PELTARION

/August 5, 2019

Preparing for an AI-first future

Anders Arpteg, PhD
Principal Data Scientist, Peltarion

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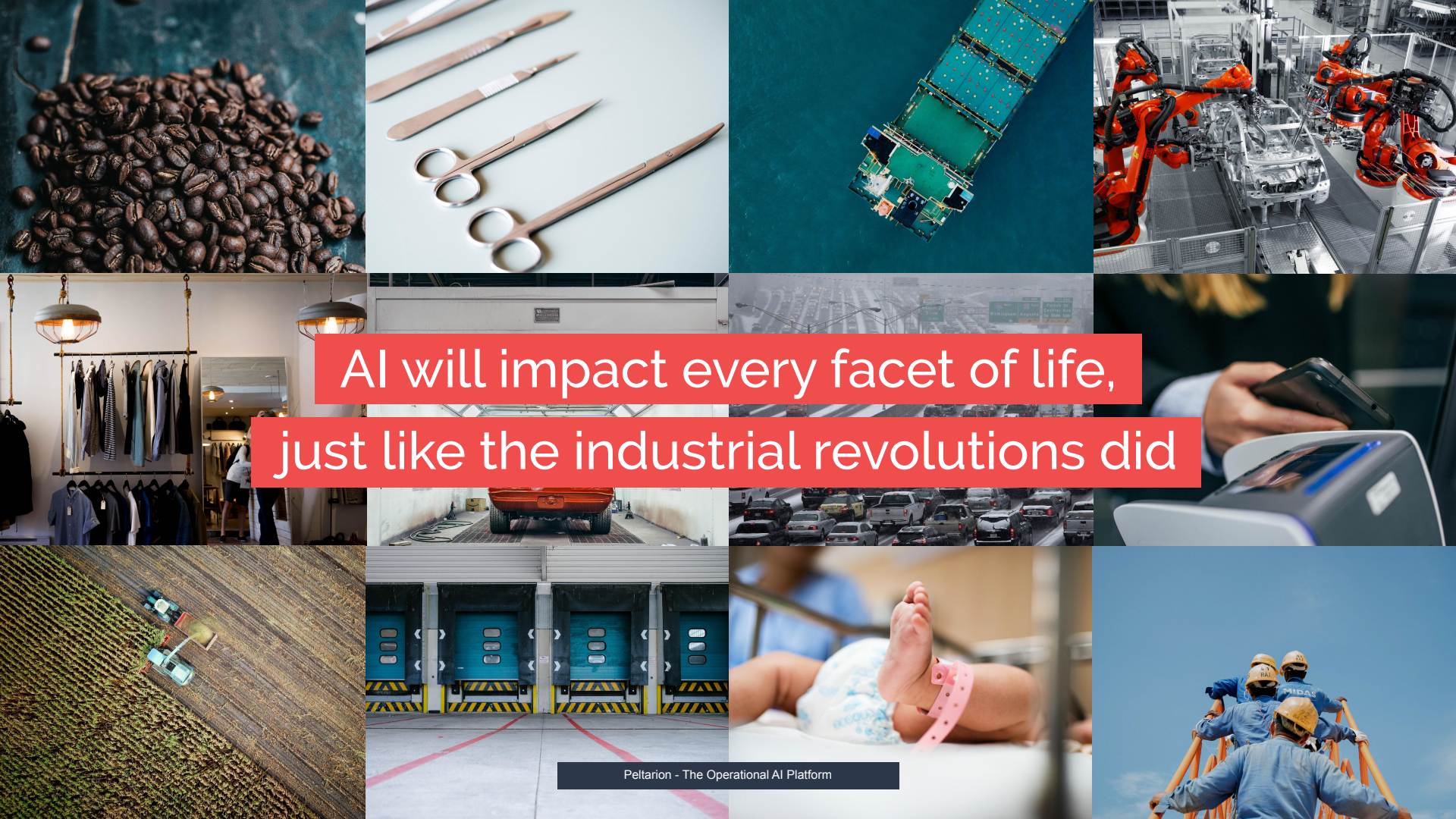
Sweden


AI will impact every facet of life,
just like the industrial revolutions did
Peltarion - The Operational AI Platform

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01 / Introduction to AI

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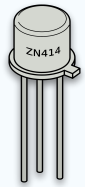
Technological disruptions

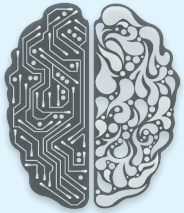


Transistor

Cost of
Arithmetic

Internet

Cost of
Distributing Information

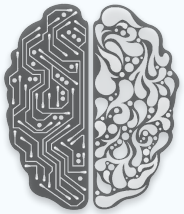


AI

Cost of
Prediction

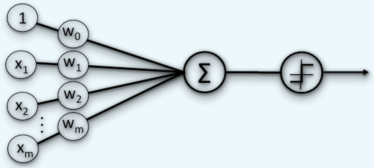
1950 1960 1970 1980 1990 2000 2010

History of Artificial Intelligence



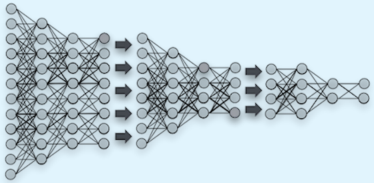
Artificial Intelligence

Science and engineering
of **building intelligent machines**



Machine Learning

Use data to automatically
learn to make predictions



Deep Learning

Learn to both **represent data**
and **make predictions**

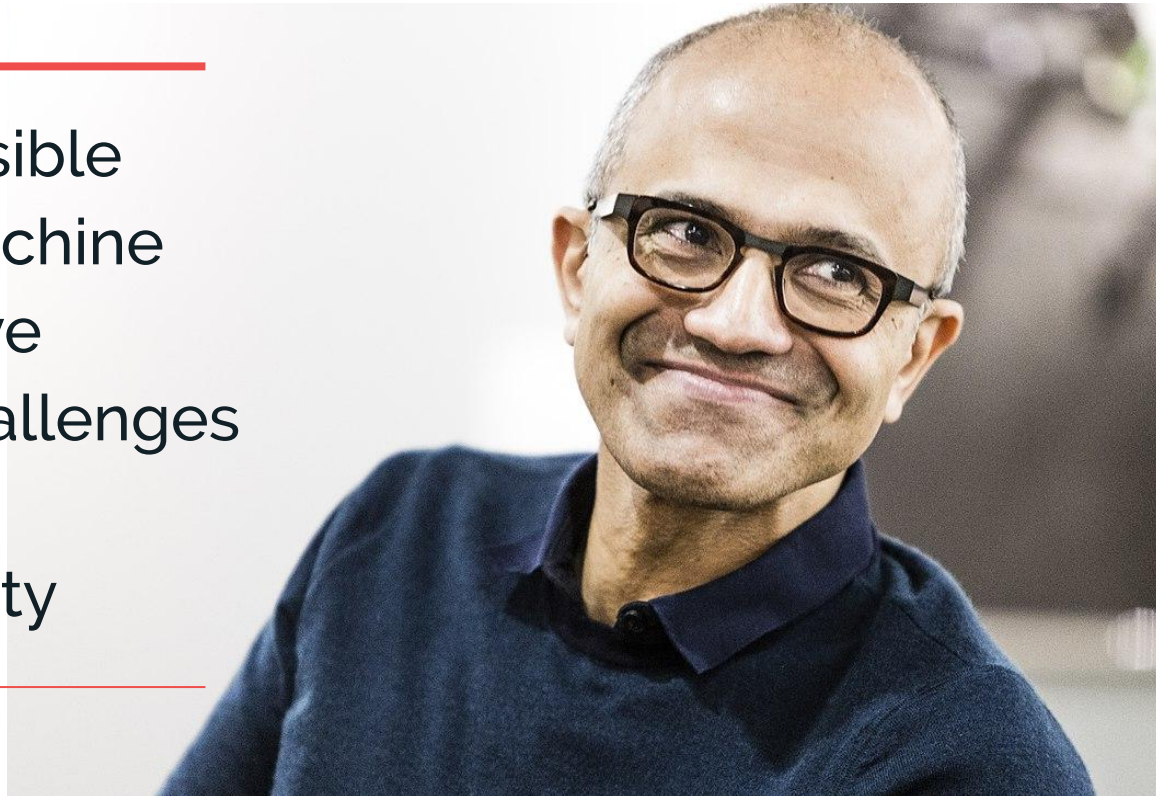
1950 1960 1970 1980 1990 2000 2010 2020

“AI is one of the most important things humanity is working on. It’s more profound than, I don’t know, electricity or fire”

Sundar Pichai / CEO Alphabet Google

...imagine what's possible when human and machine work together to solve society's greatest challenges like beating disease, ignorance, and poverty

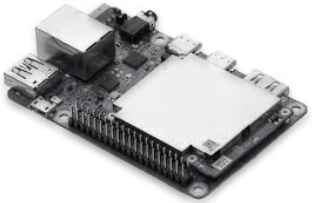
– Satya Nadella / Microsoft



Why Deep Learning revolution now?

Increase of training data

Large datasets of labeled training data like ImageNet



Increase of computing power

Especially GPUs & Distributed Computing

$$-\log\left(\frac{e^{f_{y_i}}}{\sum_j e^{f_j}}\right)$$

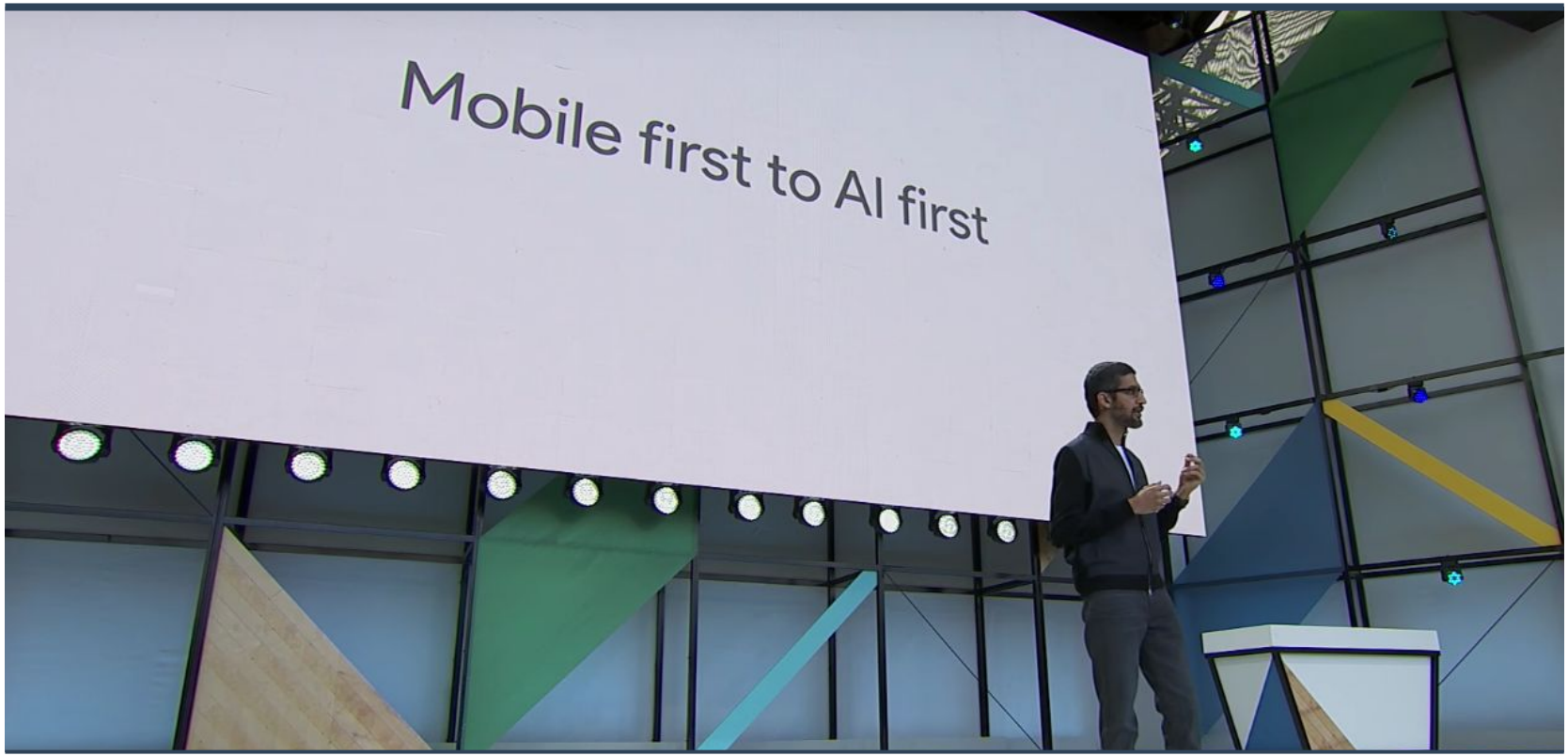
Algorithmic improvements

Especially in deep reinforcement learning but also normal DL (ReLUs [Dahl et al., 2013], Dropout [Srivastava et al., 2014], etc.)

Better tooling

Libraries like TensorFlow and Cloud Services

NVIDIA market cap


Mobile first to AI first

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02 / State of the world

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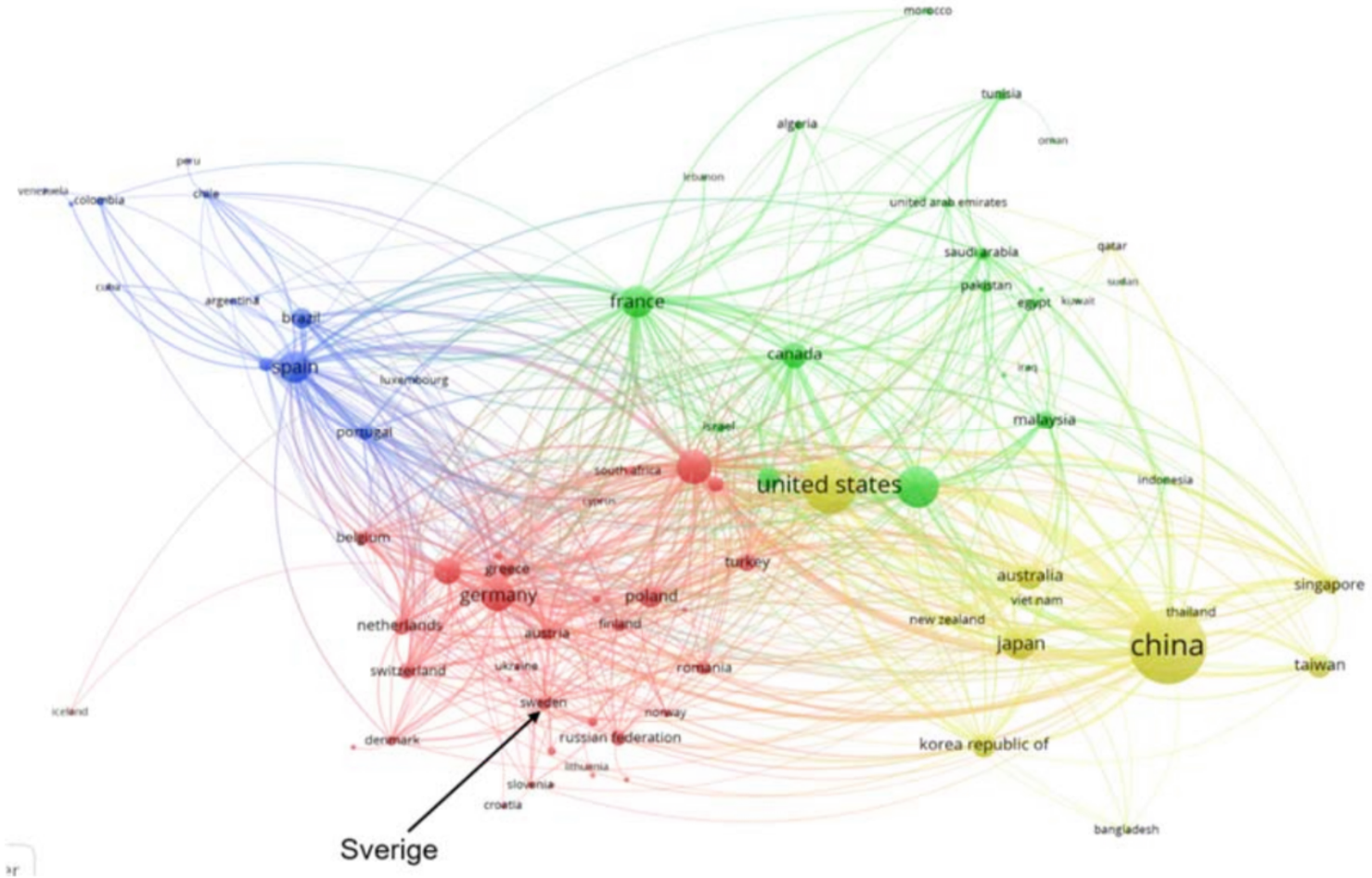
Europe is behind in private investments in AI: €2.4-3.2 billion in 2016, compared to €6.5-9.7 billion in Asia and €12.1-18.6 billion in North America.

Financial Times:

“Europe left playing catch-up in artificial intelligence”


morocco
tunisia
algeria
oman
peru
venezuela
colombia
chile
lebanon
united arab emirates
saudi arabia
qatar
pakistan
egypt
kuwait
sudan
cuba
argentina
brazil
france
spain
canada
luxembourg
iraq
malaysia
portugal
israel
south africa
united states
indonesia
cyprus
belgium
turkey
greece
australia
singapore
germany
poland
viet nam
thailand
netherlands
finland
new zealand
austria
japan
china
switzerland
ukraine
romania
taiwan
iceland
sweden
norway
denmark
russian federation
korea republic of
lithuania
slovenia
croatia
bangladesh
Sverige

Swedish and European AI initiatives

Sweden

RI.SE

VINNOVA

WASP

ZENUITY

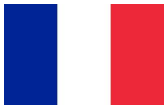
AI INNOVATION of Sweden

Swedish AI Council

EU

European Commission

eit Digital



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03 / Example AI Projects at Peltarion

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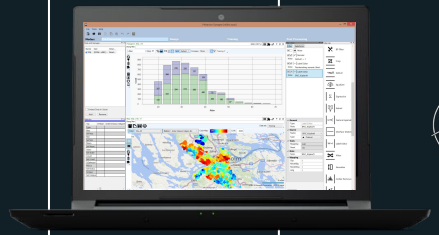
Built on 15 years of AI experience

2004
Founded

2006
Synapse



2016
Seed
Funding
EQT

2018
Platform
Launch

Seed
Funding
FAM

2019
Series A
Euclidean

2004 **2007** **2019**

Leading team & backers

Commercial AI services & enterprise software

$35M in funding (A-round)

Backed by EQT Ventures, FAM (Wallenberg) and Euclidean Capital (James Simons)

+80 person team with a background from leading tech companies

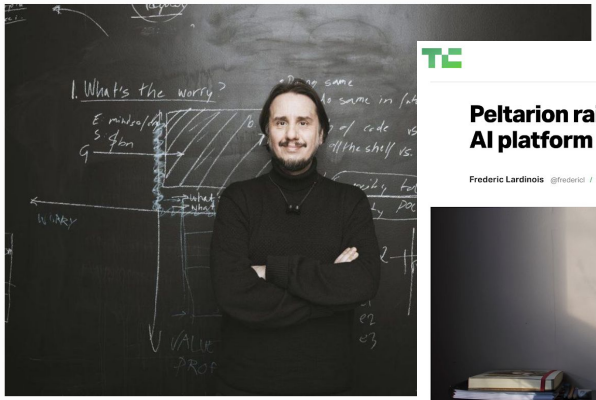
King Spotify Skype truecaller Microsoft

UBER IBM EQT

Forbes

Coders From Spotify, Klarna And Candy Crush's King Have Flocked To This AI Startup

Parmy Olson Forbes Staff
AI, robotics and the digital transformation of European business.



Luka Crnkovic-Friis, founder of Peltarion. IMAGE VIA PELTARION

TC

Peltarion raises $20M for its AI platform

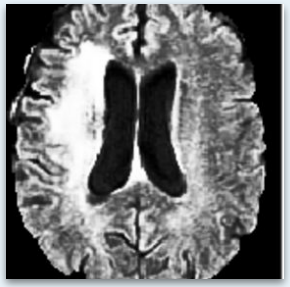
Frederic Lardinois @fredericl / 2 weeks ago

Peltarion, a Swedish startup founded by former execs from companies like Spotify, Skype, King, TrueCaller and Google, today announced that it has raised a $20 million Series A funding round led by Euclidean Capital, the family office for hedge fund billionaire James Simons. Previous investors FAM and EQT Ventures also participated, and this round brings the company's total funding to $35 million.

Peltarion example projects

01

Prediction brain tumors



02

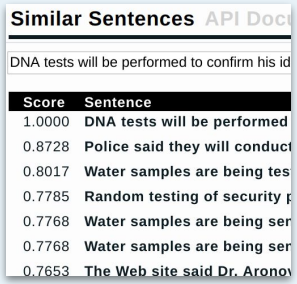
Predicting house valuation

03

Predicting wheat rust in Ethiopia

04

Predicting semantic text similarity



05

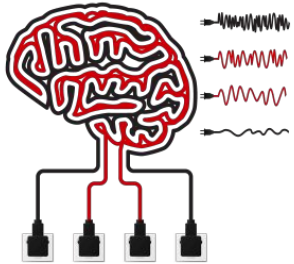
Predicting energy production

Deep weather

Problem
Predict wind turbine energy production
Cost in Sweden due to poor prediction is about 4 bn SEK/year

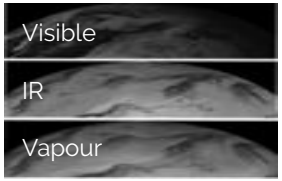
Current solution
Finite element model for weather
Finite element model for wind turbine generator
Weather model + WTG model + statistical correction -> prediction
Predictions are slow and expensive

Deep weather: the AI approach



Energy production

Satellite

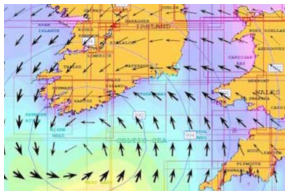


Weather stations

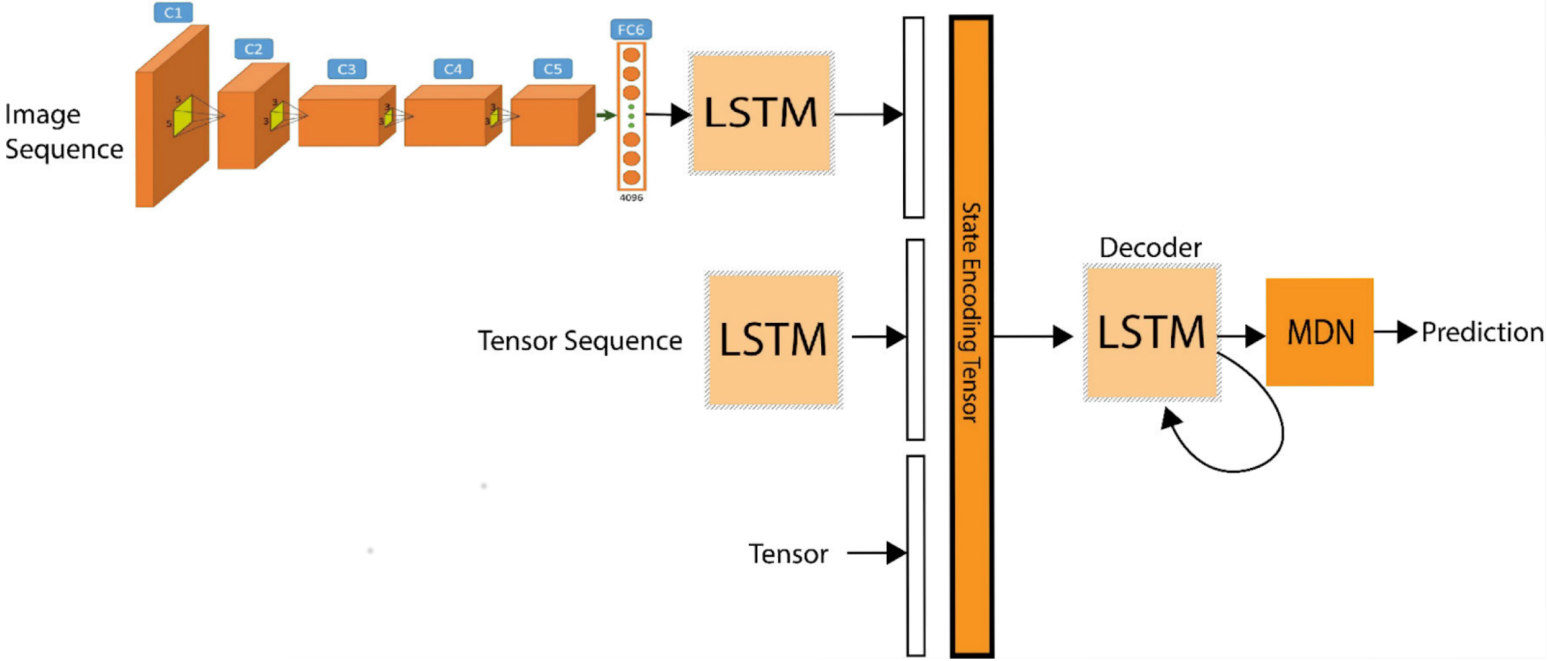
Wind parks

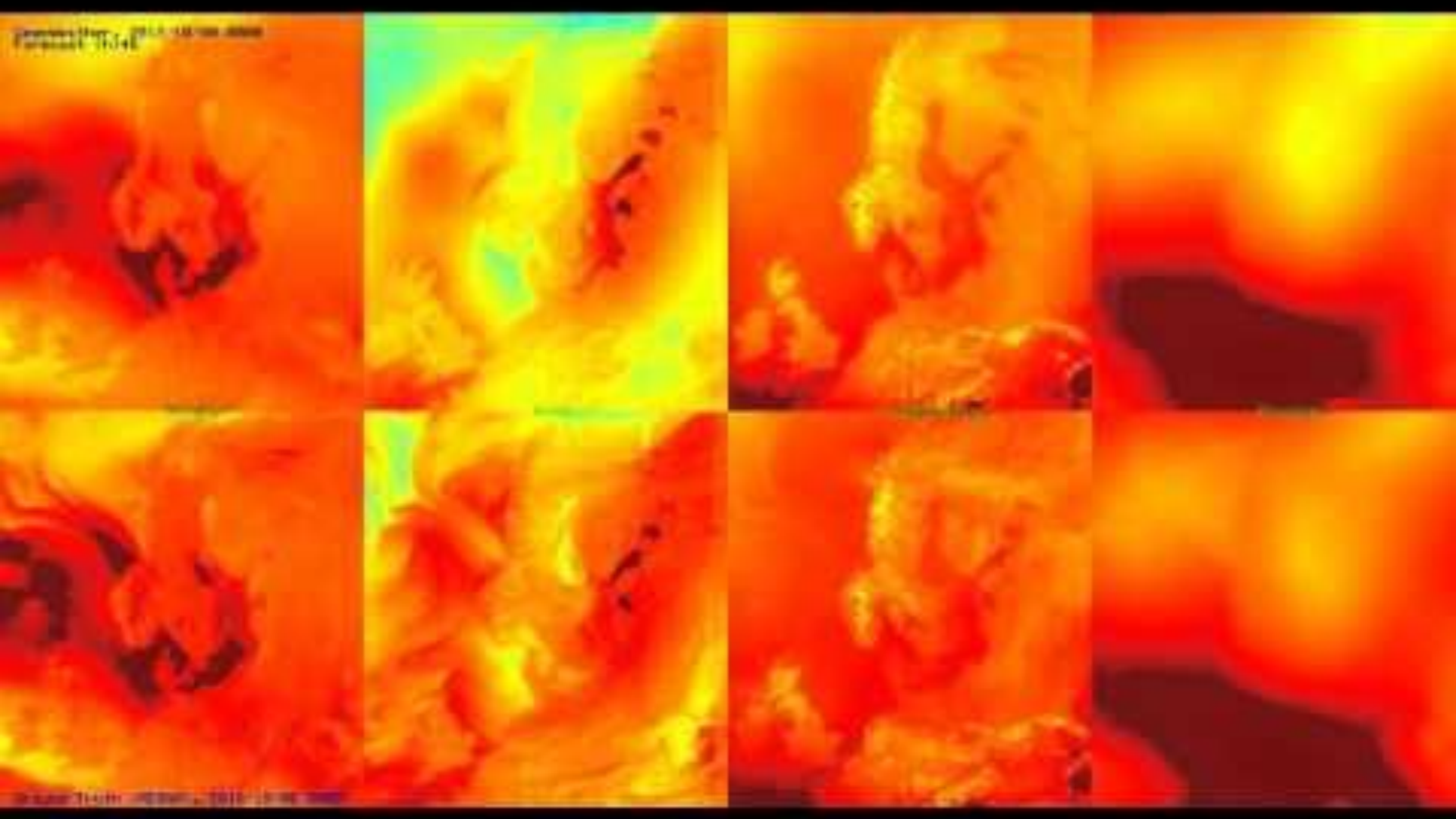
Topology

Weather forecast

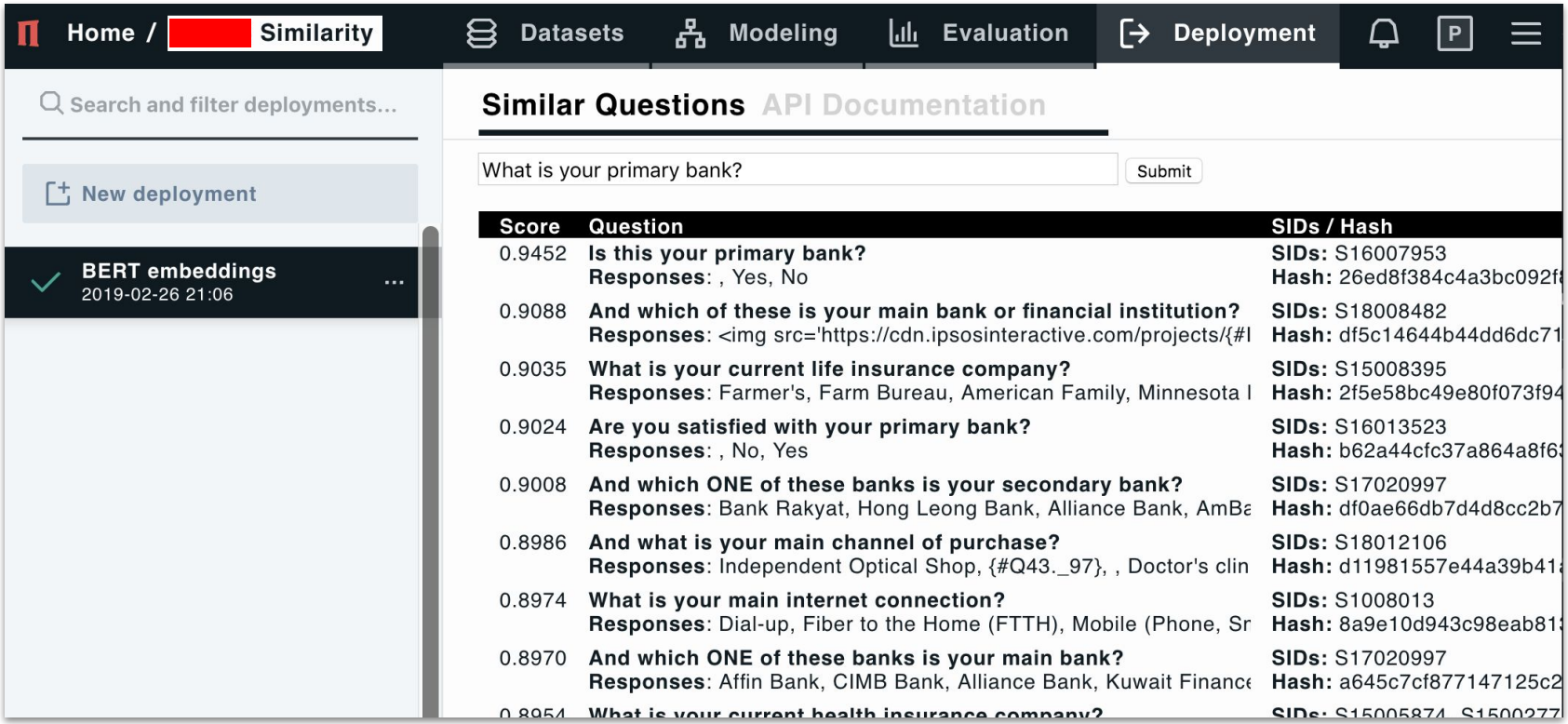


Deep weather: the model

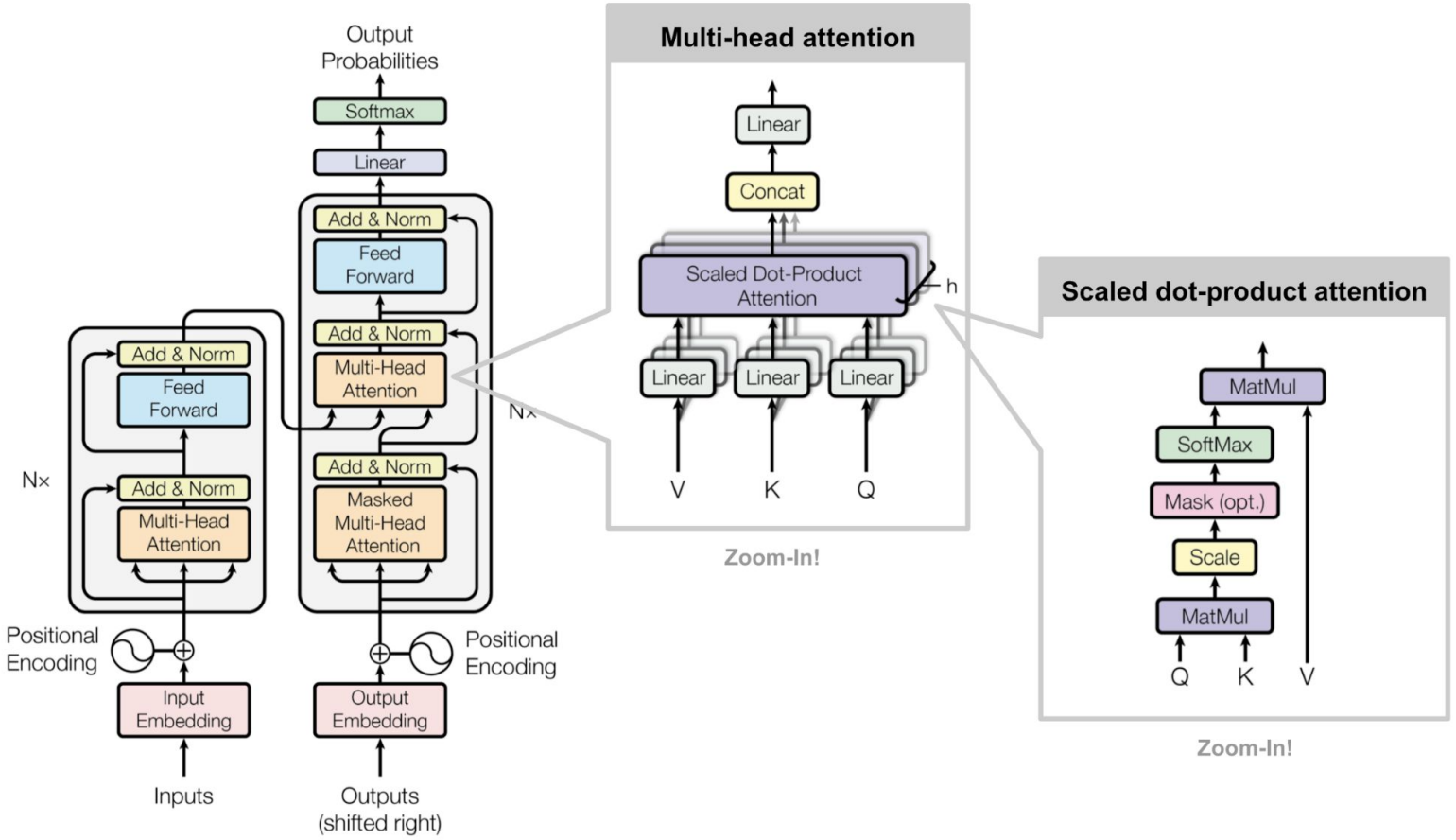




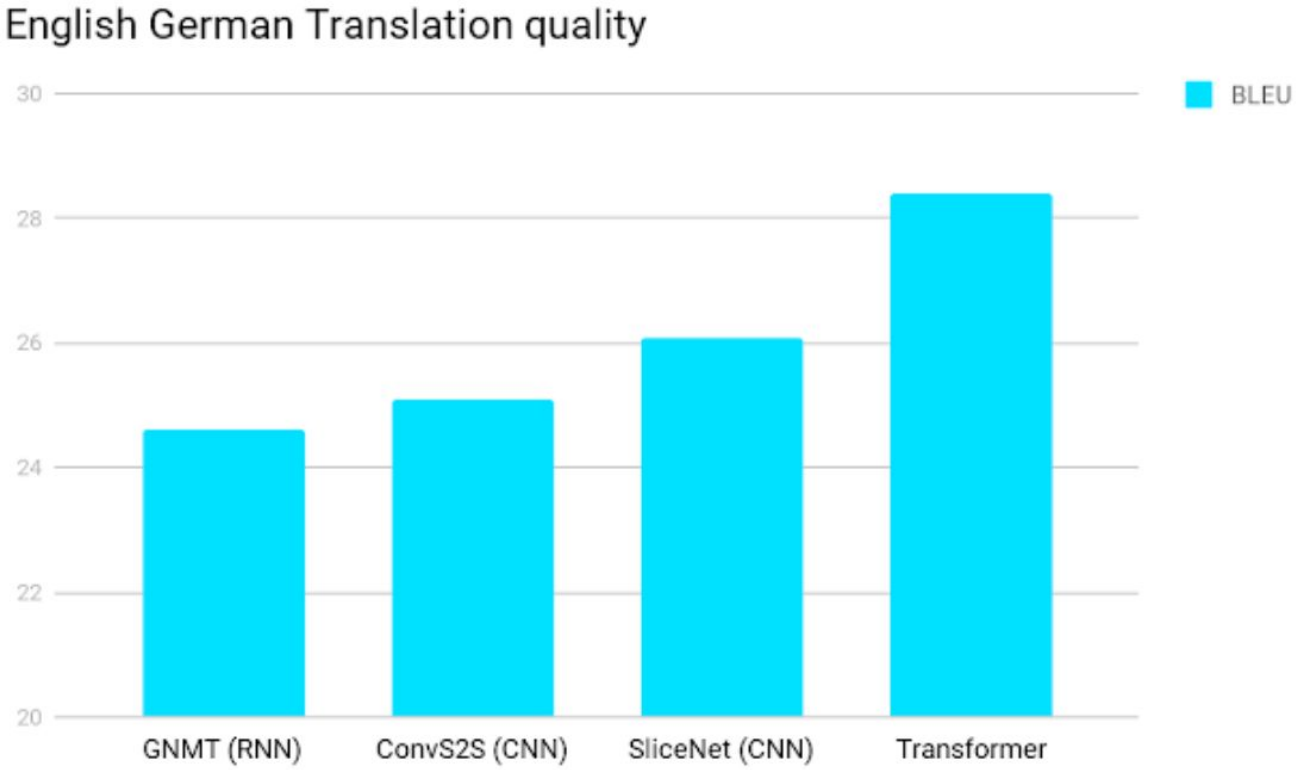
Semantic Text Similarity



Transformer self attention

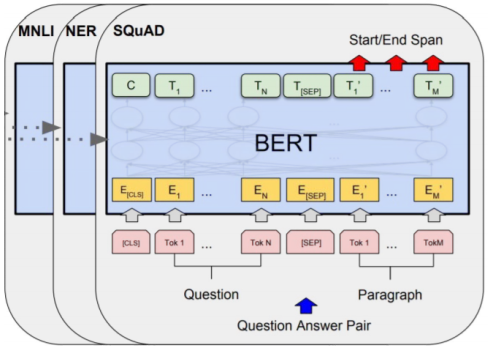


Transformer SOTA step-change



BERT overview

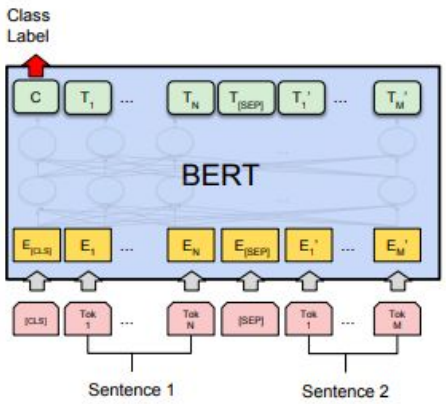
- Bidirectional Encoder Representations from Transformers
  - State-of-the-art model from Google (late 2018)
  - Bidirectional encoder part of the Transformer (2017)
  - Self-attention mechanism, avoid slow recurrent networks
  - Can attend to the whole sentence at once
  - Contextual relationships between words (or sub-words)
  - Learns semantic embedding, the meaning of words
  - Self-supervised learning without labelled data



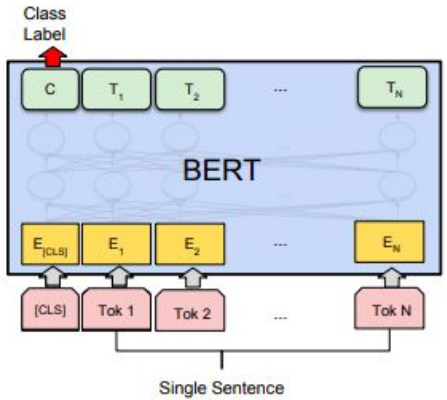
System	MNLI-(m/mm) 392k	QQP 363k	QNLI 108k	SST-2 67k	CoLA 8.5k	STS-B 5.7k	MRPC 3.5k	RTE 2.5k	**Average** -
Pre-OpenAI SOTA	80.6/80.1	66.1	82.3	93.2	35.0	81.0	86.0	61.7	74.0
BiLSTM+ELMo+Attn	76.4/76.1	64.8	79.9	90.4	36.0	73.3	84.9	56.8	71.0
OpenAI GPT	82.1/81.4	70.3	88.1	91.3	45.4	80.0	82.3	56.0	75.2
$\text{BERT}_{\text{BASE}}$	84.6/83.4	71.2	90.1	93.5	52.1	85.8	88.9	66.4	79.6
$\text{BERT}_{\text{LARGE}}$	**86.7/85.9**	**72.1**	**91.1**	**94.9**	**60.5**	**86.5**	**89.3**	**70.1**	**81.9**

BERT NLP tasks

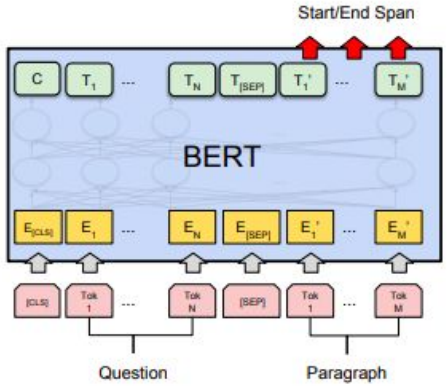
- Language understanding
- Linguistic acceptability
- Sentence embedding
- Sentiment analysis
- Named entity recognition
- Semantic textual similarity
- Question answering
- Textual entailment
- Automated summarization
- Machine Translation
- and many more



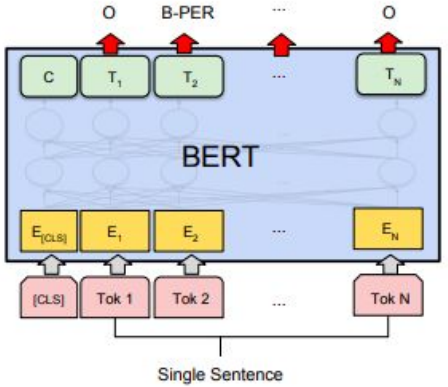
(a) Sentence Pair Classification Tasks: MNLI, QQP, QNLI, STS-B, MRPC, RTE, SWAG



(b) Single Sentence Classification Tasks: SST-2, CoLA

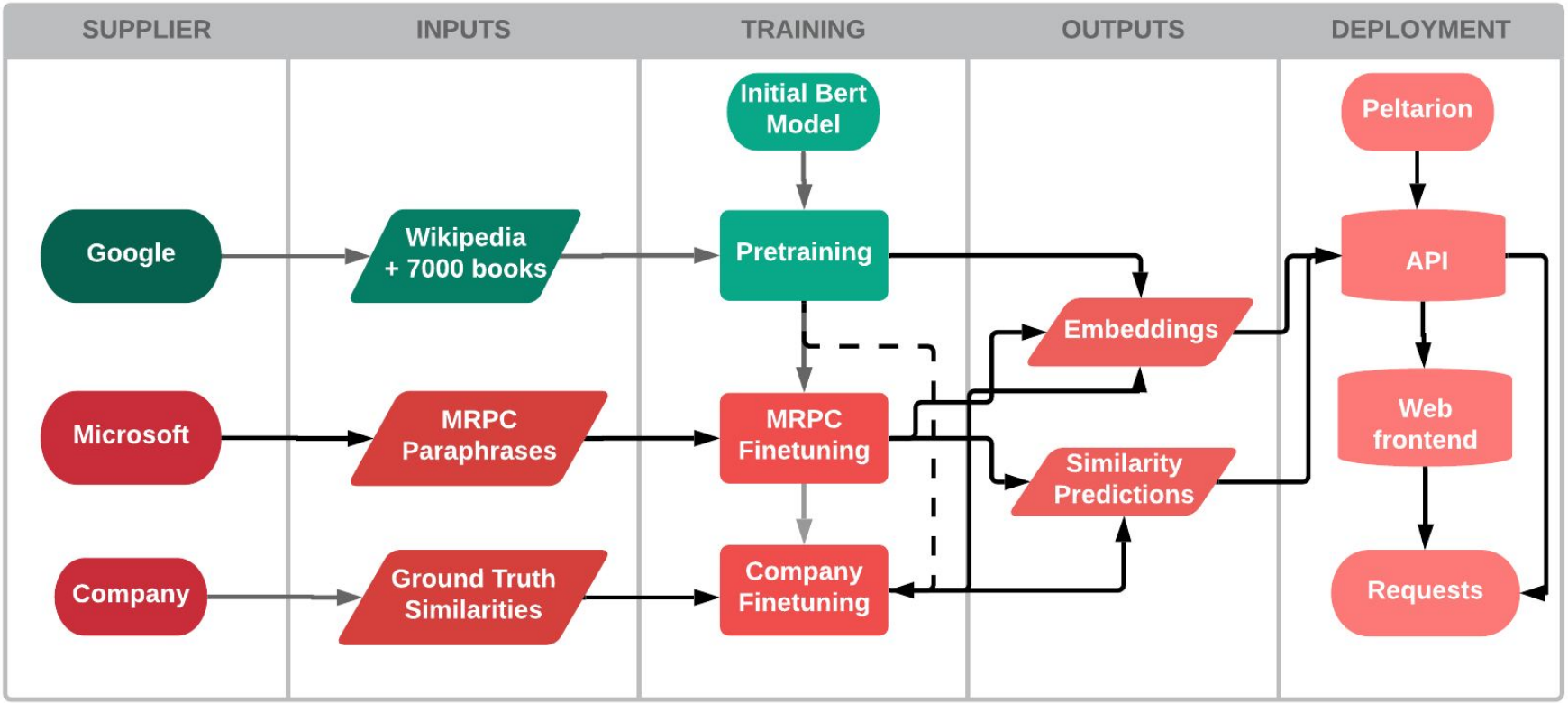


(c) Question Answering Tasks: SQuAD v1.1

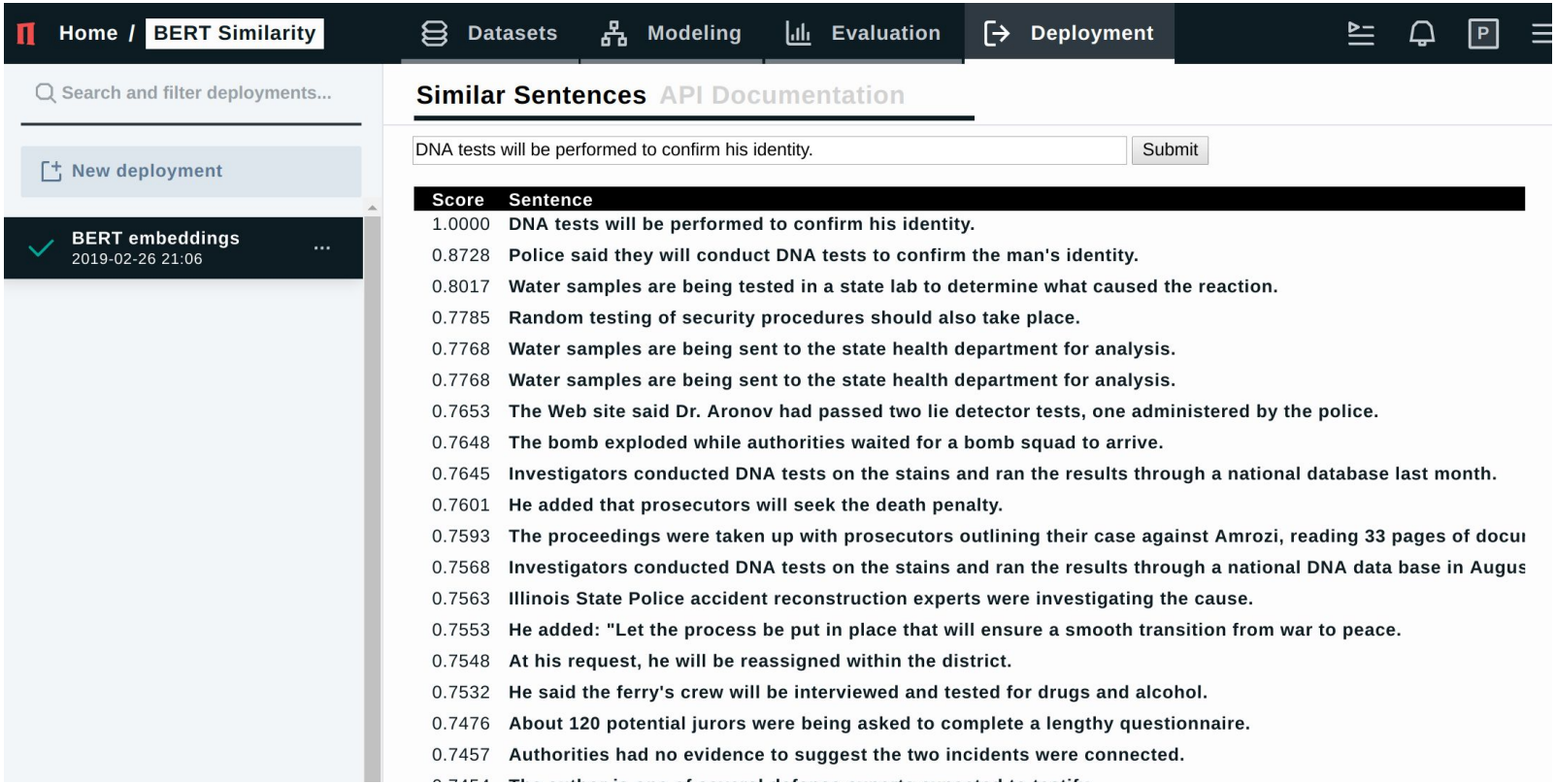


(d) Single Sentence Tagging Tasks: CoNLL-2003 NER

Text similarity training process



DEMO


Home / BERT Similarity
Datasets
Modeling
Evaluation
Deployment
Search and filter deployments...
New deployment
BERT embeddings
2019-02-26 21:06
Similar Sentences
API Documentation
DNA tests will be performed to confirm his identity.
Submit
Score Sentence
1.0000 DNA tests will be performed to confirm his identity.
0.8728 Police said they will conduct DNA tests to confirm the man's identity.
0.8017 Water samples are being tested in a state lab to determine what caused the reaction.
0.7785 Random testing of security procedures should also take place.
0.7768 Water samples are being sent to the state health department for analysis.
0.7768 Water samples are being sent to the state health department for analysis.
0.7653 The Web site said Dr. Aronov had passed two lie detector tests, one administered by the police.
0.7648 The bomb exploded while authorities waited for a bomb squad to arrive.
0.7645 Investigators conducted DNA tests on the stains and ran the results through a national database last month.
0.7601 He added that prosecutors will seek the death penalty.
0.7593 The proceedings were taken up with prosecutors outlining their case against Amrozi, reading 33 pages of docu
0.7568 Investigators conducted DNA tests on the stains and ran the results through a national DNA data base in Augus
0.7563 Illinois State Police accident reconstruction experts were investigating the cause.
0.7553 He added: "Let the process be put in place that will ensure a smooth transition from war to peace.
0.7548 At his request, he will be reassigned within the district.
0.7532 He said the ferry's crew will be interviewed and tested for drugs and alcohol.
0.7476 About 120 potential jurors were being asked to complete a lengthy questionnaire.
0.7457 Authorities had no evidence to suggest the two incidents were connected.

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04 / Example AI Projects at Spotify

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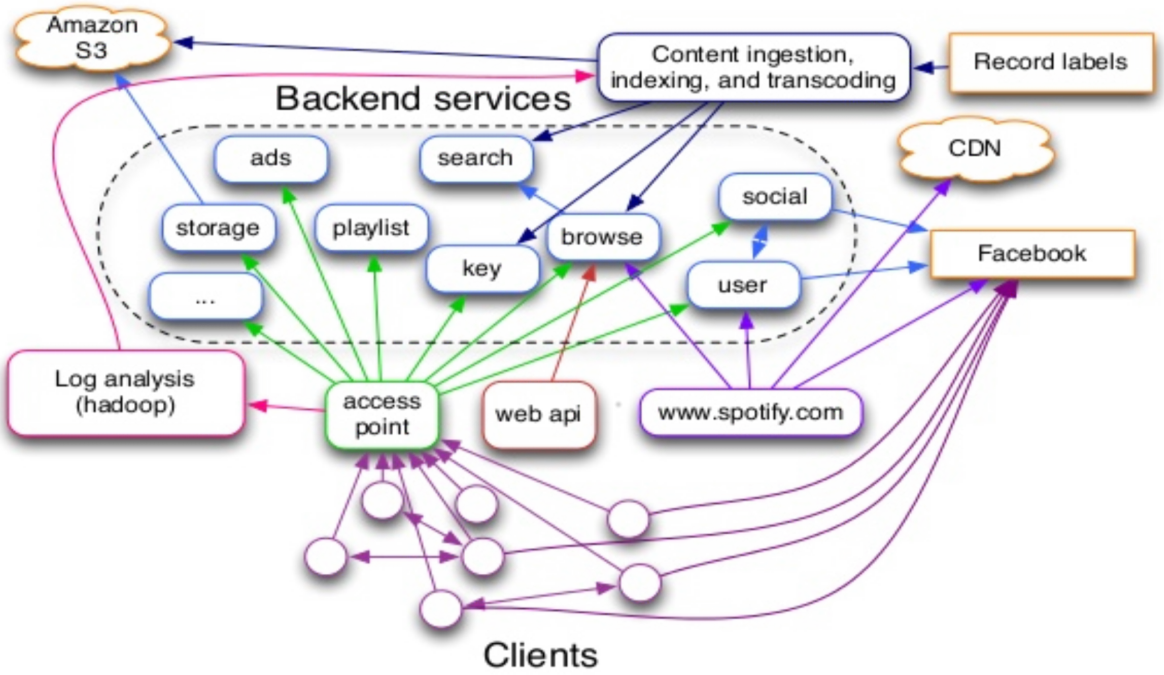
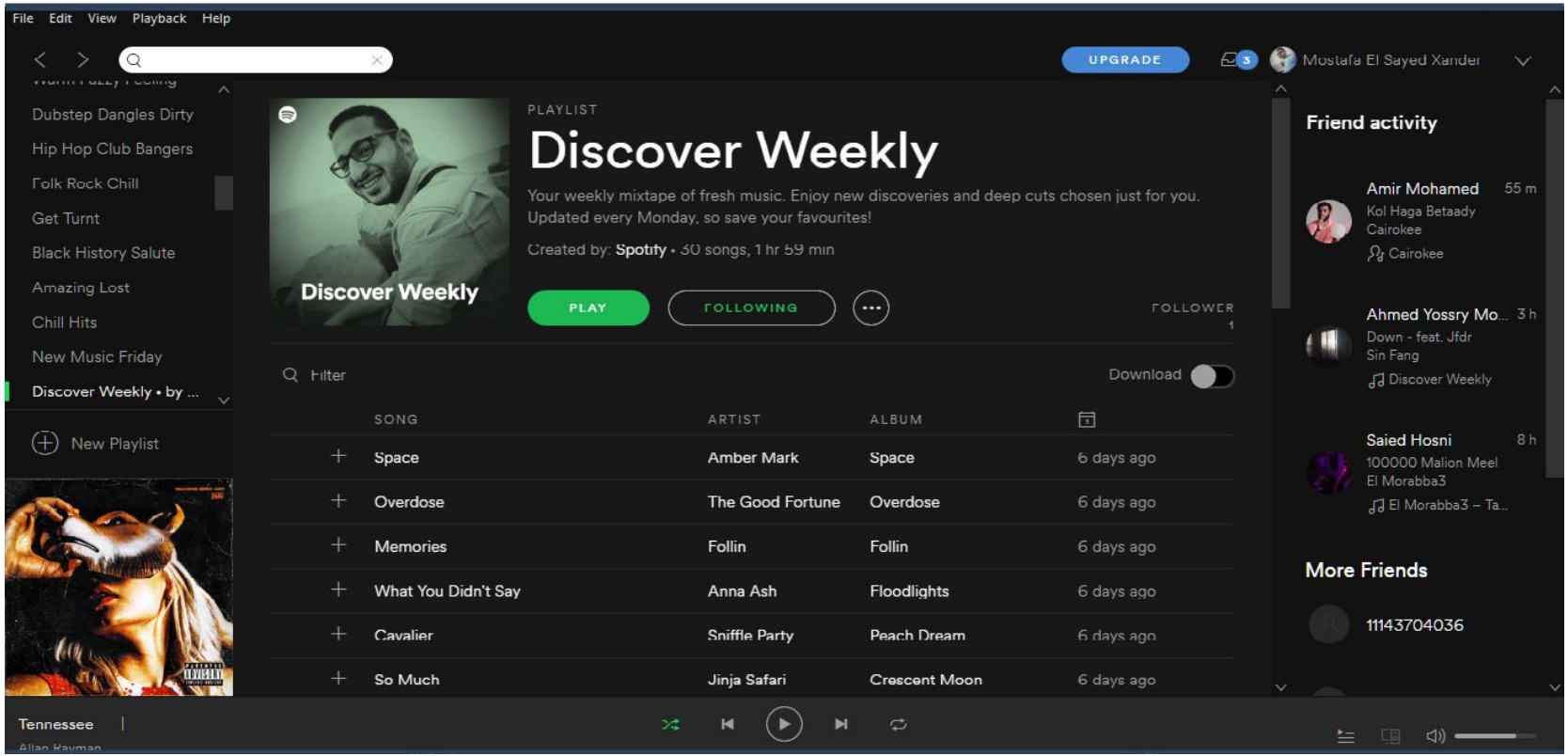
Spotify architecture




File Edit View Playback Help
UPGRADE
Mostafa El Sayed Xander
Dubstep Dangles Dirty
Hip Hop Club Bangers
Folk Rock Chill
Get Turnt
Black History Salute
Amazing Lost
Chill Hits
New Music Friday
Discover Weekly • by ...
New Playlist
PLAYLIST
Discover Weekly
Your weekly mixtape of fresh music. Enjoy new discoveries and deep cuts chosen just for you. Updated every Monday, so save your favourites!
Created by: Spotify • 30 songs, 1 hr 59 min
PLAY
FOLLOWING
FOLLOWER
1
Filter
Download
SONG
ARTIST
ALBUM
Space
Amber Mark
Space
6 days ago
Overdose
The Good Fortune
Overdose
6 days ago
Memories
Follin
Follin
6 days ago
What You Didn't Say
Anna Ash
Floodlights
6 days ago
Cavalier
Sniffle Party
Peach Dream
6 days ago
So Much
Jinja Safari
Crescent Moon
6 days ago
Friend activity
Amir Mohamed
55 m
Kol Haga Betaady
Cairokee
Cairokee
Ahmed Yossry Mo...
3 h
Down - feat. Jfdr
Sin Fang
Discover Weekly
Saied Hosni
8 h
100000 Malion Meel
El Morabba3
El Morabba3 – Ta...
More Friends
11143704036
Tennessee

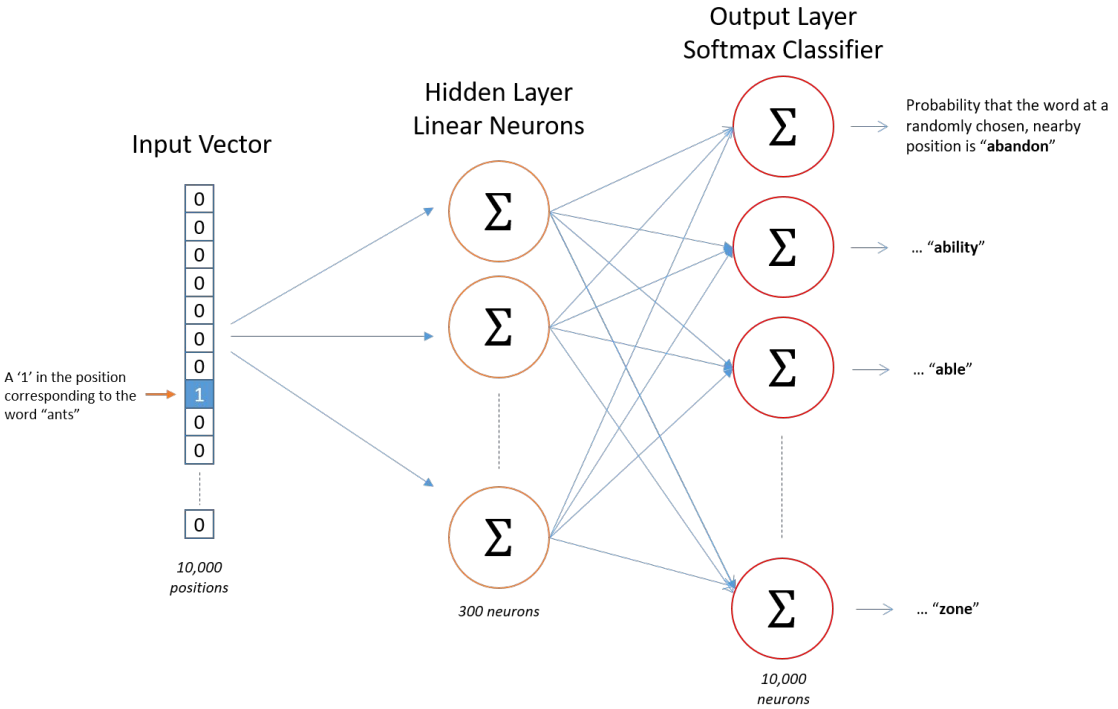
Collaborative filtering

$$P = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{pmatrix} \approx \begin{pmatrix} & X & \end{pmatrix} \begin{pmatrix} Y^T \end{pmatrix}$$

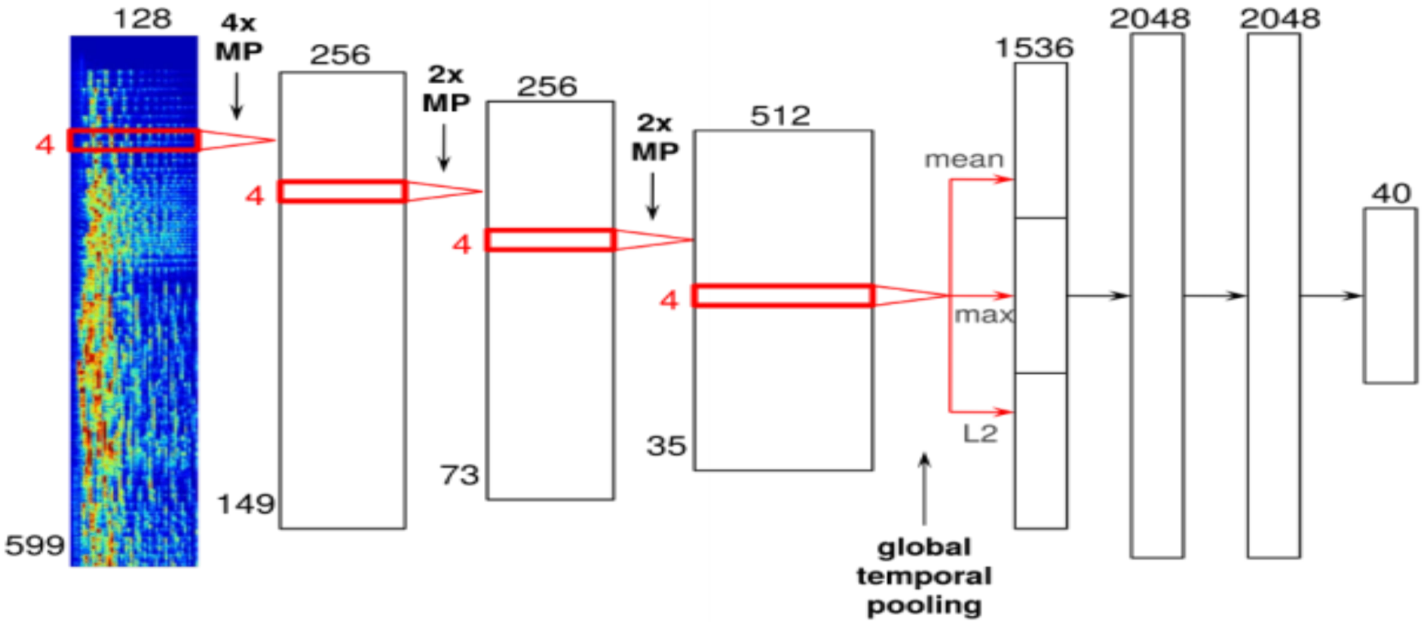
Y is all item vectors, X is all user vectors

$$\sum_{u,i} c_{ui} \left(p_{ui} - x_u^T y_i \right)^2 + \lambda \left(\sum_u \|x_u\|^2 + \sum_i \|y_i\|^2 \right)$$

Word2vec with Playlists



Raw audio recommendations with deep learning



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05 / Example AI Projects

Generic (in)famous

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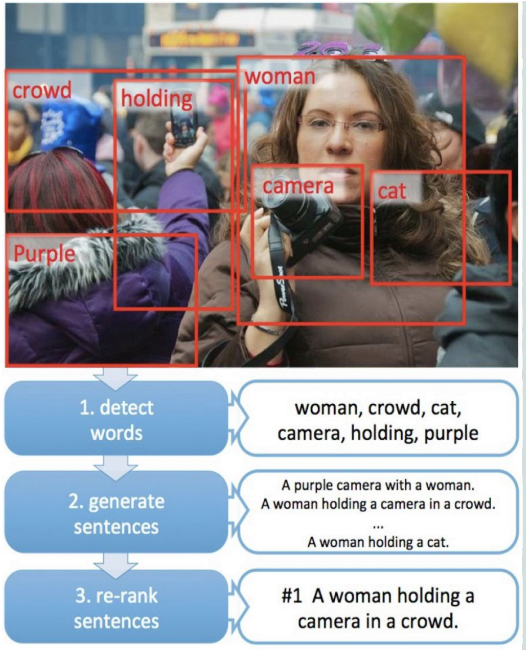
Image caption generation

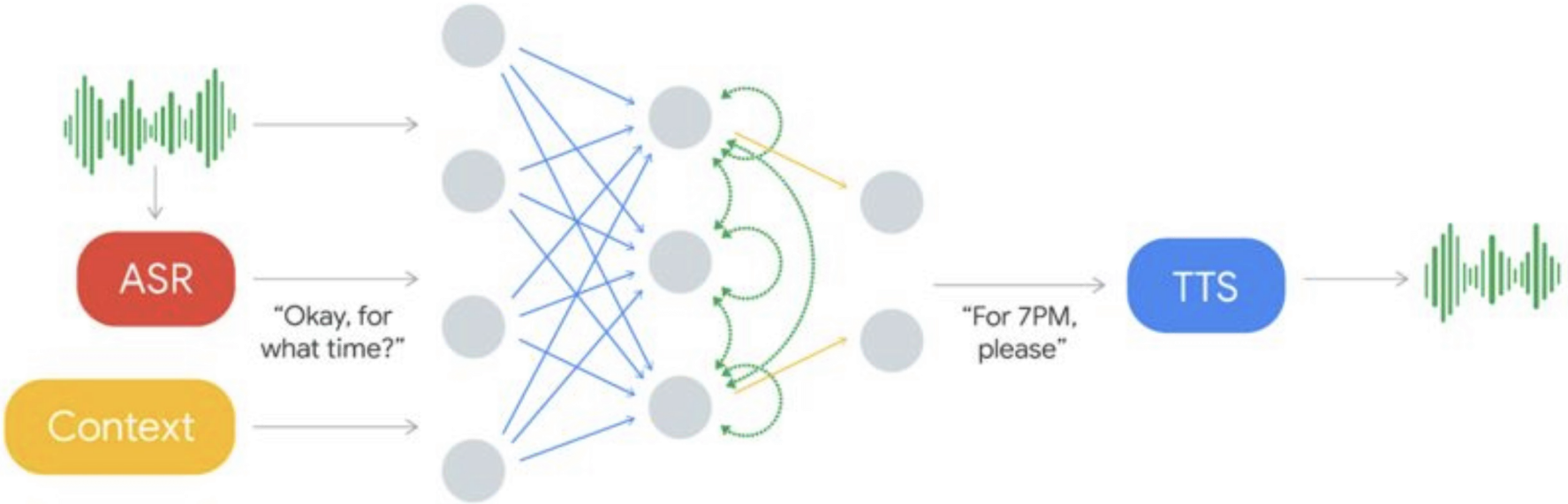


Machine translation

Amazon, 100k robots, 300k humans


9:33

Google duplex



06 / Ending notes

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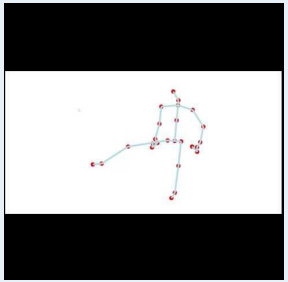
Generative choreography

01

One kinetic sensor

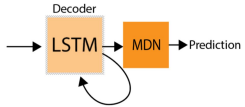
02

Five hours recorded modern dance



03

One LSTM+MDN

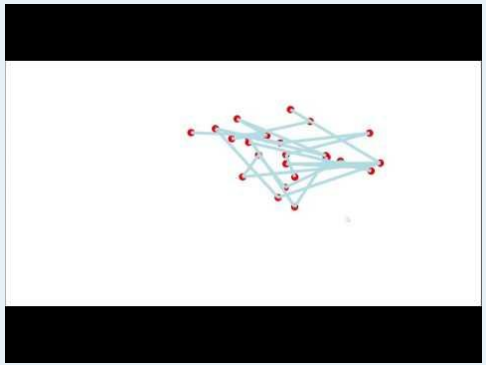


04

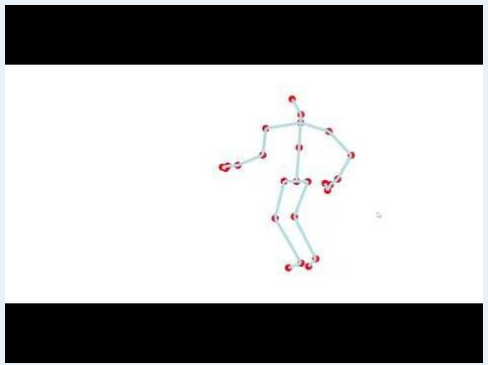
48 hours training on GPU cluster

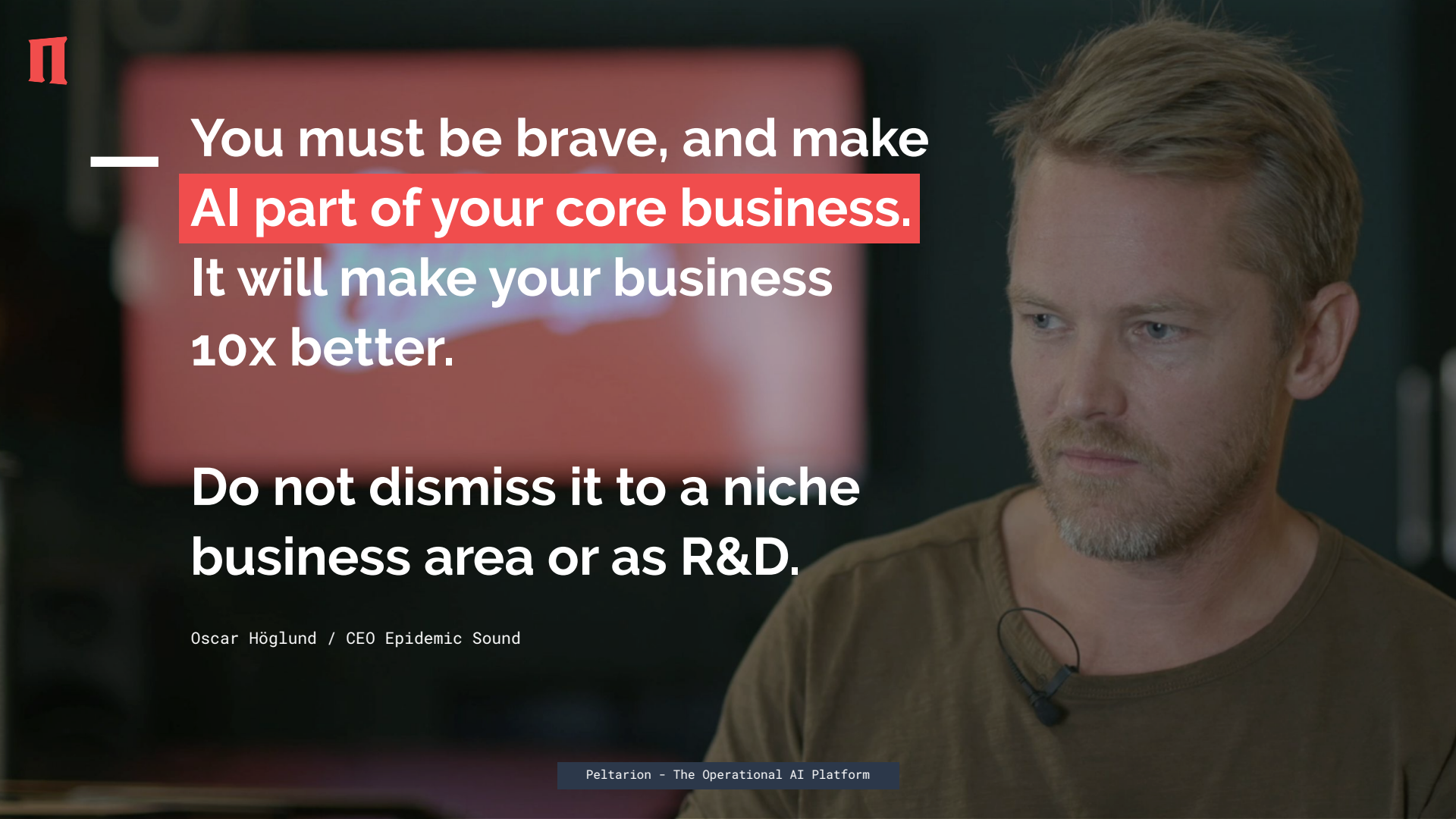
Generative choreography

After 10 min



After 48 hours




You must be brave, and make
AI part of your core business.
It will make your business
10x better.
Do not dismiss it to a niche
business area or as R&D.
Oscar Höglund / CEO Epidemic Sound

PELTARION

/August 5, 2019

Thanks

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