AI, Data and Human Society

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Utrecht University
AI Toulouse Institute

My mission for this lecture is to help you navigate our complex AI world

Navigating a complex AI world

- Gap between the **impact** AI has on your lives & your **understanding** of AI

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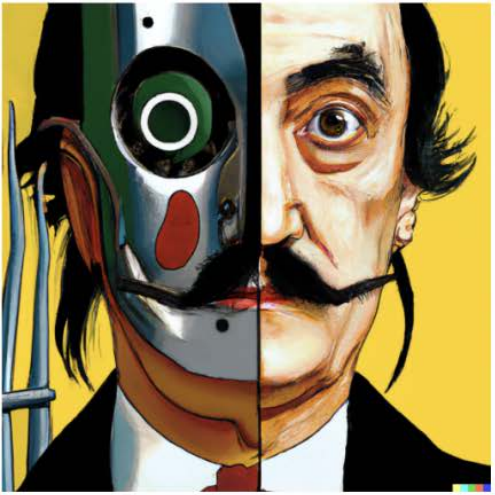
- The **AI in books & movies** is not the AI to worship or worry about: separate facts from fiction
- How to benefit from AI: solve **real-world problems**
- How to protect yourself from AI: pick the **skills** of the future

AI is taking the world by storm

AI is everywhere – cultural products



vibrant portrait painting of Salvador Dalí with a robotic half face

a shiba inu wearing a beret and black turtleneck

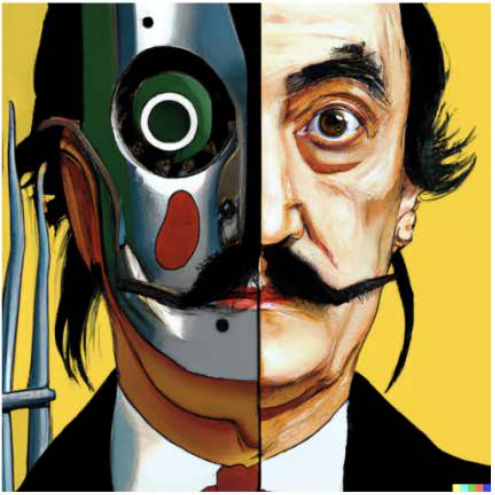
a close up of a handpalm with leaves growing from it

an espresso machine that makes coffee from human souls, artstation

panda mad scientist mixing sparkling chemicals, artstation

a corgi's head depicted as an explosion of a nebula

OpenAI's DALL-E 2



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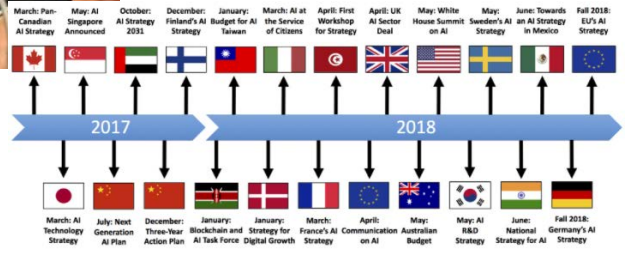
AI that can create realistic images and art from a description in natural language

It uses a 12-billion parameter version of GPT-3

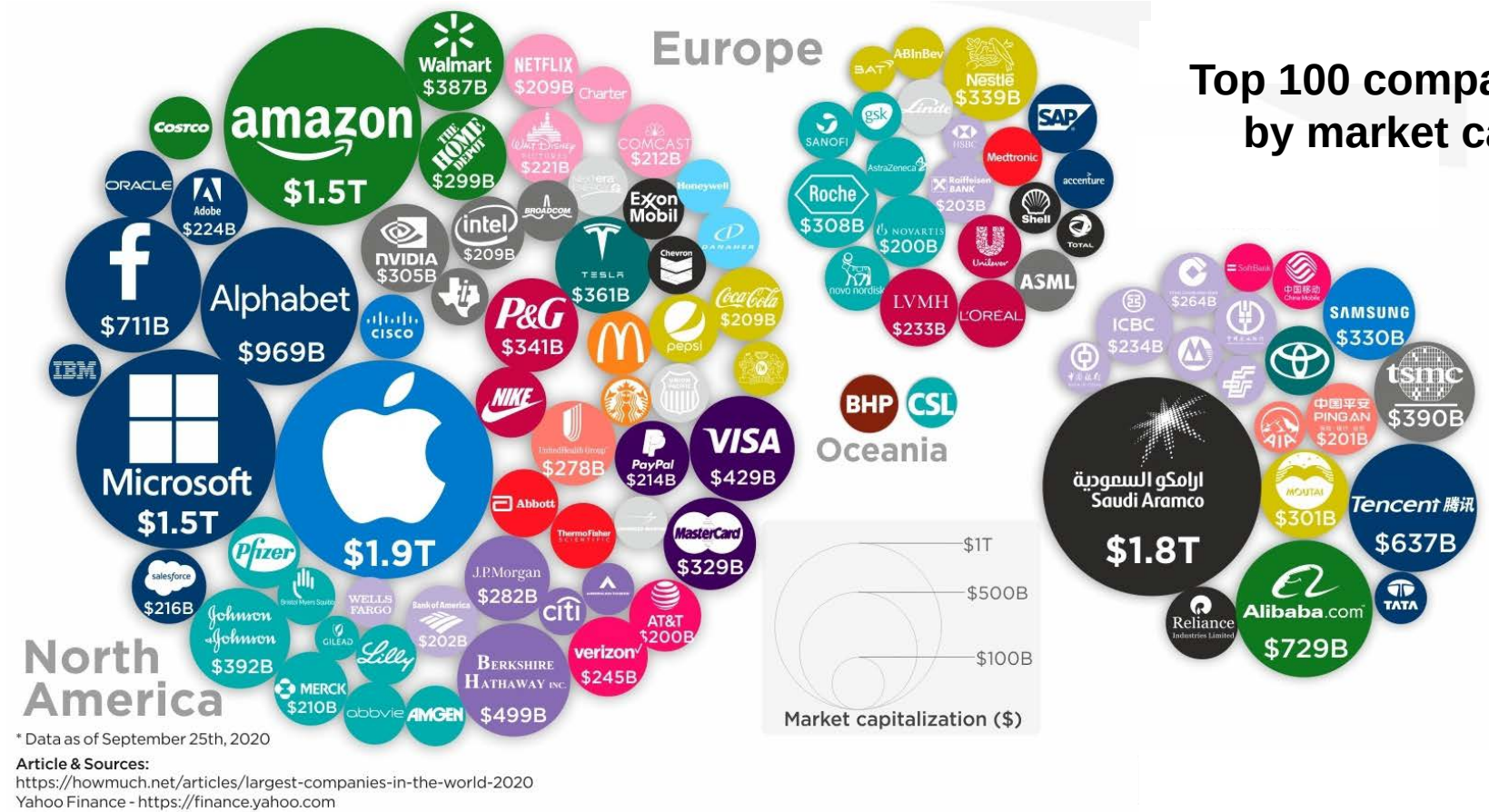
GPT-3 = language model using DL to produce human-like text

AI is everywhere – national policy

New Generation Artificial Intelligence Development Plan
(新一代人工智能发展规划)



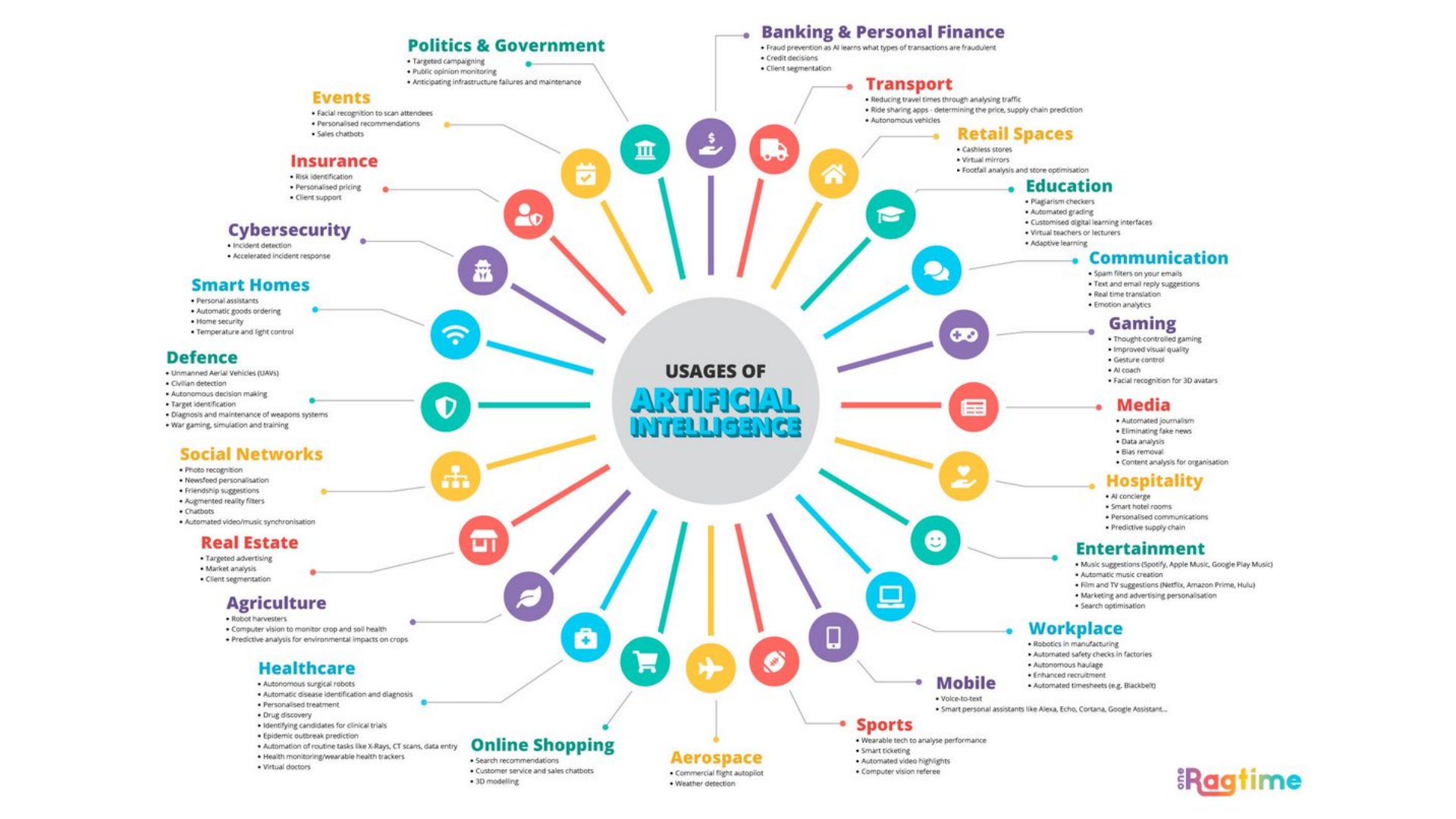
AI is disrupting the global economy



* Data as of September 25th, 2020

Article & Sources:
https://howmuch.net/articles/largest-companies-in-the-world-2020
Yahoo Finance - https://finance.yahoo.com


“Amazon provides discovery features like “customers who bought this item also bought.”
amazon

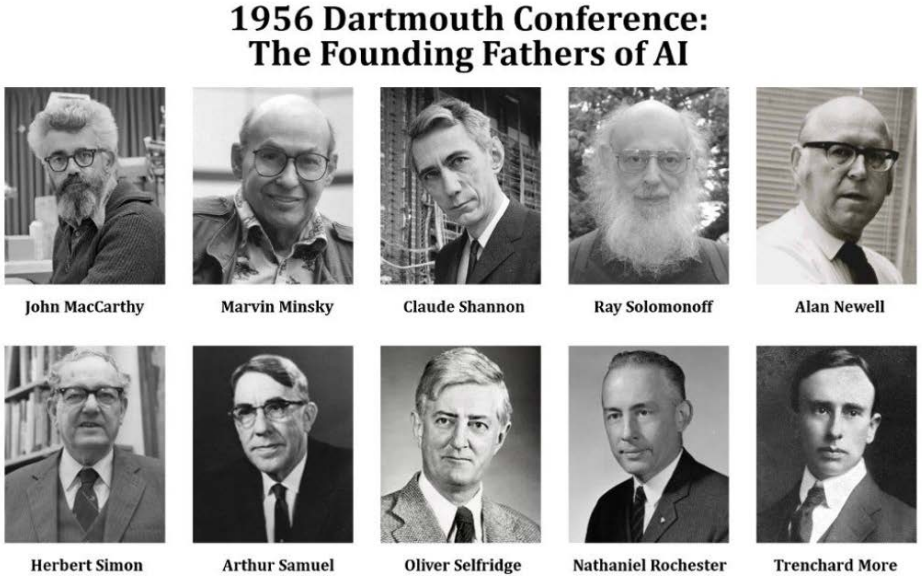

USAGES OF
ARTIFICIAL INTELLIGENCE
Politics & Government
• Targeted campaigning
• Public opinion monitoring
• Anticipating infrastructure failures and maintenance
Banking & Personal Finance
• Fraud prevention as AI learns what types of transactions are fraudulent
• Credit decisions
• Client segmentation
Transport
• Reducing travel times through analysing traffic
• Ride sharing apps - determining the price, supply chain prediction
• Autonomous vehicles
Retail Spaces
• Cashless stores
• Virtual mirrors
• Footfall analysis and store optimisation
Education
• Plagiarism checkers
• Automated grading
• Customised digital learning interfaces
• Virtual teachers or lecturers
• Adaptive learning
Communication
• Spam filters on your emails
• Text and email reply suggestions
• Real time translation
• Emotion analytics
Gaming
• Thought-controlled gaming
• Improved visual quality
• Gesture control
• AI coach
• Facial recognition for 3D avatars
Media
• Automated journalism
• Eliminating fake news
• Data analysis
• Bias removal
• Content analysis for organisation
Hospitality
• AI concierge
• Smart hotel rooms
• Personalised communications
• Predictive supply chain
Entertainment
• Music suggestions (Spotify, Apple Music, Google Play Music)
• Automatic music creation
• Film and TV suggestions (Netflix, Amazon Prime, Hulu)
• Marketing and advertising personalisation
• Search optimisation
Workplace
• Robotics in manufacturing
• Automated safety checks in factories
• Autonomous haulage
• Enhanced recruitment
• Automated timesheets (e.g. Blackbelt)
Mobile
• Voice-to-text
• Smart personal assistants like Alexa, Echo, Cortana, Google Assistant...
Sports
• Wearable tech to analyse performance
• Smart ticketing
• Automated video highlights
• Computer vision referee
Aerospace
• Commercial flight autopilot
• Weather detection
Online Shopping
• Search recommendations
• Customer service and sales chatbots
• 3D modelling
Healthcare
• Autonomous surgical robots
• Automatic disease identification and diagnosis
• Personalised treatment
• Drug discovery
• Identifying candidates for clinical trials
• Epidemic outbreak prediction
• Automation of routine tasks like X-Rays, CT scans, data entry
• Health monitoring/wearable health trackers
• Virtual doctors
Agriculture
• Robot harvesters
• Computer vision to monitor crop and soil health
• Predictive analysis for environmental impacts on crops
Real Estate
• Targeted advertising
• Market analysis
• Client segmentation
Social Networks
• Photo recognition
• Newsfeed personalisation
• Friendship suggestions
• Augmented reality filters
• Chatbots
• Automated video/music synchronisation
Defence
• Unmanned Aerial Vehicles (UAVs)
• Civilian detection
• Autonomous decision making
• Target identification
• Diagnosis and maintenance of weapons systems
• War gaming, simulation and training
Smart Homes
• Personal assistants
• Automatic goods ordering
• Home security
• Temperature and light control
Cybersecurity
• Incident detection
• Accelerated incident response
Insurance
• Risk identification
• Personalised pricing
• Client support
Events
• Facial recognition to scan attendees
• Personalised recommendations
• Sales chatbots
Ragtime

Top AI unicorns

1) Databricks
2) Tempus
3) Scale AI
4) Argo AI
5) Gong
6) Automation Anywhere
7) DataRobot
8) Pony.ai
9) Collibra
10) Horizon Robotics
11) Icertis
12) OakNorth Bank
13) SambaNova Systems
14) Dataiku
15) UBTECH Robotics
16) Outreach
17) Relativity Space
18) ThoughtSpot
19) Dataminr
20) Cerebras Systems
21) MEGVII
22) Olive
23) VAST Data
24) Highspot
25) Tekion
26) Cloudwalk
27) ECARX
28) Cars24
29) WeRide
30) Innovaccer
31) HighRadius
32) Zuoyebang
33) OpenAI
34) ContentSquare
35) Graphcore
36) Clari
37) Uniphore
38) KeepTruckin
39) Uptake
40) Dialpad
41) YITU Technology
42) Eightfold.ai
43) Moveworks
44) SoundHound
45) Black Sesame Technologies
46) Hive
47) 4Paradigm
48) Pagaya
49) Preferred Networks
50) Spring Health
51) VerbIT
52) XtalPi
53) Lightricks
54) AIWAYS
55) Harness
56) H2O.ai
57) ASAPP
58) Cognite
59) Afiniti
60) Tonal
61) Iluvatar CoreX
62) K Health
63) NotCo
64) Paradox
65) Phenom People
66) Salt Security
67) SparkCognition
68) DeepBlue Technology
69) Trax
70) HeartFlow
71) BigID
72) Enflame
73) Ada Support

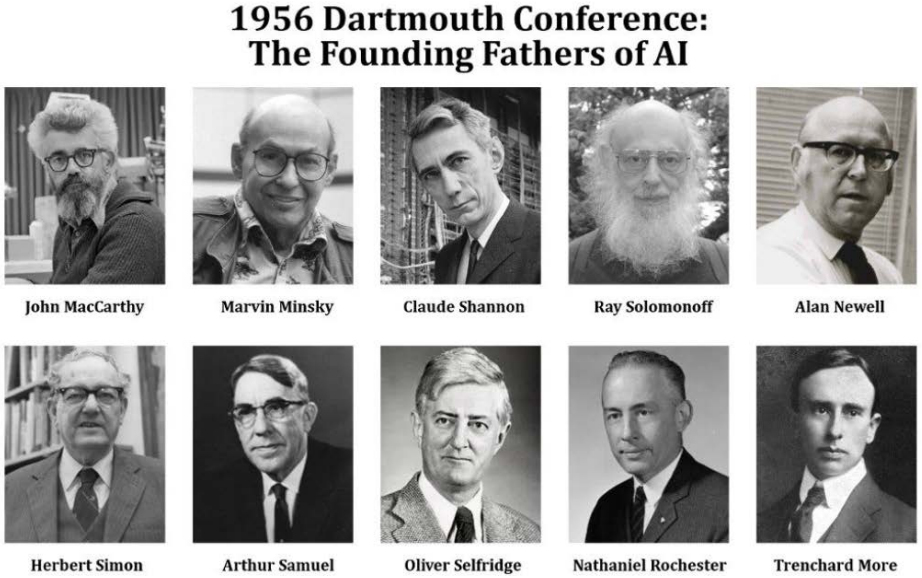
How intelligent did machines really become?

Defining AI



The ability for a machine to perform **a specific task** that requires human intelligence (**narrow AI**)

Defining AI



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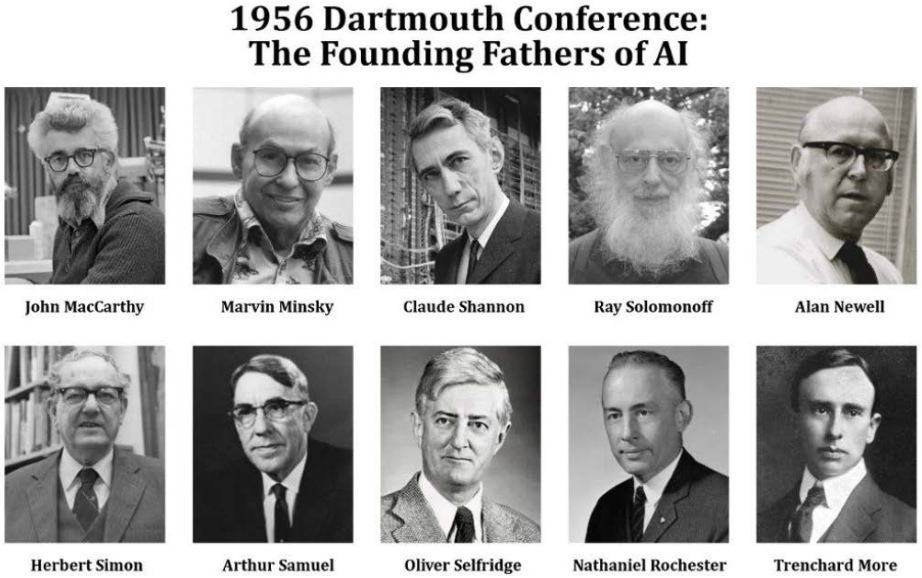

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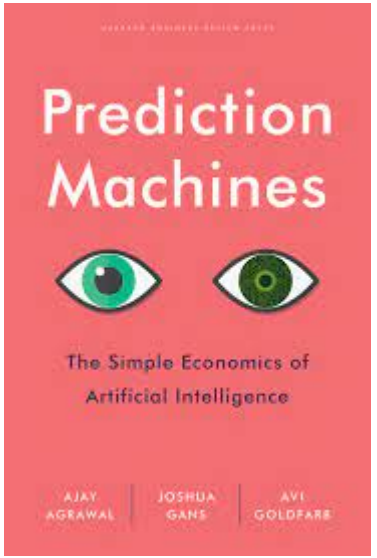
Above this stage is **superintelligence & singularity**

The state-of-the-art

- Artificial Intelligence is all about **specific AI**



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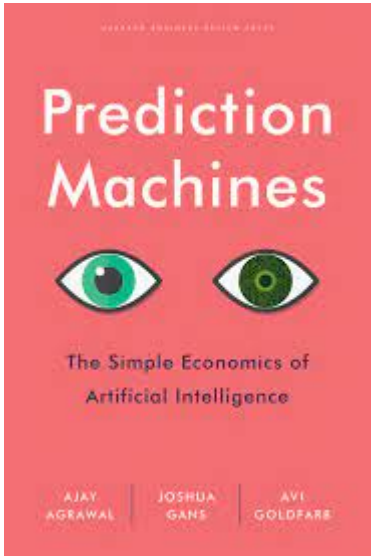
- Artificial Intelligence is all about **specific AI**
- **Huge transformative advances** have been made in specific/narrow AI (thanks to more data, computer power & better ML/DL algorithms)



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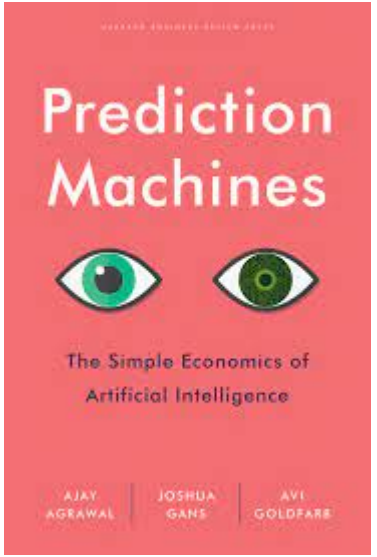

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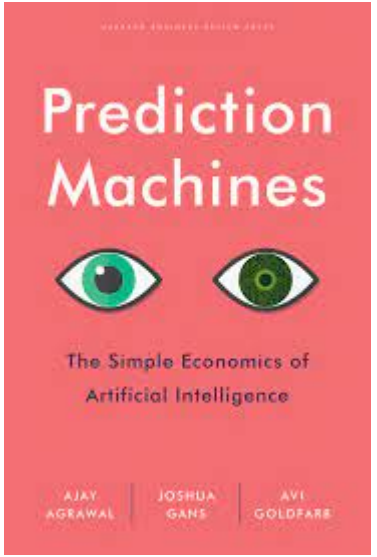

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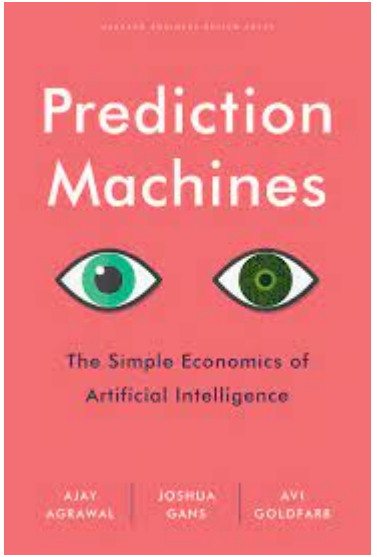

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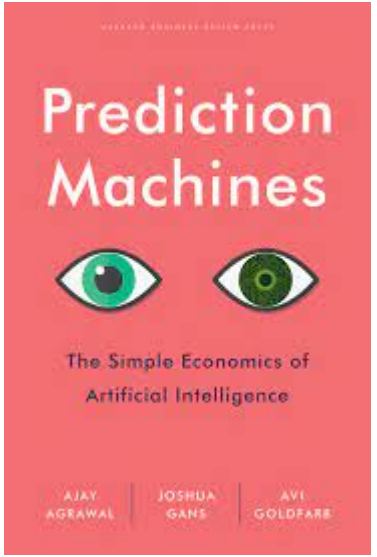
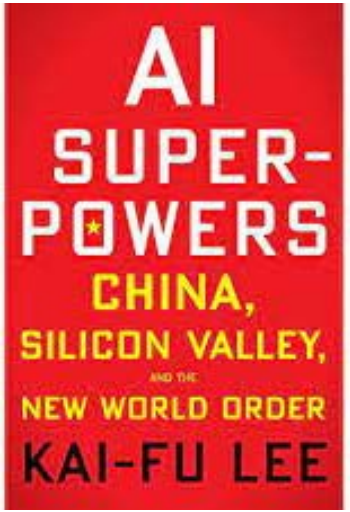
- Singularity is likely to happen but far, far away



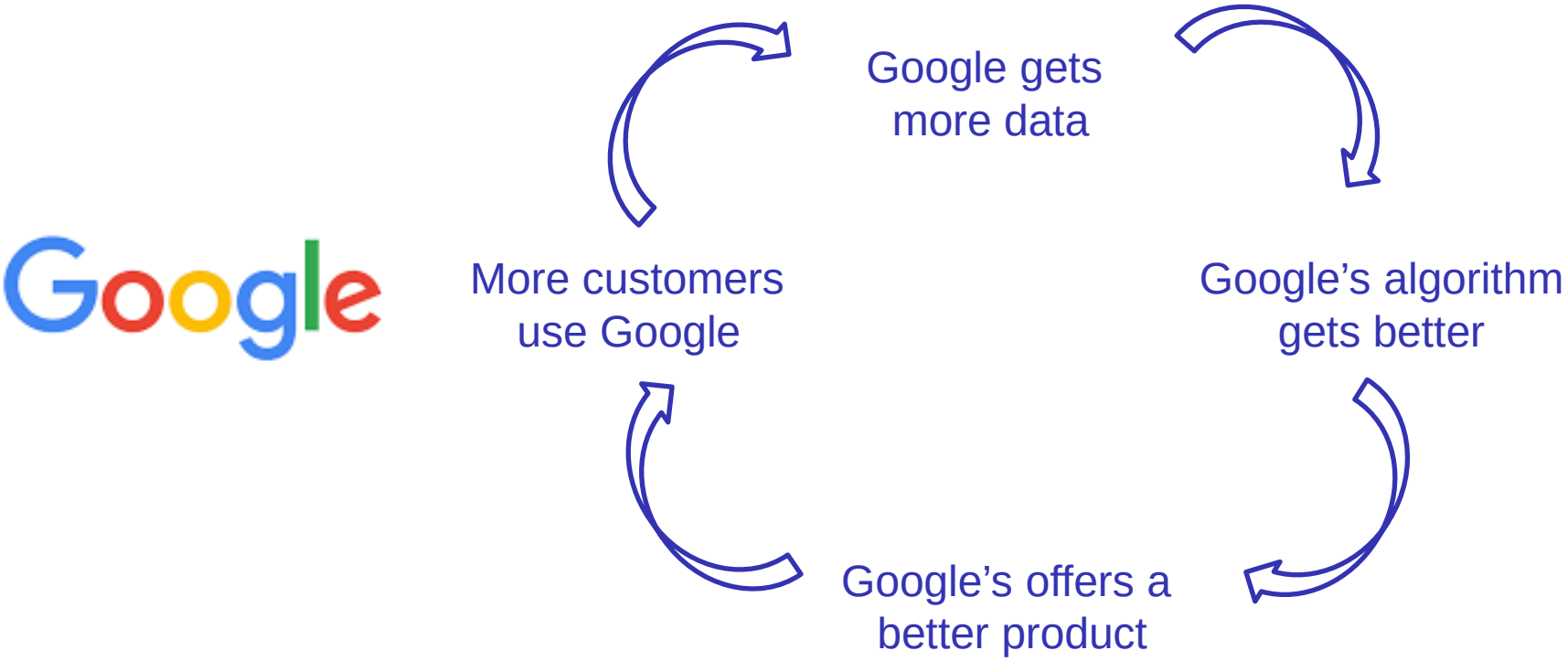
The 4 waves of AI

- 1: Building **recommendation systems** with **internet data**
- 2: Using **private data** for **decision-making**
- 3: Integrating prediction machines with sensors = **perception AI**
- 4: Fully-autonomous AI



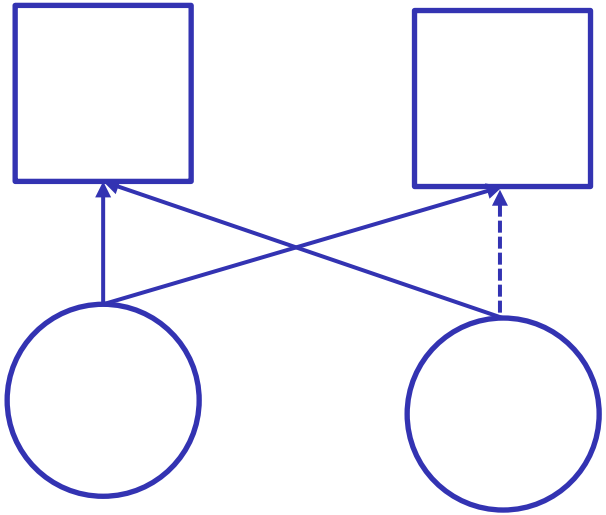
Champions of the first AI wave

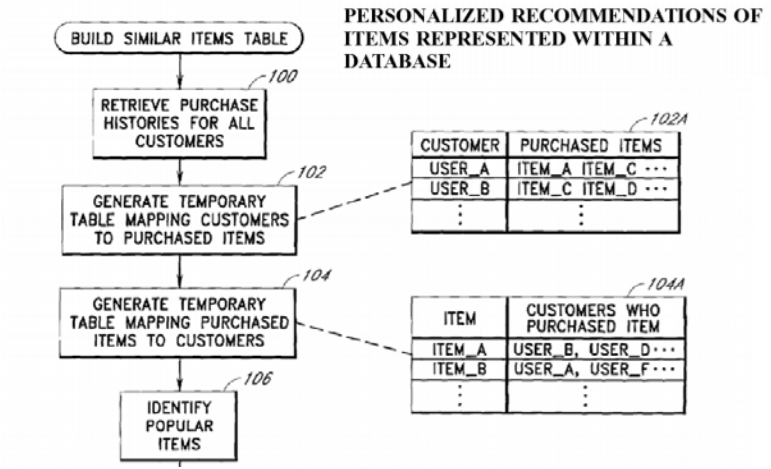
Reinforcing Feedback Loops in AI



Exploiting the network **structures** (matrices) to make **predictions**

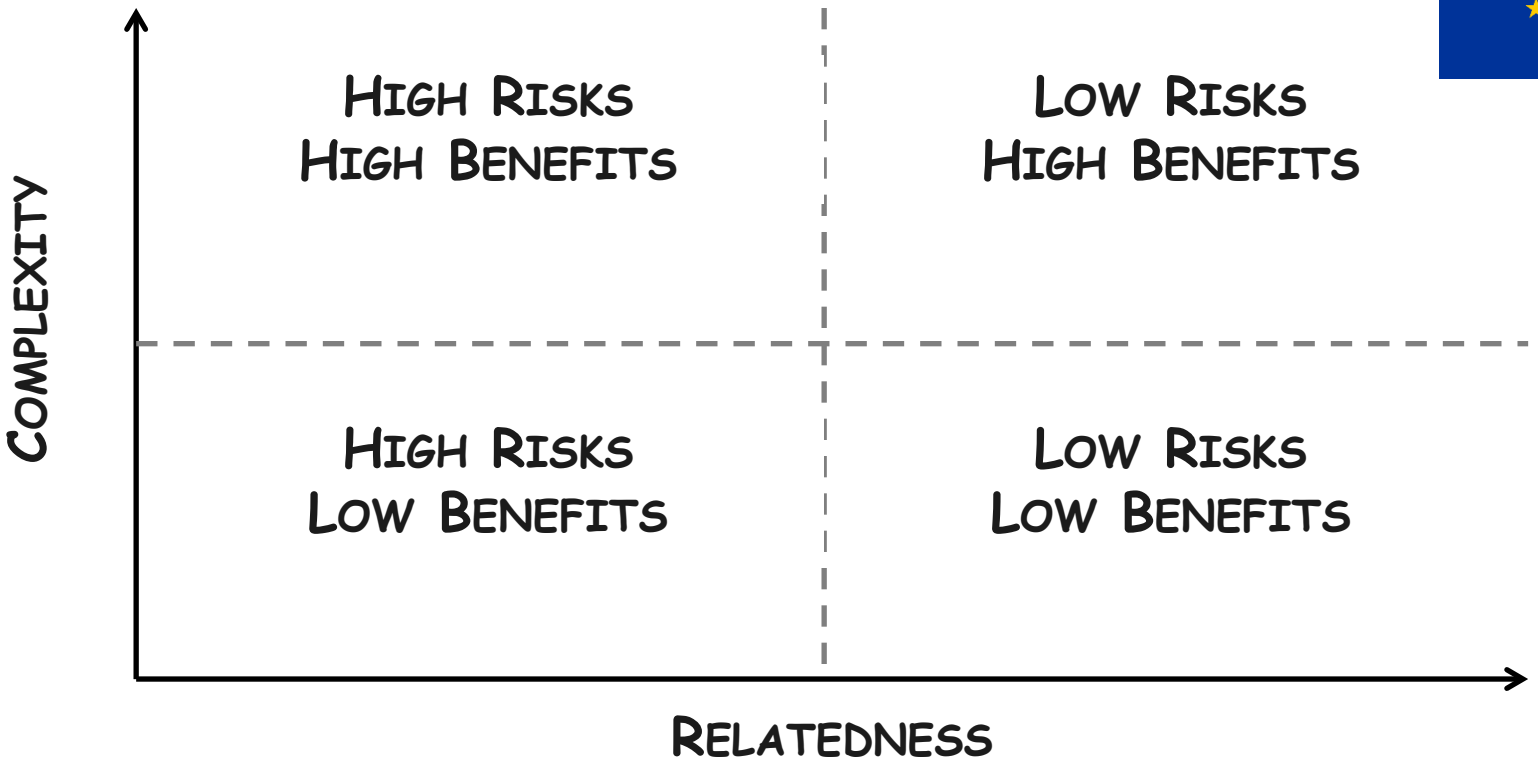
What AI can predict





Modern **AI** techniques are good at predicting the evolution of **simple** network structures

EU smart specialization ($120 billion)



Balland, P.A., Boschma, R., Crespo, J. and Rigby, D. (2019) Smart Specialization policy in the EU: Relatedness, Knowledge Complexity and Regional Diversification, *Regional Studies*

Private data for decision-making

ANALYTICS

biofourmis · Clarify · NarrativeDx · GNS HEALTHCARE · HACARUS · QUARTZCLINICAL · 惠每医疗 HUIMEI HEALTHCARE · PROTENUS · SOPHiA · UCARE.AI unlock the impossible · medignition · SIFT HEALTHCARE

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CHATBOT, VIRTUAL ASSISTANT

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MENTAL HEALTH

Woebot · wysa · Quartet · spring health · GERAS SOLUTIONS

FERTILITY AND REPRODUCTION

univfy · Life Whisperer AI Enhanced Fertility

DIAGNOSTICS AND PATHOLOGY

SkinVision · Niramai · mediktor · Triage · freenome · Haut.AI · inveox · sight · deep · vara · PAIGE · buoy · LEBEN CARE · RETINA-AI · BEYONDVERBAL · sema4 · Caption Health · Eko · IBEX · Pearl · PROSCIA · prognos · Cardiologs · StethoMe · inferVISION · skinIO · Infermedica · BrainQ · enlitic · Athelas · Healthy.io · Aural Analytics · gleamer · nucleai · CellmatiQ · ARTIQ · SIG TUPLE · PathAI · DeePathology.ai

NUTRITION

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IMAGING

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CLINICAL TRIALS AND RESEARCH

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PREVENTIVE CARE

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PERSONALIZED HEALTHCARE

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DIGITAL HEALTH AND SOFTWARE

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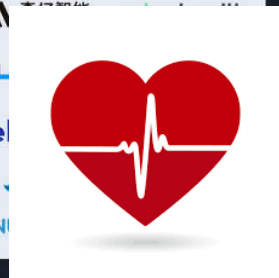
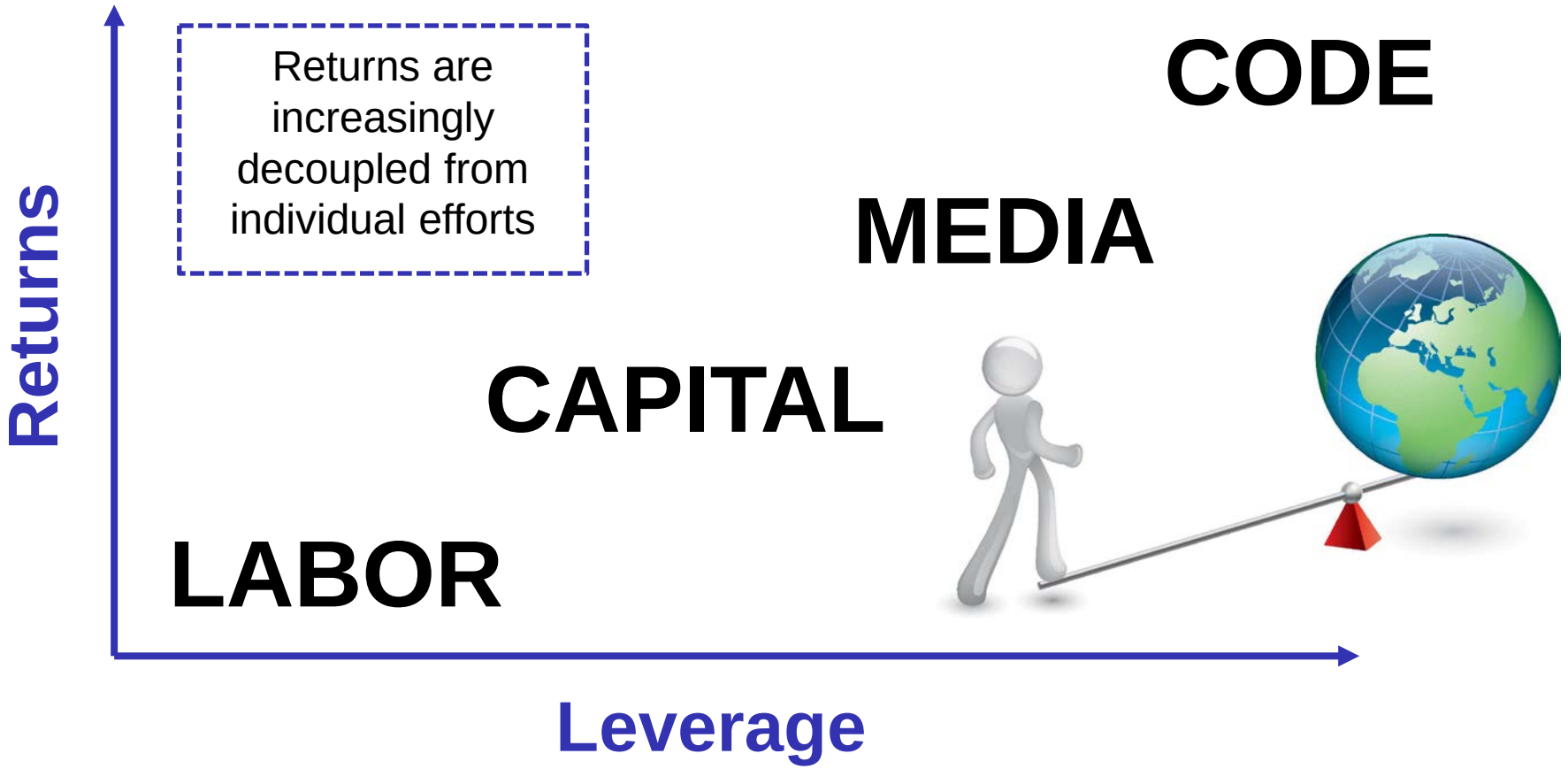


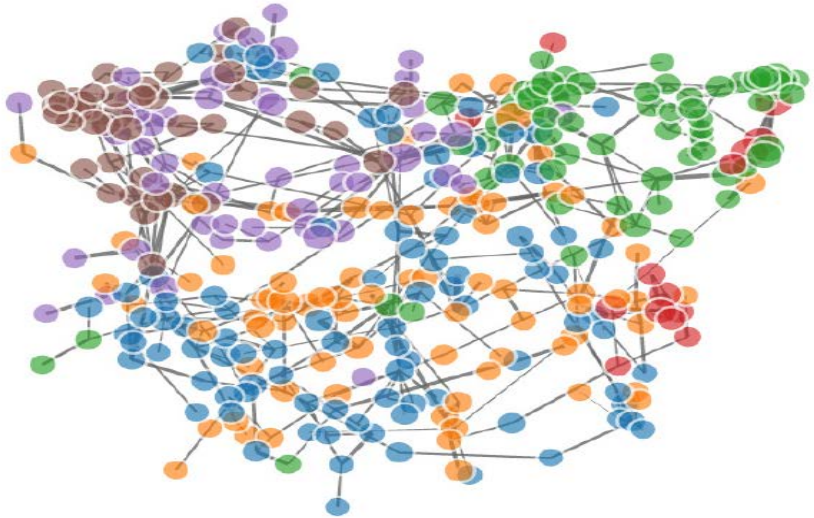
Integrating digital & physical

Leveraging complex networks



Beyond CS skills

$$v_i = \frac{1}{\lambda} \sum_j A_{ij} v_j$$



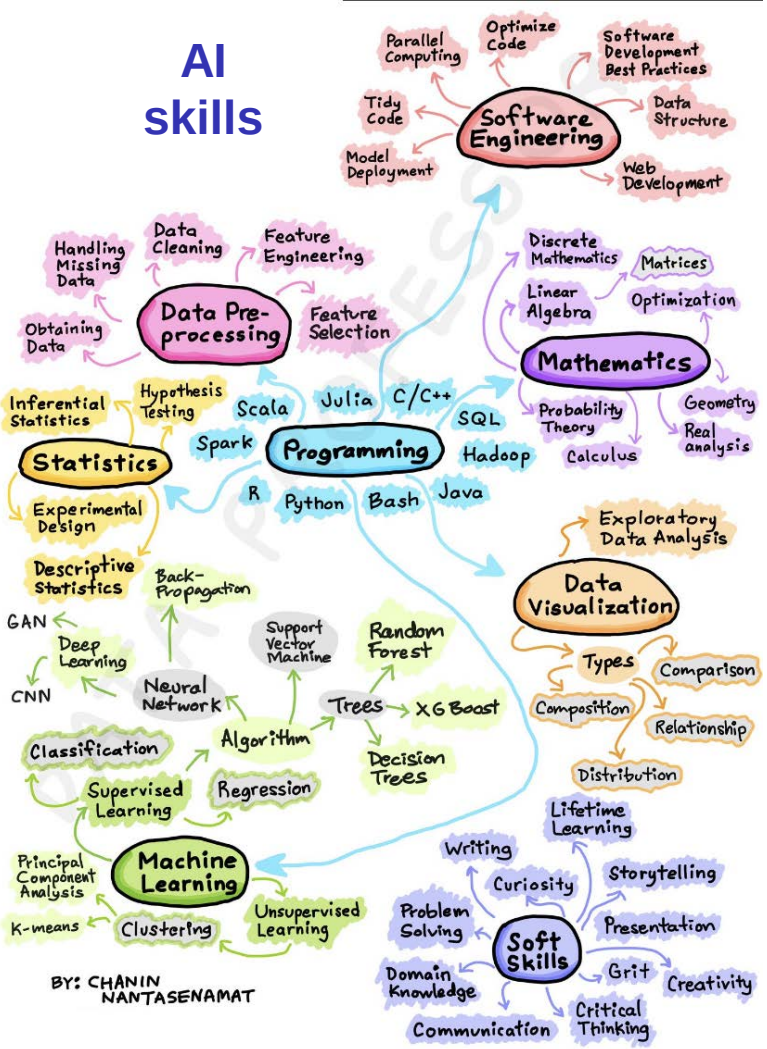
The ability to identify business problems and re-frame them as a data science solution is as important as the programming skills needed to develop AI tools

AI & the future of work

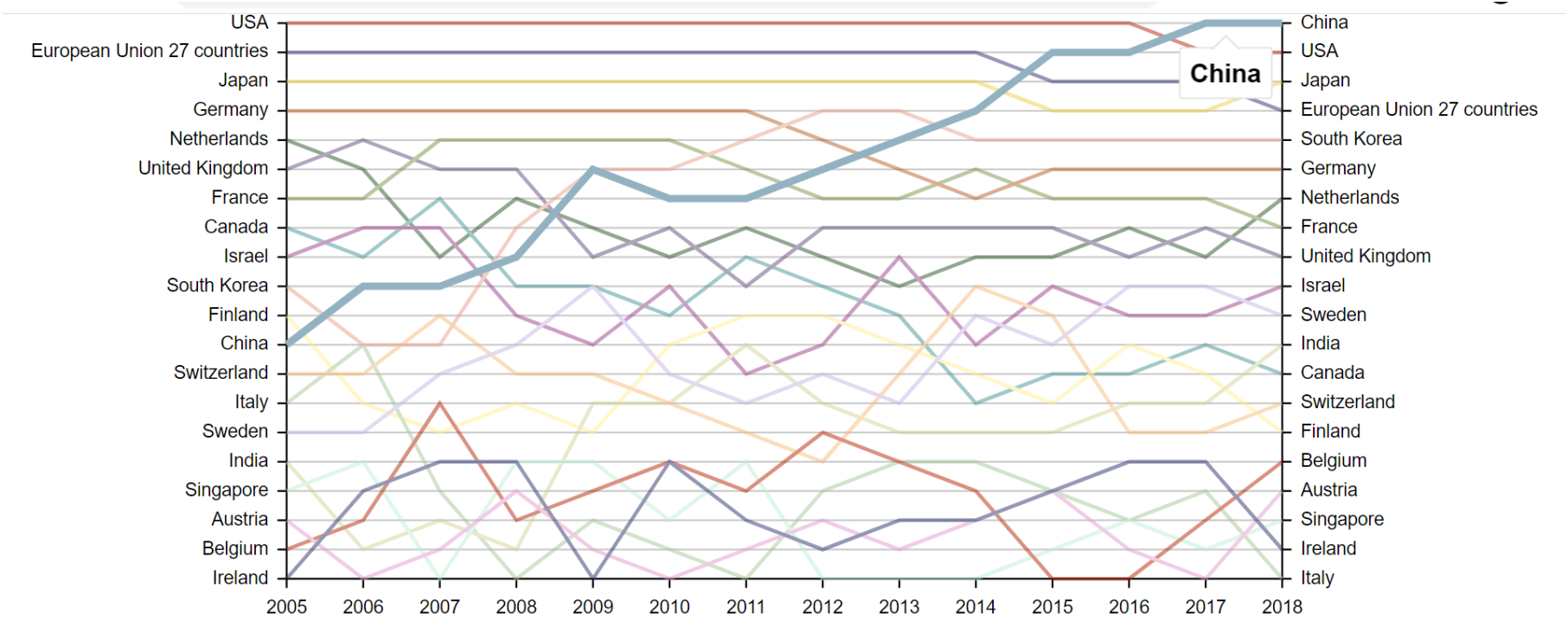
- These skills are the **foundation** of an AI world:
  - complex decision-making
  - creative content
  - business-technology interface
  - inter-human relationships
  - programming language

- They are:
  - hard to automate
  - requires new modes of education (hard to train at scale)
  - requires the re-invention of corporate culture, work ethics and lifestyle

AI skills

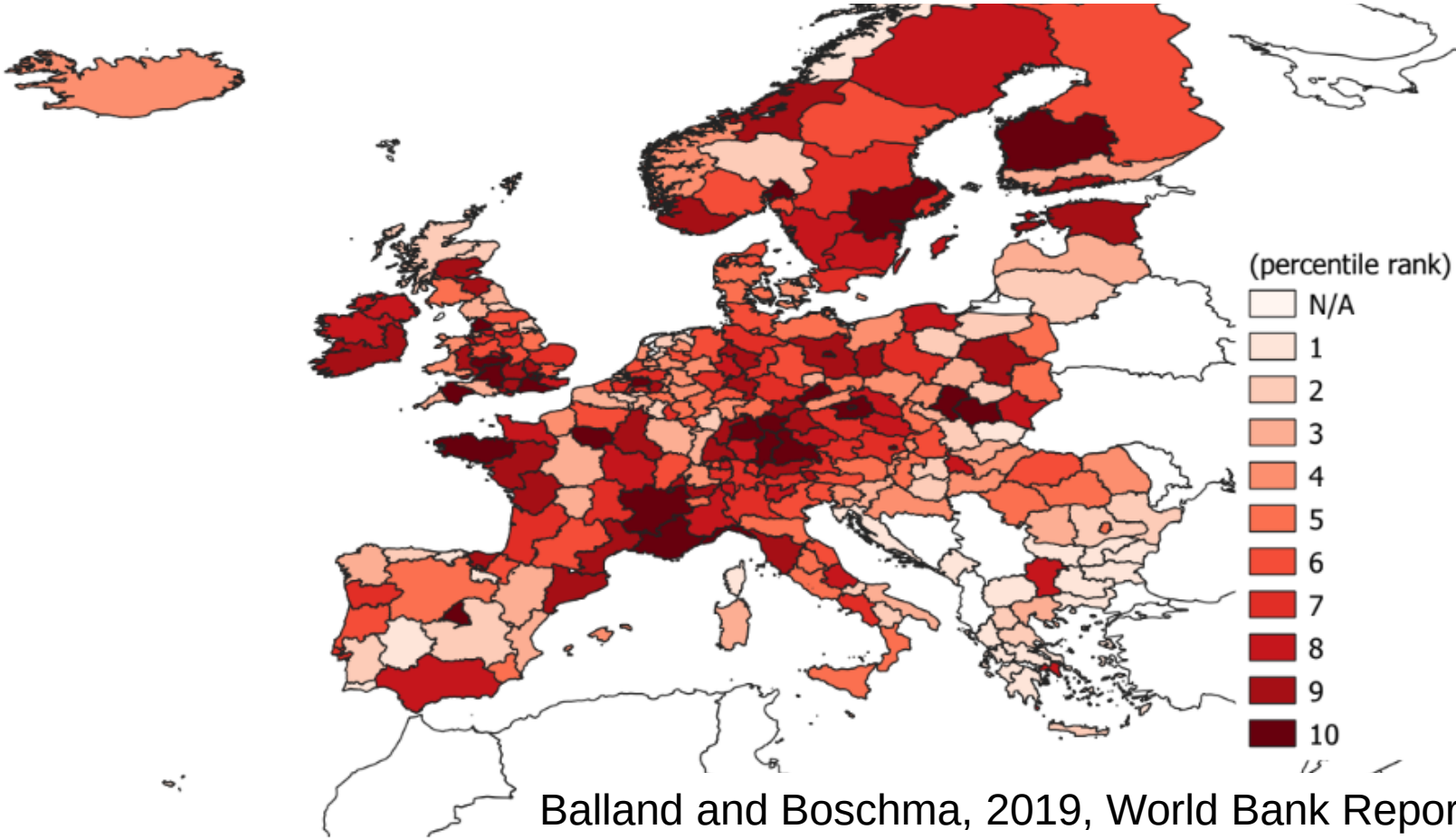

Software Engineering
Parallel Computing
Optimize Code
Software Development Best Practices
Tidy Code
Data Structure
Model Deployment
Web Development
Data Pre-processing
Handling Missing Data
Data Cleaning
Feature Engineering
Obtaining Data
Feature Selection
Mathematics
Discrete Mathematics
Matrices
Linear Algebra
Optimization
Probability Theory
Geometry
Calculus
Real analysis
Statistics
Inferential Statistics
Hypothesis Testing
Experimental Design
Descriptive Statistics
Programming
Scala
Julia
C/C++
SQL
Spark
Hadoop
R
Python
Bash
Java
Data Visualization
Exploratory Data Analysis
Types
Comparison
Composition
Relationship
Distribution
Machine Learning
Back-Propagation
GAN
Deep Learning
CNN
Neural Network
Support Vector Machine
Random Forest
Trees
XG Boost
Decision Trees
Algorithm
Classification
Supervised Learning
Regression
Principal Component Analysis
K-means
Clustering
Unsupervised Learning
Soft Skills
Lifetime Learning
Writing
Curiosity
Storytelling
Problem Solving
Presentation
Domain Knowledge
Grit
Creativity
Communication
Critical Thinking
BY: CHANIN NANTASENAMAT

The geography of AI patents



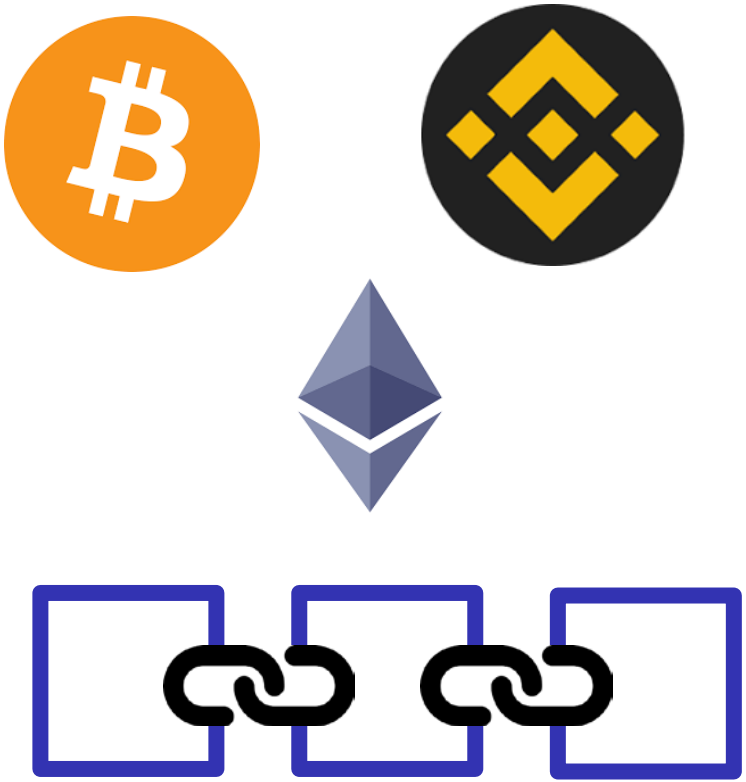
Source: Balland (2021) – Report for DG Grow

European Hubs of the industries of the future



Balland and Boschma, 2019, World Bank Report on I4.0

Blockchain is the other automation revolution



Crypto will:

- **disrupt** every industry by automating transactions
- enable the **scaling** of AI solutions (structured + interoperable data)
- increase hyperconnectivity by providing **trust** at scale