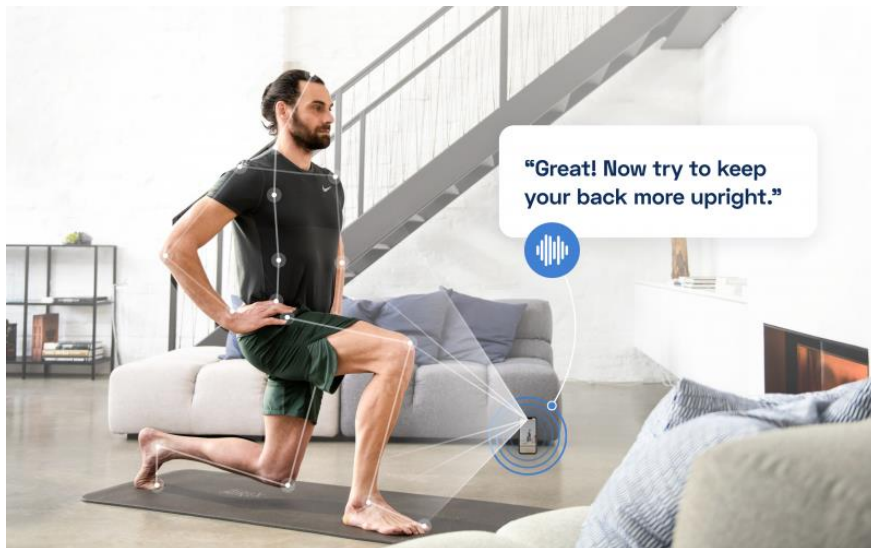
**SenseCare** - Health Prediction and Wellness



AI in de zorg

# Kaia health

## Computer vision technology from Kaia Health





BUILD AI VISION

### Create Computer Vision applications in healthcare

Use visual AI to save lives, empower healthcare workers and develop new medical treatments. Powerful on-device AI inference allows for highest privacy, performance and efficiency. Use AI vision for early diagnosis, prevention or drug discovery. Visual AI can be used to visually find patterns and anomalies or make predictions.

Use the [low-code editor of Viso Suite](#) to visually create and optimize AI vision applications.

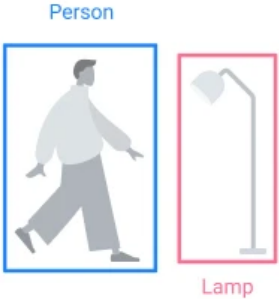
Explore the Viso Platform



#### Human Pose Estimation

Visually determine and track the human pose of patients. Identify specific poses such as seating, standing or walking.

Build >



#### Person Detection

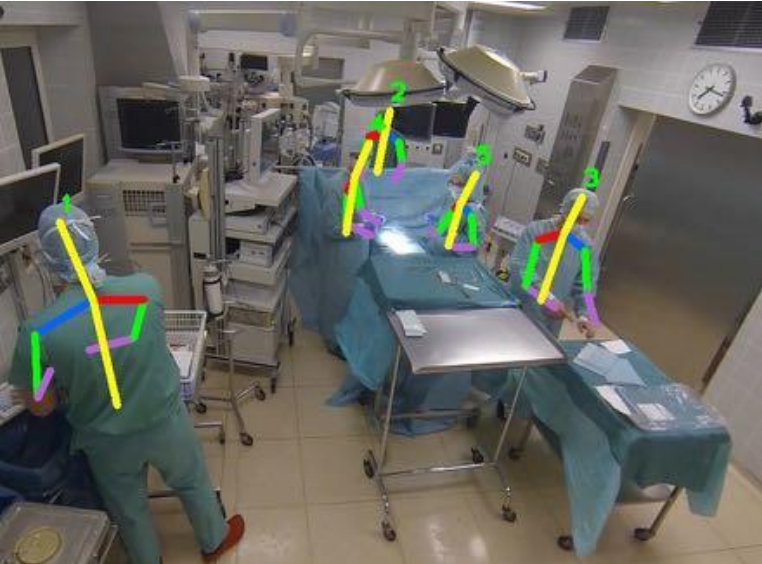
Detect people while keeping people's privacy protected. Set up rules to count the occurrence of events over time.

Build >

- ✓ HUMAN POSE ESTIMATION
- ✓ MOVEMENT ANALYSIS
- ✓ GROUP KEYPOINT DETECTION
- ✓ GAIT ANALYSIS

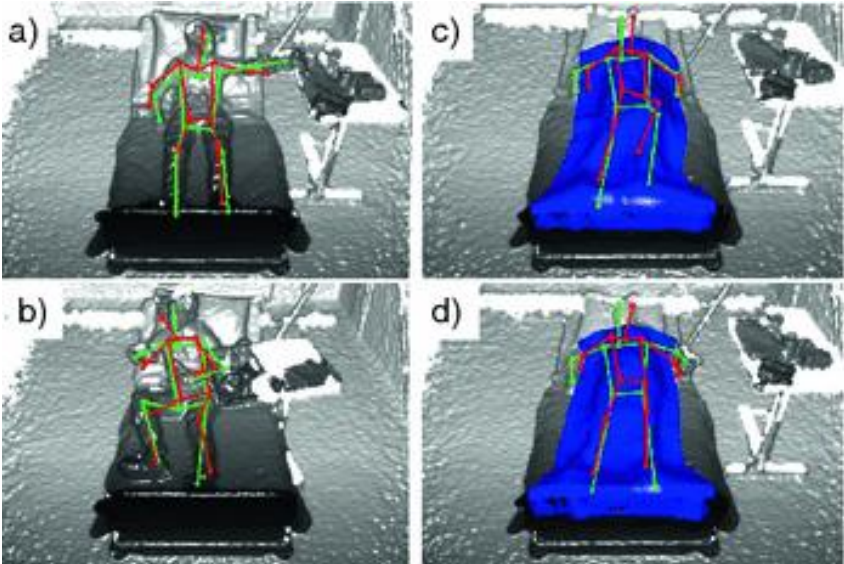
AI in de zorg

# Pose Detectie – Research



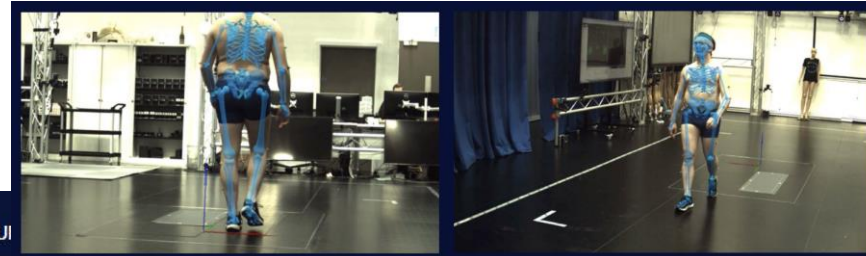
General Model

PatientPose



AI in de zorg

# Vicon Theia



## VICON

APPLICATIONS SOFTWARE HARDWARE SUI

HOME > SOFTWARE > MARKERLESS

# THEIA MARKERLESS MOTION CAPTURE

Vicon partners with Theia Markerless to unlock markerless motion tracking for life sciences within the Vicon Nexus ecosystem

DOWNLOAD FACT SHEET

READ ABOUT NEXUS





Hoe Jane werkt

Stel je vraag

Over ons

Ook voor thuis

Blog

Bestel nu

Nederlands

## Jane waakt wanneer jij er niet bent

De slimme oplossing van Jane maakt het mogelijk om alleenstaande senioren langer zelfstandig thuis te laten wonen, met of zonder professionele



### Zorgoplossing met patroonherkenning

- Temperatuur- & bewegingssensoren monitoren patroon zorgvrager
- Bij afwijking wordt de zorgverlener verwittigd
- Geen camera of geluidsopnames



# Anomaly Detection for an Elderly Person Watching System using Multiple Power Consumption Models

Maiya Hori<sup>1</sup>, Tatsuro Harada<sup>1,2</sup> and Rin-ichiro Taniguchi<sup>1,3</sup>

<sup>1</sup>*Center for Co-Evolutional Social System, Kyushu University, Fukuoka, Japan*

<sup>2</sup>*Research and Education Center of Carbon Resources, Kyushu University, Fukuoka, Japan*

<sup>3</sup>*Graduate School of Information Science and Electrical Engineering, Kyushu University, Fukuoka, Japan*

*maiya-h@ieee.org, harada@cm.kyushu-u.ac.jp, rin@kyudai.jp*



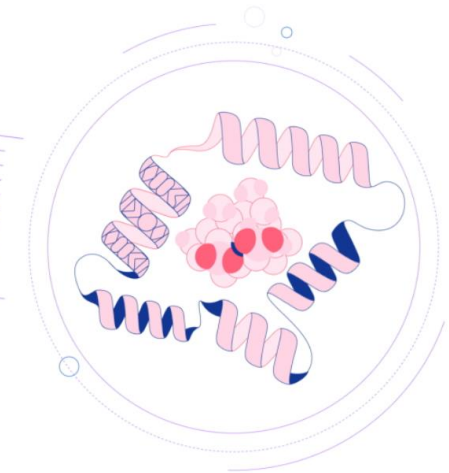
AI in de zorg

# AlphaFold

BLOG POST  
RESEARCH

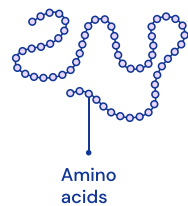
30 NOV 2020

## AlphaFold: a solution to a 50-year-old grand challenge in biology

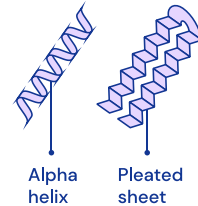


AlphaFold is an AI system developed by DeepMind that predicts a protein's 3D structure from its amino acid sequence. It regularly achieves accuracy competitive with experiment.

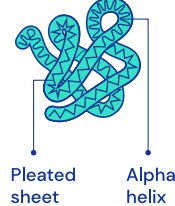
Every protein is made up of a sequence of amino acids bonded together



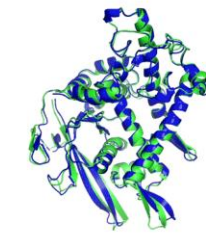
These amino acids interact locally to form shapes like helices and sheets



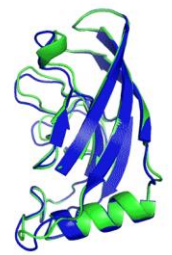
These shapes fold up on larger scales to form the full three-dimensional protein structure



Proteins can interact with other proteins, performing functions such as signalling and transcribing DNA



T1037 / 6vr4  
90.7 GDT  
(RNA polymerase domain)



T1049 / 6y4f  
93.3 GDT  
(adhesin tip)

● Experimental result  
● Computational prediction

AI in de zorg

**Neurable**

# NEURABLE

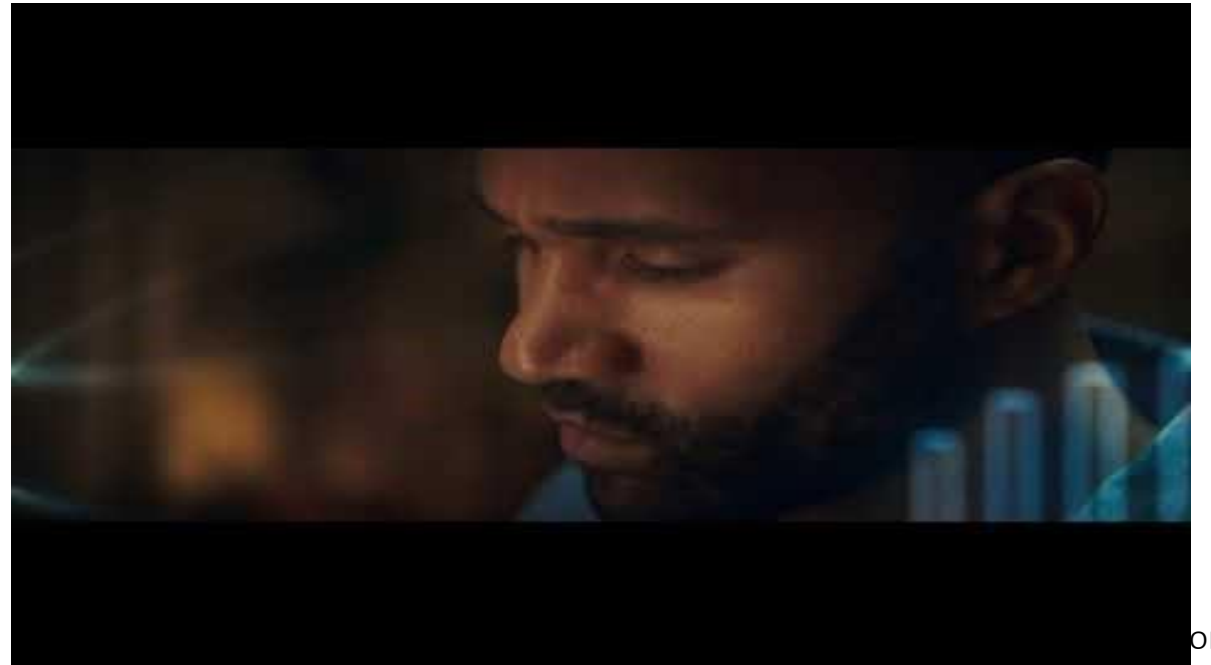
JOIN OUR EMAIL LIST

The mind.  
Unlocked.

••  
At  
act  
all,



ter



AI in de zorg

# Emotiv

EMOTIV

GET STARTED

HARDWARE

RESEARCHERS

DEVELOPERS

ENTERPRISE

THE SCIENCE

NEWS



LOGIN

CART / \$0.00



## Connecting you, your brain, and the world.

JOIN THE MOVEMENT



### 5 CHANNEL EEG

whole brain sensing



### MINIMAL SET UP TIME

only 1-2 minutes



### SEMI-DRY POLYMER SENSORS

easy to use and clean



### WIRELESSLY CONNECTS

PC and mobile devices



### RECHARGEABLE

up to 9 hours of battery



### 9 AXIS MOTION SENSORS

detect head movements





# Flow

Kernel Flow is a non-invasive, full-coverage, optical headset that can be used in nearly any environment for recording real-time cortical hemodynamics to establish precise patterns of brain activity. Flow is currently available for research and consumer markets.

[CONTACT SALES](#)[SIGN UP FOR NEWSLETTER](#)

Expected delivery is Q2 2022, see [FAQ](#) for pricing and additional information.



AI in de zorg

# Bitbrain



- Products
- Services
- Applications
- Science
- About us
- Contact us

## Advanced neurotechnology

**Bitbrain® is a neurotechnology company that combines neuroscience, artificial intelligence, and hardware to develop innovative products.**

High-tech EEG brain sensing devices and software solutions for real-world human behaviour research, health and neurotechnology development.

We help research, tech and health professionals to leverage neuroscience in a practical and reliable way.

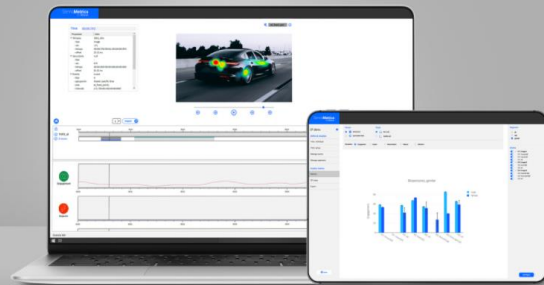
Contact us



## SennsMetrics

A step forward in the data analysis of human behavior, with a complete, flexible, and practical solution developed for applied research.

Contact us



AI in de zorg

# NextMind

**INEXTMIND**

HOME

PRODUCT

TECHNOLOGY

DEVELOPER

BLOG

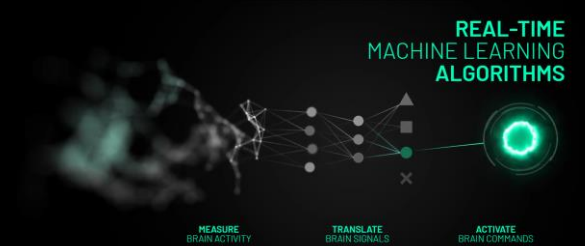
ORDER



## HOW IT WORKS

**NextMind technology decodes the act of focusing.**

Our Brain-Computer Interface translates brain activity into digital commands, allowing you to control visual interfaces in real time.



AI in de zorg

# Paradromics


[Home](#) [News](#) [Careers](#) [Neurotech Pub](#) [Contact](#)

## Brain Computer Interfaces Turning Data Into Medicine



Our physical capabilities may limit us, but they do not define us.

Injuries and illnesses have serious consequences, especially when they affect the brain and nervous system, but they shouldn't diminish our dignity or our worth.



Brain-computer interface technology will open up new opportunities.

In order to enable new, effective therapies for brain-related disorders, we need to build technologies that can communicate effectively with the brain. This means developing a specialized data interface that will translate between bioelectric and digital signals.



AI in de zorg

# Neuralink

## Understanding the Brain

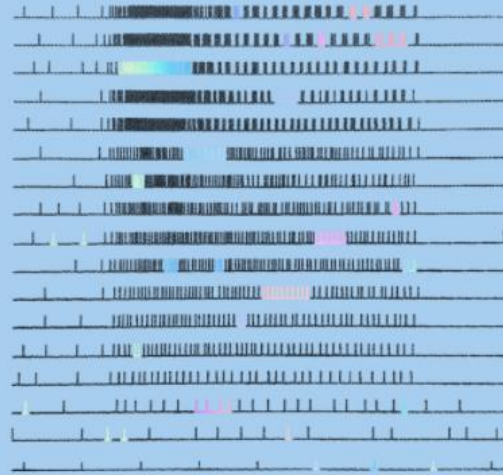
FIG. 1



SCIENCE →

## Interfacing with the Brain

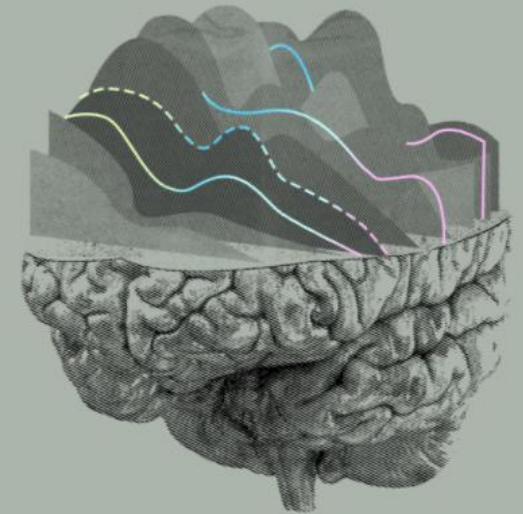
FIG. 2



APPROACH →

## Engineering with the Brain

FIG. 3



APPLICATIONS →

AI in de zorg

# Neuralink

## The Link

We're designing the first neural implant that will let you control a computer or mobile device anywhere you go.

Micron-scale threads are inserted into areas of the brain that control movement. Each thread contains many electrodes and connects them to an implant, the Link.

## The Neuralink App



### BE IN CONTROL

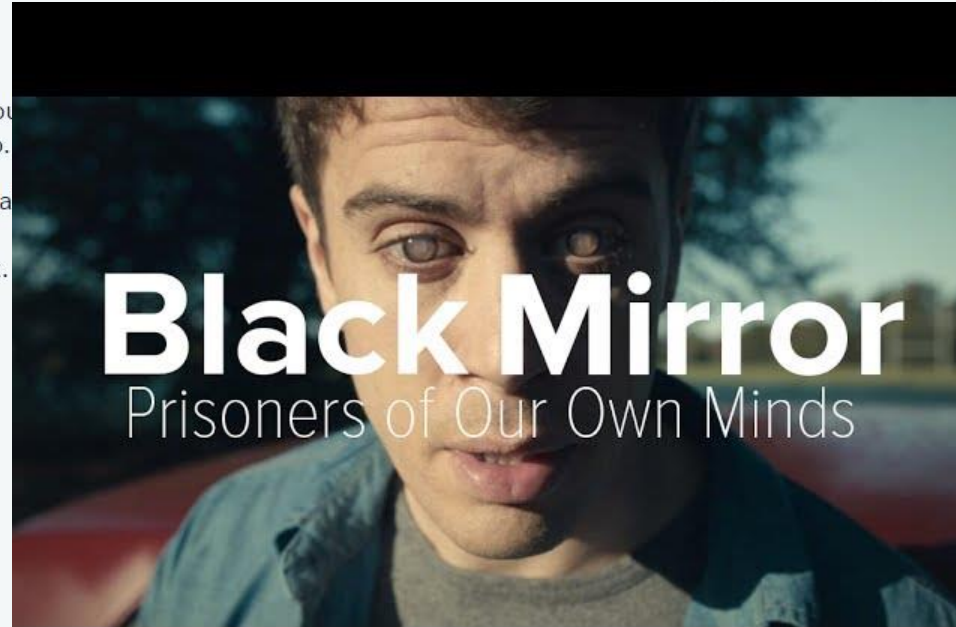
The Neuralink app would guide you through exercises that teach you to control your device.

SIMULATION.  
NOT FDA-APPROVED OR  
AVAILABLE.



### BE AUTONOMOUS

With a bluetooth connection, you would control any mouse or keyboard, and experience reality — unmediated and in high fidelity.



**Black Mirror**  
Prisoners of Our Own Minds



LINK

Sealed, implanted device that processes, stimulates, and transmits neural signals.

AI in de zorg

# Rejoint



PATIENTS

HEALTHCARE PROFESSIONALS

HEALTHCARE MANAGERS

NEWS &amp; STORIES

ABOUT

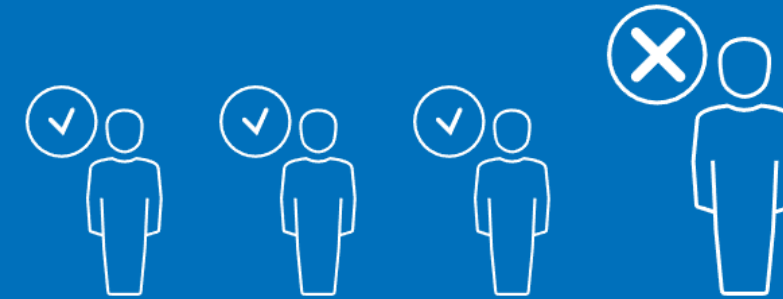
Log In

“

## IT IS ALL ABOUT YOU

You know? Over **25%** of patients are dissatisfied about their knee replacement mainly due to non-optimal implant fit. Learn how Rejoint is helping you to get better results.

”



# 1 OUT OF 4

A personalized knee replacement experience for better outcomes and faster recovery.

The power of personalization, smart surgery and big data for better treatment outcomes.

A breakthrough and sustainable solution for higher standards of care.

## Artificial Intelligence at the service of TKA patients

The new **algorithm** for the optimal size selection and positioning of Rejoint prostheses has been released in alpha version. Thanks to Machine Learning techniques applied to medical images, the surgeon is supported in choosing among the **75.000 implant sizes** available at Rejoint and optimally positioning the chosen prosthesis.

Rejoint exploits the power of artificial intelligence to provide total knee arthroplasty patients and surgeons with automated support for **best-fit** personalized implant configuration.

AI in de zorg

# BrainRobotics

[BrainRobotics Hand](#)[Users](#)[User Stories](#)[Clinicians](#)[About Us](#)[News](#)[FAQs](#)[Contact](#)

## Explore What You Can Do

Welcome to the next generation of upper limb prosthetics.

[Stay in the Know](#)

### How is the BrainRobotics Hand Different?

**Although similar to many other direct control myoelectric systems out on the market, the BrainRobotics 2-channel system mimics more advanced pattern recognition systems out on the market.**

The device uses 2-channel electromyography (EMG) sensors to obtain the muscle signals from the users' forearm and using an advanced Artificial Intelligence algorithm analyzes the users' movement intention.

After the user has recorded their grip control data, the BrainRobotic server will be able to create a personalized control model and write it into the terminal hand.

Through this method, every user will be able to create the unique model of their own and realize better control of the prosthetic hand.



# Smart Walker

Smart walker

# Aanpak ontwikkeling smart walker

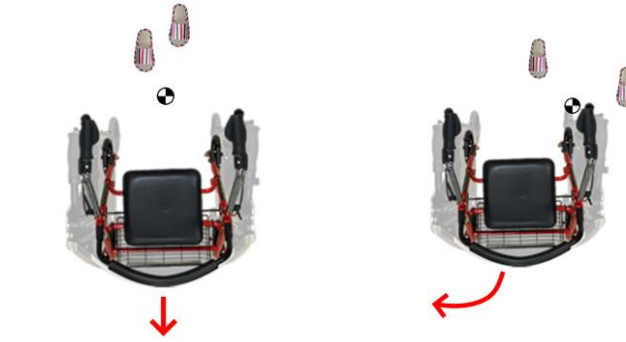
- **Wat en waarom?** – Wat is een smart walker en waarom is er nood aan
- **De ideale smart walker** – Wat zijn de user requirements en barrières
- **De eerste stap naar de ideale smart walker** – Afbakenen objectieven
- **Wat bestaat er al?** - Literatuurstudie & markonderzoek
- **Metingen** – Welke gegevens zijn er nodig
- **Selectie componenten** – Hoe gaan we de nodige gegevens verzamelen en verwerken
- **Hardware Setup** – Selectie componenten en montage op rollator
- **Software ontwikkeling** – Ontwikkeling slimme modellen
- **Gebruik smart walker** – UI en workflow
- **Volgende stappen**

Smart walker

## Wat & Waarom

*“Een rollator is een hulpmiddel die extra steun biedt tijdens het wandelen aan zowel ouderen mensen als mensen die vanwege een lichamelijke beperking slecht ter been zijn. Een rollator biedt steun aan de gebruiker, waardoor het risico op vallen afneemt.”*

➔ Op voorwaarde dat de rollator correct gebruikt wordt!



- Zorgverleners spelen cruciale rol bij het aanleren van het correct gebruik van een rollator
- Vraag vanuit de zorg: Bestaat er een rollator die het gangpatroon van de gebruiker controleert en actief feedback geeft?

Dit zou:

1. De zorgverlener ontlasten
2. De zorgvrager de mogelijkheid geven om zelfstandig te oefenen



SAIRE Smart Walker: Een rollator die het gangpatroon van de gebruiker controleert en actief feedback geeft om het correct gebruik van de rollator te stimuleren

Smart walker

# De ideale smart walker

- Metingen & Analyse
  - Positie voet t.o.v. de rollator
  - Ganganalyse: Staplengte, stapbreedte, stapnelheid, voetafrol, ...
  - Controle houding van de gebruiker (Rechte rug, niet voorovergebogen)
  - Controle of bochten breed genoeg genomen worden
  - Stappenteller – Als motivatie bij autonoom stappen
  - Stabiliteitsanalyse: Kracht op rollator, zwaartepunt, symmetrie
  - Valdetectie
  - Analyse vloer voor bijvoorbeeld waarschuwing natte vloer
- Feedback
  - Auditieve cues: gesproken en signalen, alarmen en metronoom
  - Visuele cues: projecties op de grond, led indicaties
  - Resultaten direct afleesbaar op device
- Remsysteem
  - Sit-to-stand
  - Loslaten handvaten
- Automatisch opladen
- Instellingen per patiënt
- Minimale kost



Smart walker

# De eerste stap naar de ideale smart walker

- Metingen & Analyse
  - Positie voet t.o.v. de rollator
  - Ganganalyse: Staplengte, stapbreedte, stap snelheid, voetafrol, ...
    - ~~Controle houding van de gebruiker (Rechte rug, niet voorovergebogen)~~
    - ~~Controle of bochten breed genoeg genomen worden~~
    - ~~Stappenteller — Als motivatie bij autonoom stappen~~
    - ~~Stabiliteitsanalyse: Kracht op rollator, zwaartepunt, symmetrie~~
    - ~~Valdetectie~~
    - ~~Analyse vloer voor bijvoorbeeld waarschuwing natte vloer~~
- Feedback
  - Auditieve cues: gesproken en signalen, alarmen en metronoom
  - Visuele cues: ~~projecties op de grond~~, led indicaties
  - Resultaten direct afleesbaar op device
- ~~Remsysteem~~
  - ~~Sit to stand~~
  - ~~Loslaten handvaten~~
- ~~Automatisch opladen~~
- Instellingen per patiënt
- Minimale kost



Smart walker

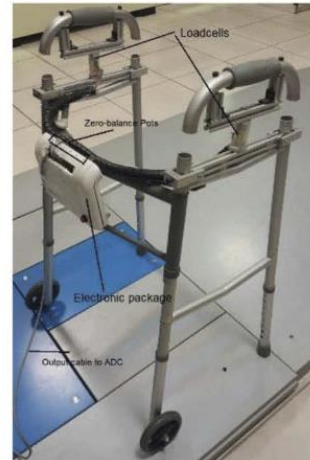
## Wat bestaat er al? – Off-the-shelf

- ~~Lea Smart Rollator~~
  - ~~Motorische ondersteuning & kan zich autonoom verplaatsen naar eigenaar en oplaadpunt~~
  - ~~Metronoom~~
  - ~~Skype verbinding, GPS, ...~~
  - ~~Richtprijs €10000~~
- Beactive+e
  - Motorische ondersteuning
  - Veiligheidsfuncties zoals een automatische rem
  - Vanaf €3531
- Parkinson Rollator (Mobio, Sunrise Medical)
  - Laserlijn op de grond
  - Metronoom
  - Vanaf €780
- i-Walker
  - Motorische ondersteuning
  - Automatisch remmen
  - Krachtmetingen in handvaten
  - Obstructie detectie, ..
  - EU erkenning voor klinische studies

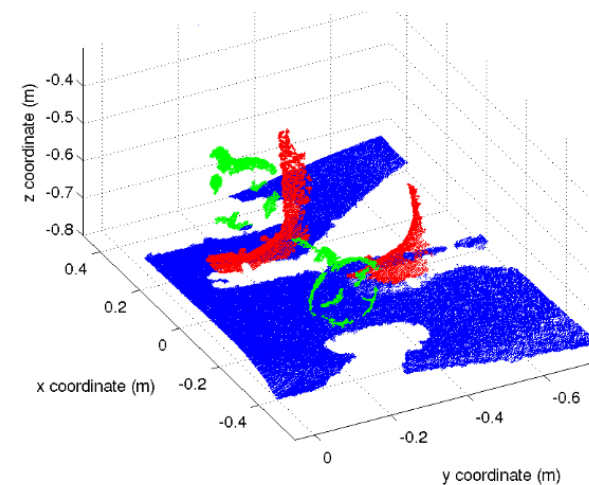
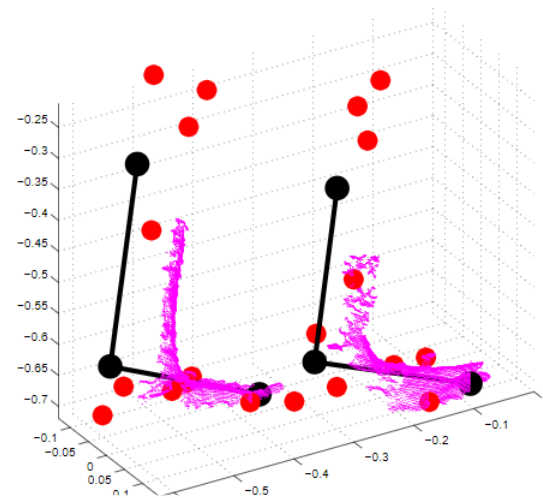
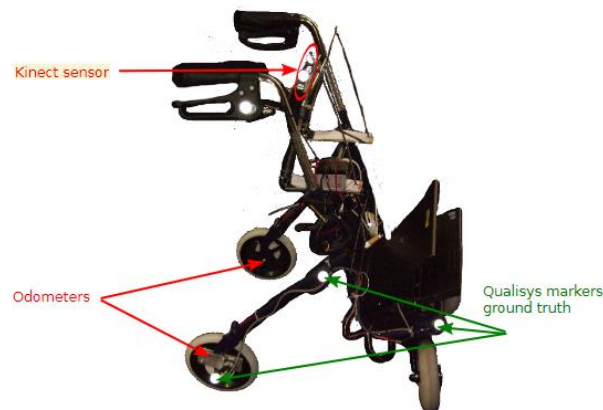
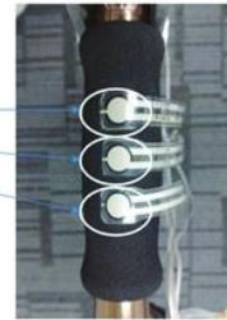


Smart walker

# Wat bestaat er al? - Onderzoek

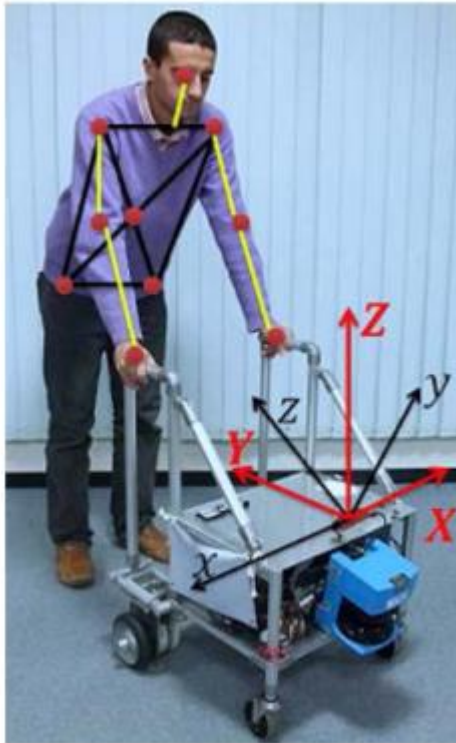


Sensor 1  
Sensor 2  
Sensor 3



Smart walker

# Wat bestaat er al? - Onderzoek



(a) Sit



(b) Fall Front



(c) Fall Down



(d) Fall Back

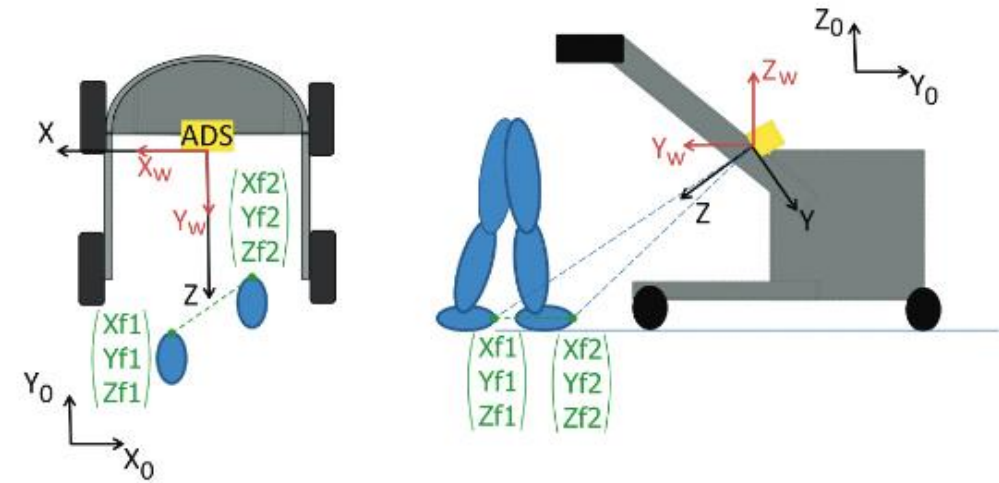
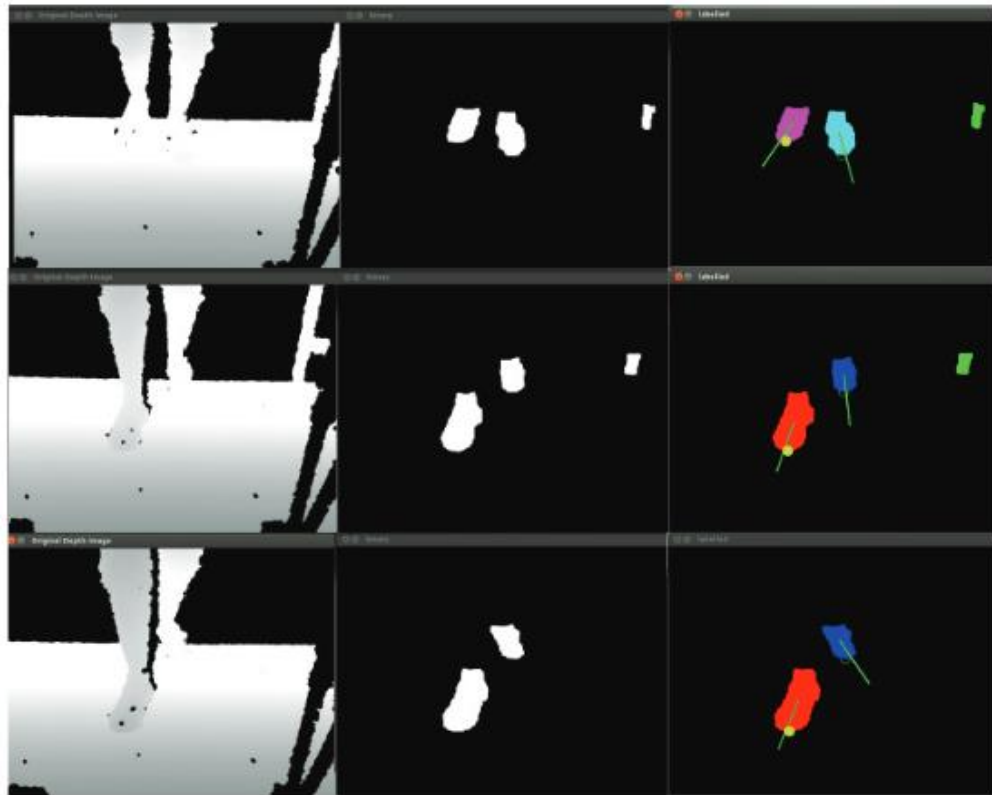


(e) Fall Side



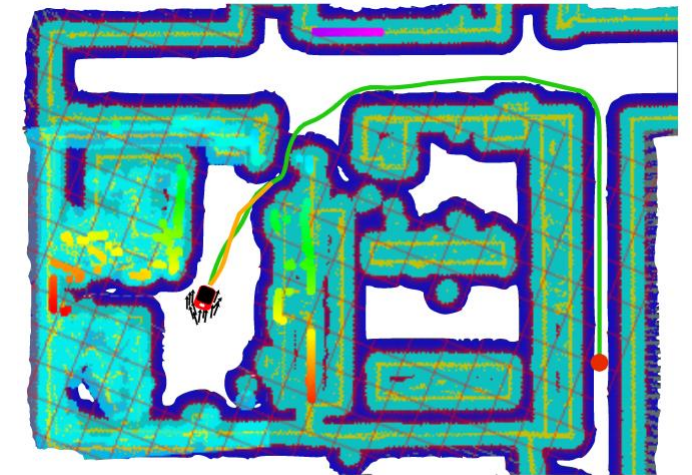
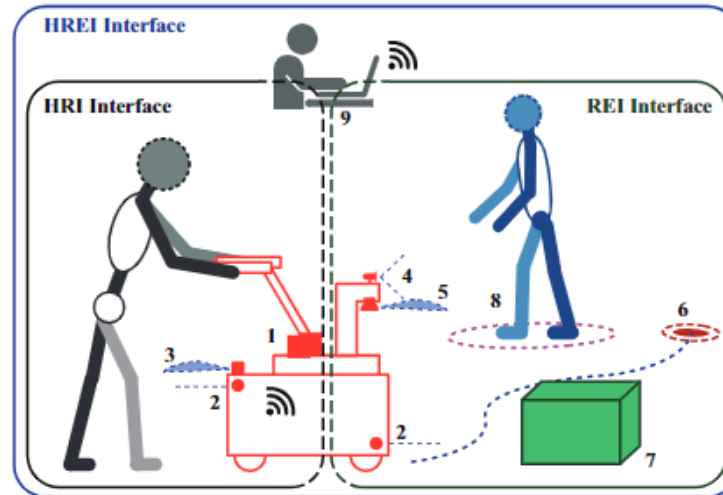
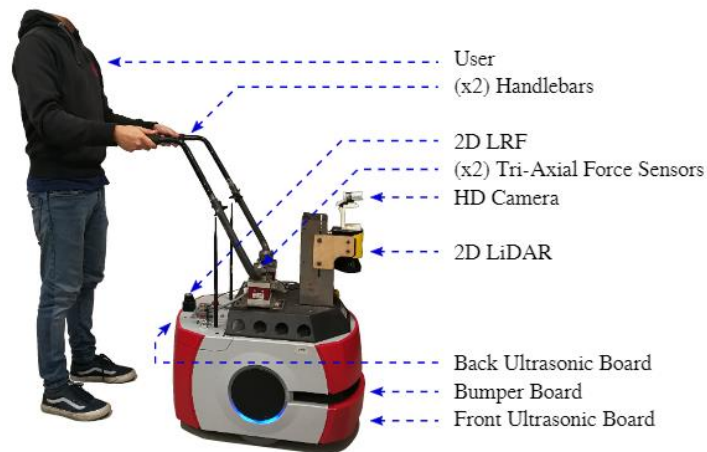
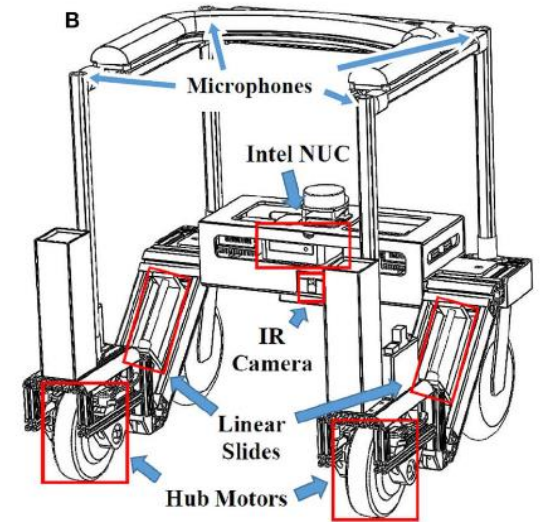
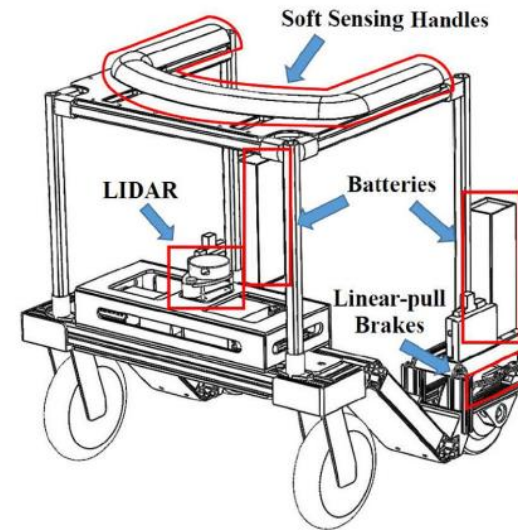
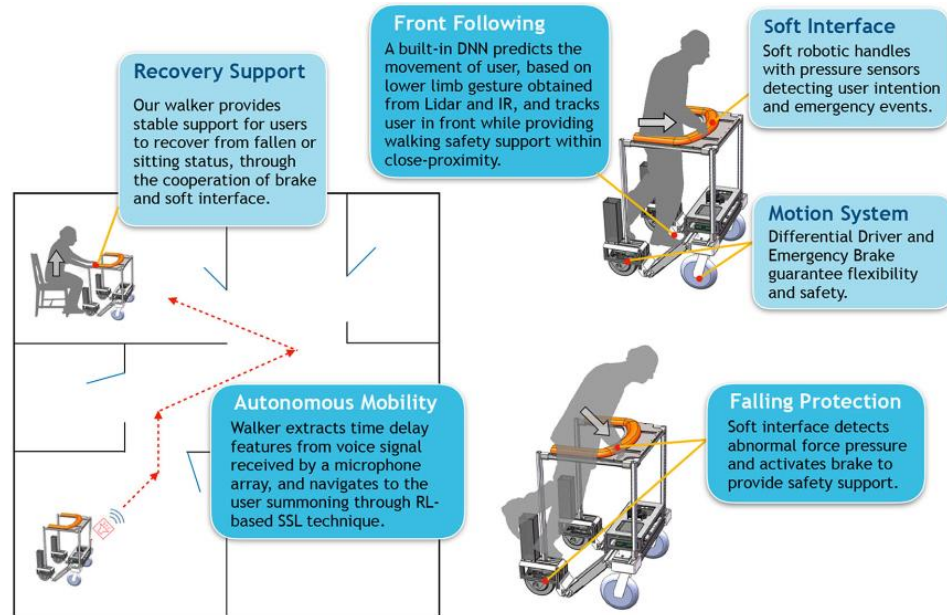
Smart walker

# Wat bestaat er al? - Onderzoek



Smart walker

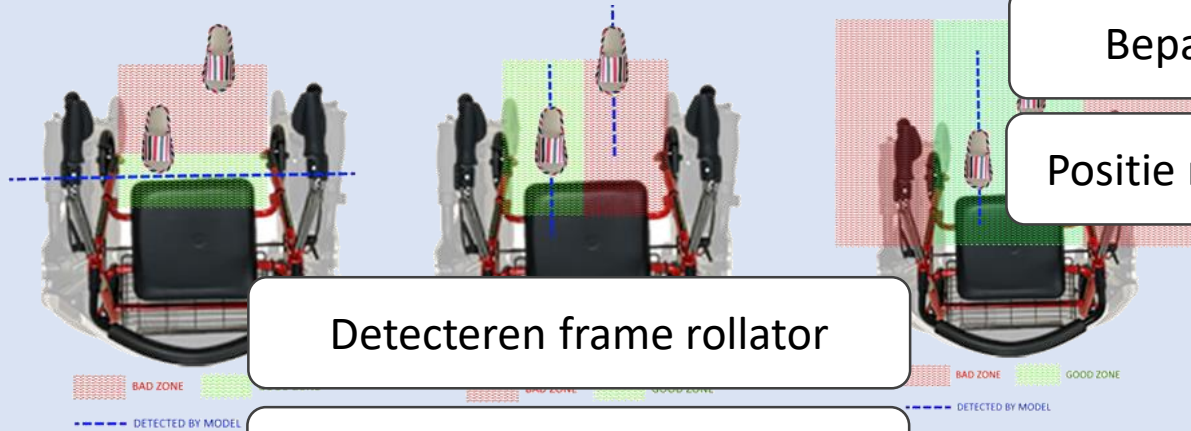
# Wat bestaat er al? - Onderzoek



Smart walker

# Metingen

## Positie voeten t.o.v. de rollator



Detecteren frame rollator

Positie voet relatief tot rollator

Zet de gebruiker zijn voeten op de rollator. Is de gebruiker binnen het kader?

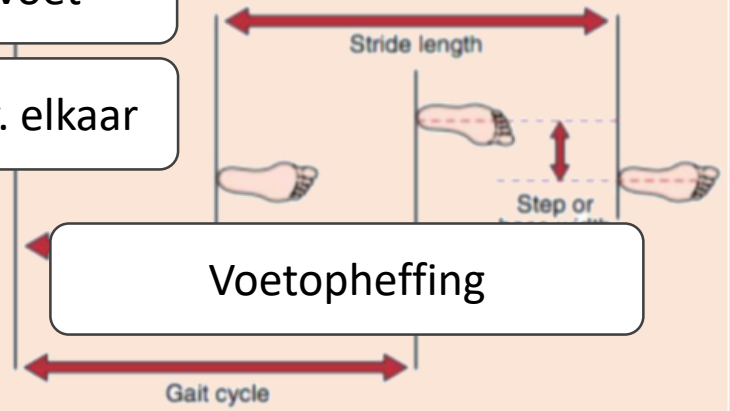
Wandelt de gebruiker symmetrisch t.o.v. de rollator?

Detecteren van de voeten

Bepalen positie voet

Positie relatief t.o.v. elkaar

## Ganganalyse



Voetopheffing

**Extra restrictie:** Rollator moet op zichzelf kunnen werken, geen externe markers of sensoren

Smart walker

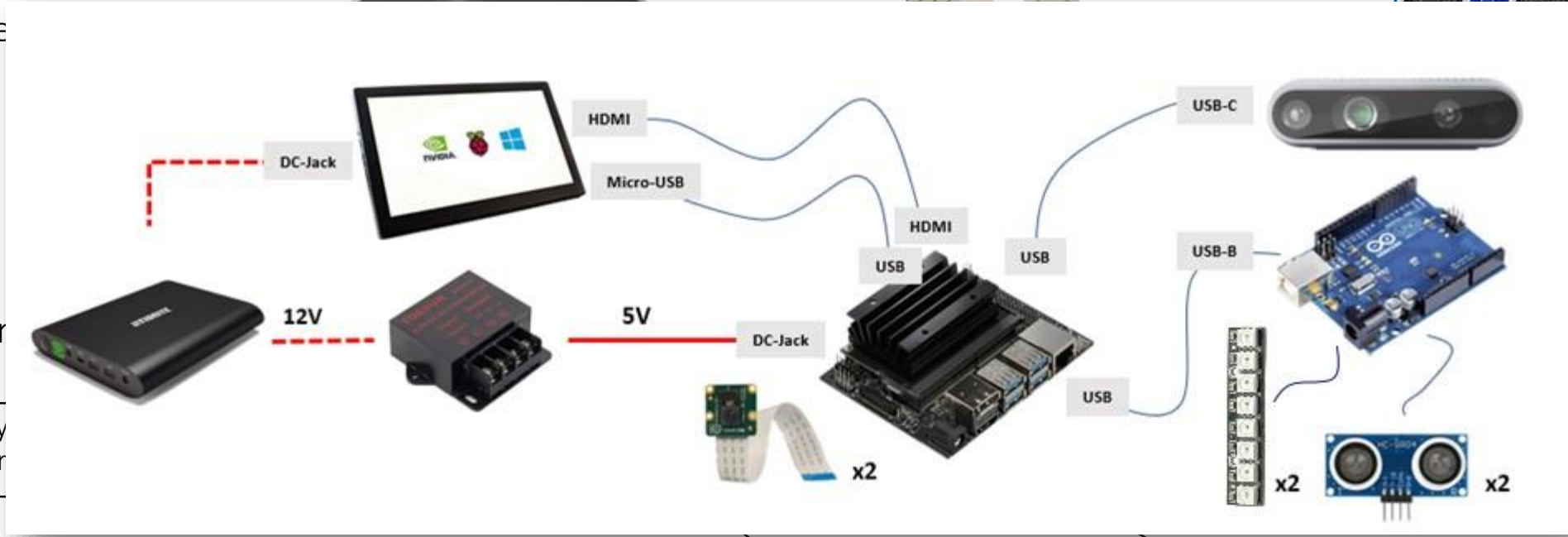
# Selectie componenten

2xRGB camera  
Infrarood camera  
IMU

Sensore

Data ver

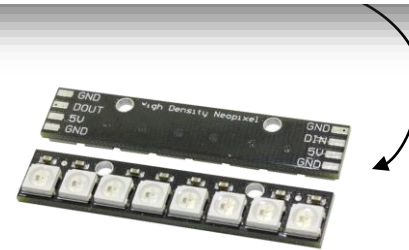
Analy  
Stuur



User Interface & Feedback



Touch Monitor



2 x Led sticks

Smart walker

# Hardware Setup



Smart walker

# Software – Voetdetectie met dieptecamera

1. Creëer referentie-diepte-profiel van de rollator
2. Vergelijk frame van dieptecamera met referentie-diepte-profiel
3. Postprocessing aan de hand thresholds
4. Detecteer de contouren van het resultaat
5. Filter op grootte en bepaal omschreven rechthoek
6. Map de gedetecteerde contouren op het RGB frame

## Voordelen:

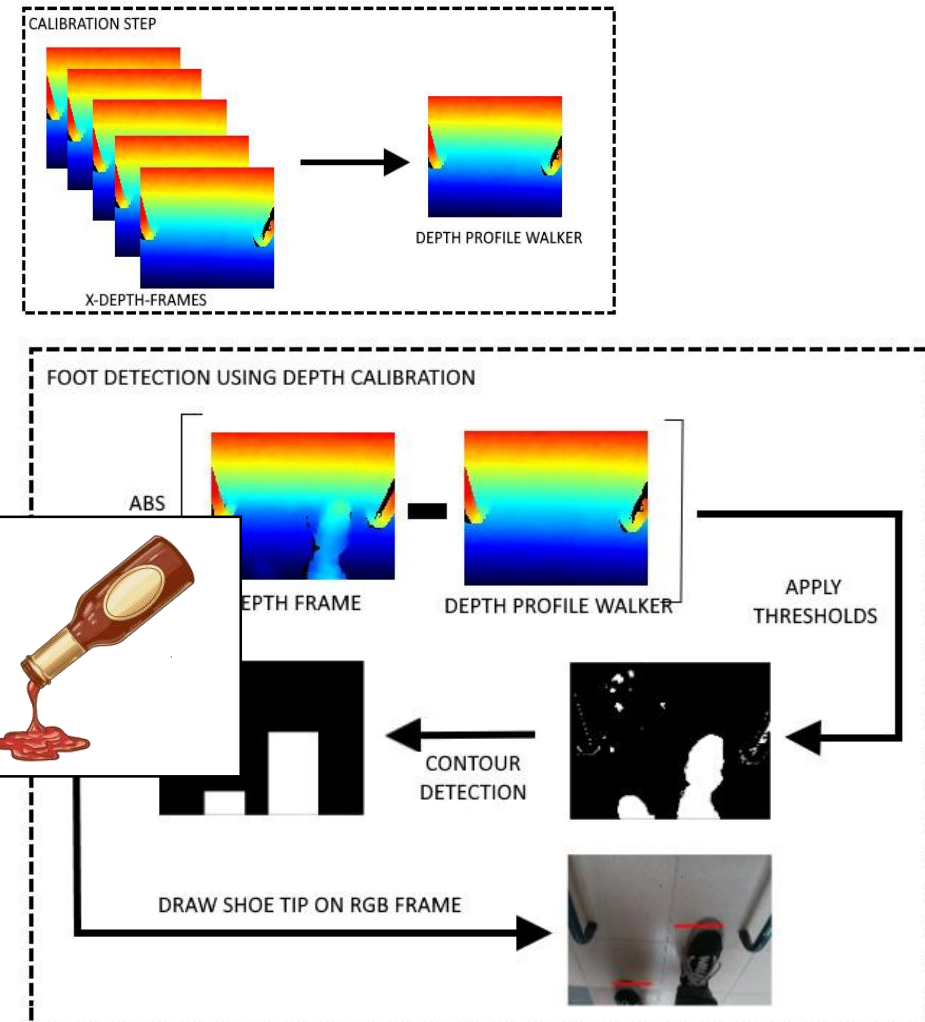
- Snel & simpel

## Nadelen:

- Afhankelijk van de camera
- Niet robuust, elk object die even groot is als een schoen zal gedetecteerd worden als een schoen
- Afhankelijk vooraf ingestelde parameters zoals minimum grootte van een schoen
- Dieptecamera nodig

## Toevoegen AI-Saus

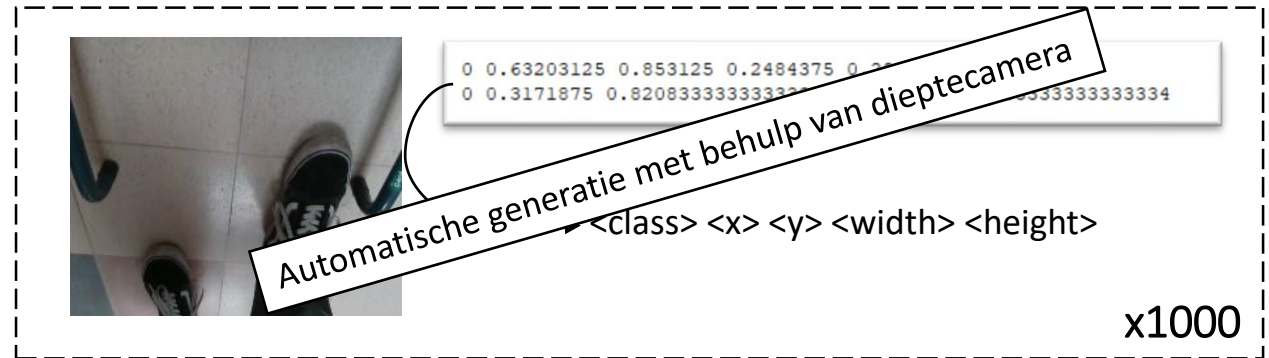
- Robuustheid verhogen
- Herkenning via gewone camera



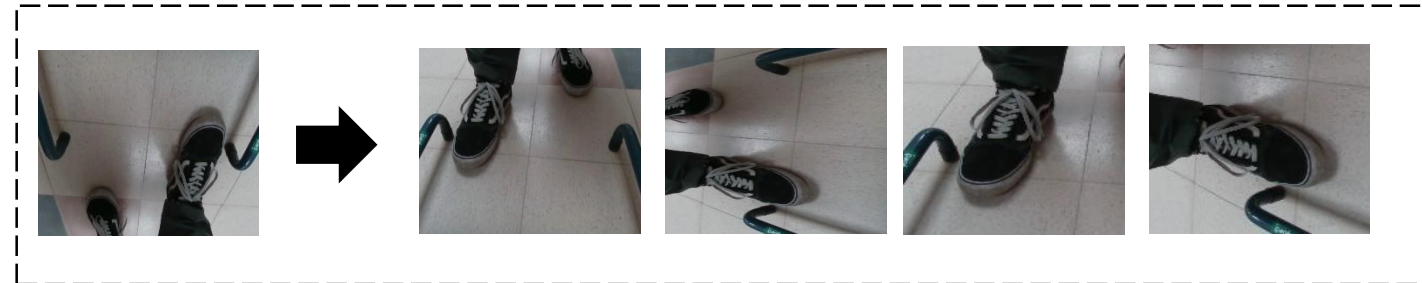
Smart walker

# Software – Voetdetectie met AI

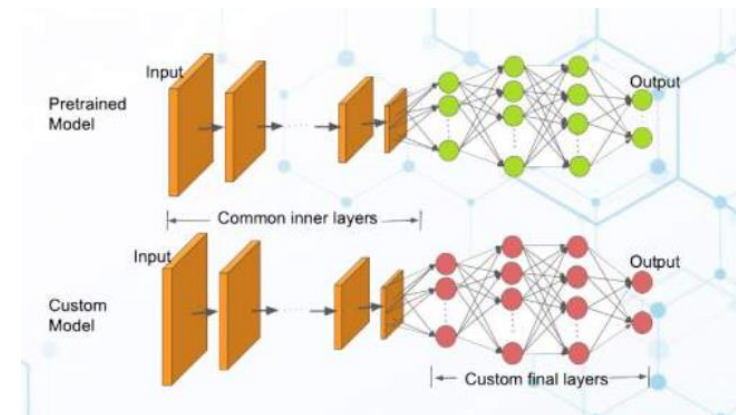
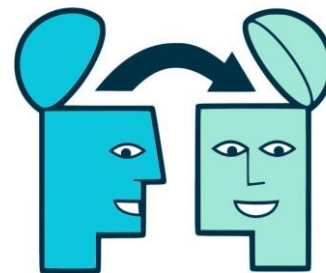
1. Verzamelen afbeeldingen
2. Voeten labelen op afbeeldingen



3. Toepassen “data augmentation”



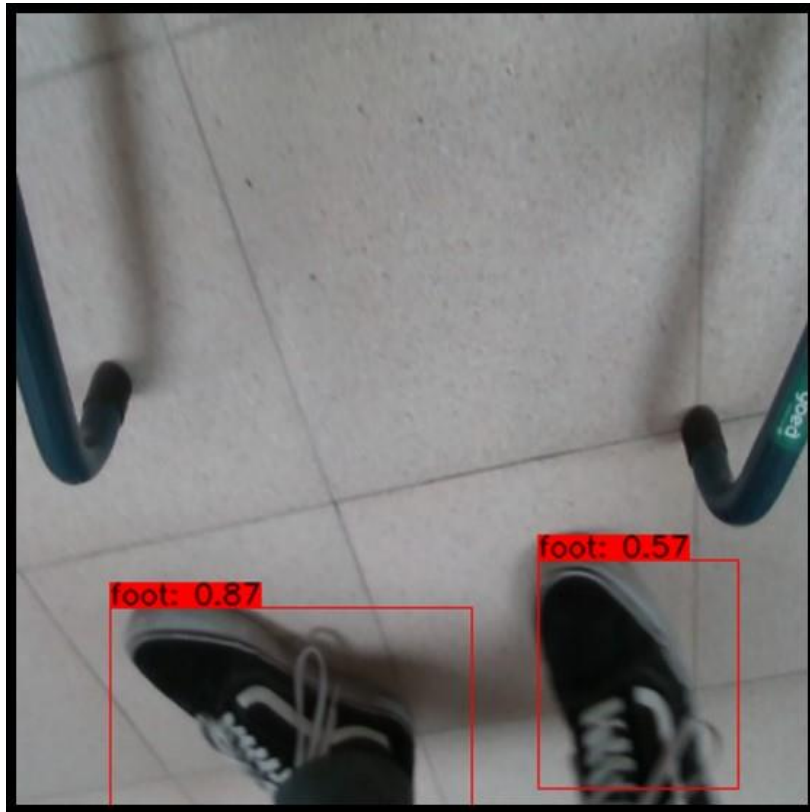
4. Trainen AI model via Transfer Learning
5. Evaluatie + Fine tuning



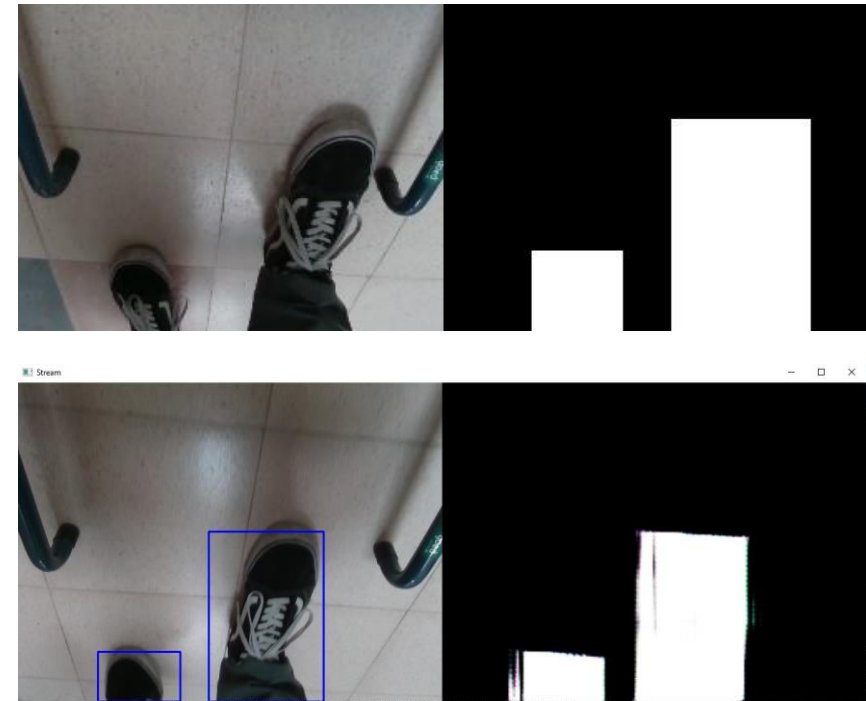
Smart walker

# Software – Voetdetectie met AI

Object lokalisatie – YoloV4



Segmentatie netwerk – Pix2Pix





Smart walker

# Software – Edge computing



Computing power

Size

Energie

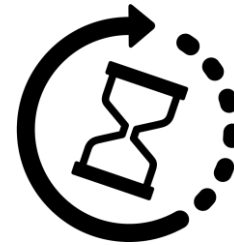




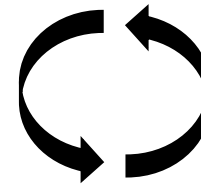
Smart walker

# Volgende stappen

1. Data verzamelen – Labo omgeving
2. (AI-)modellen selecteren, ontwikkelen en testen
  1. Positie voet
  2. Positie rollator
  3. Ganganalyse



3. Testen met rollator gebruikers
4. Optimaliseren: UI – Modellen – Rapportering – Feedback systemen



# Q&A

**S**AIRE

[www.saire.be](http://www.saire.be)



# Einde

Bedankt voor jullie aandacht

**S**AIRE

[www.saire.be](http://www.saire.be)

