

# Introduction to the Artificial Intelligence Programme

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Elizabeth Savochkina | 5<sup>th</sup> June



# Elizaveta Savochkina (Elizabeth)

- DPhil Candidate in Biomedical Engineering at the University of Oxford
- Work with Deep Learning and Ultrasound (US)
- Creating and automating guidance mechanisms for real-time first trimester US scanning

Focus:

- Gaze estimation
- 3D fetal reconstruction
- Probe motion

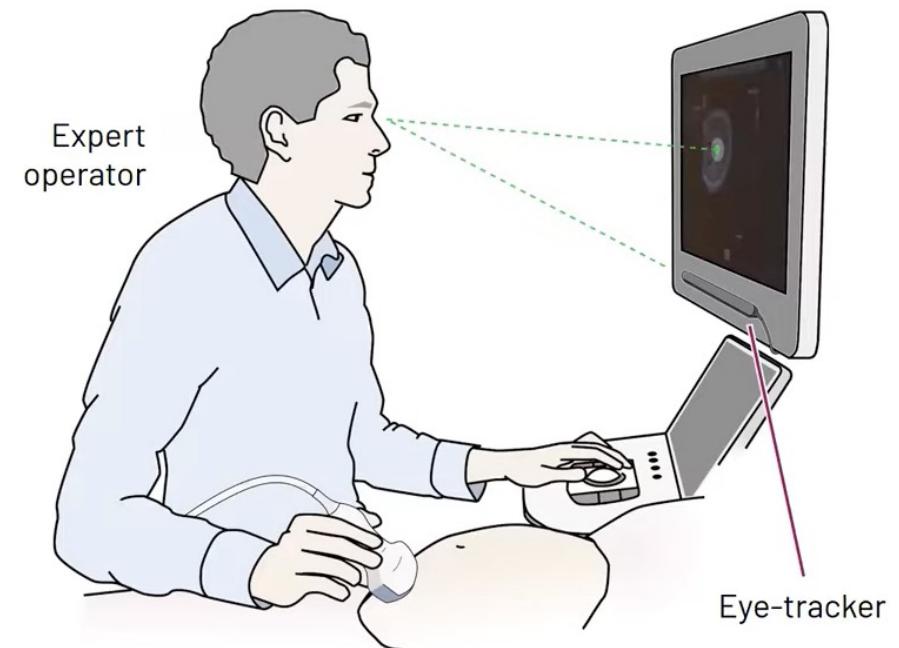
Goal:

- Help identify high risk pregnancies
- Abnormality finding
- Improve and ease general screening practices

Background:

- Robotics and Autonomous Systems (MSc)
- Economics and Mathematics (BSc)

Eye-tracker attached to screen of a clinical ultrasound machine.

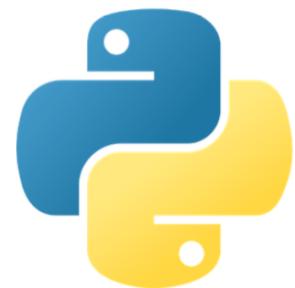


# Programme Outline Week 1

Monday 4 July 2022	Tuesday 5 July 2022	Wednesday 6 July 2022	Thursday 7 July 2022	Friday 8 July 2022
<b>Registration</b> 9.00am to 9.30am	<b>Registration</b> 9.00am to 9.30am	<b>Registration</b> 9.00am to 9.30am	<b>Registration</b> 9.00am to 9.30am	<b>Registration</b> 9.00am to 9.30am
<b>Welcome &amp; Introduction to Artificial Intelligence in 2022</b> 9.30am to 11.30am	<b>History of AI</b> 9.30am to 11.00am	<b>Supervised Learning</b> 9.30am to 11.30am	<b>Unsupervised Learning</b> 9.30am to 11.30am	<b>Reinforcement Learning</b> 9.30am to 11.30am
	<b>Team Formation</b> 11.00am to 11.30am			
<b>Break 11.30am to 13.30 pm</b>	<b>Break 11.30am to 13.30 pm</b>	<b>Break 11.30am to 13.30 pm</b>	<b>Break 11.30am to 13.30 pm</b>	<b>Break 11.30am to 13.30 pm</b>
<b>AI - What is possible?</b> 13.30am to 14.00pm	<b>Workshop: Identifying Opportunities for AI</b> 13.30am to 14.30pm	<b>Hands on: RapidMiner, Python and Jupyter</b> 13.30am to 15.30pm	<b>Project Discussion: Opportunity Identification &amp; Ideation</b> 13.30am to 15.30pm	<b>Keeping up with AI &amp; Machine Learning updates</b> 13.30am to 14.30pm
<b>Ice breaker and discussion exercises about AI</b> 14.00am to 15.30pm	<b>Workshop: Team Poster + Optional Installation</b> 14.30am to 15.30pm			<b>Key Industry Players + Discussion</b> 14.30am to 15.30pm



rapidminer



python<sup>TM</sup>

# **Shape of a Day**

## **Registration**

**9.00am to 9.30am**

## **Welcome & Introduction to Artificial Intelligence in 2022**

**9.30am to 11.30am**

**Break 11.30am to 13.30 pm**

## **AI - What is possible?**

**13.30am to 14.00pm**

## **Ice breaker and discussion excersises about AI**

**14.00am to 15.30pm**

Lectures

Assignments

Class Discussions

Exercises

Workshops

Group Work

Capstone Project

Networking

# Capstone Project

## Capstone Project - Summary

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The *Capstone Project* is an Artificial Intelligence development exercise which requires the students to

*Identify, examine and report on a way to apply AI to solve a problem or to improve or remove an existing process in an organisational entity.*

This represents the key deliverable from the programme, prepared by the students, working in teams.

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This represents the key deliverable from the programme, prepared by the students, working in teams.

**No coding is required and no marks are given for writing computer code or developing working software.**

## Capstone Project – Elements

Business Goals

Technical Requirements

What Data are needed?

Ethical Considerations

- Set out the objective of the AI system
- Identify the opportunity to use AI in the proposed project
- Justify the use of an AI powered solution
- Explain how it links with the strategic goals of the sponsoring organisation

## Capstone Project – Elements

Business Goals

Technical Requirements

What Data are needed?

Ethical Considerations

- Clearly identify the process to which you would apply the AI solution
- Describe the relevant business processes using Business Process Modelling and Notation (BPMN)
- Use BPMN to show which existing parts or processes it improves (or creates, or eliminates)
- Describe any machine learning models you would be applying to your data set, and explain why they would be appropriate

## Capstone Project – Elements

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Business Goals

Technical Requirements

What Data are needed?

Ethical Considerations

- Describe the potential data set and the required pre-processing considerations
  - Identify any sources of error or bias arising from the expected data sources
  - What are the potential data sources?
  - How much data are likely to be available and what quality are they?
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## Capstone Project – Elements

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Business Goals

Technical Requirements

What Data are needed?

Ethical Considerations

- Consider any privacy and other ethical issues related to the data.
  - Discuss the ethical, social and security implications of your use of AI.
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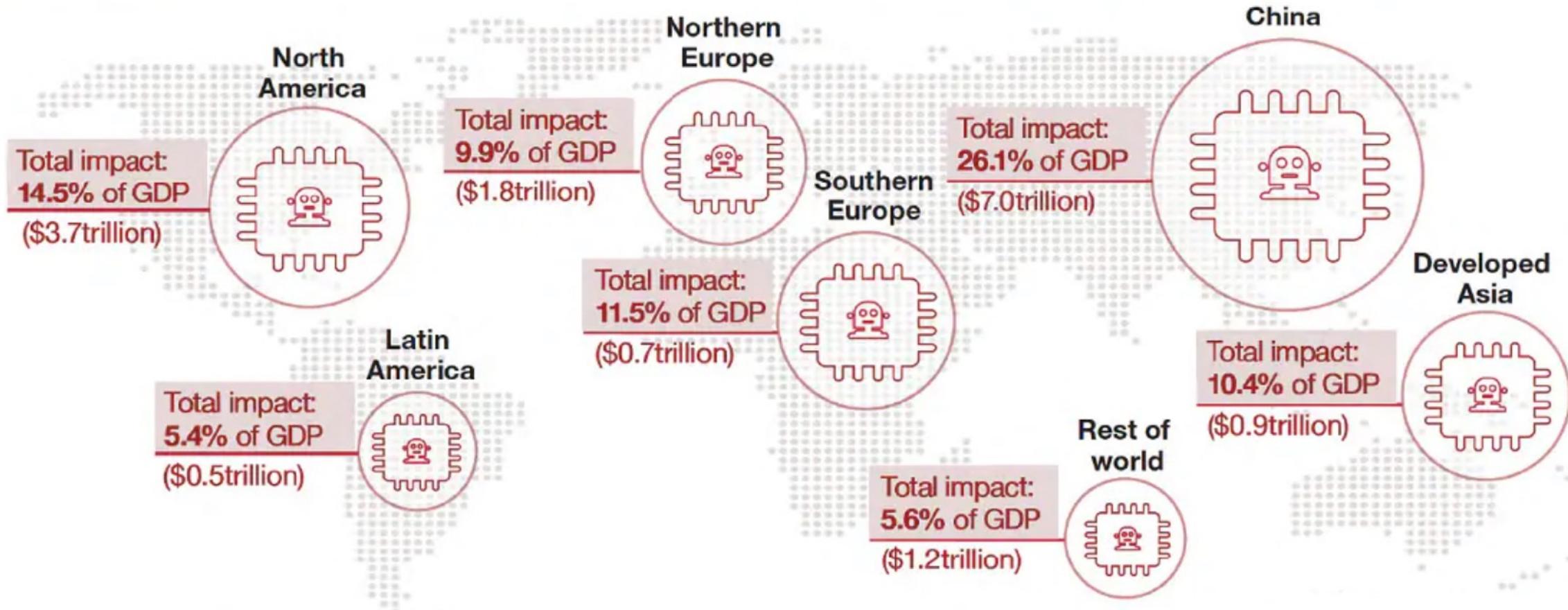
AI in 2022

# Introduction to Artificial Intelligence



Advances in Artificial Intelligence (AI) are changing the way the government, business and society work and the impact on public policy is wide-ranging.

# Economic Potential



# Four key factors underpin the current developments in AI

- 
- Growth in Big Data technologies
  - Unlimited access to computer power
  - Unlimited access to storage
  - Developments in algorithms

# What are the chief characteristics of AI?

- There is no one technology that represents AI
- The term refers to multiple technologies and there are different definitions.



“There are a range of different ways in which the technological nature of the AI is discussed and understood, *and many of them have ambiguous interpretations.*”

# Artificial Intelligence – a definition:



## Oxford English dictionary

*The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.*

# Many definitions of AI are available

“The science of making machines do things that would require intelligence if done by human.”

*Marvin Minsky*

# Many definitions of AI are available

“The science of making machines do things that would require intelligence if done by human.”

*Marvin Minsky*

“The study of mental facilities through use of computational models. The ultimate goal of AI is to build an artificial person.”

*Charniak and McDermott*

# What is intelligence?

How can we know whether a machine can think?



# What is Artificial Intelligence?

What is artificial about it?

- Some claim that artificial should stand for ‘false’ because it’s not human
- ‘Artificial’ only because it is created by humans and didn’t originate from natural causes
- So far, we can say AI is the best umbrella term for explaining advanced computer intelligence

# What is Artificial Intelligence?

- It summarises the efforts to make computers think the way we think, to be able to simulate human cognitive thinking and decision-making, leading to human-like actions, and ultimately to be better and faster at problem-solving than we are

# What is Artificial Intelligence?

- Artificial intelligence (AI) makes it possible for machines to use experience for learning, adjust to new inputs and perform human-like tasks

# Types of Artificial Intelligence

- Artificial intelligence is generally divided into two types – narrow (or weak) AI and general AI, also known as AGI or strong AI

# Narrow AI

- Perform one task at a time and to continue improving its execution.
- Improve something that already works, but can work better
- Most of Artificial Intelligence is Narrow AI
- Software that is automating an activity typically performed by humans

Examples of narrow AI:

- Self-driving cars that learn how to drive (Google, Uber cars)
- Ask our smartphones about the weather etc

# General AI

- The goal is the machine's ability to think generally, to be able to make decisions based on learning rather than previous training
- Independent learning from experience, which is the way humans learn and reason, is the goal
- Creating an intelligence that is equivalent to that of a human being

# General AI

- Four tests of AGI have emerged as the primary definitions of the concept and the marker for judging whether something is generally intelligent
1. Turing Test (1950)
  2. The Coffee Test
  3. The Robot University Student Test
  4. The Employment Test

# 1. Turing Test (1950)

- AI program needs to be able to win the the \$100,000 Loebner Prize (This prize has been available for over 28 years, and no one has won it yet)
- \$25,000 for the first program that judges cannot distinguish from a real human, and which can convince judges that the human is the computer program.
- \$100,000 first program that judges cannot distinguish from a real human in a Turing test that includes deciphering and understanding text, visual, and auditory input.

## AI Application areas

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Driverless cars

Virtual agents

Identity Analytics

Speech Analytics

Cognitive automation

Cognitive Robotics

Recommendation Systems

Modelling & Data Visualisation

L.A.W.S.

# AI Risks and Ethics

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L.A.W.S.

Lethal Autonomous Weapon System

Driverless Cars

Algorithmic Bias

Continuation of  
Introduction to AI...

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# Biomedical Image Analysis

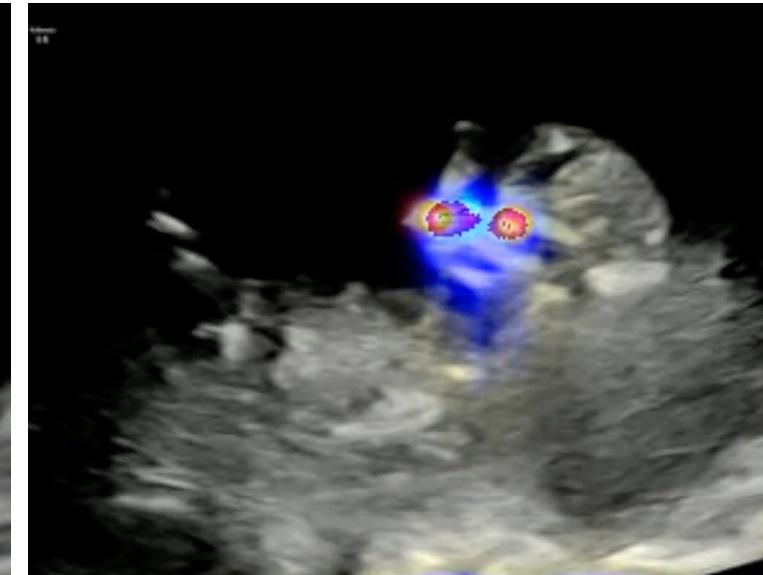
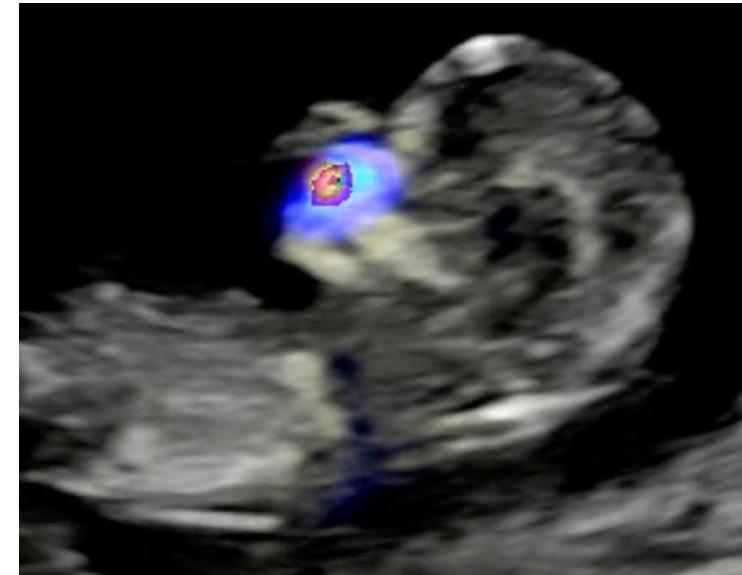
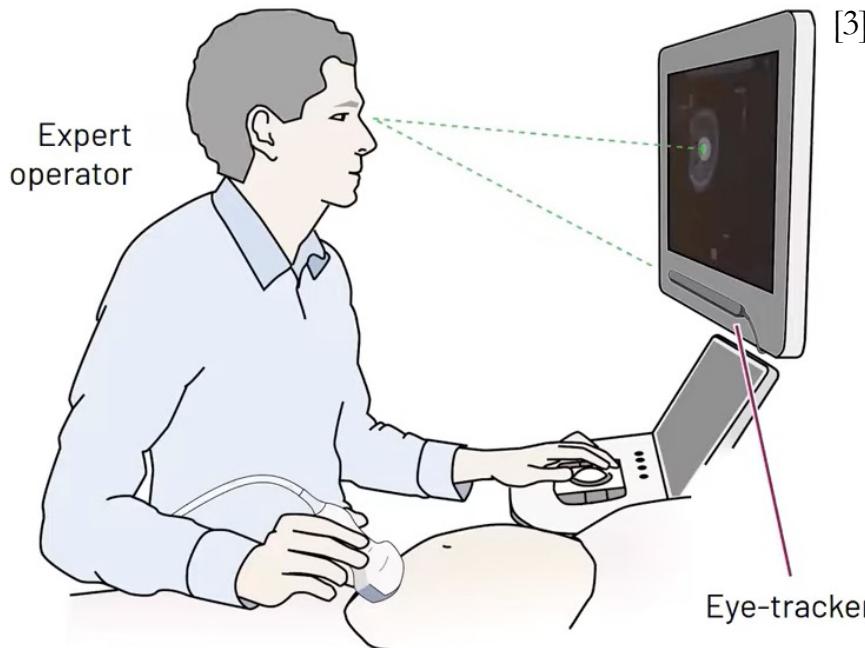
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# BIOMEDICAL IMAGE ANALYSIS

## FIRST TRIMESTER VIDEO SALIENCY PREDICTION

Eye-tracker attached to screen of a clinical ultrasound machine.



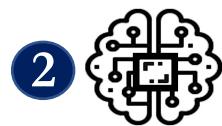
Actual gaze overlaid as a **yellow map**

Predicted gaze overlaid as a **blue map**

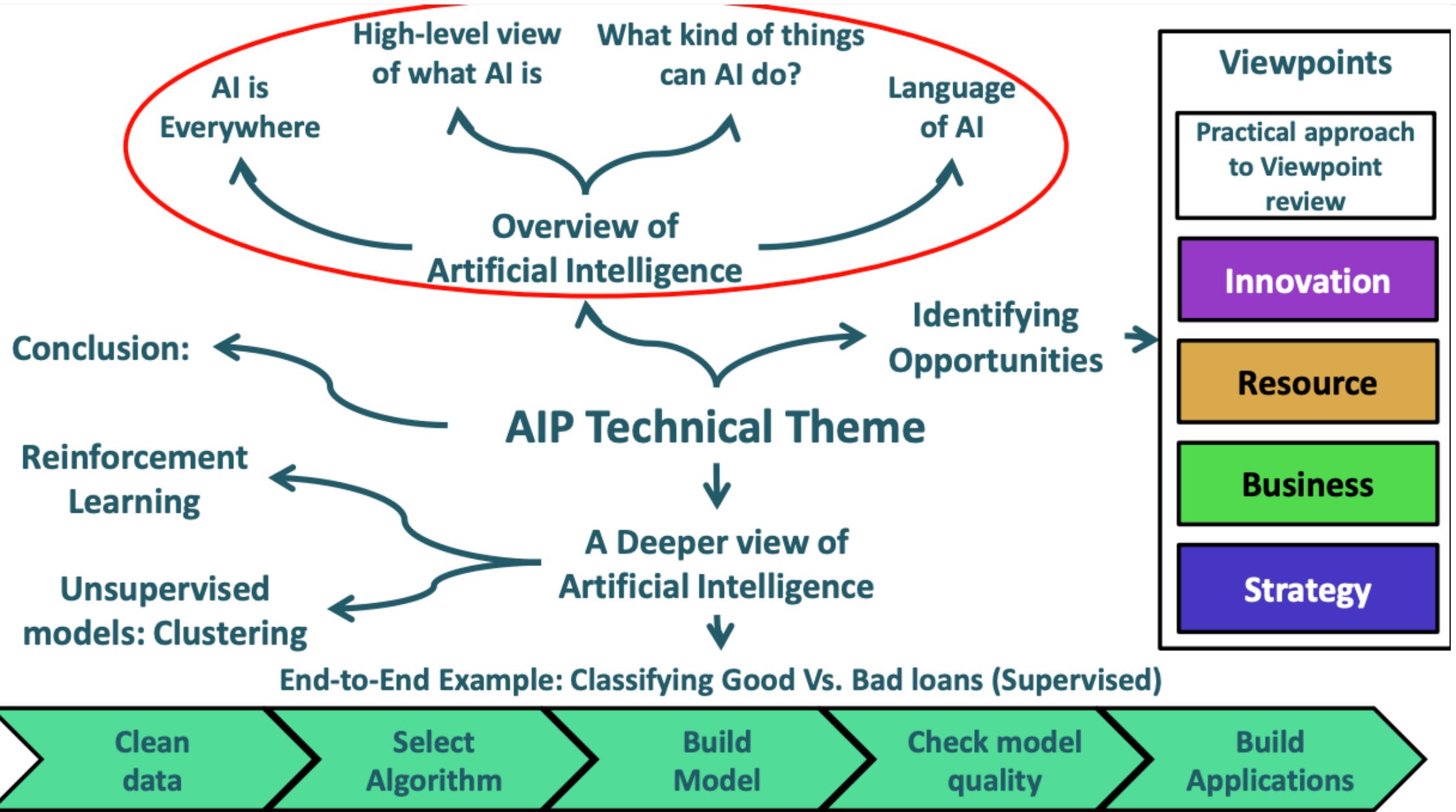
Overlap of both creates a **red map**



1 Acquire **image and gaze data** during a routine ultrasound examination



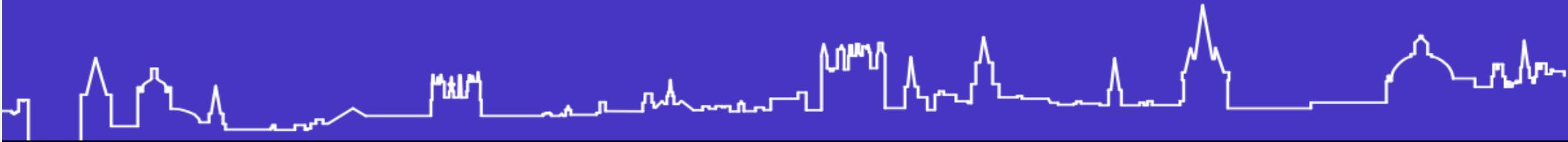
2 Train a model to predict the sonographer gaze distribution: **visual saliency map**



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**More Human  
than Human**

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# **“An entity that cannot be defeated”**

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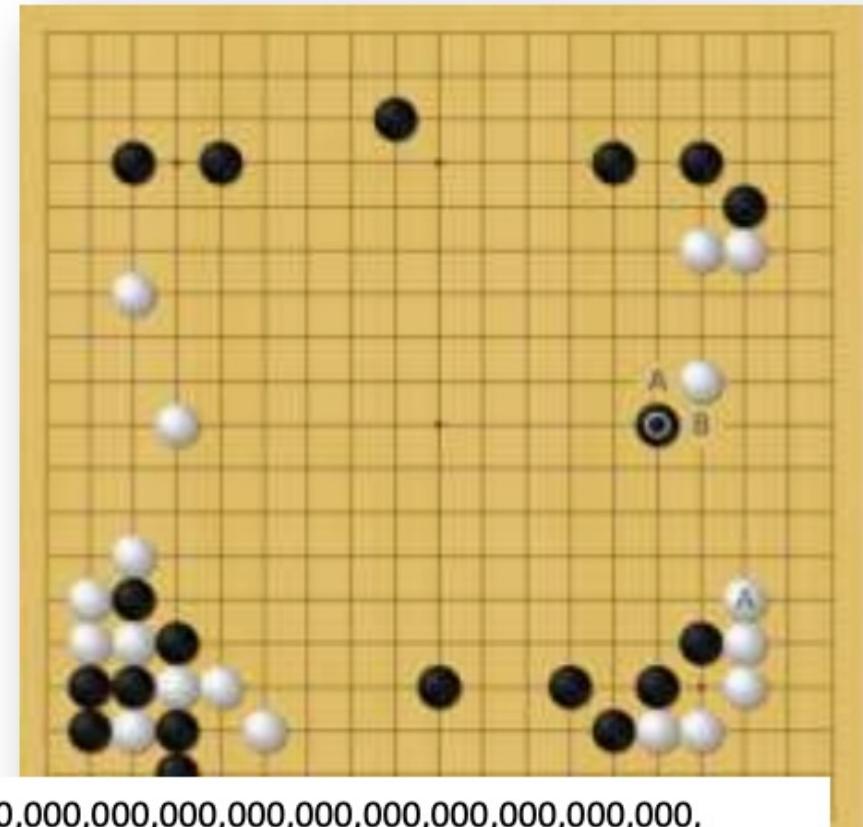
- Lee Sedol - South Korean Go player of 9 dan rank
- Became a professional Go player at the age of 12
- By 2016 he ranked as the world's number 2 player
- On 19 November 2019, Lee announced his retirement from professional play
- He realised that he could never be the top overall player of Go due to the increasing dominance of AI

<https://youtu.be/WXuK6gekU1Y>

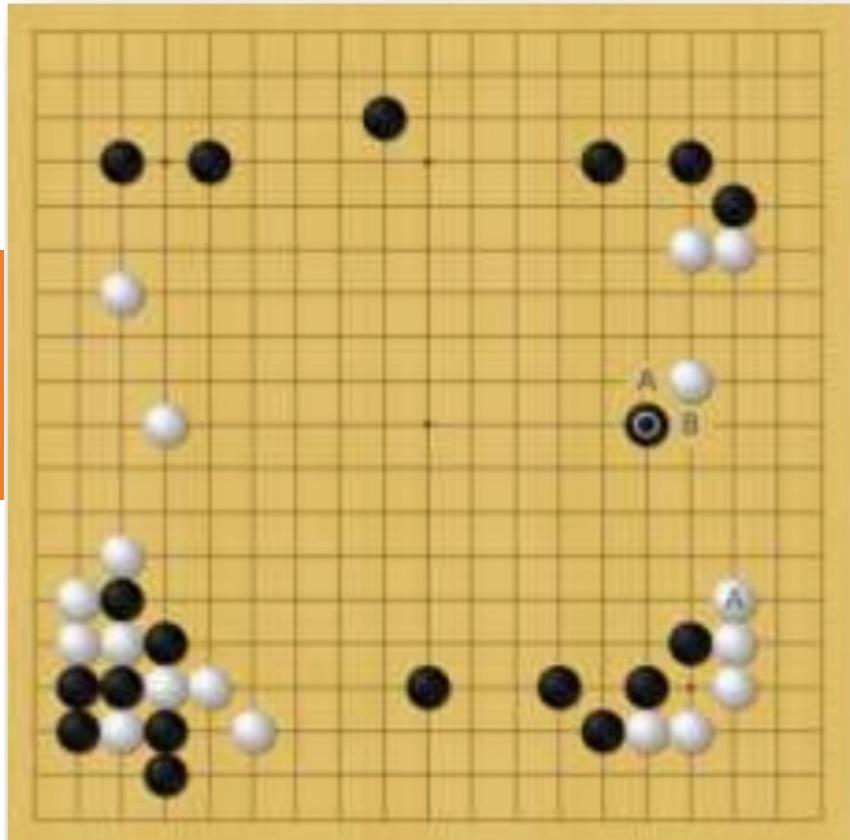


# Go : The most difficult strategy board game

- Go is a 2500 year-old strategy board game
    - Played with black and white ‘stones’
    - On a 19x19 grid
  - The number of legal board positions in Go has been calculated to be approximately  $2 \times 10^{170}$ 
    - The number of atoms in the known, observable universe, estimated to be about  $10^{80}$



# Move 37



- During March 2016 Lee Sedol played a match against the computer programme AlphaGo
- Ahead of the match, Sedol was confident of victory
- He lost the first 3 games of a five-match competition
- During game 2, AlphaGo made an astounding move that looked like extremely poor game play ..
  - Professional commentators were sure that the program had made a huge mistake
  - But by the end of the game, it was clear that the extremely unusual move was key to AlphaGo winning the game
- “Move 37” is now regarded as a turning point both for AI/ML and for Go

<https://youtu.be/WXuK6gekU1Y>

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# **What is Artificial Intelligence? An Overview**

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“AI is the new electricity. Electricity transformed industries: agriculture, transportation, communication, manufacturing. Just as electricity transformed industry after industry 100 years ago, I think AI will do the same”

Andrew Ng, Chief scientist at Baidu, Coursera co-founder, and Stanford adjunct professor

# What is Artificial Intelligence (AI)?

*“... the science of making machines do things that would require intelligence if done by a human being”*

Marvin Minsky

- Examples include

- Translating text from one language to another
- Naming the type of flower shown in a photograph
- Predicting if a person will repay a bank loan or not
- Playing complex strategy games such as chess or go
- A computer-controlled, self-driving car



Image via [www.vpnsrus.com](http://www.vpnsrus.com)



# Over-loading / Over-lapping Buzz-Words

**Artificial Intelligence : Generalised Problem solving,  
.. ‘Thinking’ and Acting**

**Data-Science :**

- The science of data ..
- Collecting, storing, managing and using data
- Statistical methods
- Hypothesis generation and testing in data

**Machine Learning :**

- Automated construction of ‘models’ from data
- Algorithmic extraction of patterns
- Automated organisation and simplification of data

**Deep Learning:**

- The use of a specific technology in these domains .. That of ‘Neural Networks’

**Reinforcement Learning**

- “A computational approach to learning from interaction”

Sutton, R.S. and Barto A.G. (2017)

# Artificial General Intelligence (AGI)

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- Artificial General Intelligence (AGI) would be machines that think and learn at least as well as human beings ..
  - Maybe they would be ‘conscious’ (strong AI)
- AGI exists in the popular imagination, in Hollywood and it literature ...
- But in reality it is not coming any-time soon!

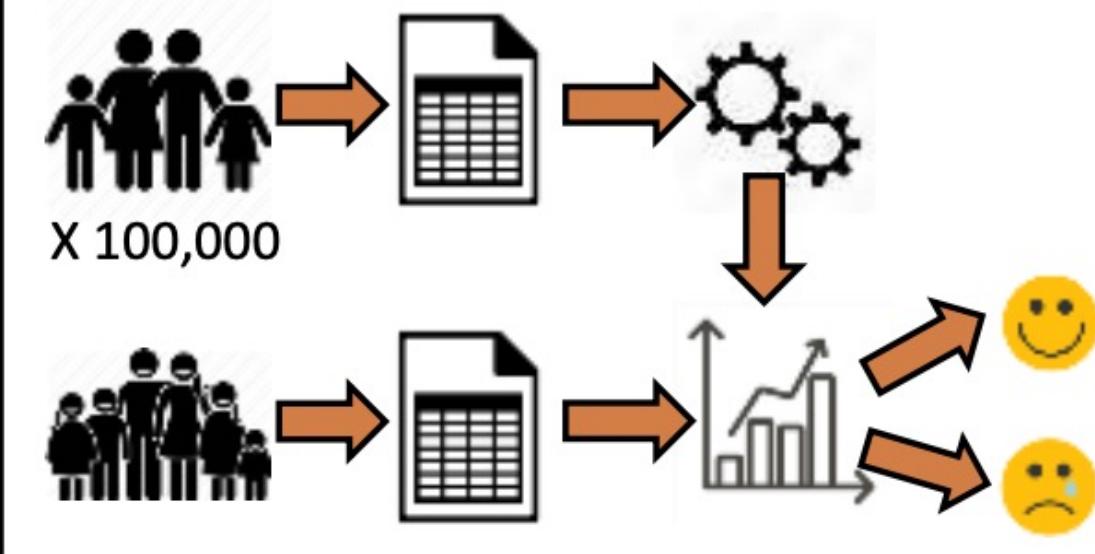


# Machine Learning : Decisions Built from Data

## 'Traditional' Decision Making in Software

```
if income < 35000 then  
    cs = get_credit_score  
    if cs < 650 then  
        print "reject application"  
    else  
        print "Offer loan"
```

## Machine Learning

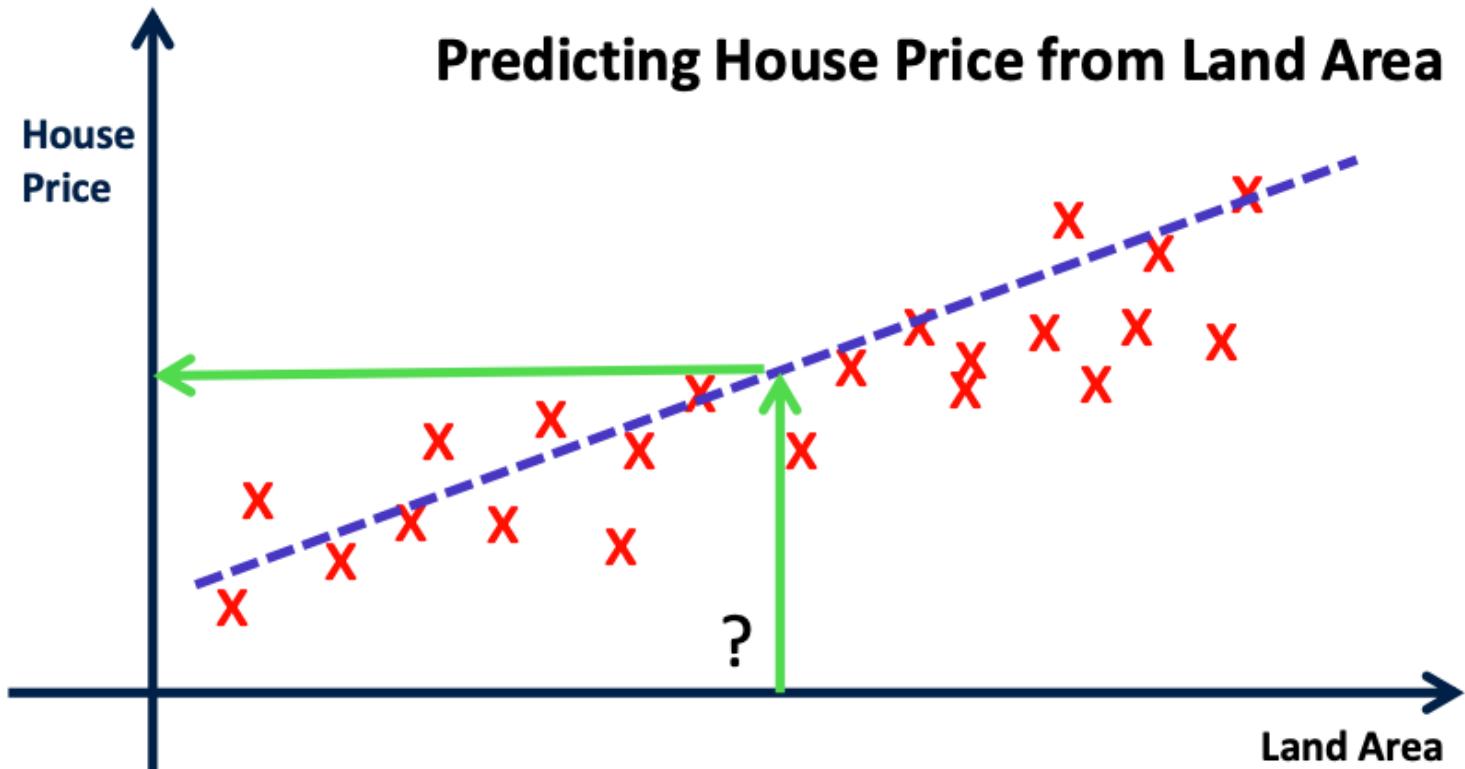


# But how?!?!

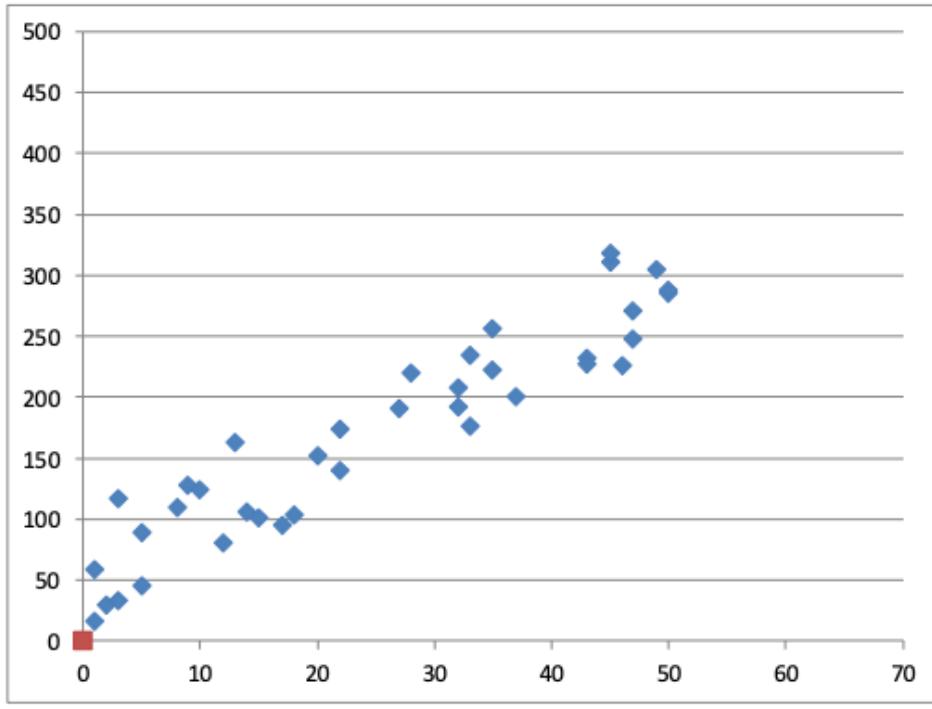
There are many ways ..

But some are as simple as drawing a 'straight-line' through existing data points and reading off new predictions

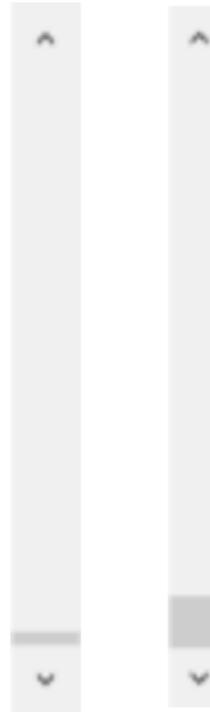
(Linear Regression)



# But How do you “Wiggle the Line Until it fits?”



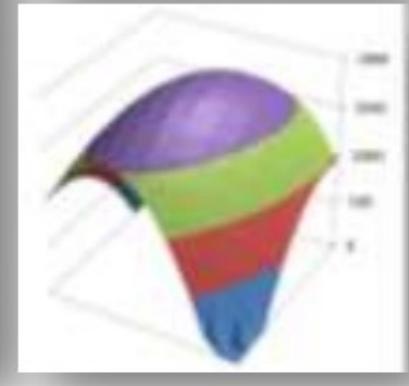
Error 1,372,453



# It can't be that easy!

- It isn't ..
- ML models don't just work with straight-lines
  - .. They can fit more complex curves ..
- And they can work with many more variables
  - Often 1000's!

X2	0	20	40	60	80	100	120	140	160	180	200	220	240
0	0	0	0	0.293	245.0	405.2	625.0	784.9	889.2	959.5	979.2	979.1	979.2
20	0	0	200.4	499.3	718.6	899.1	1048	1159	1237	1305	1366	1400	1432
40	227.8	422.4	624.1	820.1	1018	1208	1398	1476	1553	1646	1738	1876	1989
60	981.5	1929.8	2888	3835	4781	5731	6688	7537	8386	9235	10084	10932	11781
80	938.7	1352	1781	2214	2674	3119	3567	3862	4162	4467	4778	5079	5384
100	1180	1387	1579	1727	1840	1948	2052	2152	2254	2354	2456	2557	2662
120	1374	1585	1722	1844	1962	2083	2200	2322	2443	2564	2684	2722	2845
140	1480	1697	1798	1883	1944	1975	1942	1938	1945	1957	1979	1997	2006
160	1584	1679	1778	1847	1886	1962	1947	1979	1954	1954	1961	1952	1987
180	1500	1613	1692	1783	1748	1717	1698	1663	1631	1665	1668	1619	1617
200	1389	1478	1528	1548	1528	1478	1399	1298	1113	923.3	884.3	818.6	797.8
220	1302	1283	1288	1280	1237	1198	1046	898.1	718.6	498.4	248.4	0	0
240	978.2	973.2	975.2	958.5	909.1	764.0	625.0	452.2	245.0	0.0	0	0	0



# Fundamentally .. Its Statistics

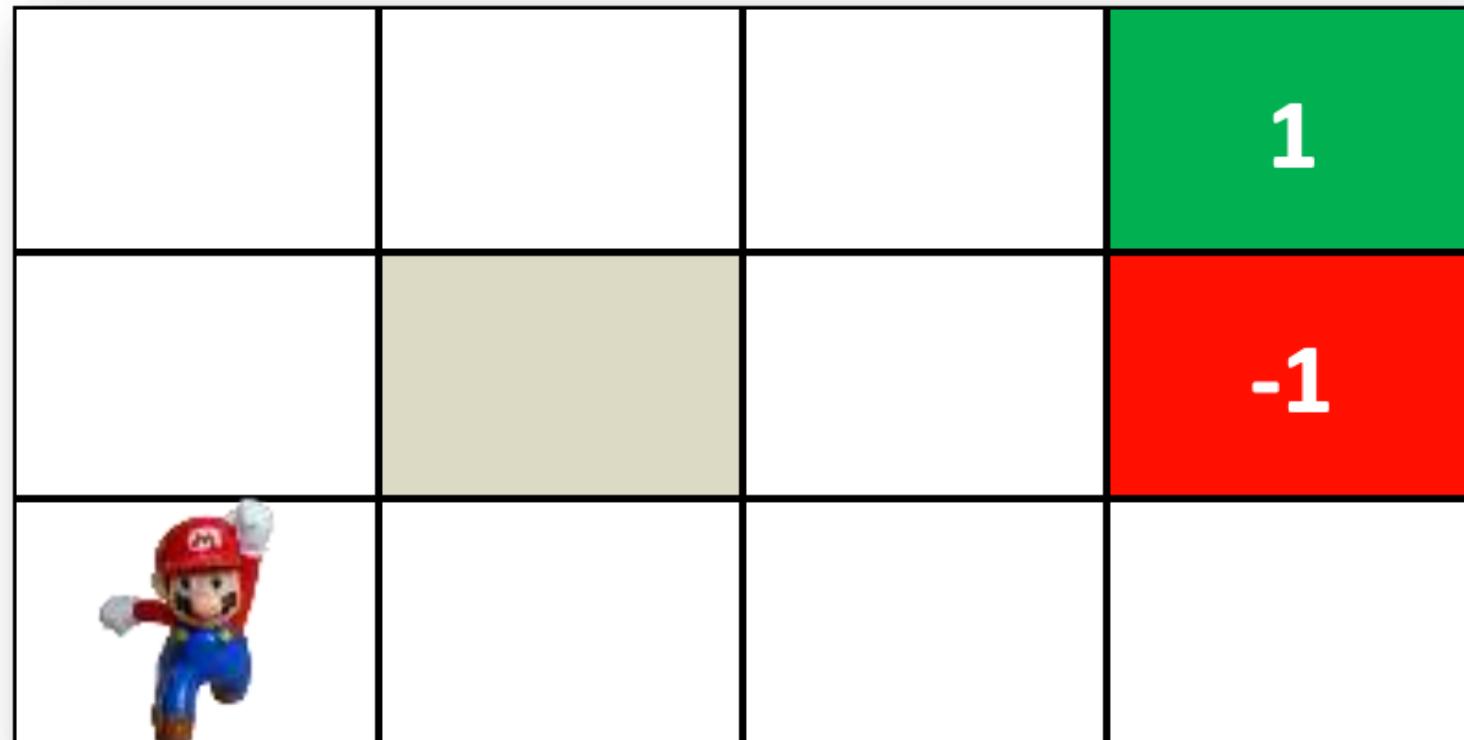
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- Fundamentally .. Machine Learning is Statistics ..
- Often using large data-sets ..
- Involving potentially hundreds of millions of calculations
- But still, fundamentally .. statistics



# Reinforcement Learning : Behaviour from Exploration

In Reinforcement Learning an Agent explores a World and attempts to achieve a Goal by developing optimum Policies



Sutton, S.S. and Barto, A.G. (2017) "Reinforcement Learning: An Introduction"



# The ‘Best Route’ is not Always Simple

- Why does the agent take the long way around?
- Because in this world the agent can ‘slip’ in an unintended direction – and going past the ‘Pit of doom’ is dangerous!

→	→	→	1
↑		↑	-1
↑	←	←	←





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**What kind of things can  
Artificial Intelligence do?**

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# What kind of things can AI do?

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- Filter Spam
- Detect fraudulent applications
- Sort resumes for jobs
- Direct enquiries to the correct expert
- Classify images from x-rays as malignant / benign



- Segmenting customers into groups
- Grouping products into families that customers will relate to
- Grouping complaint types
- Personalised product offerings



# What kind of things can Machine Learning do?

Detecting  
patterns in  
data



Recognition

- Identify money laundering
- Recognise when a machine is wearing out or needs maintenance
- Detect computer hacking attempts
- Identify misshaped / defective parts in production processes
- Identify fraudulent transactions
- Facial recognition for security

- Predicting product /service prices (from suppliers / to customers)
- Predicting product /service demand
- Predicting process yield
- Predicting productivity
- Predicting performance



Prediction

Regression



# What kind of things can Machine Learning do?

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## Dimensionality reduction

- Identify the most important features of large data-sets
- Compress data : More ‘computable’, simpler, more explainable
- Modelling of complex dynamical systems
- Singular Value Decomposition (SVD) : Generalises Eigen Decomposition to non-square matrices



## Complex Adaptive Control

- Learn to control and stabilise complex processes by trial-and-error



# What kind of things can Machine Learning do?

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Natural Language Processing (NLP)

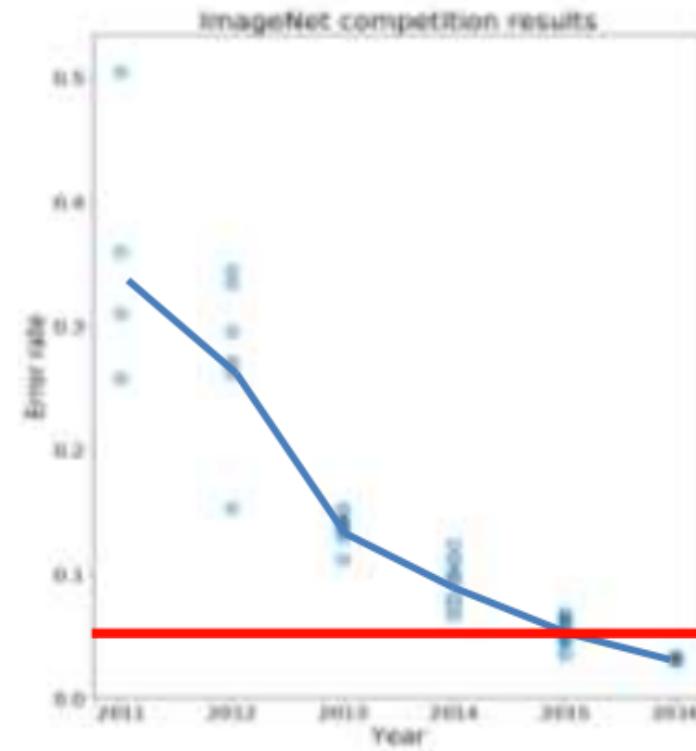
- Statistical processing of text : frequency counts, distributions
- Grammatical analysis – Part-of-Speech (PoS) tagging
- Text cluster analysis : Group commonly occurring words
- Theme extraction : Discover common themes in large text corpus
- Sentiment analysis : Is the emotional tone positive or negative?
- Semantic associations : E.g. Word2Vec ..
  - Queen ⇔ King, Queen ⇔ Woman, King ⇔ Man, Man ⇔ Woman
  - King – Man + Woman = Queen
- Human like conversation
- Translation



# It May be Better (Worse) Than you Think

- The ImageNet Challenge is a competition focussed on Visual Recognition
- In particular, the task is correctly label a series of images based on a very large set from the ImageNet database
- Human performance on the same task is around the 5% error level

<http://image-net.org/index>



## And Sometimes Not So Good ..

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**Even state-of-the art  
visual recognition can  
make some 'obvious'  
mistakes**



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# Introducing Some of the Language of AI ..

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# Machine Learning ‘Algorithm’

- An ‘algorithm’ is an unambiguous set of instructions for solving a problem
  - First described by the 8<sup>th</sup> Century Persian mathematician Muhammad ibn Musa al-Khwarizmi
- Algorithms are the ‘mechanisms’ of AI
- They solve problems such as:
  - Clustering data into sets with similar characteristics, and
  - Building predictive models from data sets



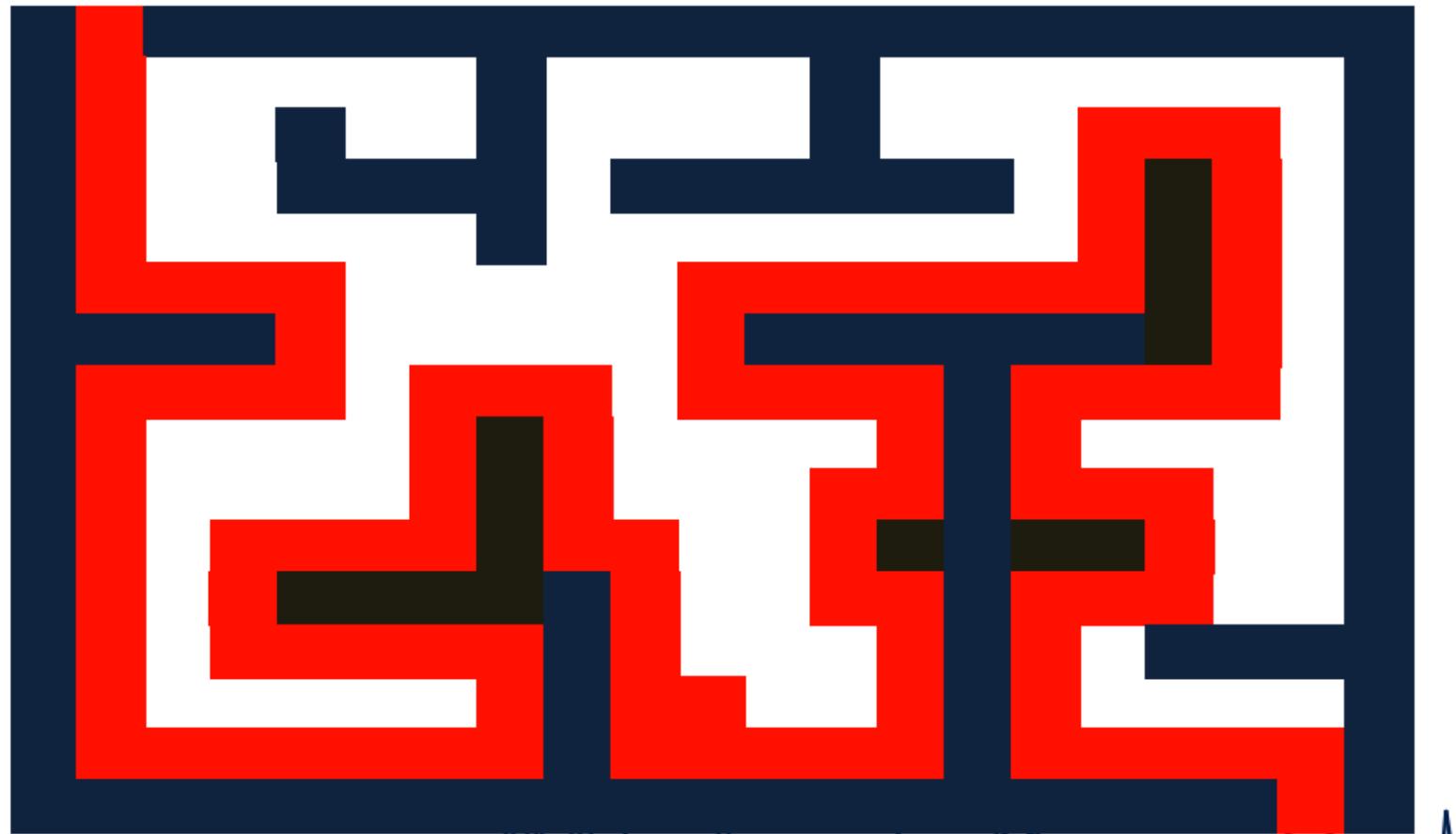
Muhammad ibn Musa al-Khwarizmi



## Example: Simple Maze Solving Algorithm (Not AI!)

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**Rule:**  
**Stick to the**  
**right-hand**  
**wall**



# Describing sets of Data

Observations

Features / Dimensions				Label
ID	Homeowner	Marital Status	Income	Loan Default
1	Yes	Single	High	No
2	Yes	Married	High	No
3	Yes	Divorced	High	Yes
4	No	Married	Average	No
5	No	Married	Average	No
6	No	Divorced	High	No
7	Yes	Single	Low	Yes
8	No	Single	High	No
9	Yes	Married	Low	No

Labelled data creates  
the opportunity for  
supervised learning

Owning a large,  
labelled data-set  
could be a significant  
business asset

Do you have one or  
could you build one?



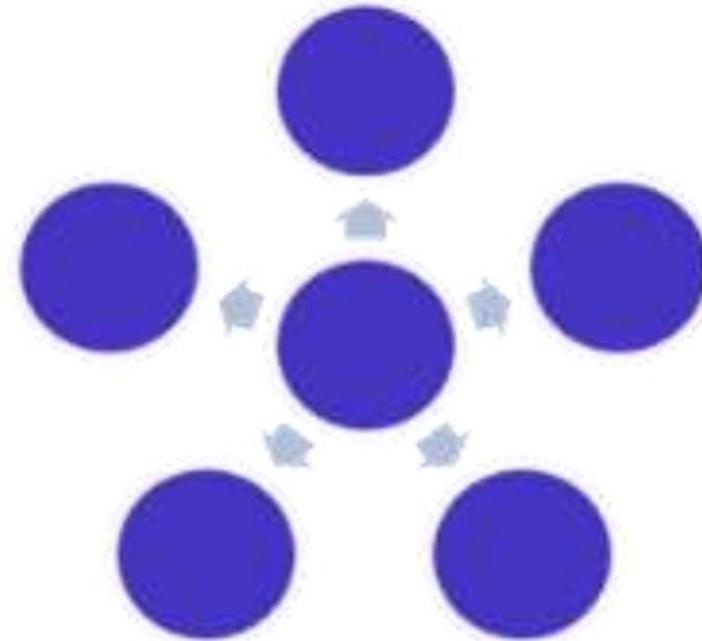
# You Want to Squeeze Information from Data?

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## Un-Supervised Learning

Hunting for  
patterns in data  
Extracting essential  
features  
Making sense of data



**Example: Clustering**



# You Have Examples of the ‘Right’ Answer?

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## Supervised Learning

Learning the  
‘right’ answer  
Learning from examples  
Inferring rules

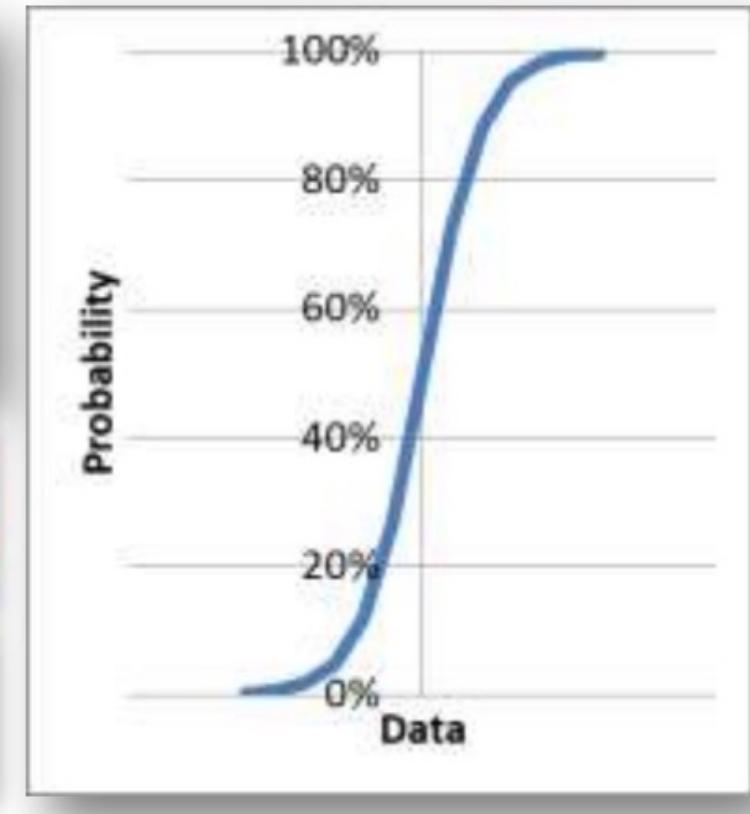
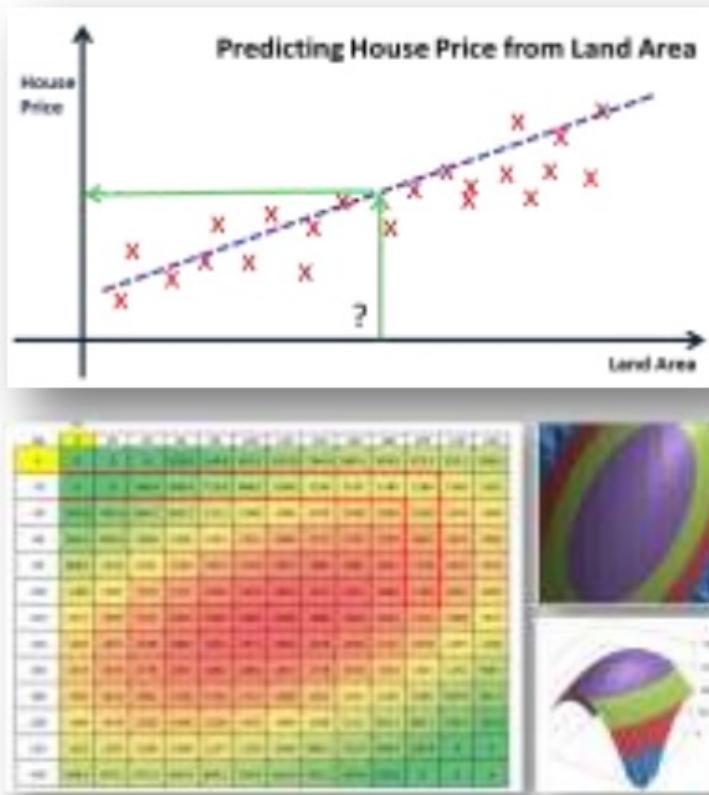


**Example : Classification**



# Making Predictions based on Known Data : Regression

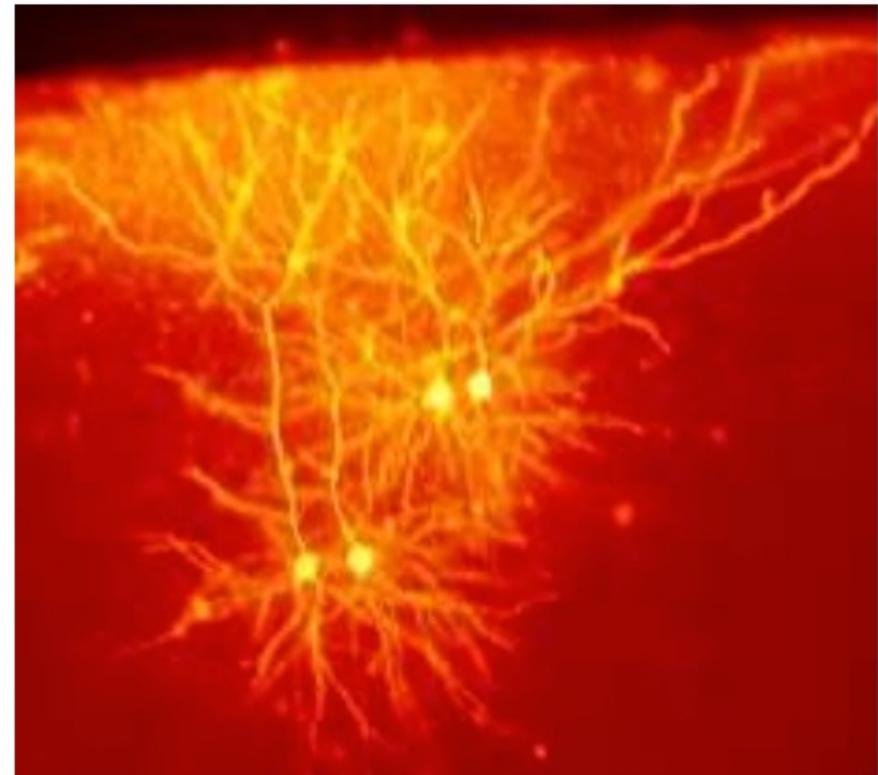
- Fitting lines, curves and surfaces to data-points
- Using these to make predictions for new data



# Complex Recognition : ‘Neural Networks’

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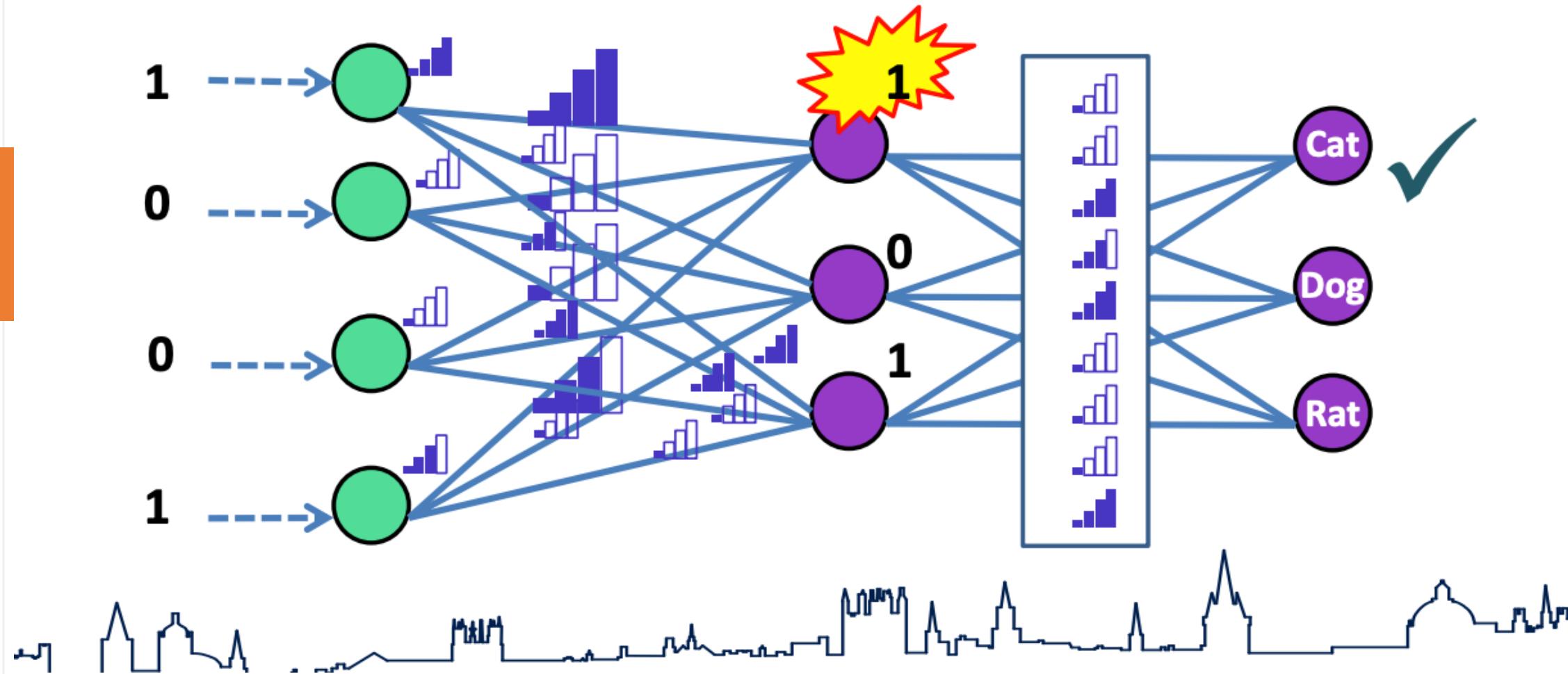
- Neural Networks were inspired by our understanding animal brains
- They are built from many, relatively simple but highly connected elements

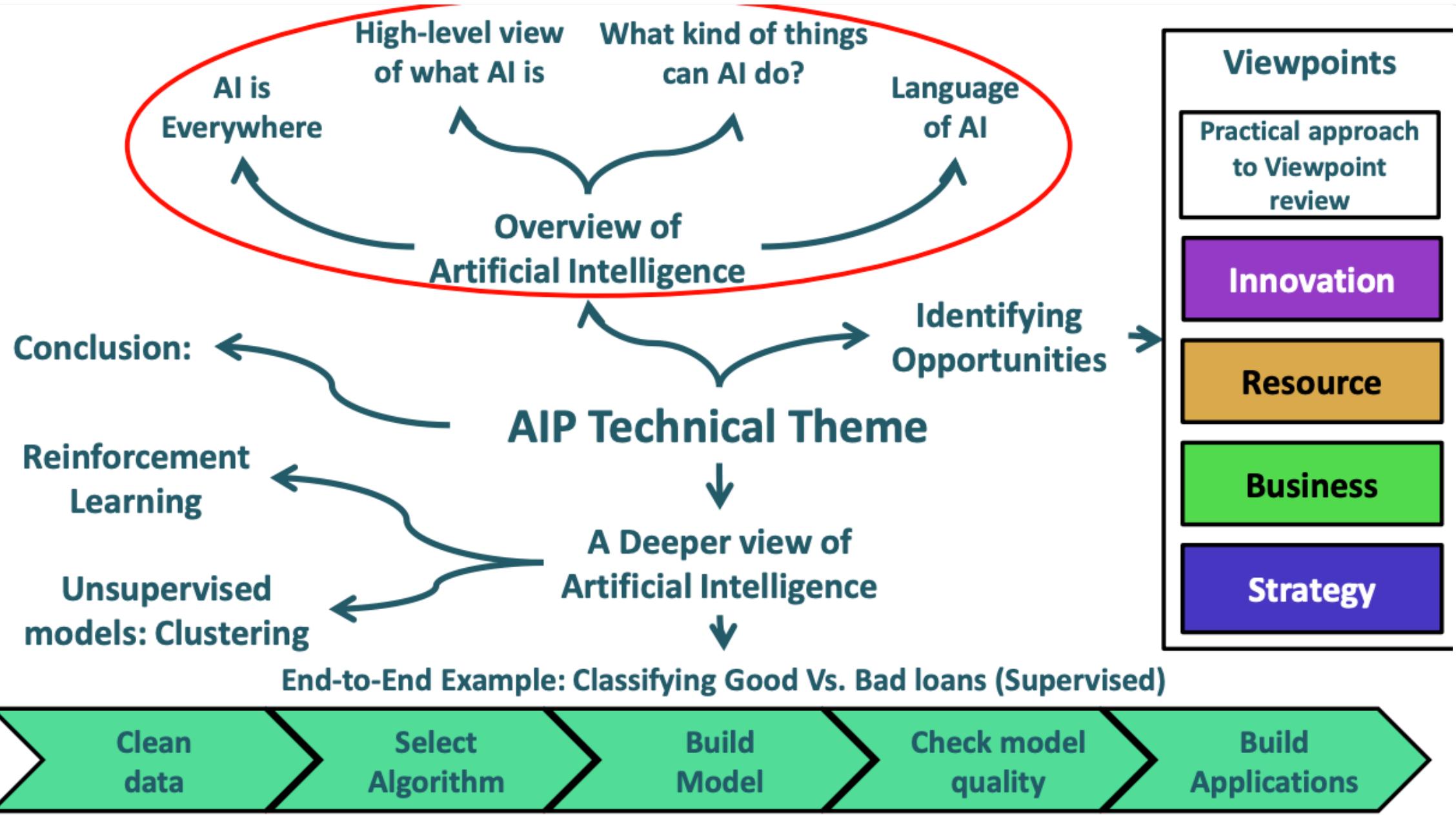


By Mark Miller from San Francisco, CA, USA - tyramideFills, CC BY-SA 2.0,



# Complex Recognition : 'Neural Networks'





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## References and Further Study

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## References

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- Russell, S and Norvig, P. (2010) "Artificial Intelligence, A Modern Approach", Prentice Hall : Boston
- Sutton, S.S. and Barto, A.G. (2017) "Reinforcement Learning: An Introduction", The MIT Press, Cambridge, Massachusetts



# Further Study

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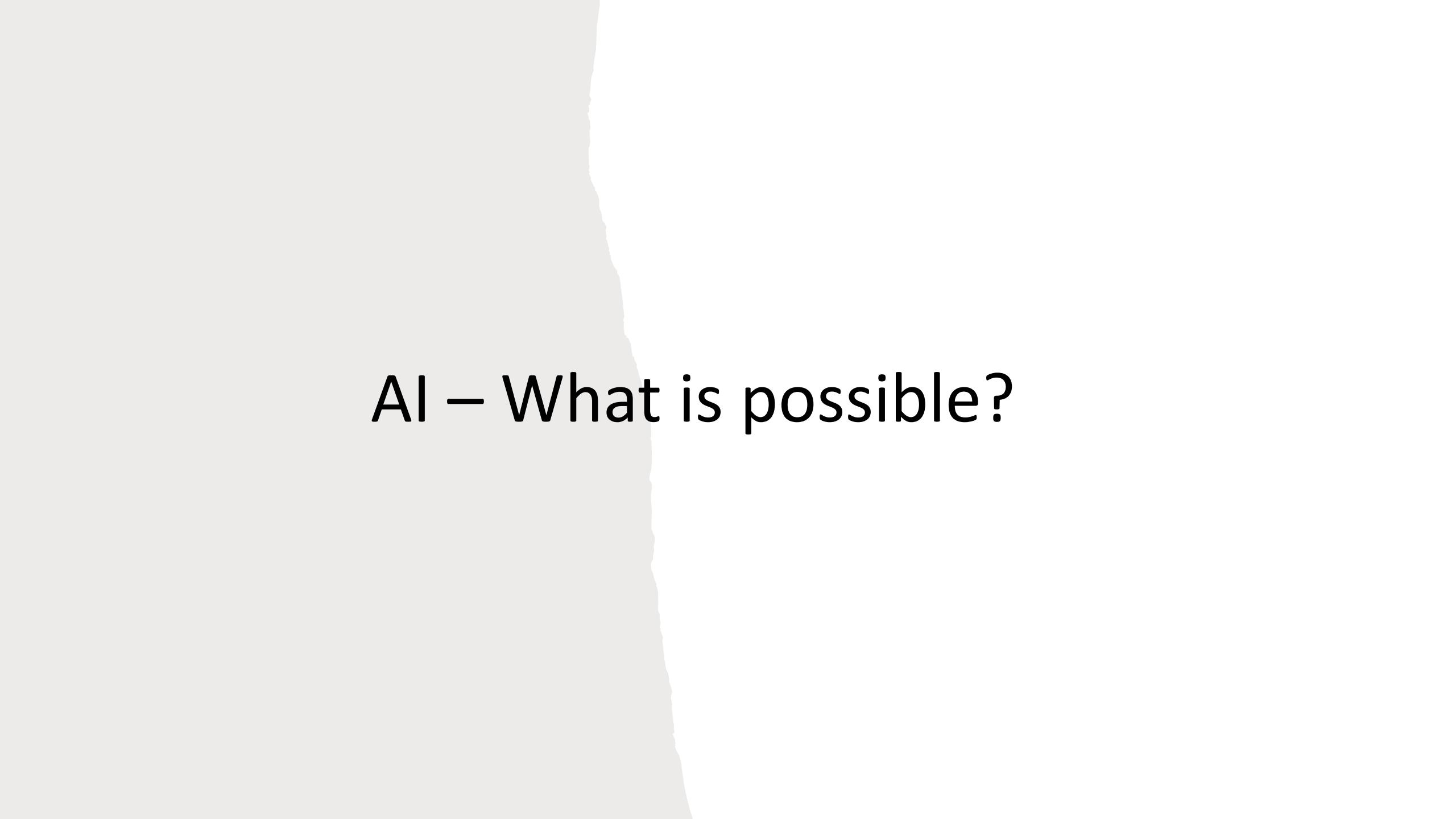
- General Interest / Awareness:

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- Ford, M. (2015) “The Rise of the Robots: Technology and the Threat to Mass Unemployment”, Oneworld : London
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# AI – What is possible?

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# Information from images

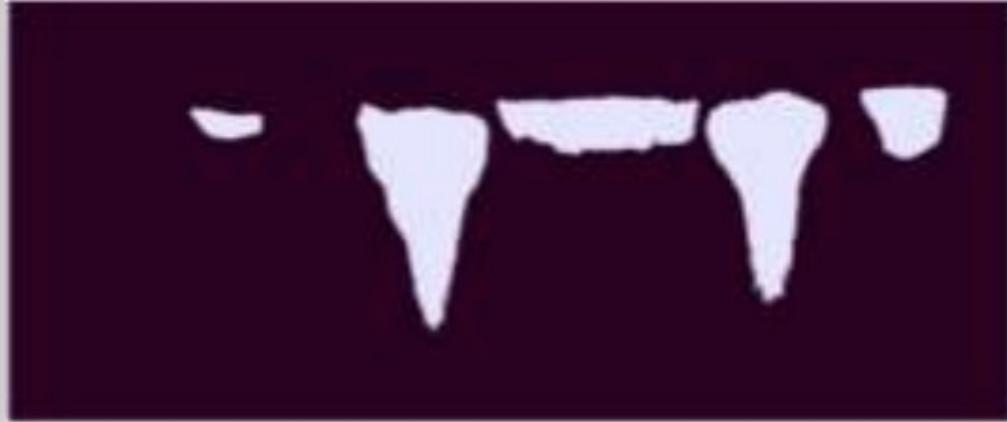
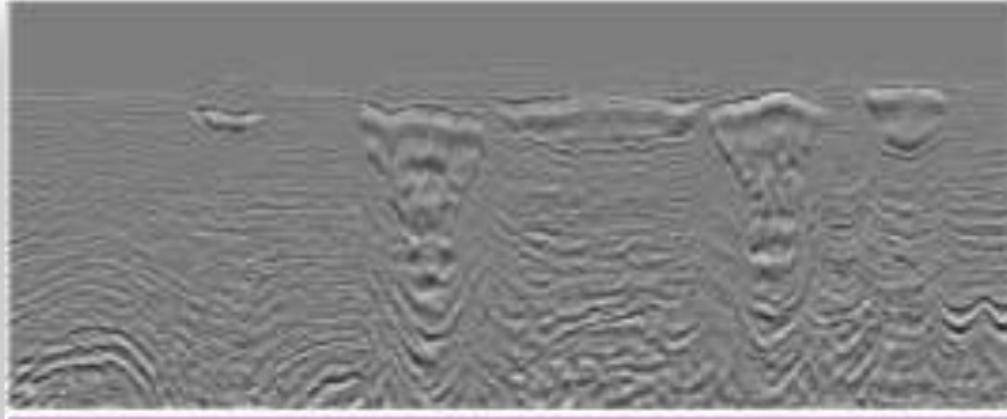
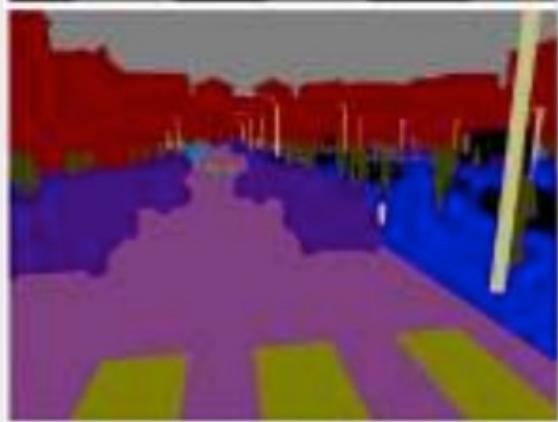
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# Image Classification



# Classification of Parts of Images



Deep learning based image segmentation



Applied to seismic images for salt detection



# Real-time image segmentation



Further information: <https://towardsdatascience.com/understanding-semantic-segmentation-with-unet-6be4f42d4b47>

Original Video: <https://www.youtube.com/watch?v=ATlcEDSPWXY>

DeepLab source code: <https://github.com/tensorflow/models/blob/master/research/deeplab/README.md>





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# Insights from Natural Language

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Trustpilot Review Experience X

https://www.trustpilot.com

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Read reviews. Write reviews. Find companies.

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Recent reviews

Diamond Pylipko  EssayShark.com  
"This service is amazing. Will

Margaret McDonagh  TalkTalk  
"great internet"

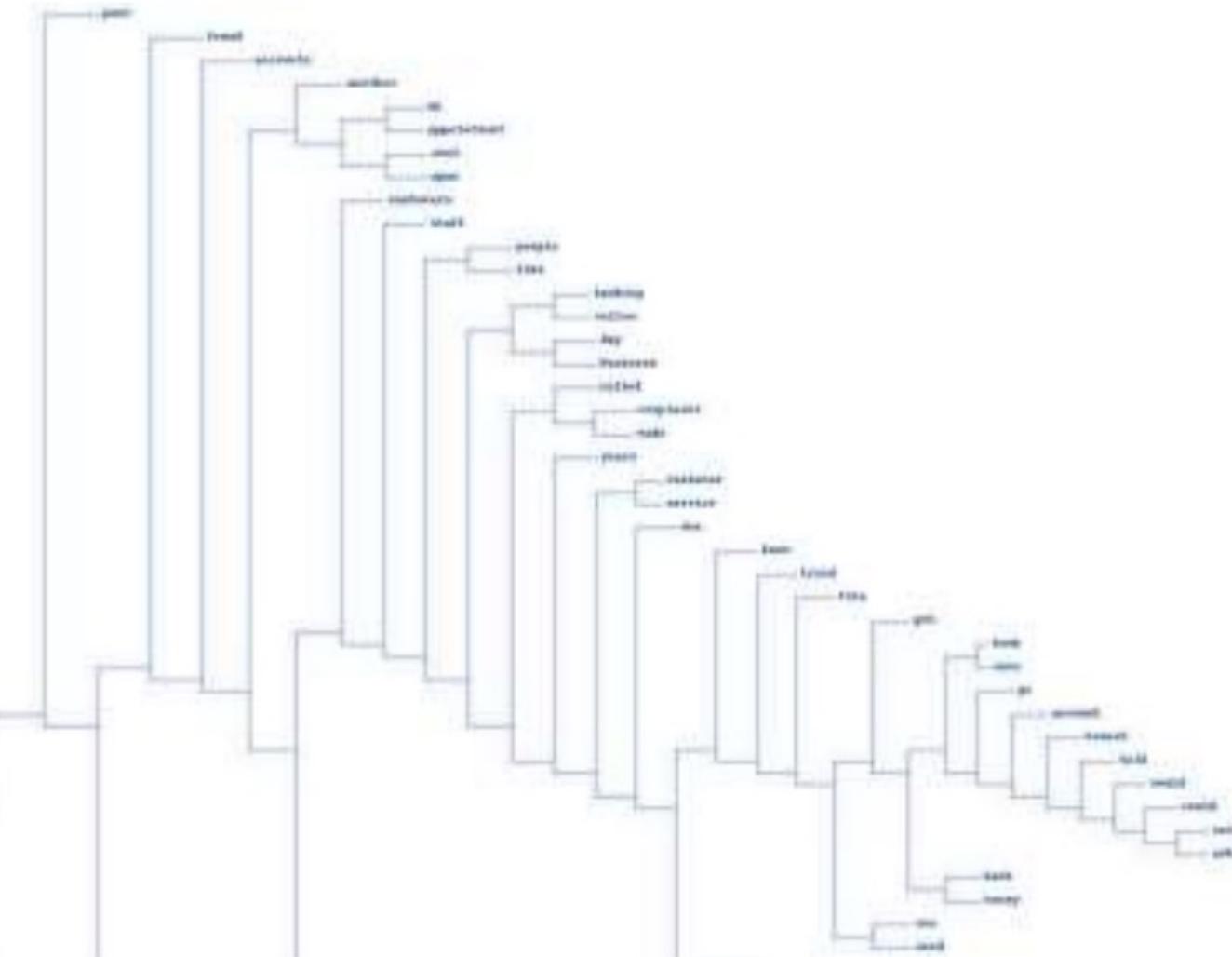
Adam Welsh  ASOS  
"Customer service just ends the

Princ Edet  LinguaShop  
"I just started learning Yoruba.. I bought the Yoruba audio CD and

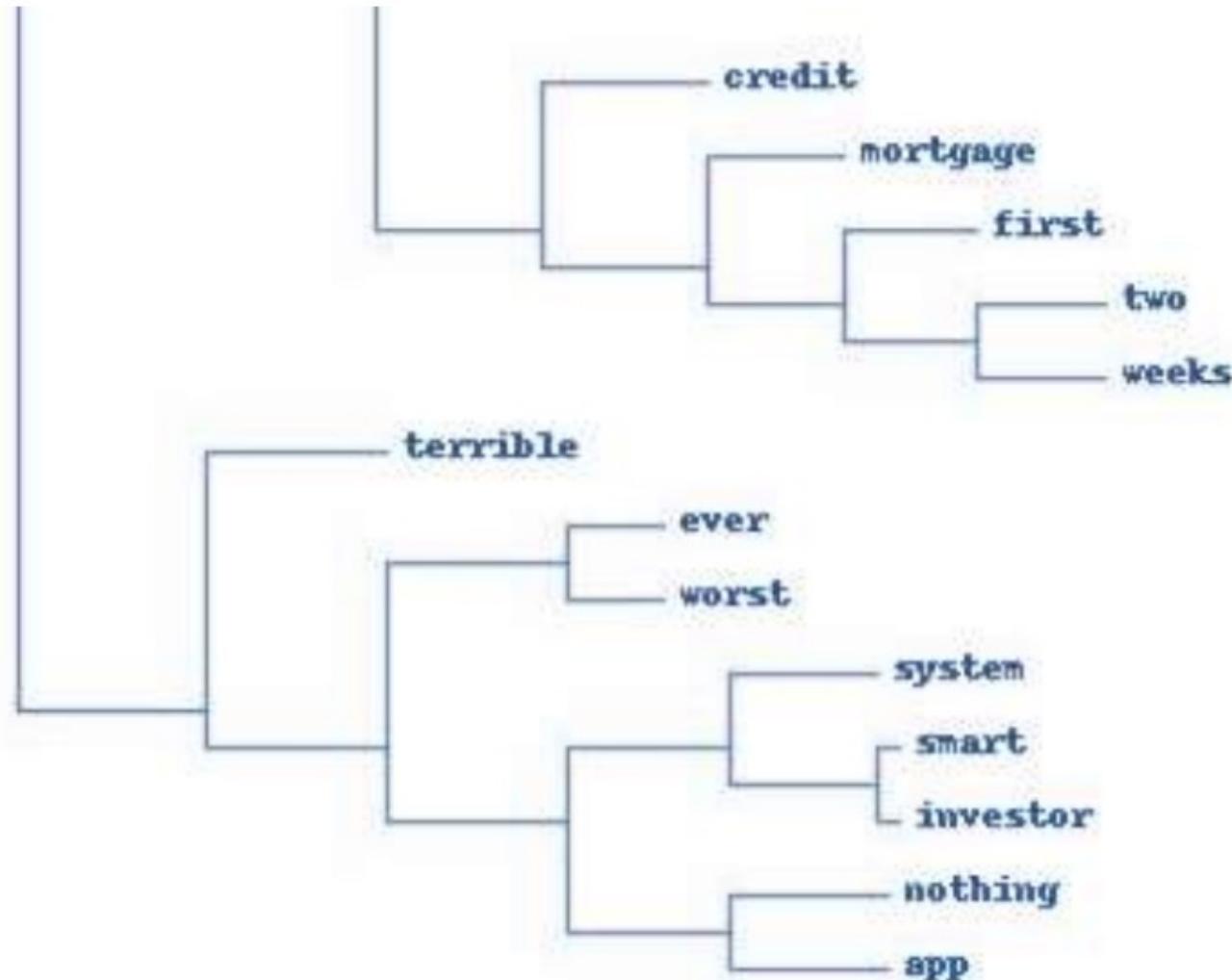
Sharon Meanders  Complete Care Shop  
"Great choice of products at really affordable prices. Very

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Cluster dendograms  
provide one  
mechanism for  
visualising  
hierarchical clusters



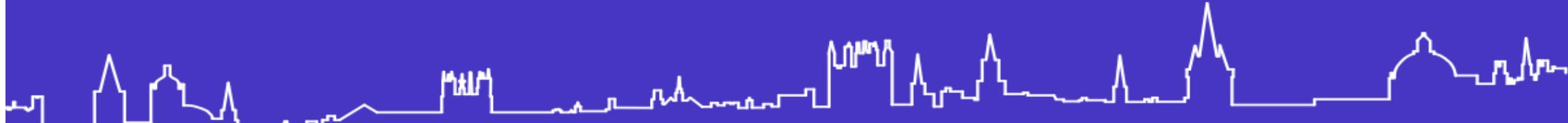
# Word clusters suggest problem areas



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**'Squeezing the juice'  
from data with  
Dimensionality Reduction**

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# Removing noise using Principle Component Analysis (PCA)



Errors (noise) reduced by reconstructing the images based only on 12 principle components





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# Writing software code by AI

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# AI Application areas : Alpha Code

- Code can be thought of as just another language
- Sequence to sequence translation – just like natural language translation!
- To do this very very large models are required (in terms of numbers of parameters)
- The agent performs in the top 54% of code submissions....and keeps on rising

```
EXTRACT_NUMBERS_and_INCR(destination, source) int
destination; unsigned char **source; int extract_number_identification, *numbers; numbers == 3; #ifndef EXTRACT_MACROS #undef EXTRACT_NUMBER_AND_INCR #define EXTRACT_NUMBER_AND_INCR(extract_number_and_incr_element, base) #endif /* not EXTRACT_MACROS */ #endif /* DEBUG */ #if DEBUG #include <regex.h>
#include <assert.h> static int
debug = 0; #define DEBUG_STATEMENT(x) #define DEBUG_PRINT(x) if(debug) printf(x) #define DEBUG_PRINT(x1, x2) if(debug) printf(x1, x2) #define DEBUG_PRINT(x1, x2, x3) if(debug) printf(x1, x2, x3) #define DEBUG_PRINT_COMPILED_PATTERN(x, y) if(debug) print_partial_compiled_pattern(y, x) #define DEBUG_PRINT_DOUBLE_STRING(x1, x2, x3, x4) if(debug) print_double_string(x1, x2, x3, x4)
extern void printchar(); /* Print the backtrace in human-readable form. */ void print_backtrace(char *backtrace); unsigned max_a, range = 0; unsigned i = 0; while(i < 1 << BYTESWORTH) if(backtrace[i] >= 0 && backtrace[i] <= 9) max_a, range = 0; printchar(0 - 1); while(i < 1 << BYTESWORTH) if(backtrace[i] >= 0 && backtrace[i] <= 9) if(max_a, range) | print(0 - 1); i++ } /* Print a compiled pattern using human-readable form, starting at the START pointer into it and ending just before the pointer END. */ void
print_partial_compiled_pattern(start, end) unsigned char *start; unsigned char *end; { int maxa, maxd; unsigned char *p = start; unsigned char *pend = end; if(start == NULL) {printf("NULL"); return;} /* Loop over pattern commands. */ while(p < pend) { switch(*p) { case '0'.. '9': case max_a, op: print("%u,%c"); break; case exact_mont: /* p++ */ if(*p == '0') print("exact_mont"); mont; do i pushchar(i); printchar(p+i+1); while(i < mont); break; case start_memory: mont = *p + 1; print("start_memory,%d,%d", mont, *p+1); break; case stop_memory: mont = *p + 1; print("stop_memory,%d,%d", mont, *p+1); break; case duplicate: print("duplicate"); *p++; break; case anchor: print("anchor"); break; case channel: case channel_not: (regchar(i), i); print("channel"); /* or, _opcode */ if(*p == '1' || *p == '2') print("channel"); for(i = 0; i < *p; i++) { unsigned bit; unsigned char mask; mask = p[1 + i]; pushchar(i); for(j = 0; j < *p; j++) { if(mask & (1 << j)) print("1"); else print("0"); } i++; } if(mask & (1 << i)) print("1"); else print("0"); } break; case begin_line: print("beginline"); break; case endline: print("endline"); break; case on_failure: jump(mont, 8); print("on_failure_jump,%d,%d", mont, 8); break; case on_failure_keep_string_jump: extract_number_and_incr(element, 8); print("on_failure_keep_string_jump,%d,%d", element, 8); break; case cleanup: fallure_jump(mont, 8); break; case push_dummy_fallure: print("push_dummy_fallure,%d,%d", mont, 8); break; case maybe_pop_jump: extract_number_and_incr(element, 8); print("maybe_pop_jump,%d,%d", element, 8); break; case pop_fallure: print("pop_fallure,%d,%d", mont, 8); break; case pop_fallure_jump: print("pop_fallure_jump,%d,%d", mont, 8); break; case jump: print("jump,%d,%d", element, 8); break; case extract_number_and_incr: print("extract_number_and_incr,%d,%d", element, 8); break; } }
```

# AI Application areas : : Alpha Code

## Problem Description

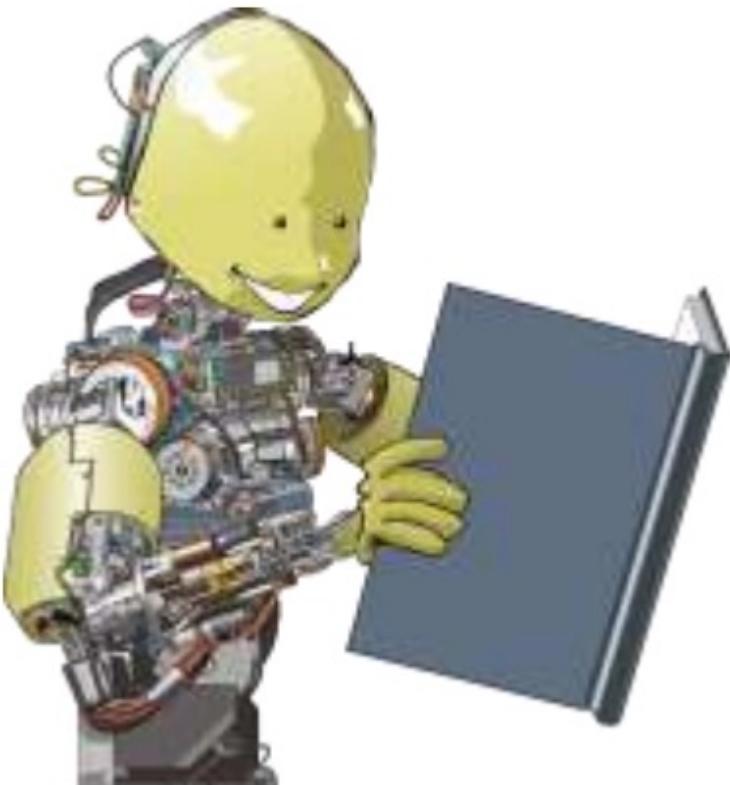
```
// RATING: 1200
// TAGS: *special_implementation*
// LANGUAGE: Python3
// CORRECT SOLUTION
// You are given two strings s and t, both consisting of lowercase English
// letters. You are going to type the string s character by character, from the
// first character to the last one.
//
// When typing a character, instead of pressing the button corresponding to it,
// you can press the "Backspace" button. It deletes the last character you have
// typed among those that aren't deleted yet (or does nothing if there are no
// characters in the current string). For example, if s is "abcd" and you press
// Backspace instead of typing the first and the fourth characters, you will get
// the string "bc" (the first press of Backspace deletes no character, and the
// second press deletes the character 'c'). Another example, if s is "abca" and
// you press Backspace instead of the last two letters, then the resulting text
// is "a".
//
// Your task is to determine whether you can obtain the string t, if you type
// the string s and press "Backspace" instead of typing several (maybe zero)
// characters of s.
//
// Input:
//
// The first line contains a single integer q ( $1 \leq q \leq 10^5$ ) – the number of
// test cases.
//
// The first line of each test case contains the string s ( $1 \leq |s| \leq 10^5$ ). Each
// character of s is a lowercase English letter.
//
// The second line of each test case contains the string t ( $1 \leq |t| \leq 10^5$ ).
// Each character of t is a lowercase English letter.
```

## Solution

```
def solve():
    q = int(input())
    for _ in range(q):
        s = input()
        t = input()
        if len(s) == 0 and len(t) == 0:
            print("YES")
        else:
            i = 0
            j = 0
            while i < len(s) and j < len(t):
                if s[i] == t[j]:
                    i += 1
                    j += 1
                else:
                    if i > 0 and s[i-1] == t[j]:
                        i -= 1
                    else:
                        print("NO")
                        break
            if i == len(s) and j == len(t):
                print("YES")
            else:
                print("NO")
```

## AI Application areas : Alpha Code

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- What will the future look like with AI writing our code for us?
- Do you think this is a good thing? Will it be safe?
- Should there always be a human in the loop?
- How would you feel if your aeroplane/autonomous car was programmed by an artificial intelligence?

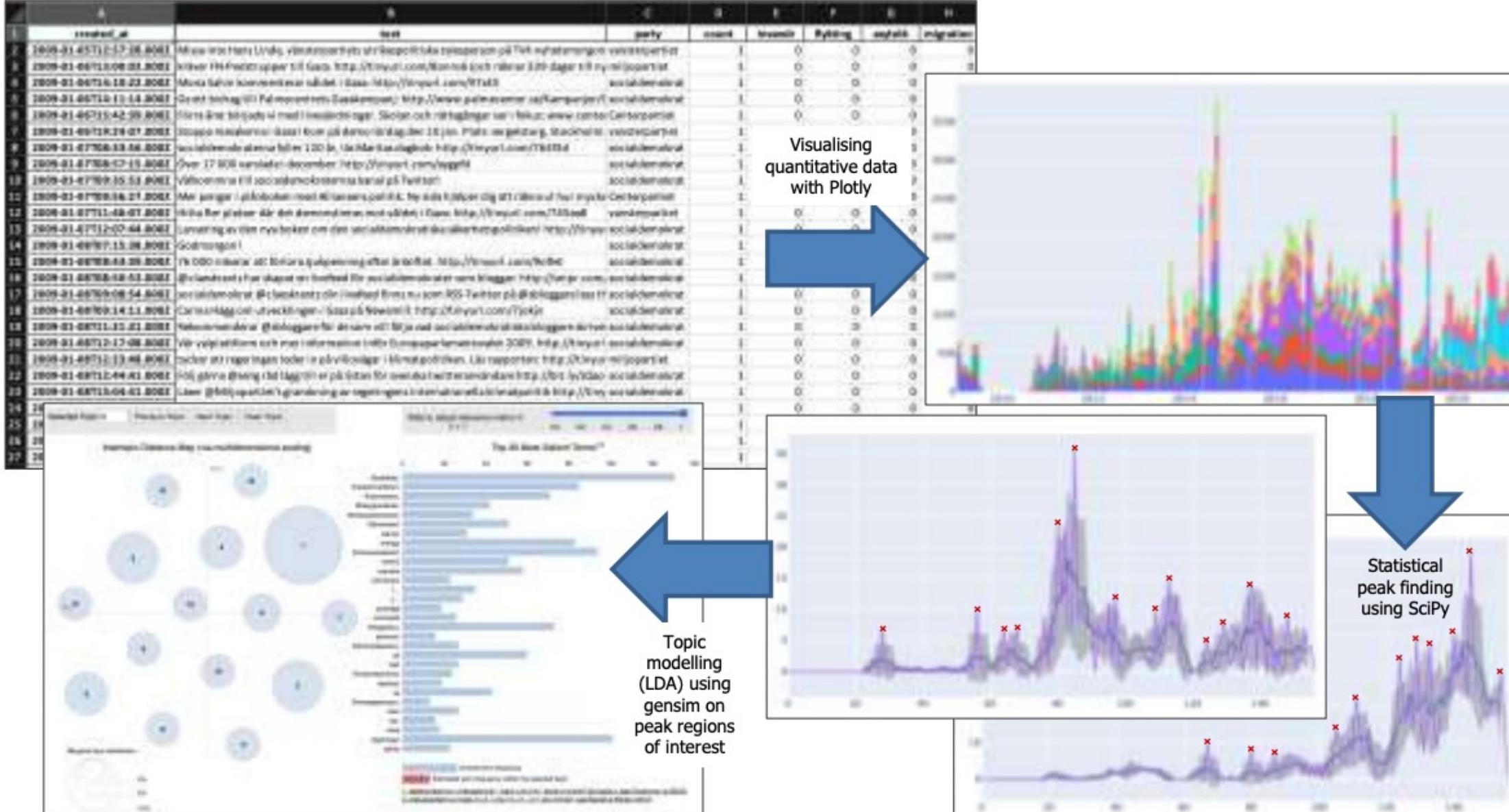


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# Insights from Social Media

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# How you can build your high-performing team



**Focus on Team Dynamics -**  
Think about your team's  
behaviours and act to  
improve its performance

**Focus on a great goal and a  
vision of the future**  
Inspire your team to be  
something special

**Build trust by sharing  
positive experiences,  
supporting other  
team members**

# Team Poster

- Name
- Background
- Location
- Skills I have
- Something I do for fun
- Something I am proud of

# Team Poster

1. Each team to create a ‘Team Poster’
2. Agree a name for your team
3. Agree a ‘Slogan’ or ‘Catch phrase’ that helps describe your team and its goals
4. Add some graphics, icons and pictures to illustrate your poster:

What motivates and excites you as a team?

What is your interest in AI?

What is your ‘Big Goal’ as a team?

How will you work together as a high-performance team?