SCYFER

Artificial Intelligence

Tijmen Blankevoort

Scyfer

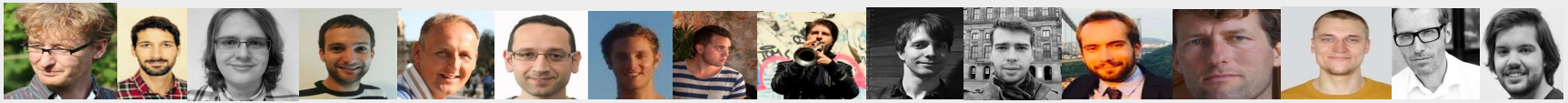
- Opgericht 2013
- Prof. dr. Max Welling
- Omzet+talent verdubbeld elk jaar

Scyfer maakt state-of-the-art Artificial Intelligence oplossingen voor o.a. Multinationals in Nederland. Onze expertise laat AI echt werken voor business.

Amsterdam Center for Entrepreneurship
ACE VENTURE LAB

AMSTERDAM SCIENCE PARK

UNIVERSITEIT VAN AMSTERDAM



Onze klanten

Reap the benefits of AI

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Een intelligente revolutie

Live vertalingen (Skype 2015)

Zelfrijdende auto's (Veel bedrijven)

Professioneel Go (Google 2016)

Jeoperdy (IBM 2013)

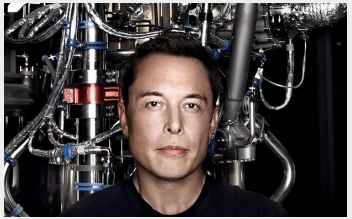
The AI jungle

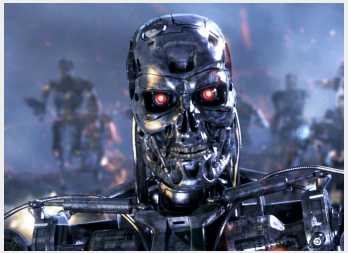
Moeilijke ethische vragen over auto’s

Bovenmenselijke beeldherkenning

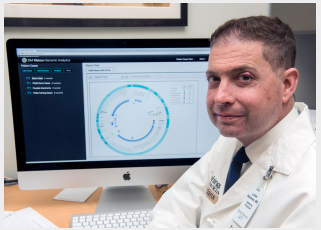
AI Vertaalt

Stephen hawking en Elon Musk zijn bang voor AI





AI Neemt de wereld over?



IBM Watson verhelpt kanker

Google is “AI-first”

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The AI jungle

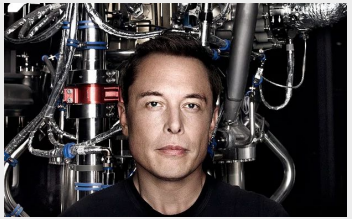
Moeilijke ethische vragen over auto's

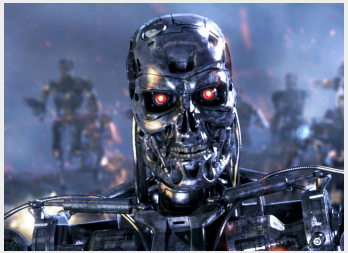
Bovenmenselijke beeldherkenning

AI Vertaalt

Stephen hawking en Elon Musk zijn bang voor AI

Wat is er nu eigenlijk aan de hand?





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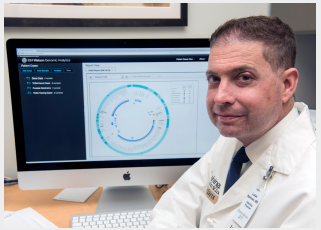

IBM Watson verhelpt kanker

Google is "AI-first"

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Doel van deze presentatie

- Ik laat zien dat AI slim is
- Ik laat zien dat AI dom is
- Wat is er mogelijk in de business
- Hoe maken we algoritmes die zichzelf uitleggen
- Een kleine blik op de toekomst

Machine Learning

Machine learning

We willen dat een computer iets voor je doet

```
If Number = 1 Then
    Count1 = Count1 + 1
ElseIf Number = 2 Then
    Count2 = Count2 + 1
ElseIf Number = 3 then
    Count3 = Count3 + 1
Else
    CountX = CountX + 1
End If
```

Waarom programmeren als de computer kan leren?

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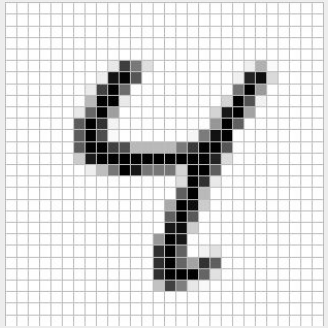
Voorbeeld

De computer leert om karakters op brieven te lezen



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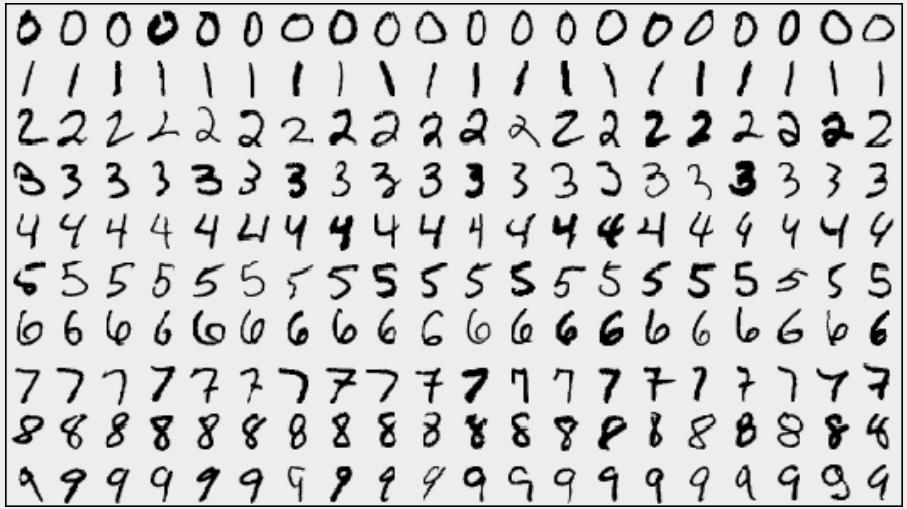
Herhaal veelvuldig

Dit zijn 0’en, 1’en, 2’en...



60.000 voorbeelden met een label (0, 1, 2, etc.)

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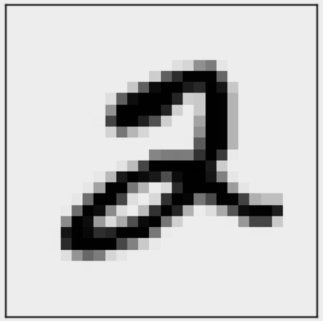
Na veel studeren



Dit is een 2

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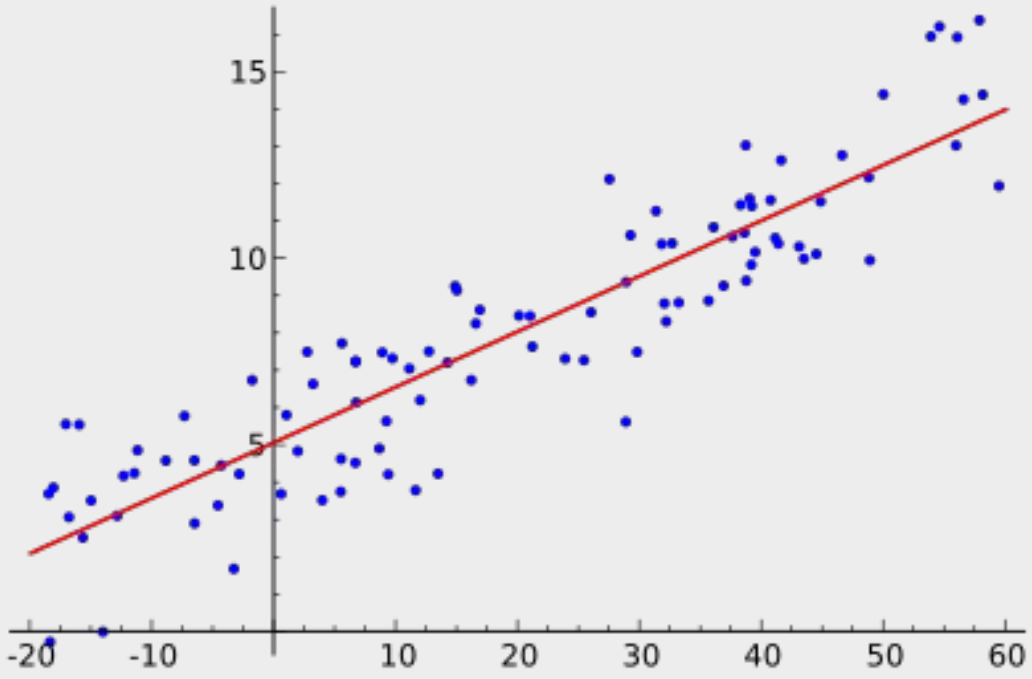
Lijkt erg op statistiek!



De punten worden na het maken van het model weggegooid. Alleen de rode lijn blijft over

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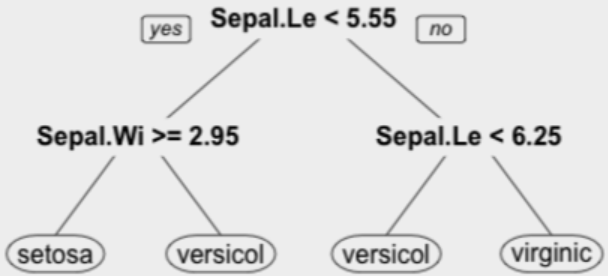
Erg lastig om te doen

Virginica

Versicolor

Setosa



Een beslisboom kan niet
goed een plaatje uitleggen

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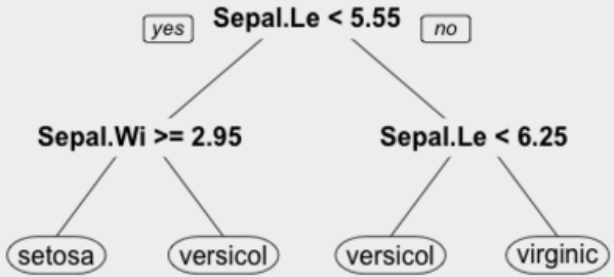
Oude methode

Ruwe data

Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
5.1	3.5	1.4	0.2	setosa
4.9	3.	1.4	0.2	setosa
4.7	3.2	1.3	0.2	setosa
4.6	3.1	1.5	0.2	setosa
5.	3.6	1.4	0.2	setosa
5.4	3.9	1.7	0.4	setosa
4.6	3.4	1.4	0.3	setosa
5.	3.4	1.5	0.2	setosa
4.4	2.9	1.4	0.2	setosa
4.9	3.1	1.5	0.1	setosa

Features



Model

Feature Extraction

Machine Learning

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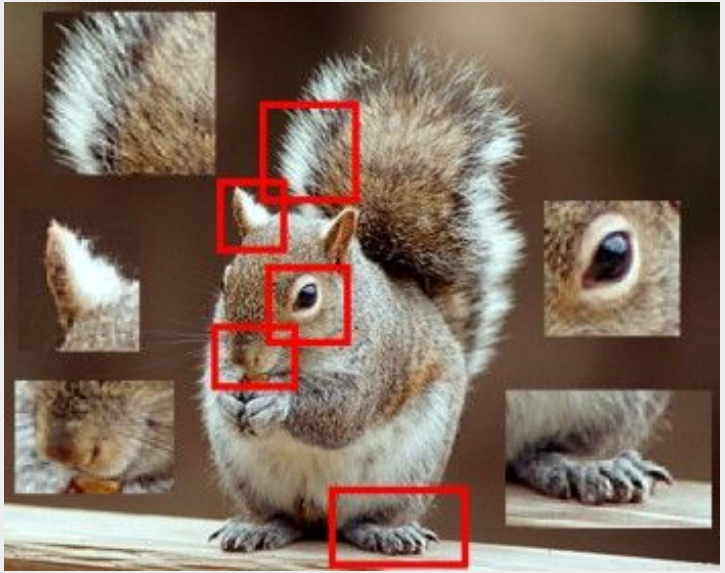
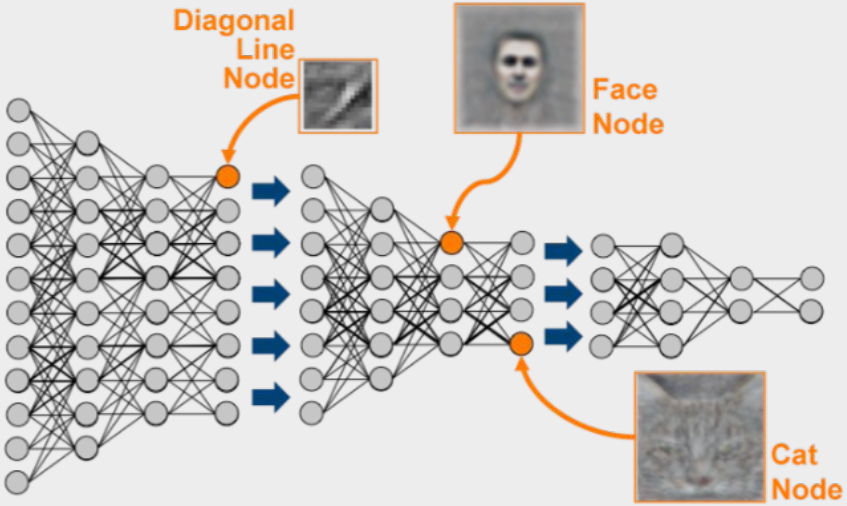
Deep Learning (2012 - nu)





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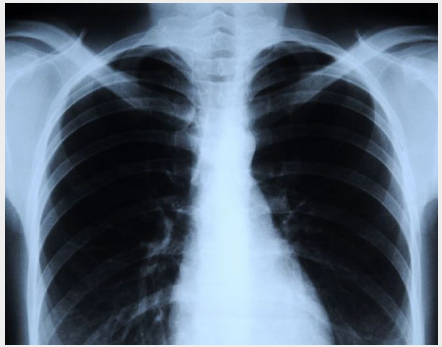
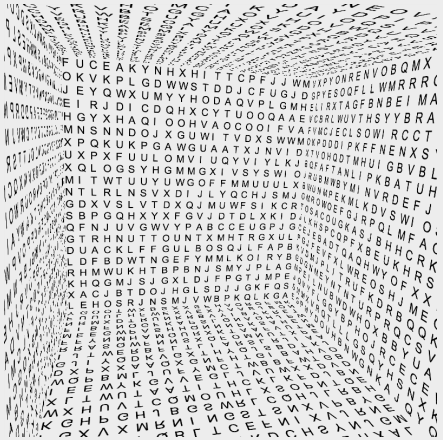
Plots: Mogelijkheden

Nu kunnen we Machine Learning toepassen op complexe data!

- Tekst
- Plaatjes
- Geluid
- Sensor data
- …





Geef mij genoeg (input, output), en Deep Learning kan dezelfde voorspellingen doen!

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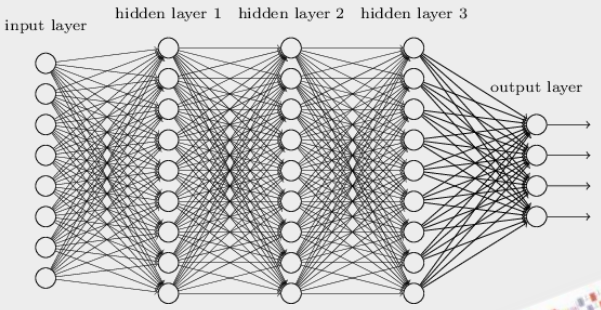
Deep Learning

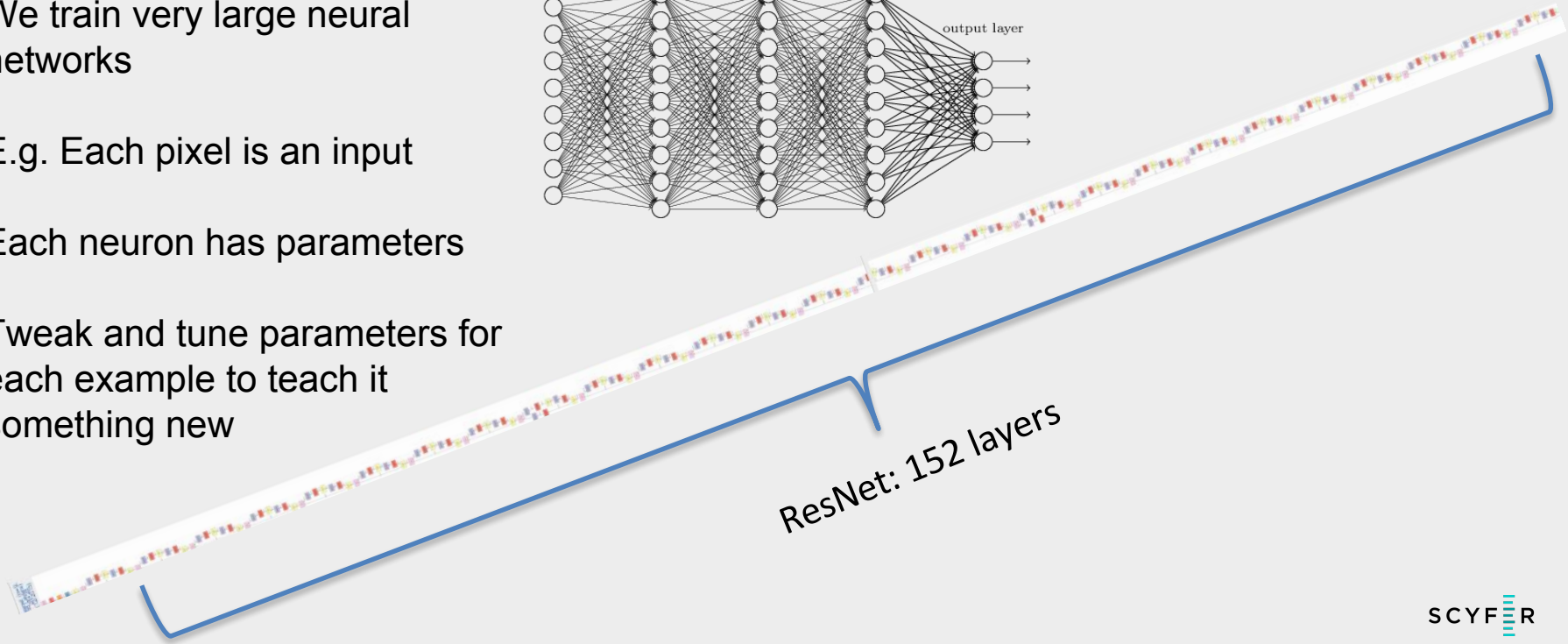
We train very large neural networks

E.g. Each pixel is an input

Each neuron has parameters

Tweak and tune parameters for each example to teach it something new





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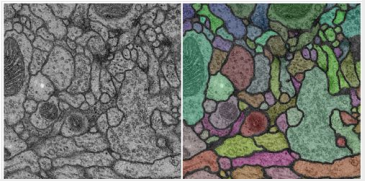
Netwerk zoekt het zelf uit

Let the machine figure it out!

Best results on almost all competitions

- ICDAR 2011 Chinese handwriting recognition
- IJCNN 2011 Traffic signs
- Cell segmentation challenge 2012
- Kaggle



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Deep learning voor plaatjes

IMAGENET

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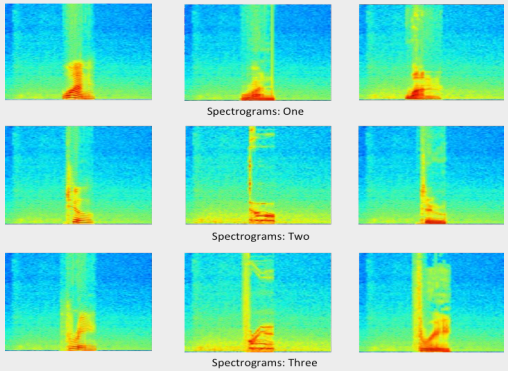
Speech recognition



Neem 5.000 audiobooks
Data zijn losse zinnen

Input: Spraak
Output: Tekst

Geef dit aan Deep Learning:

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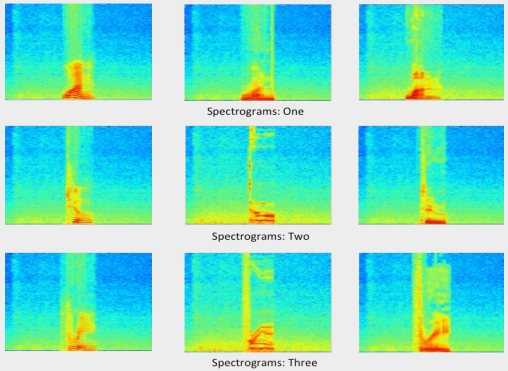
Speech recognition



Neem 5.000 audiobooks
Data zijn losse zinnen

Input: Spraak
Output: Tekst

Geef dit aan Deep Learning:

Siri
Herkent spraak!

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E-mails

Really love your startup idea

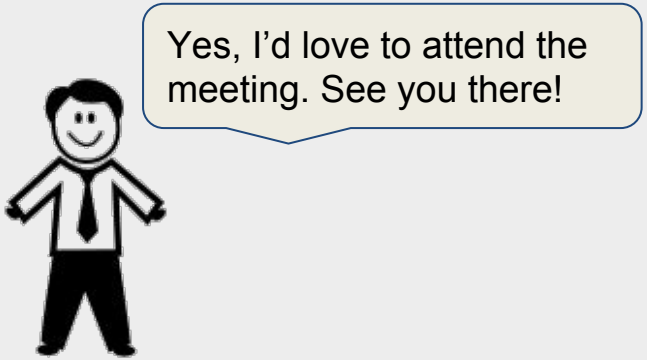
Oleg Campbell <oleg@replyapp.io> 2:01 AM (5 minutes ago)
to Jason

Hey Jason,

My name is Oleg. I found your startup on AngelList and really liked the idea.
Quick question: what are your future plans as for attracting new users?

I though I may have some ideas for you. Let me know what to you think.

Oleg



Verzamel miljoen e-mails

Input: e-mails
Output: Korte antwoorden

Geef aan Deep Learning:

SCYFER

E-mails

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Oleg Campbell <oleg@replyapp.io> 2:01 AM (5 minutes ago)

to Jason

Hey Jason,

My name is Oleg. I found your startup on AngelList and really liked the idea.
Quick question: what are your future plans as for attracting new users?

I though I may have some ideas for you. Let me know what to you think.

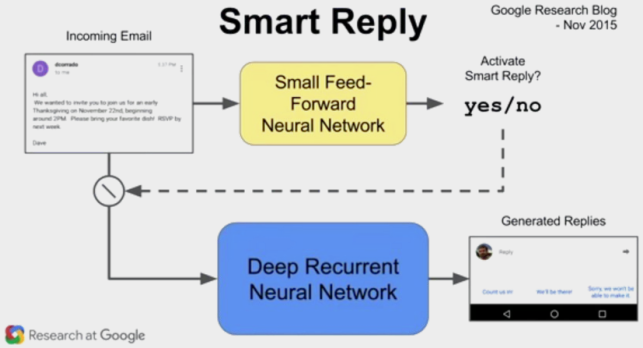
Oleg

Yes, I'd love to attend the meeting. See you there!

Gather millions of e-mails

Input: e-mails
Output: short responses

Give it to Deep Learning:



Inbox smart reply
Automatically generate simple possible responses to e-mails

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Combine text and images

What happens if you give the algorithm context?
Dataset: Images -> Text

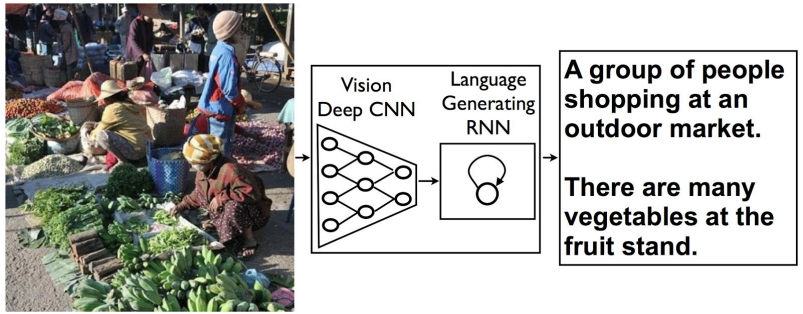
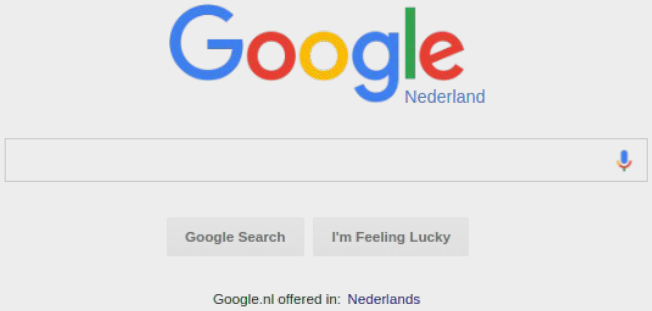
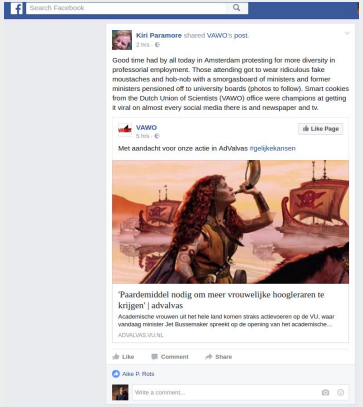


Image to text (Google 2014)

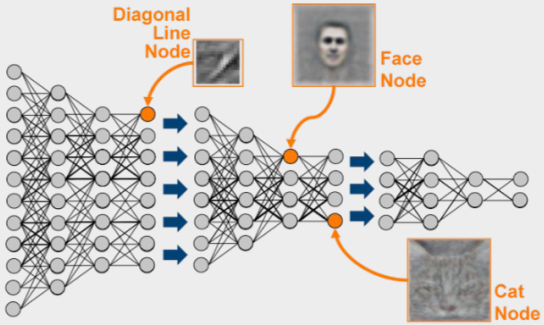
Deep learning is overal!



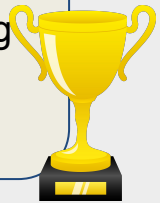


Facebook Timeline

Google Translate



De meest gebruikte technologie waar weinig van hebben gehoord!



Apple Siri

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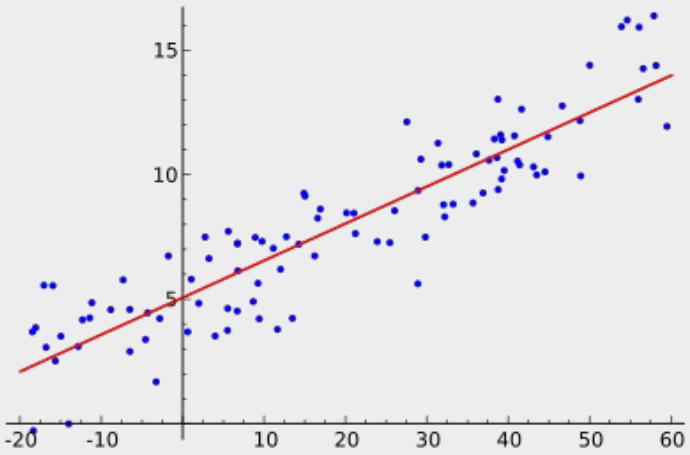
Terug naar AI

AI is geen magie, maar functie approximatie!



Bruikbare AI oplossingen zijn momenteel bijna altijd een combinatie van:

- Machine Learning
- Een dataset met veel voorbeelden (input en output)
- Een hele hoop handwerk in programmeren en implementeren.

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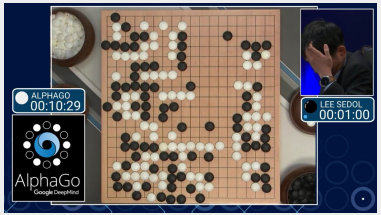
Leer computer games

Input: Pixels
Output: Score, Actie

Neem elke tijdsstap de actie die de score optimaliseert

Heb je de voorspelling verkeerd, leer van die fout

Ook AlphaGo is zo gemaakt!



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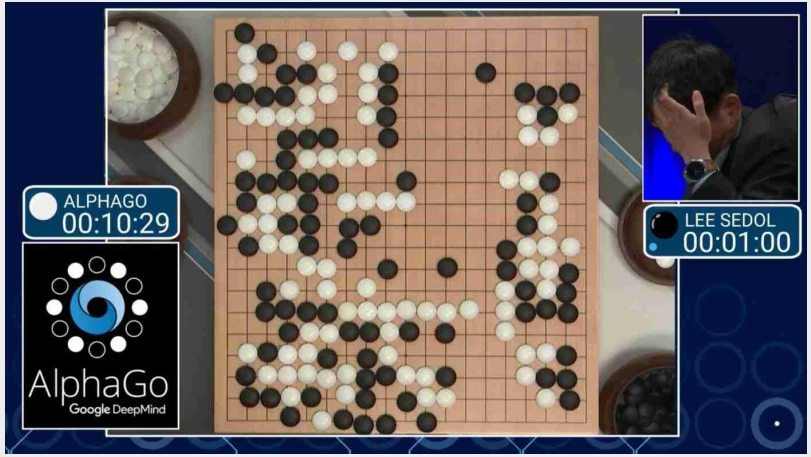
AI zijn puntoplossingen



AlphaGo verslaat Lee Sedol! Veel beter in Go dan de mens!

Maar… kan geen Stratego spelen!

Huidige AI zijn allemaal puntoplossingen die 1 ding erg goed kunnen

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AI is eigenlijk niet zo slim

- AI maakt niet menselijke fouten
- AI heeft erg veel voorbeelden nodig om iets te leren
- AI heeft geen common-sense
- AI generaliseert totaal niet
- AI kan niet goed conceptualiseren en redeneren
- Geen creativiteit
- Geen geheugen
- Kan niet uitleggen waarom beslissingen worden gemaakt
- ....

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AI als ‘teachable software tool’

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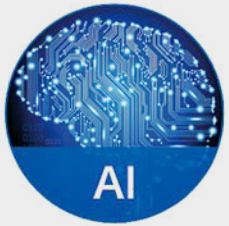
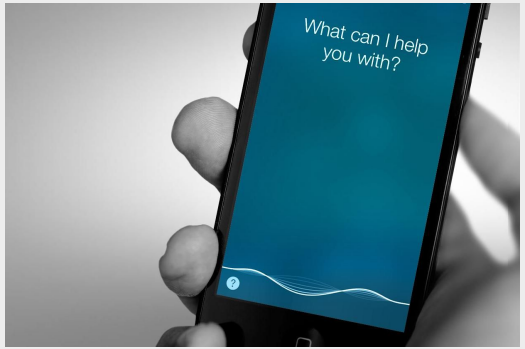
Maar de potentie is geweldig!

1.25 miljoen mensen verongelukken in het verkeer. Zelfrijdende auto's gaan dit sterk reduceren!



IoT en AI, devices worden 'slimmer'

AI kan veel processen in bijv. De healthcare verbeteren



AI assistenten helpen met dagelijkse taken, en maken informatie veel makkelijker beschikbaar

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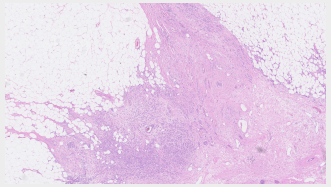
Wat kan onze business met AI?



Complexe repetitieve taken
assisteren/overnemen

‘Gebruik maken’ van meer data
Huidige modellen verbeteren
Voorspellen

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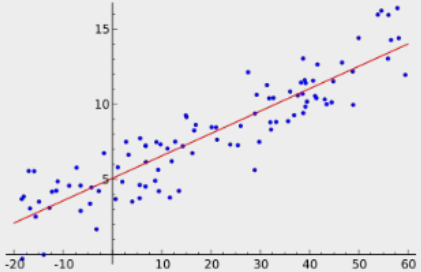
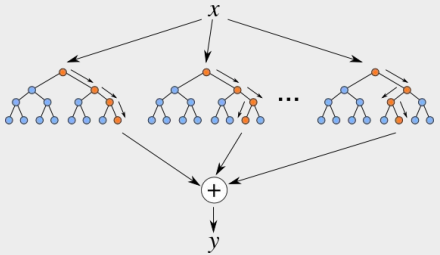
The black box

Complex correlations and decisions are difficult to explain in an easy way.





Deep learning feels like a black box, or does it?

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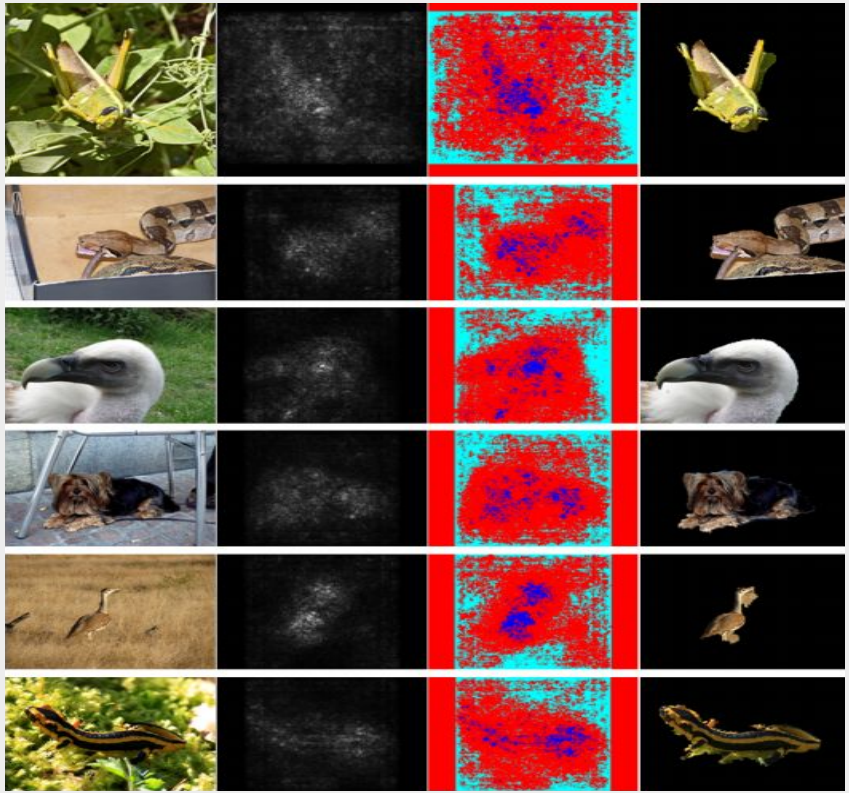
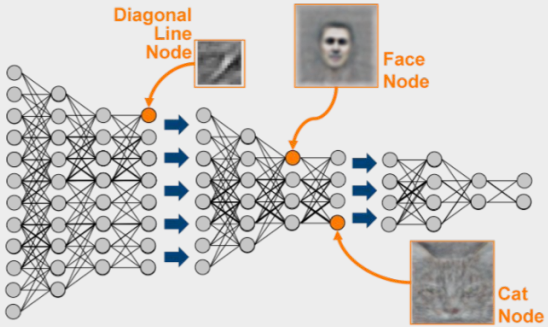
Input features



The 'concepts' make complex algorithms easier to understand!



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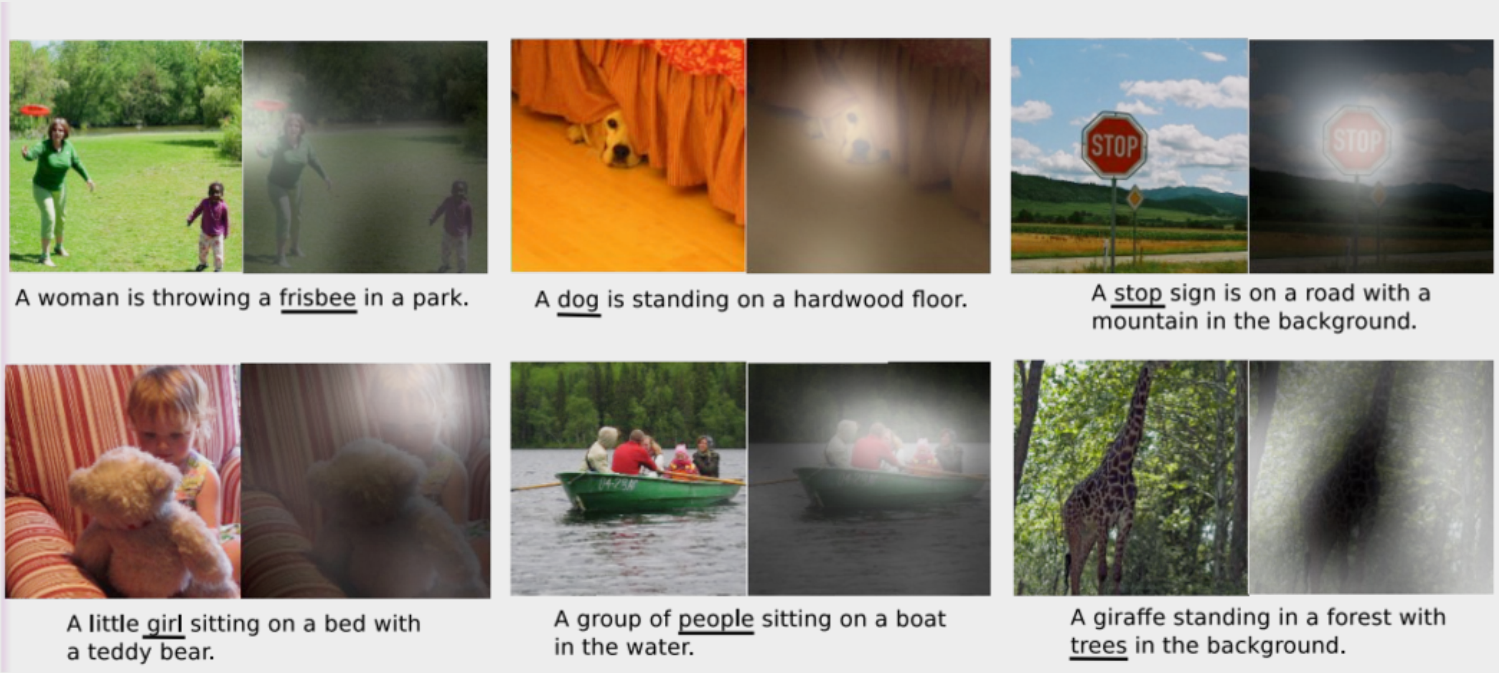
Where in the image do we look



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Nudity filter

Filtered response maps (Zeiler 2014)

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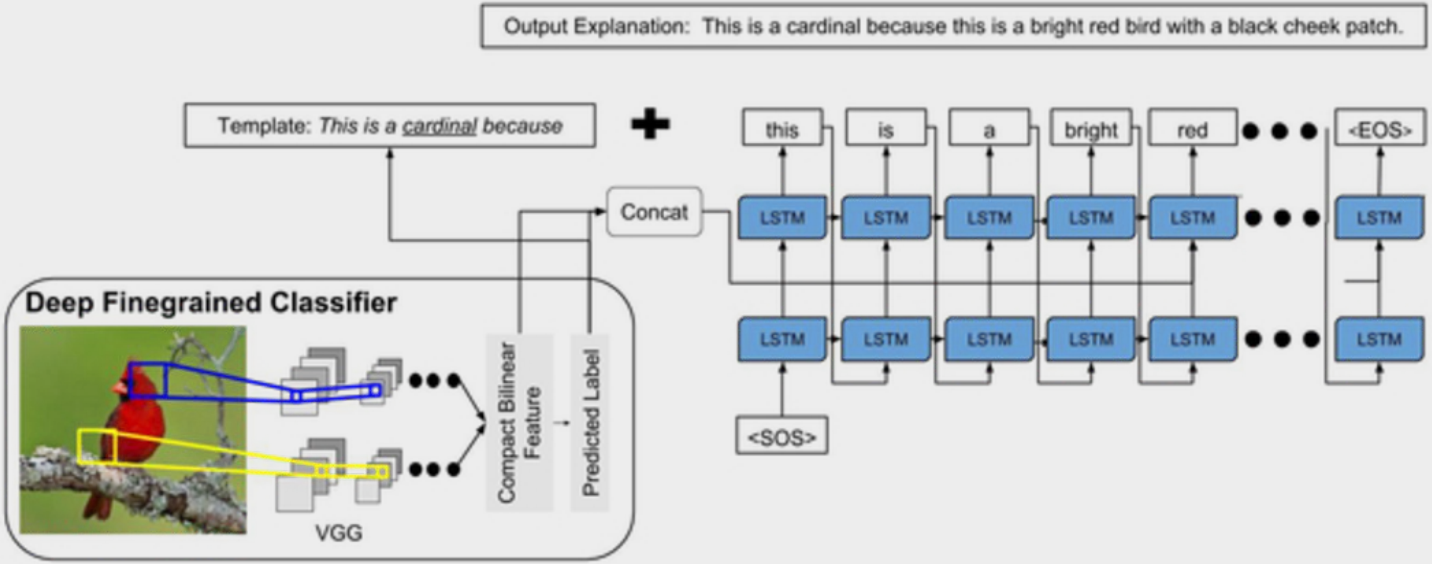
Text explanation of decisions



Donahue et al. 2016

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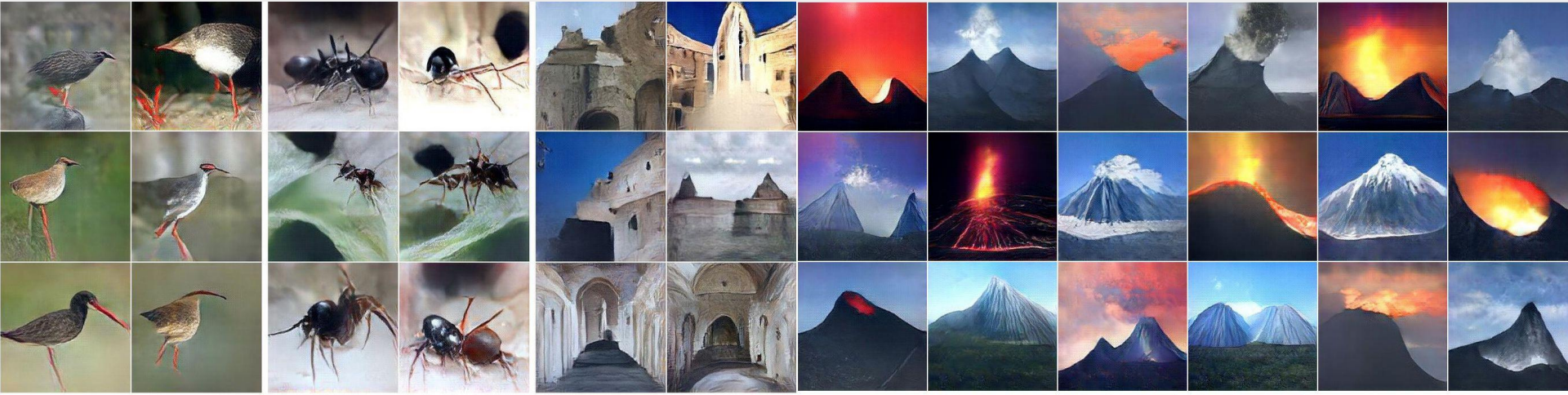
Image generation



Nguyen et al. 2016

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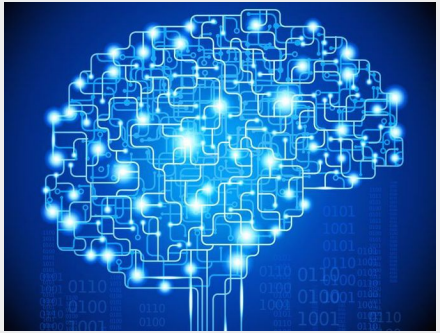
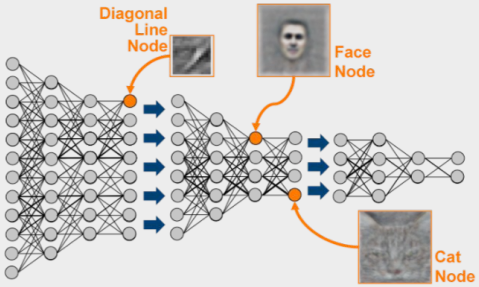
Evolutie van AI

```
If Number = 1 Then
    Count1 = Count1 + 1
ElseIf Number = 2 Then
    Count2 = Count2 + 1
ElseIf Number = 3 then
    Count3 = Count3 + 1
Else
    CountX = CountX + 1
End If
```





Programmeren
Niet te doen voor moeilijke taken

Machine Learning
Maakt het ons mogelijk makkelijker algoritmes te maken voor complexe taken

Deep Learning
Nu kunnen we gebruik maken van zeer complexe data voor machine learning

Active Learning
Maakt het mogelijk om zelf een AI te leren een taak uit te voeren

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Active learning

De komende paar jaar gaat het mogelijk worden om zelf AI taken te leren

- AI doet met je mee
- Maakt de AI een fout dan kan je het verbeteren
- AI zal vragen stellen om slimmer te worden
- AI legt uit waarom beslissingen worden gemaakt
- De AI wordt steeds slimmer door interactie

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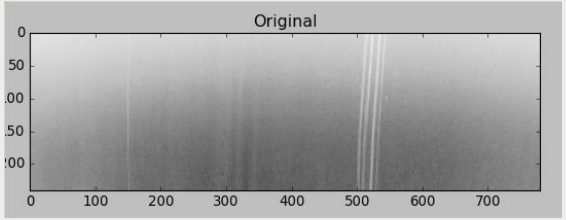
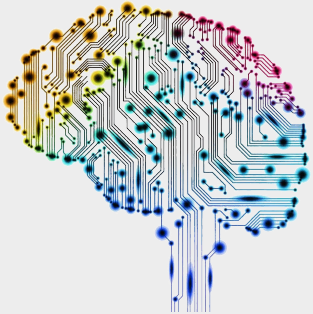
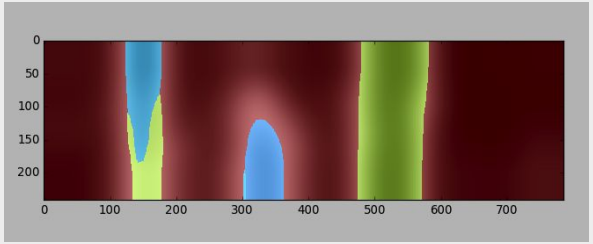
SCYFER TATA STEEL

Zeer accurate inspectieresultaten





Deep Learning



SIS expert

Feedback geven

Vragen stellen

Vera

Fouten aangeven

Gebruikers

Resultaten

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Geweldige mogelijkheden

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Kunde als toegankelijk product

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Tijmen’s DL/AL guide

Deep Learning/AI will help you when:

1) You want the computer to perform a (repetitive) task
2) There are a lot of examples
3) Each example has a label (action/prediction/class)
4) The samples have complex data as input

Tijmen’s Letterbox

In which we will answer questions asked by real customers that wanted to do something with AI

Let’s apply the guide together!

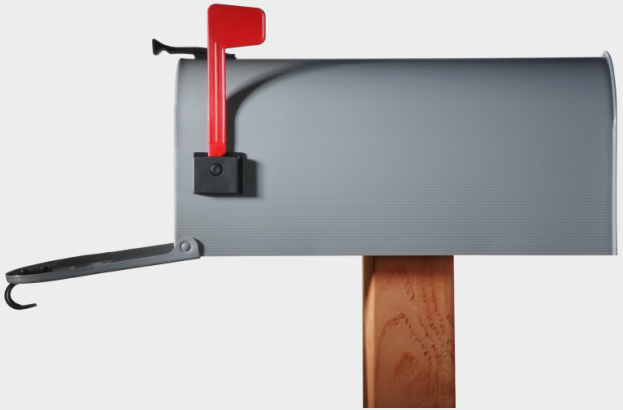

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Image -> Caption

Dear Tijmen,

I want to make an algorithm that takes images as input, and generates explanatory captions underneath. I could use this to help blind people understand images online.

Love,

Samus

Is this possible?

The man at bat readies to swing at the pitch while the umpire looks on.

Tijmen's guide:

- Repetitive task
- Complex input data
- A lot of examples
- Each example has a label

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Image -> Caption

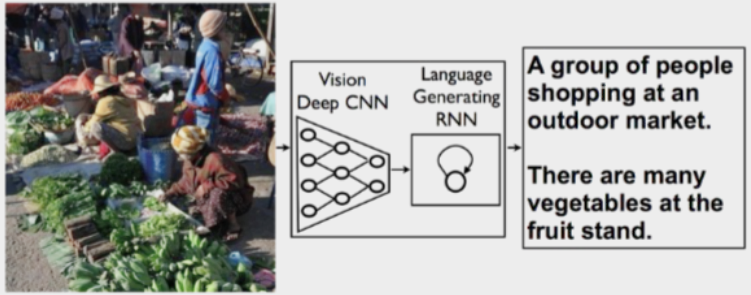

Image to text (Google 2014)

- Repetitive task
- Complex input data
- A lot of examples
- Each example has a label

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Boat engine data

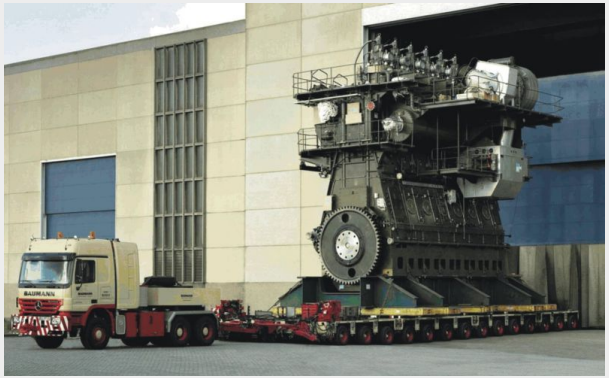
Dear Tijmen,

We put 200 sensors in large boat engines we produce. They produce a lot of data. Parts of the engines break sometimes. Can you make an algorithm that predicts engine failure based on the sensor data?

Love,

Zelda

Is this possible?



Tijmen's guide:

- Repetitive task
- Complex input data
- A lot of examples
- Each example has a label

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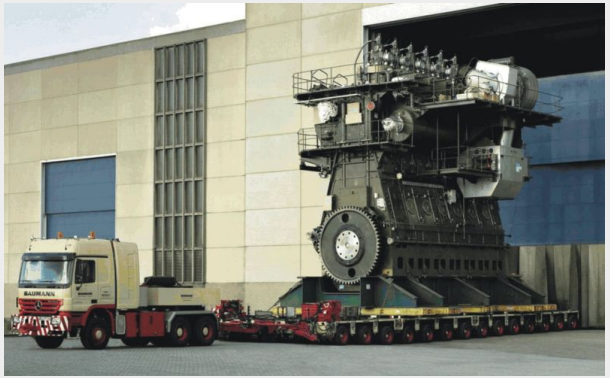
Boat engine data

Reason:
There are not enough engine breakdowns for the terabytes of sensor data that are being produced!

Big difference between a lot of data and a lot of examples!

Tijmen's guide:

- Repetitive task
- Complex input data
- A lot of examples
- Each example has a label



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Big Data

Dear Tijmen,

We are an insurance company and we were advised to store a lot of Big Data to prepare us for the future. We stored all sorts of information, like customer interactions, marketing campaigns and risk model predictions. Can you apply Deep Learning to help us find use for this data?

Love,

Jace

Is this possible?

Tijmen's guide:

- Repetitive task
- Complex input data
- A lot of examples
- Each example has a label

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Big Data

There is no task in this question!
First think of what you want an algorithm to do!

Deep Learning does not magically find patterns in your Terabytes of data

Just saving all data without a reason is a great recipe for storing nonsense and missing important data

Tijmen's guide:

- Repetitive task
- Complex input data
- A lot of examples
- Each example has a label

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Eye Scans

Dear Tijmen,

Our company has around 50.000 eye scans of Diabetes patients. We want an algorithm that automatically determines the severity of eye damage due to diabetes. Each scan has a severity indication made by an eye doctor. The problem is that the input is very complex: damage can be hard to spot as it is very small in the image

Love,

Thrall

Tijmen's guide:

- Repetitive task
- Complex input data
- A lot of examples
- Each example has a label

Is this possible?

SCYFER

Eye Scans

Complexity of the input does not matter. If a human can see it, Deep learning can see it.

The 50.000 images are on the edge of being enough, but if we gather more from practice we can make the algorithm!

Tijmen's guide:

- Computer performs a task
- Complex input data
- A lot of examples
- Each example has a label

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Cancer death prediction

Dear Tijmen,

Our hospital chain has a lot of patient data about cancer therapy outcomes. For each patient we have 20 indicative variables, like blood pressure, age and medicine usage. There are about 1.000.000 patients that we have data of. Can you make an algorithm that predicts therapy outcome for patients?

Love,

Kvothe

Is this possible?

Tijmen's guide:

- Repetitive task
- Complex input data
- A lot of examples
- Each example has a label

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Cancer death prediction

The input data is not complex.

Deep Learning adds nothing here.

A few thousand patients and simple machine learning algorithm will create the best results you can get

Tijmen's guide:

- Repetitive task
- Complex input data
- A lot of examples
- Each example has a label

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Reading assistant

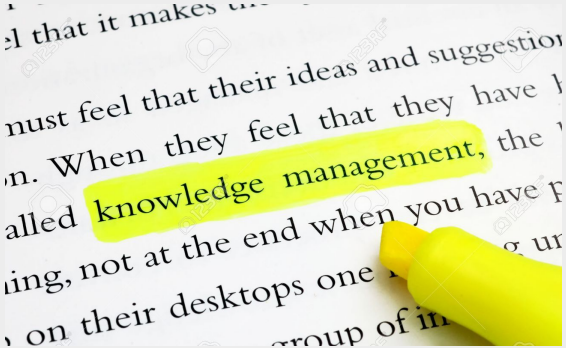
Dear Tijmen,

My company processes around 300 very thick digital text reports from other companies, reporting on several business aspects. We only have the manpower to read so much. There are always specific paragraphs and word usages we look for in the reports to make an assessment. A tool that could help us find these paragrahps/words quickly would be great. We do not mind tagging the paragraphs/words that we look for.

Love,

Charlotte

Is this possible?



Tijmen's guide:

- Repetitive task
- Complex input data
- A lot of examples
- Each example has a label

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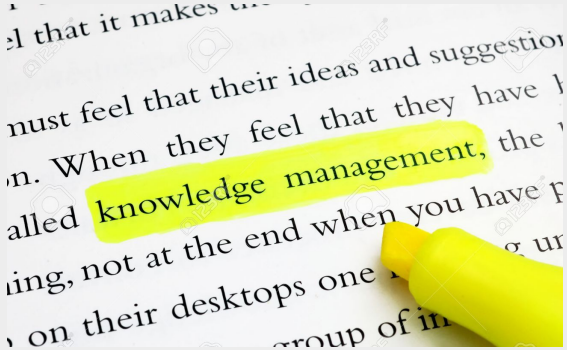
Reading assistant

If enough examples get annotated this is doable

We might be able to use pretrained text algorithms for this…

Tijmen's guide:

- Repetitive task
- Complex input data
- A lot of examples
- Each example has a label



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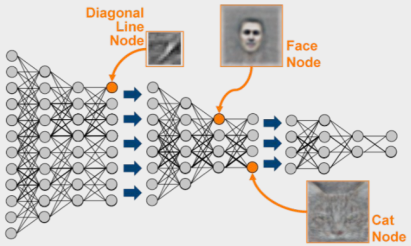
Conclusie

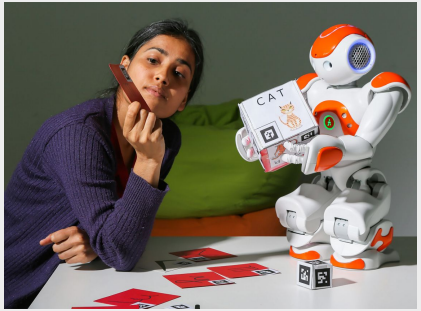


1) Veel van de huidige AI hype komt door Deep Learning/Machine learning

3) Added-value, zoek naar:
- Repetetieve taken
- Beter gebruik van meer data
  - Huidige modellen verbeteren
  - Betere voorspellingen doen

2) AI is niet zo slim, beter uit te leggen als ‘teachable software tool’

4) De nabije toekomst van active learning, stelt mensen en AI in staat om steeds beter samen te werken



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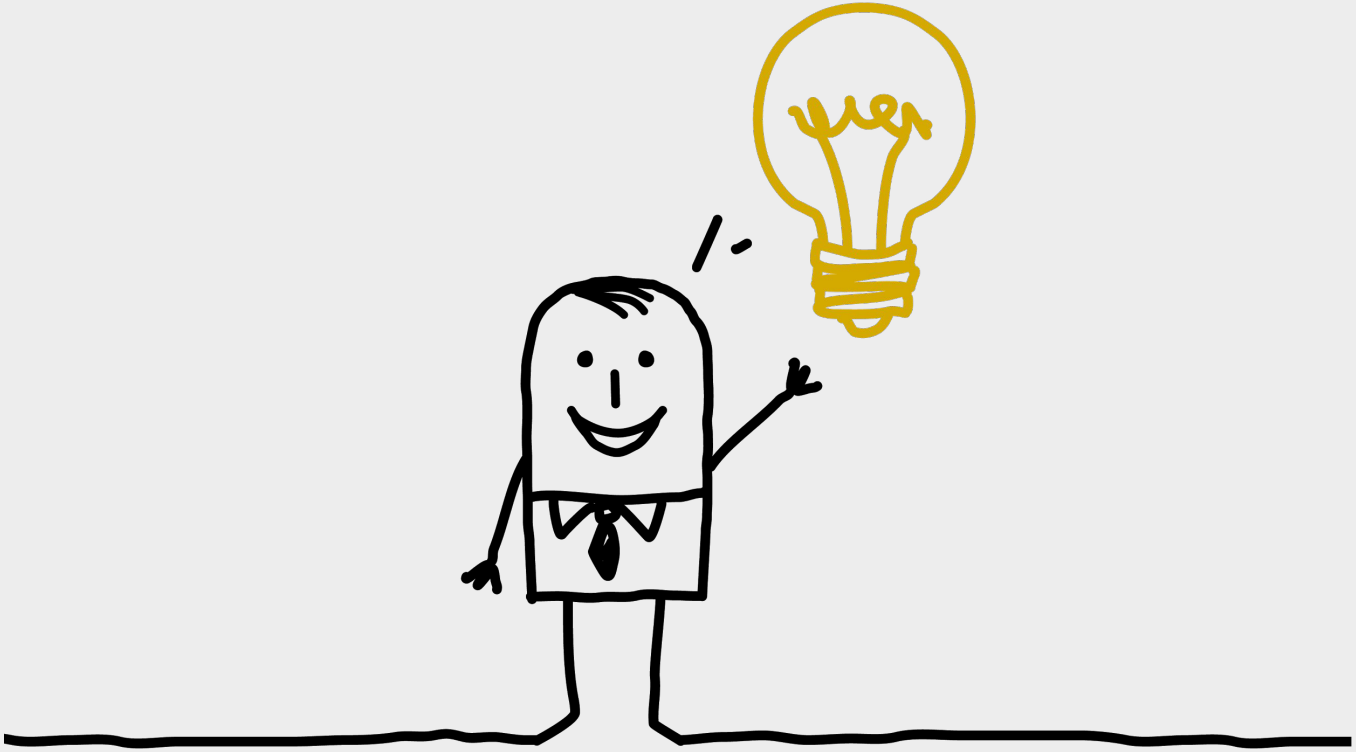

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