European Challenges for AI and Cognitive Systems

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state of affairs in 2018

big data

affordable HPC

open source software

deep learning systems

progress in AI
dramatic progress in cognitive computing

text analysis and understanding
image understanding
speech recognition
robotics

Socher et al., Proc. EMNLP, 2013
example: super human performance in medical diagnostics

Gulshan et al., JAMA, 316(22), 2016
Esteva et al., Nature, 542(7936), 2017
how is this possible?

a human expert sees

100 images per day
500 images per week
25,000 images per year
1,000,000 images in 40 years

a neural network sees

$\geq 10,000,000$ images for training

a human experts gets

tired, distracted, ...

a neural network never gets

tired, distracted, ...
linked open data / semantic Web
conversational agents

Siri

Alexa

Cortana

Google Assistant
strange decisions

husky classified as wolf

Ribeiro et. al, arXiv, 2016
strange decisions

husky classified as wolf

reason why

Ribeiro et. al, arXiv, 2016
adversarial input

Brown et. al, arXiv, 2017
state of affairs in 2018

big data + affordable HPC + open source software + deep learning systems = progress in AI

problems in industry

1) VC theory demands that complex models are trained with massive data, but *labeled data are scarce*

2) even labeled data may be biased

3) (deep) neural networks are black boxes, *connectionist architectures are not accountable*
take home messages

machine learning needs **thick data** rather than BIG DATA

next generation AI must be able to cope with / avoid bias

next generation AI must be explainable / accountable

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European opportunities

view data acquisition, storage, exchange, and analysis holistically

data sovereignty and ethical AI for economic and social benefits

invigorate industry 4.0

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European challenges

Tech companies lead in R&D spending

Amazon: $16.1 billion
Alphabet: $13.9 billion
Intel: $12.7 billion
Microsoft: $12.3 billion
Apple: $10.0 billion
Johnson & Johnson: $9.0 billion
General Motors: $8.1 billion
Pfizer: $7.8 billion
Ford: $7.3 billion
Oracle: $6.2 billion
Cisco: $6.1 billion
Merck: $6.0 billion
Facebook: $5.9 billion
IBM: $5.4 billion
Eli Lilly: $5.2 billion
Qualcomm: $5.1 billion
General Electric: $4.8 billion
Boeing: $4.6 billion
Celgene: $4.5 billion
Bristol-Myers Squibb: $4.4 billion

Includes latest fiscal year data for reporting S&P 500 companies.

Race of the machines

China has outdone the US in AI-related patent applications

sources: FactSet, Economist, Datenna
thank you!

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