



Al: The New Electricity to Harness Our Digital Future Workshop: Digitalisering inomenergisektorn Dec.7 2017 Devdatt Dubhashi

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Al: the New Electricity

"Al is the new electricity. Just as electricity transformed industry after industry 100 years ago, I think AI will do the same."



Andrew Ng, Stanford, Baidu, Coursera



"I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted." - Alan Turing,

Computing Machinery and Intelligence (1950)



Every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.

John McCarthy, Dartmouth Workshop 1956

ARTIFICIAL INTELLIGENCE



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.



- No labels
- No feedback
- "Find hidden structure"

- Decision process
- Reward system
- Learn series of actions

Email Spam Detection Delete all spam messages now (messages that have been in Spam more than 30 days will be aut

deleted)

公		Mr Collins Belly	Attention Funds Owner, - Attention Funds Own
\$		Anti-Fraud Unit ICPC	PAYMENT NOTIFICATION - ICPC NIGERIA (An
N	*	Zipeem	Per raggiungere i tuoi progetti, scopri le rego
\$		Anti-Fraud Unit ICPC	PAYMENT NOTIFICATION - ICPC NIGERIA (An
\$	*	UsTrendy Indie Fashion	New Arrivals Just Added! - This message was
\$3		YOU'RE-APPROVED	YOUR Roof is Covered FREE!!
23	*	WORK @ HOME	(PLEASE REPLY) Woburn FULL TIME - 2 Rem
\$		Office	Re:Confirm deposit - DEPOSITED INHERITAN
27		Mr.Sambo Ngene	Message From Mr.Sambo Ngene, Director, Forei
23	*	Congratulations!	Here is your chance to win a brand new Ford!
\$	*	Jocelyn Weir	Do not regret skipping these jobs - Jul 27, 20 [.]
\$		Registered_Offender_List.	SEX-Offender living near-YOU!! {Find-Out}

Email Spam Detection: GOFAI

- "If the message contains the word "sex" ..."
- "If the message contains the string "\$\$\$" ..."
- "If the message contains "PAYMENT NOTIFICATION" ..."
- "If the message sender is from Nigeria ..."

Too many rules, too brittle!

Email Spam: Let the Data Speak!

Learn the rules automatically



Supervised Learning

- Large amount of labelled (annotated) training data consisting of pairs (x,y) where x is the raw data and y is a label.
- Example: (email1, spam), (email2, not spam)



Image Recognition



- ImageNet Dataset
- 15 million labeled highresolution images of objects in roughly 22,000 categories





CHALMERS

Google Translate

Input sentence:	Translation (PBMT):	Translation (GNMT):	Translation (human):
李克強此行將啟動中加 總理年度對話機制,與 加拿大總理杜魯多舉行 兩國總理首次年度對 話。	Li Keqiang premier added this line to start the annual dialogue mechanism with the Canadian Prime Minister Trudeau two prime ministers held its first annual session.	Li Keqiang will start the annual dialogue mechanism with Prime Minister Trudeau of Canada and hold the first annual dialogue between the two premiers.	Li Keqiang will initiate the annual dialogue mechanism between premiers of China and Canada during this visit, and hold the first annual dialogue with Premier Trudeau of Canada.

reduce translation errors across its Google Translate service by between 55 percent and 85 percent

CHALMERS

AI Revolution in NLP



Supervised Learning



- EU Parliament documents in multiple languages
- Bibles in multiple languages

Unsupervised Learning

- Large amount of raw data without labels/annotations
- Example: cluster your emails into different folders based on projects they are about
- Example: cluster archive of GP news articles topic-wise: politics, sport, entertainment ...

CHALMERS

Document summarization



Automatically extract a Summary of documents From raw text without any supervision.

Document Summarization

Summaries

(Approx. 40 words)

Multiple Kernel

Learning]

The report said Andreas Lubitz repeatedly set the plane for an unauthorised descent earlier that day. He had locked the flight captain out of the cockpit. Five minutes on the Duesseldorf-Barcelona flight 07:21:10 - Plane told to descend to 21,000ft

[TextRank]

The co-pilot of the Germanwings plane that

Original Text

ness Tech Science Magazine Entertainment & Arts Health Pictures World selected Africa Asia Australia Europe selected Latin America Middle East US & Canada [Germanwings crash: Co-pilot Lubitz 'practised rapid descent'] 21 minutes ago From the section Europe [Germanwings co-pilot Andreas Lubitz is known to have suffered depression in the past] [Alps plane crash] What drives people to murder-suicide? The victims of the Germanwings plane crash Germanwings: Unanswered questions Flight 4U 9525: The final 30 minutes [The co-pilot of the Germanwings plane that crashed in the French Alps in March appears to have practised a rapid descent on a previous flight, a report by French investigators says.]] The report said Andreas Lubitz repeatedly set the plane for an unauthorised descent earlier that day. Lubitz is suspected of deliberately crashing the Airbus 320, killing all 150 people on board. [He had locked the flight cantain out of the cockpit.]] The plane had



FINDWISE

SEARCH DRIVEN SOLUTION

Data-driven Secure Business Intelligence





David Sands, Peter Damaschke, Devdatt Dubhashi, Gerardo Schneider, Andrei Sabelfeld



SEARCH DRIVEN SOLUTIONS

Reinforcement Learning





AlphaGoZero: Al Tabula Rasa







Trained from scratch without any Human input only for 36 hours and beat the previous version 100-0!

Why Now? Convergence of Technologies

- Data sensing, acquisition revolution
- Rapid increase in computing power
- Novel algorithms
- Software frameworks











Electricity and AI as General Purpose

- Wide scope for Technologies improvement and elaboration
- Application across a wide range of uses
- Potential for use in a wide variety of products and processes
- Strong complementarities with existing or potential new technologies

25	
THE SECOND	
MACHINE AGE	
WORK, PROGRESS, AN IN A TIME OF BRILLIANT TECHNOL	ND PROSPERITY .ogies
ERIK BRYNJOLFSSON Andrew McAfee	

- AI will contribute as much as \$15.7 trillion to the world economy by 2030 (PwC)
- \$6.6 trillion from increased productivity as businesses automate processes and augment with new Al technology, and \$9.1 trillion from consumption sideeffects as shoppers snap up personalized and higherquality goods



Google Data Centers

- 40% energy saving on cooling gave a 15% reduction in power usage efficiency, (PUE).
- self-learning algorithms to predict how hot data centres were going to get within the next hour.



Al in Energy

- Supervised Learning:
 - Predict customer usage based on historical data
 - Predict volatility of renewable energy generation
 - Balance grid using battery storage
 - Energy infrastructure decisions
- Unsupervised:
 - Segment customers according to energy usage
 - Generate reports on energy usage

CHALMERS



Synthetic Sweden

Optimal charging station locations.

Artificial Intelligence The Future of Humankind

SPECIAL EDITION