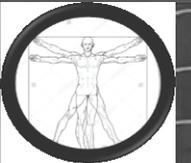


Augmented Intelligence for disrupting Research



Fabrizio Renzi

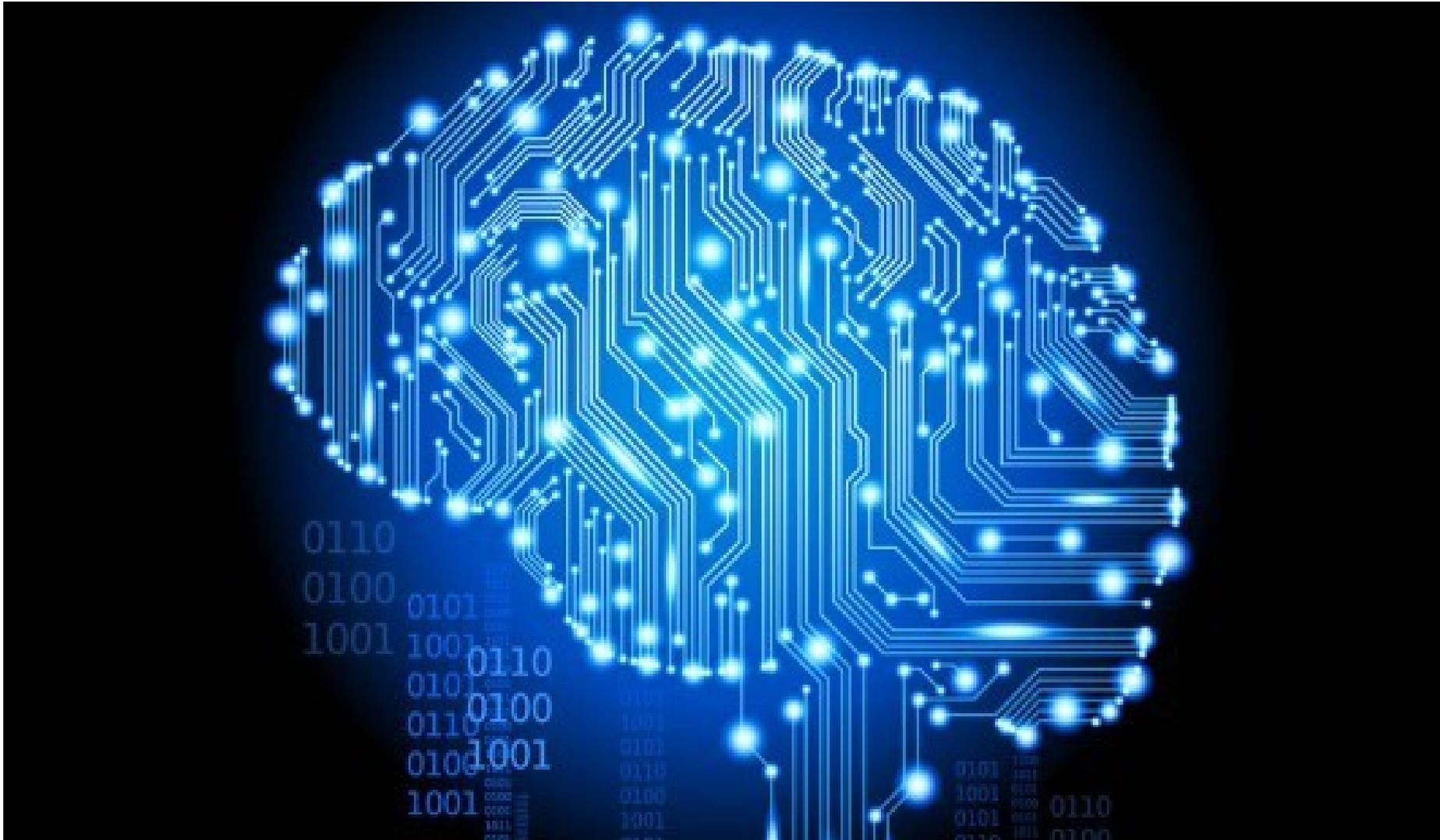
Director of Research Technology & Innovation
IBM Italy



IBM Italy Research
& Business Unit

R&b

Artificial Intelligence ...quindi Computer e Cervello.
Convergenza, Cooperazione, Competizione,o?





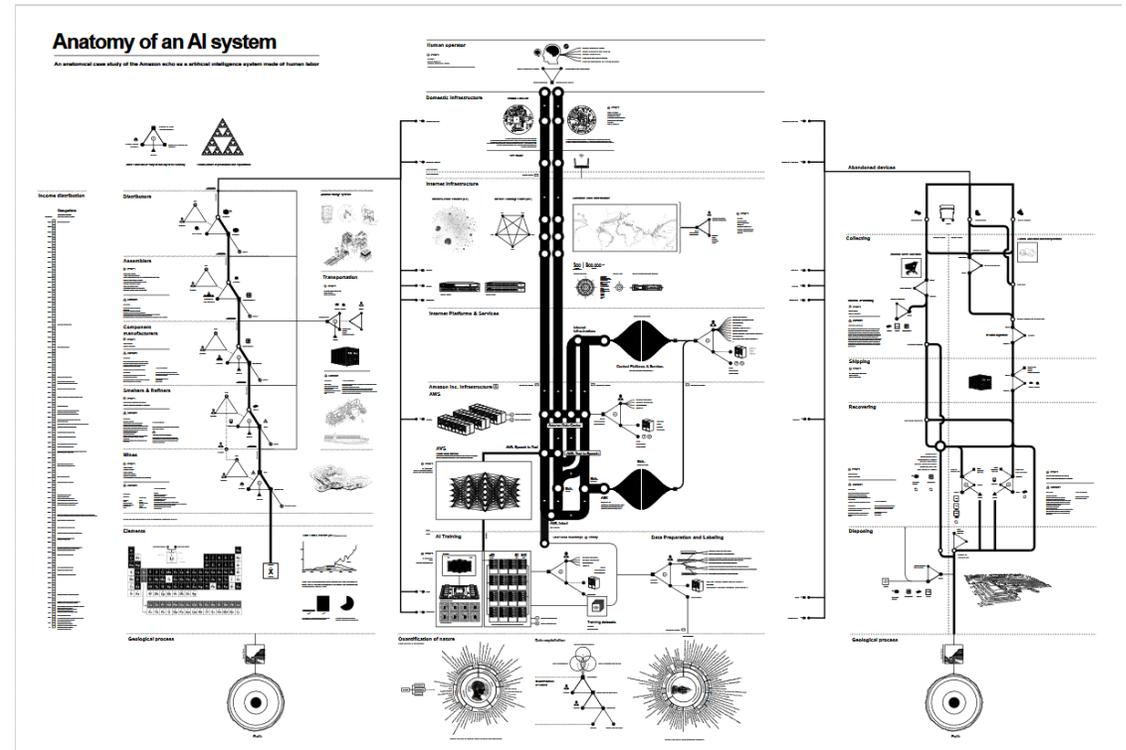




<http://www.brokennature.org/>



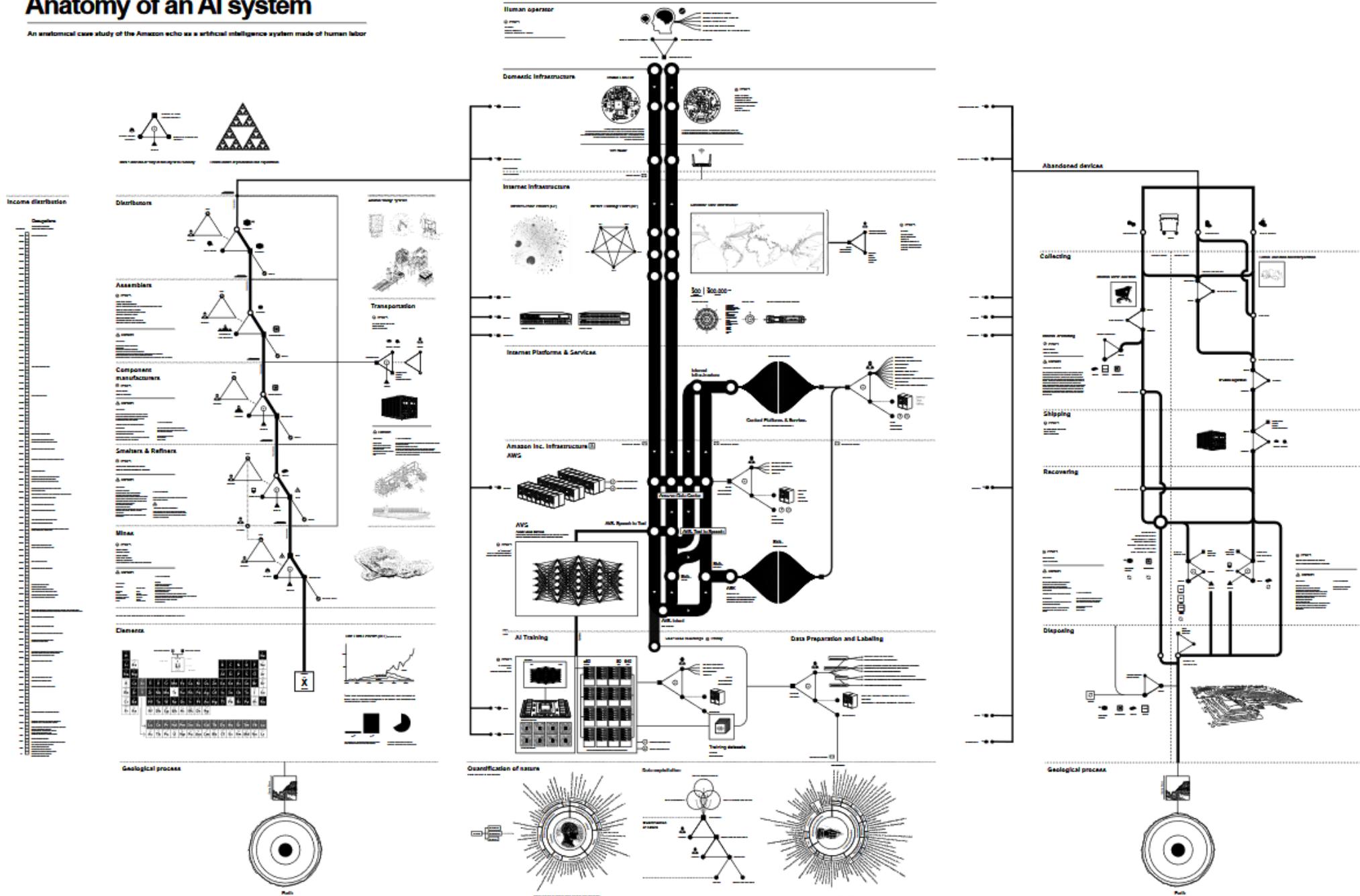
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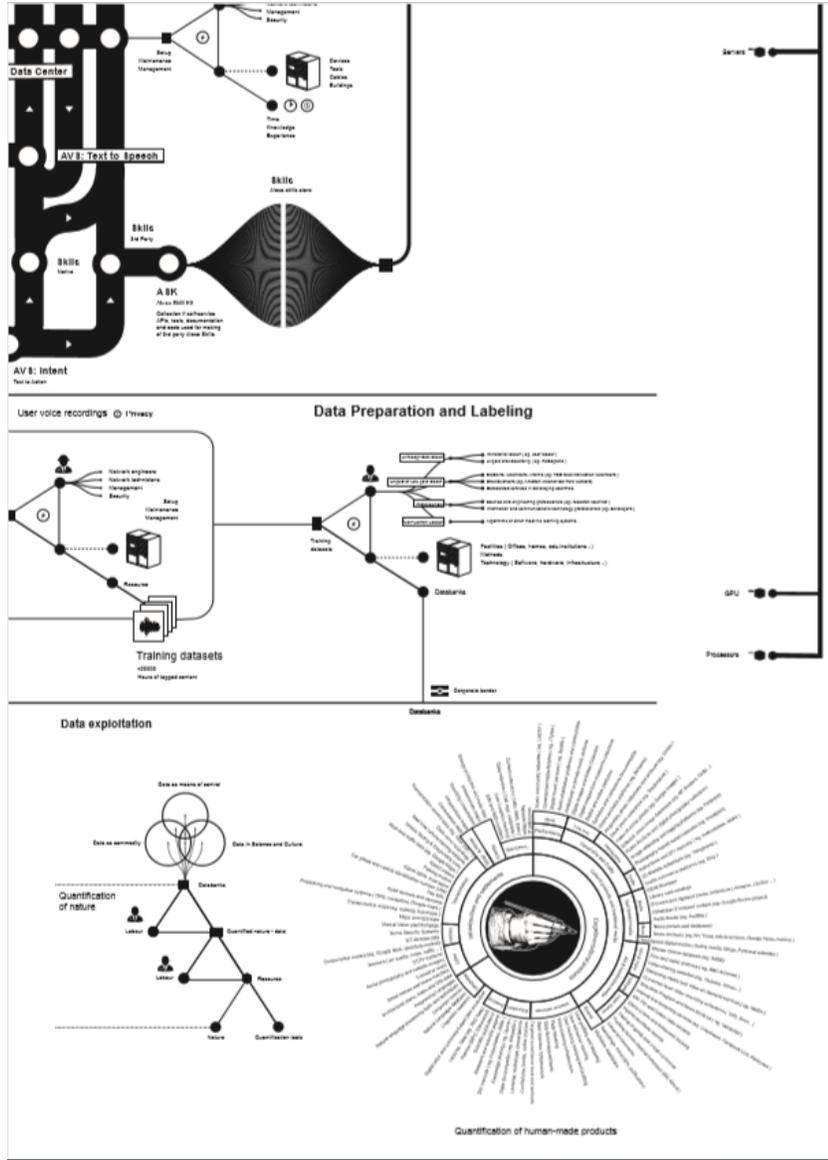
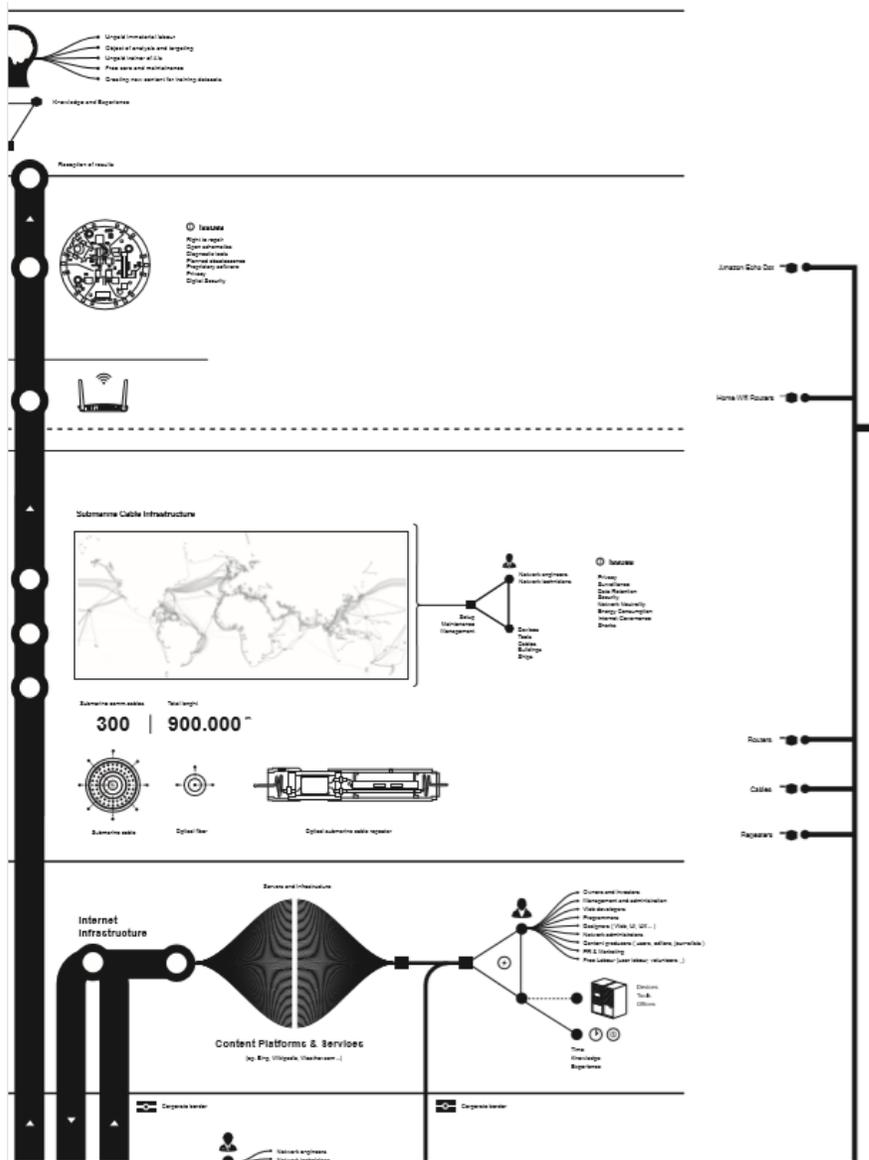


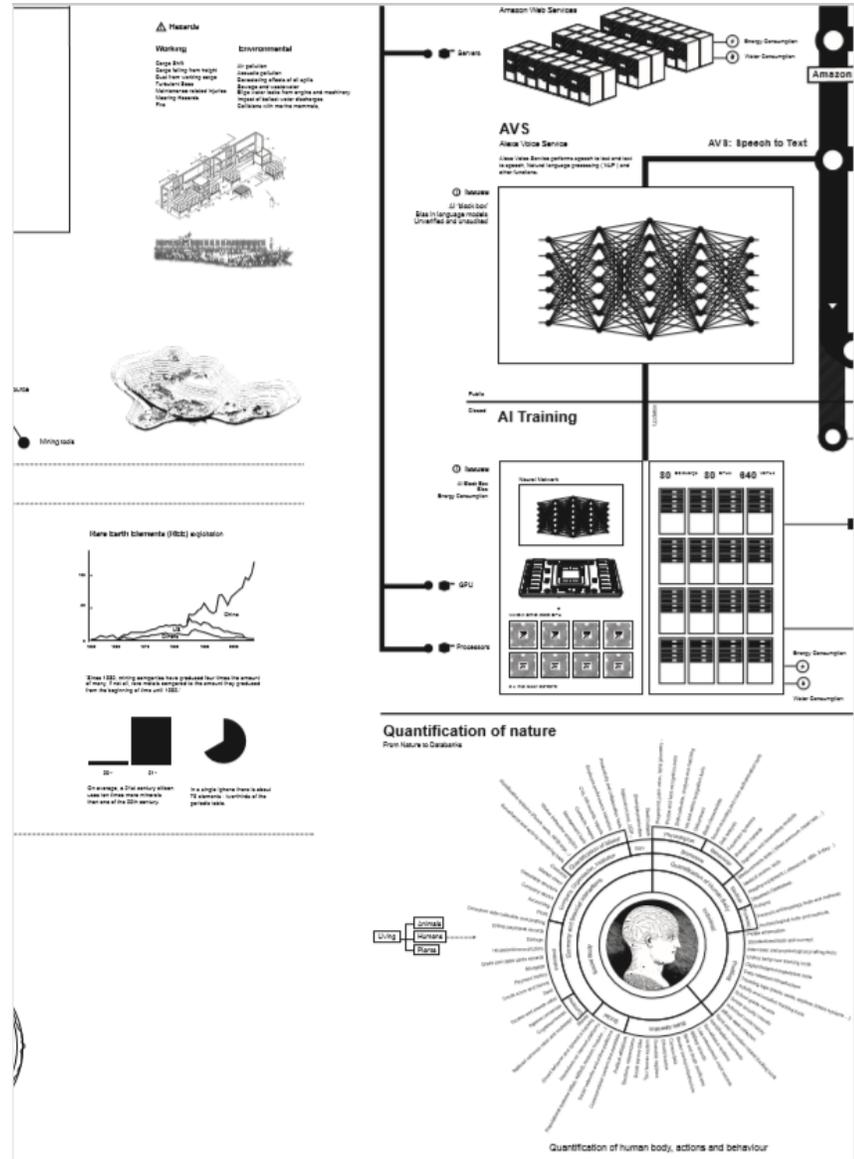
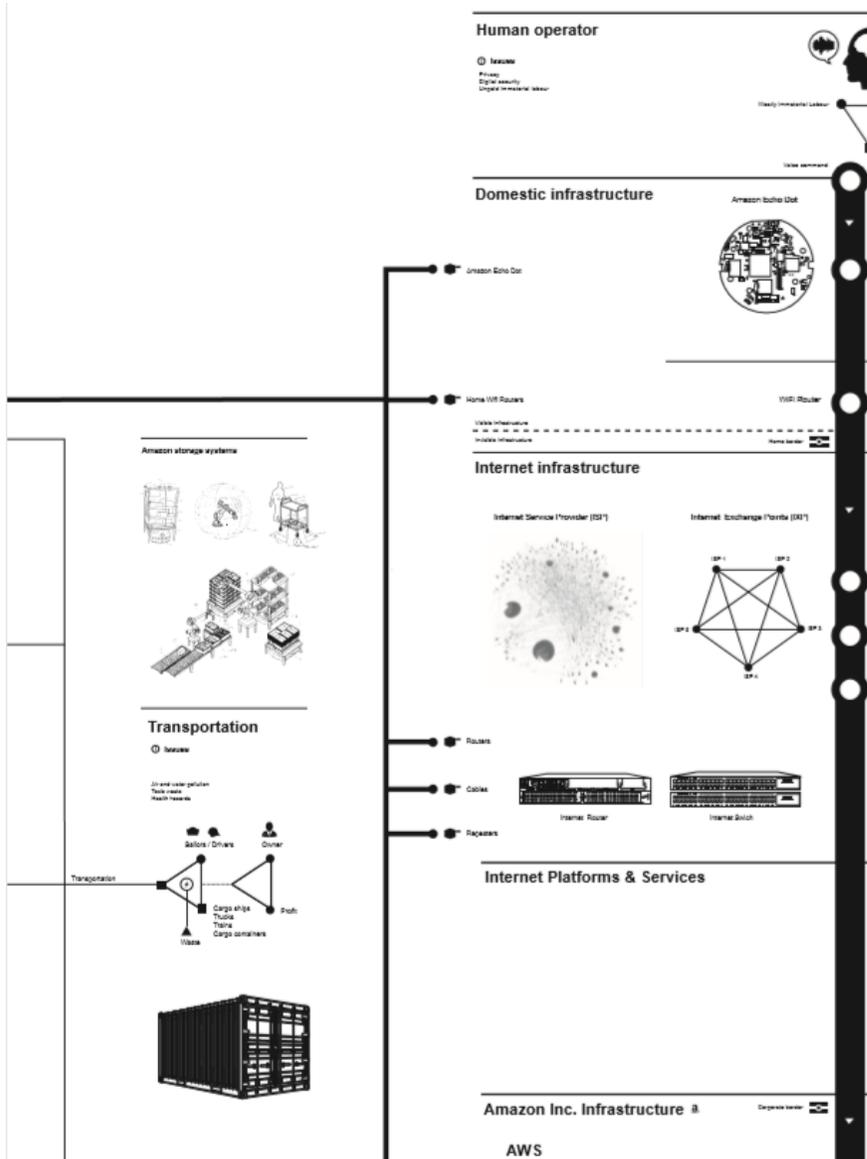
<https://anatomyof.ai/>

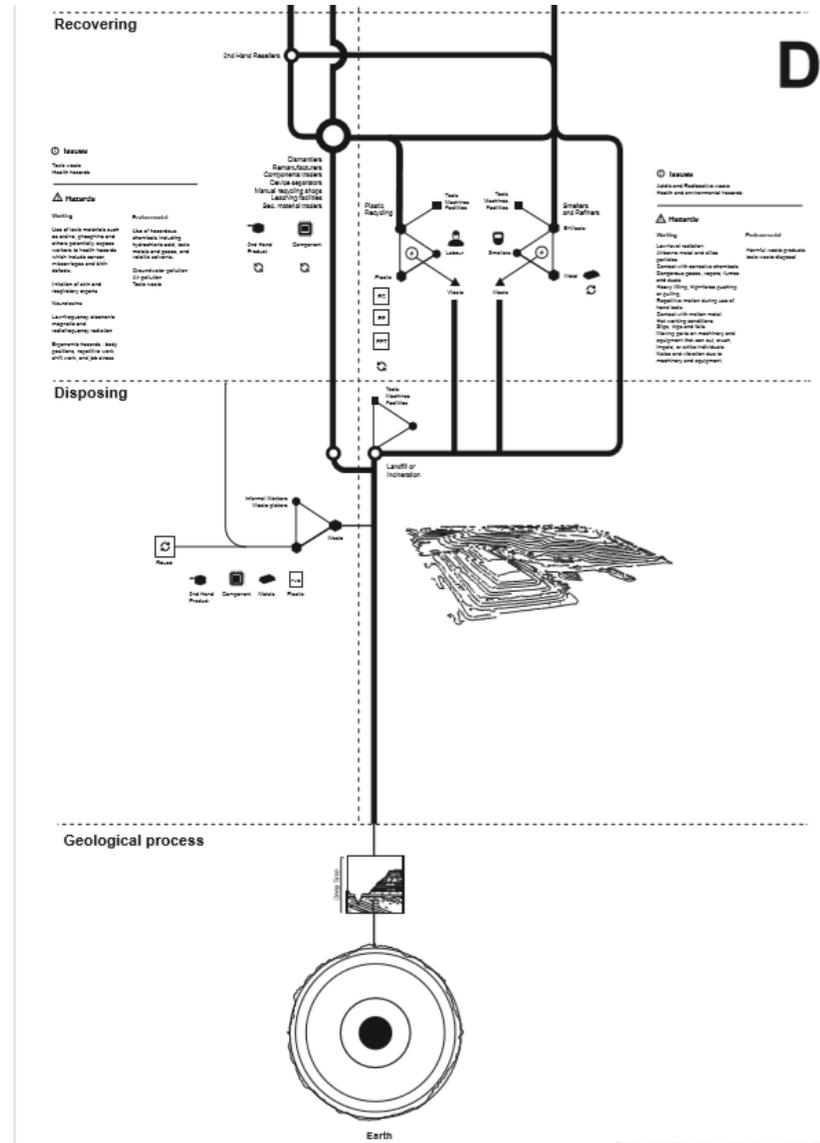
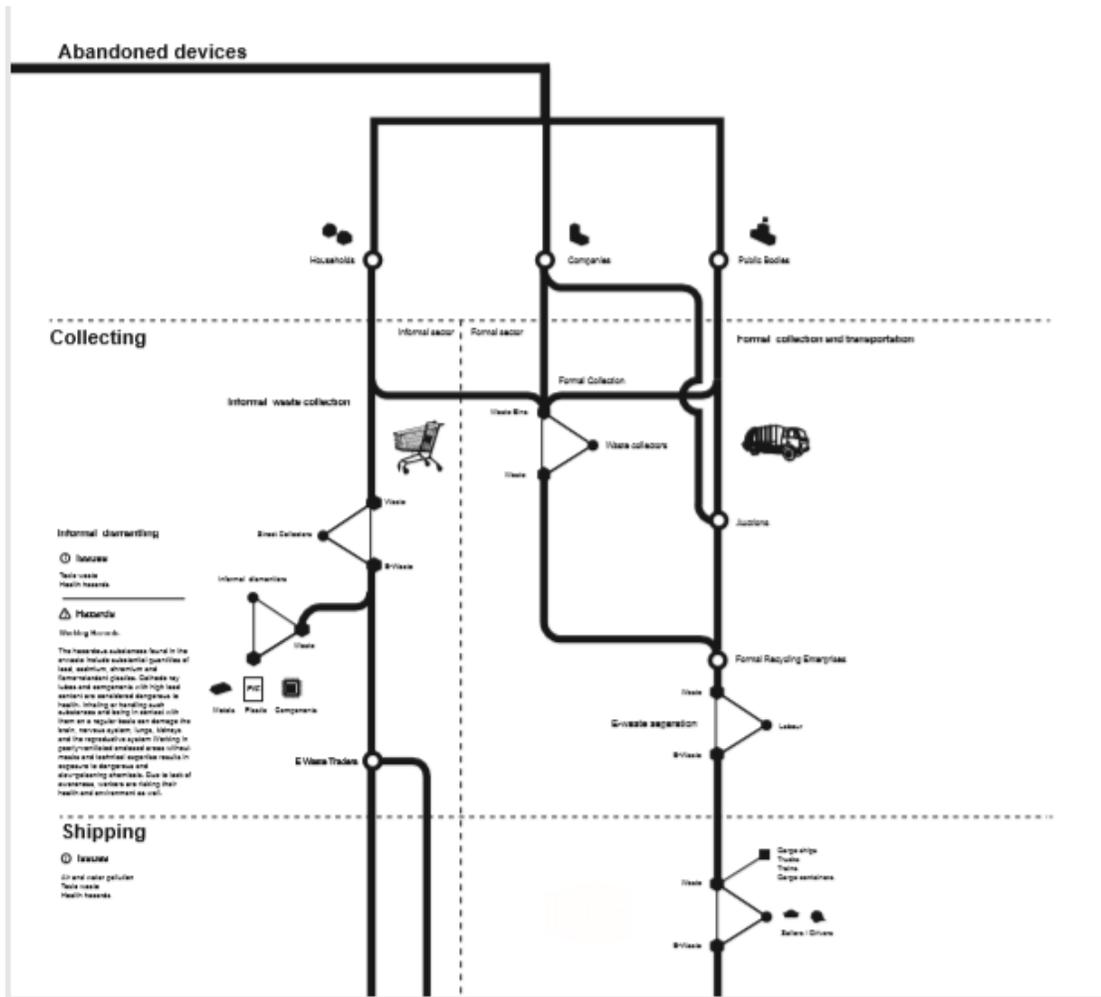
Anatomy of an AI system

An anatomical case study of the Amazon Echo as a artificial intelligence system made of human labor

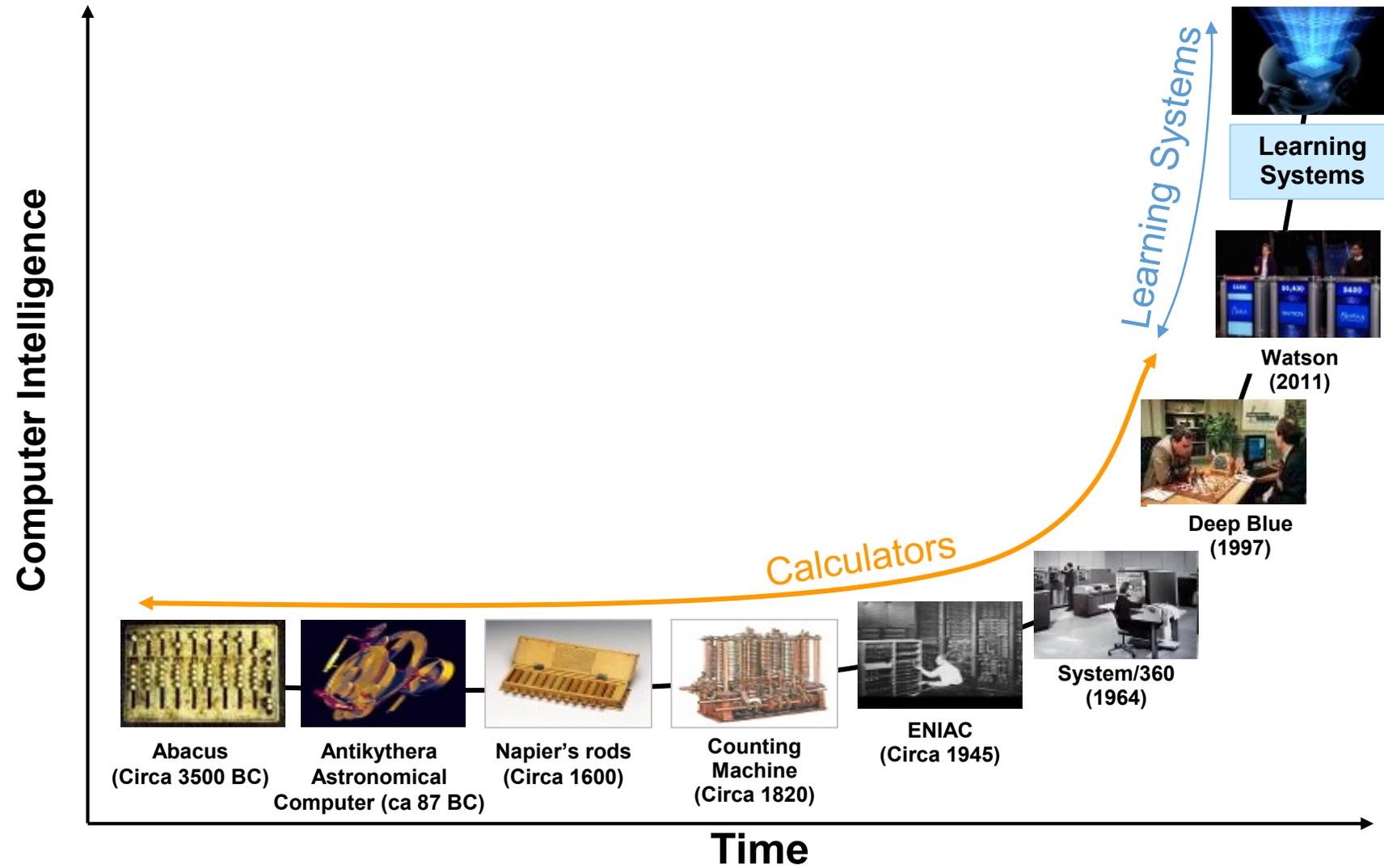




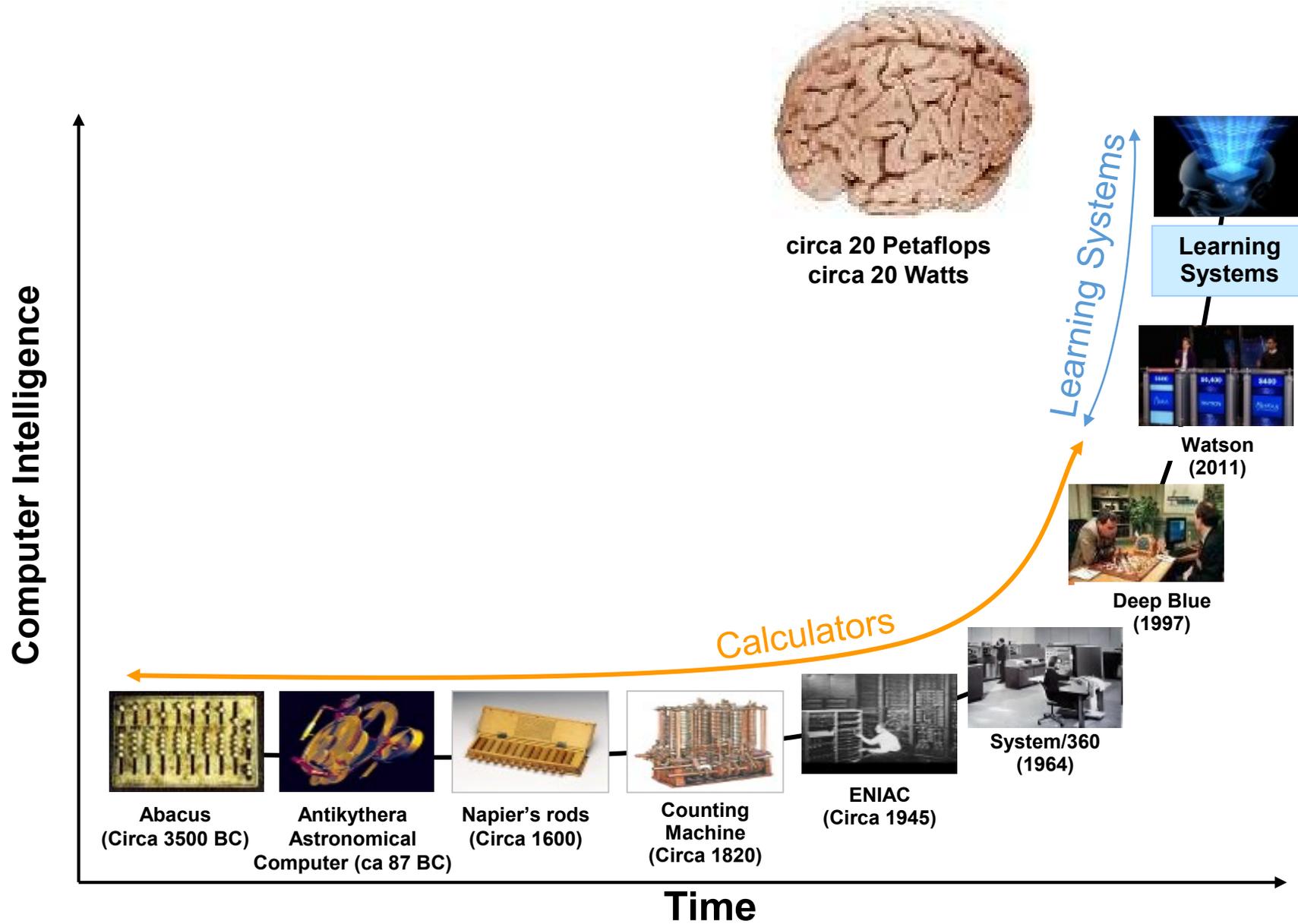




Una breve storia dell'informatica



C'è molto ancora da fare: dal cervellone al cervello

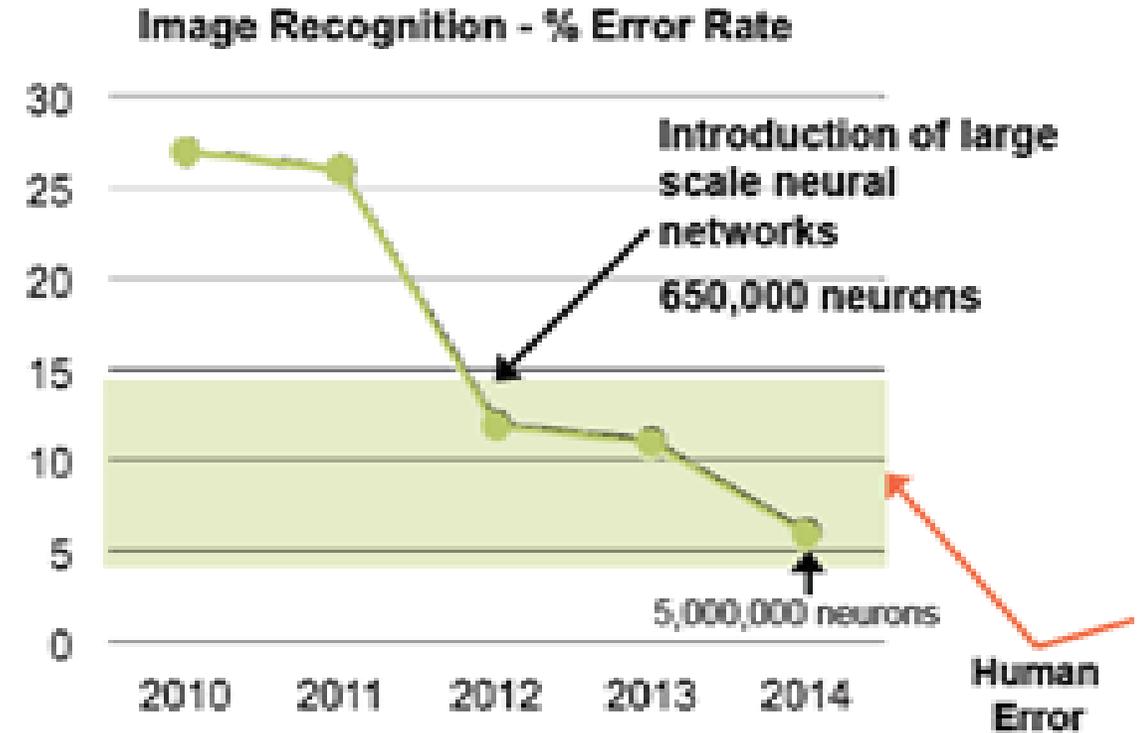


Cosa fa un cervello umano?



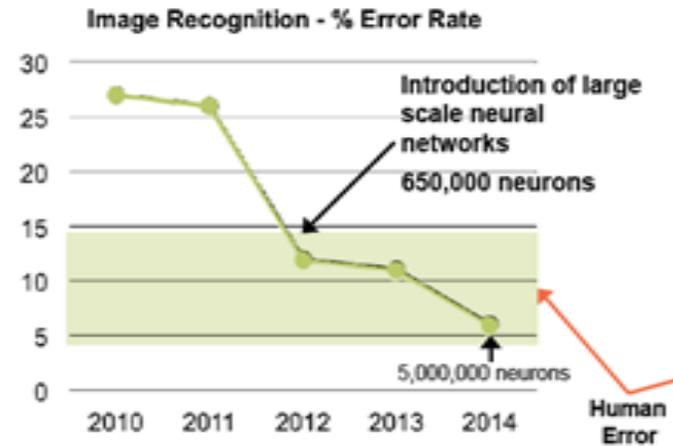
4 trends nell'Intelligenza Artificiale

1. Algoritmi migliori nel machine learning



4 trends nell'Intelligenza Artificiale

1. Algoritmi migliori nel machine learning



Web Sites

2. Disponibilità per il training di Massive datasets



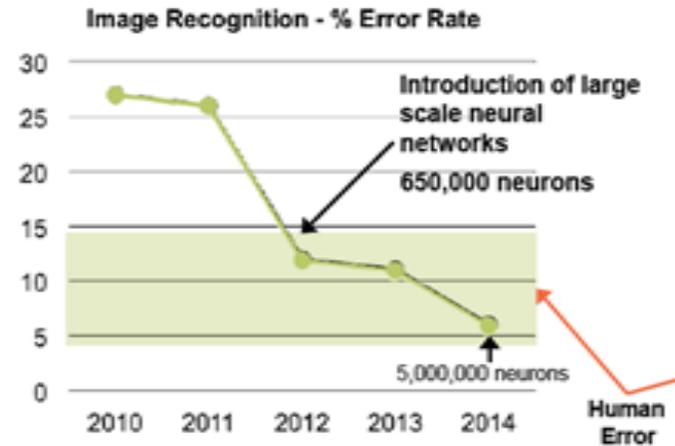
Social Media



Video Sharing Sites

4 trends nell'Intelligenza Artificiale

1. Algoritmi migliori nel machine learning



Web Sites



Social Media

Video Sharing Sites

2. Disponibilità per il training di Massive datasets

3. Performance e costo del computing

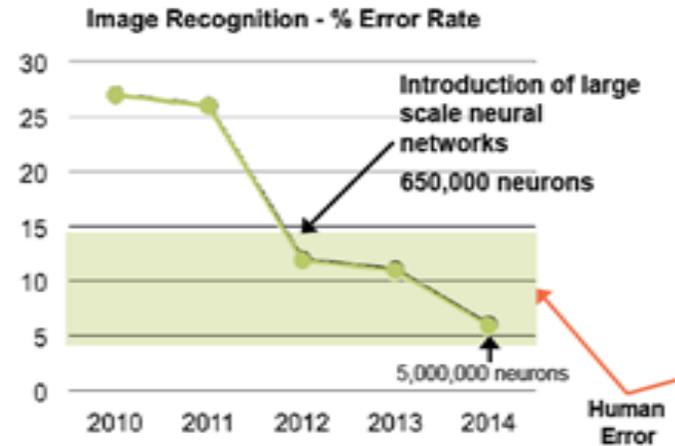
2,400% improvement in performance and 90% smaller

2011

2015

4 trends nell'Intelligenza Artificiale

1. Algoritmi migliori nel machine learning



Web Sites



Social Media

Video Sharing Sites

2. Disponibilità per il training di Massive datasets

3. Performance e costo del computing

4. Flusso massiccio di talenti e

investimenti nell'area **17B\$**

2,400% improvement in performance and 90% smaller

2011

2015

Potete provare a casa (es. 1): Personality Insights

Che cos'è?

Enables deeper understanding of people's personality characteristics, needs, and values to help engage users on their own terms

Come funziona?

Extracts a set of personality and social traits based on the way a person communicates.

Provatelo con un testo di vostro piacere:

<http://www.ibm.com/smarterplanet/us/en/ibmwatson/developercloud/personality-insights.html>

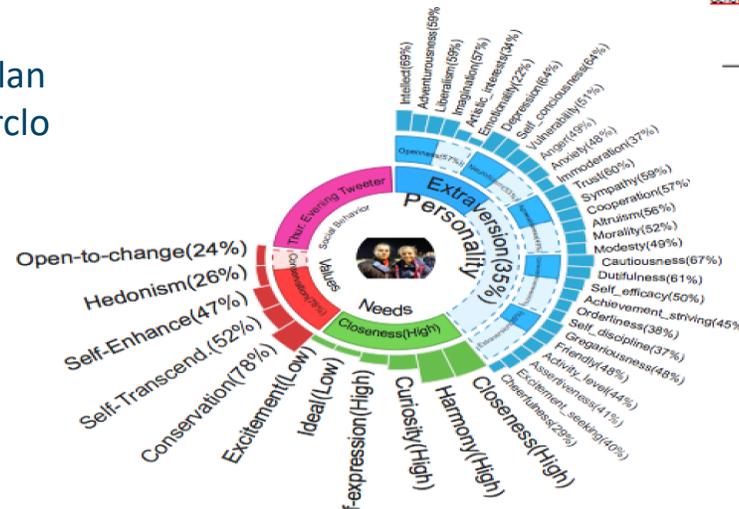


Cognitive "building block" Services

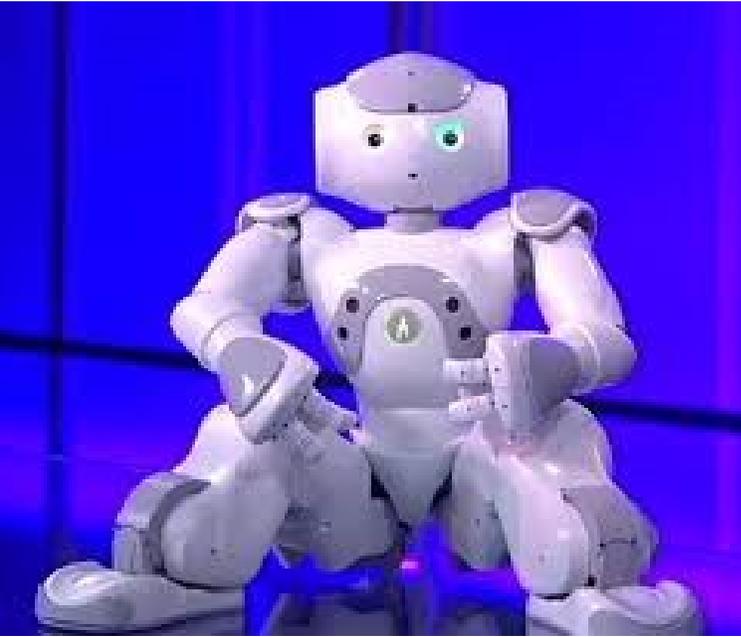
Global IBM Cognitive Services



IBM Italy RaaS Cognitive Services & Resources for Italian language



Quindi le macchine stanno acquisendo senso e sensibilità?



TRECCANI, LA CULTURA ITALIANA



CREA UN EBOOK CON QUESTA VOCE

SCARICALO ORA (0)

senso



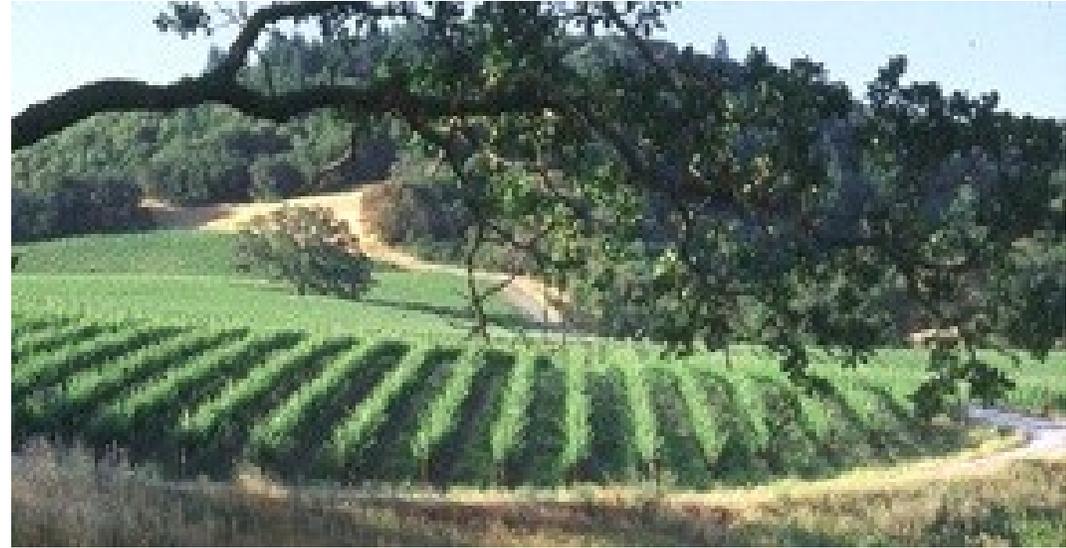
ANATOMIA

FILOSOFIA

LINGUISTICA

.....

Quindi le macchine stanno acquisendo senso e sensibilità? SI per forza



Stiamo creando un pianeta, più o meno smarter, ma

Instrumented (gli uomini e le macchine insieme a decine di miliardi di devices e **sensori**)



Interconnected (generano un enormità di dati, testo ed immagini)

Intelligent (...a cui non riescono più a dare un **senso** da soli)

.... E andando avanti i devices e soprattutto i sensori saranno centinaia di miliardi ed i dati saranno centinaia di zettabytes ed il **senso** dovranno fornirlo necessariamente le macchine.

In teoria l'uomo è in vantaggio sulla macchine sul Senso comune ed i ragionamenti ad esso correlati per almeno 5 ragioni :

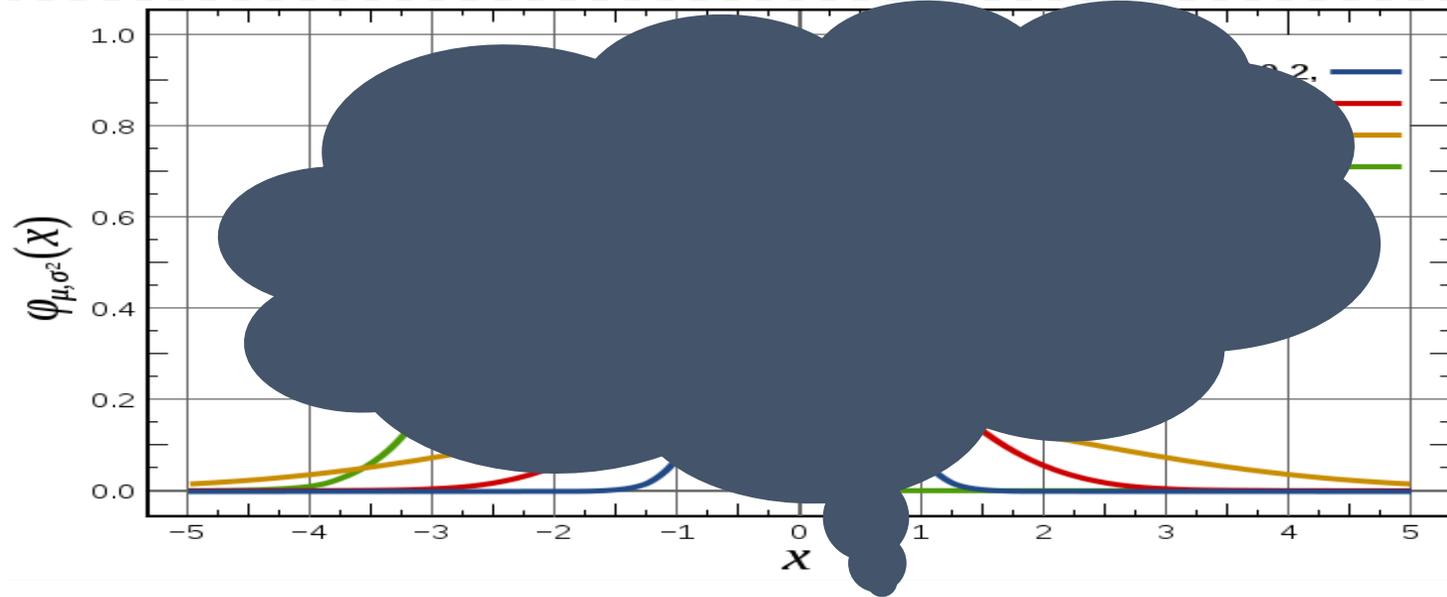


Una lettura per approfondire:

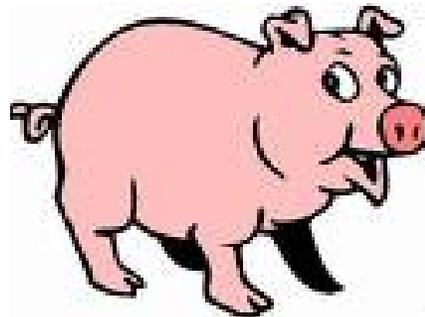
Communications of the ACM, settembre 2015 «commonsense Reasoning and commonsense knowlegde in artificial intelligence» by Ernest Davis and Gary Marcus



In teoria l'uomo è in vantaggio sulla macchine sul Senso comune ed i ragionamenti ad esso correlati per almeno 5 ragioni :



In molti domini la soluzione statistica non è applicabile.
I casi a bassa frequenza (long-tail) sono molti e significativi.
(es. Maiale statistico e contadino di Nicolas Taleb)



It is a fact that the engine of the new wave of the technology innovation will be Artificial Intelligence, that will be used to optimize decisions across all industries



Healthcare

Personalized Healthcare, Diagnostic Tools, Integrated Wellness and Health Systems, Behavior Tracking, Security



Education

Personalized Education, Learning Content Indexing-to-Skill & Search, Custom Teaching Methods, Smart View Devices



Science

Data Analysis, Experiments, Predictive Modeling, Theorem Proving, Deductive Reasoning, Experiment Planning



Business Solutions

Interactive Chatbots that Learn from Experience with Customers, Regulatory Support, Prediction, Marketing



Government

Campaign Content and Planning, Citizen Experience, Public Security, Policy Planning Support



Finance

High Frequency Trading, Risk Modeling, Equity Research, Asset Mgmt, Underwriting, Investment Planning, Security



Agriculture

UAV / Satellite Crop Field Analysis, Disease Recognition, Comprehensive Strategic Crop Planning



Energy

Strategic Oil Drilling, Risk Minimization, Geological Analysis, Demand Prediction, Adjustment of Resource Generation

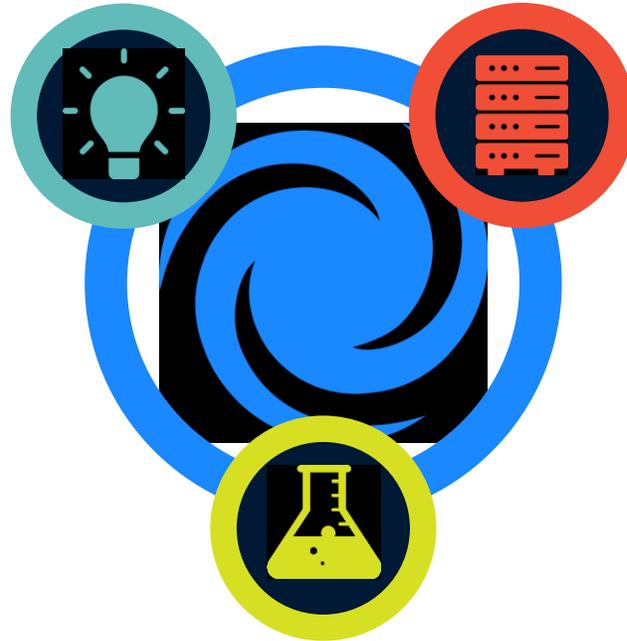
Technical R&D today: Disruption opportunity

Knowledge

Researchers need to easily access quickly growing and widely diverse information sources.

Highly unstructured/dark

Current human based approach not scalable



Evidence & Experiments

Internal evidence and experiments are driven primarily empirically, often brute force, and their results are isolated from wider knowledge space.

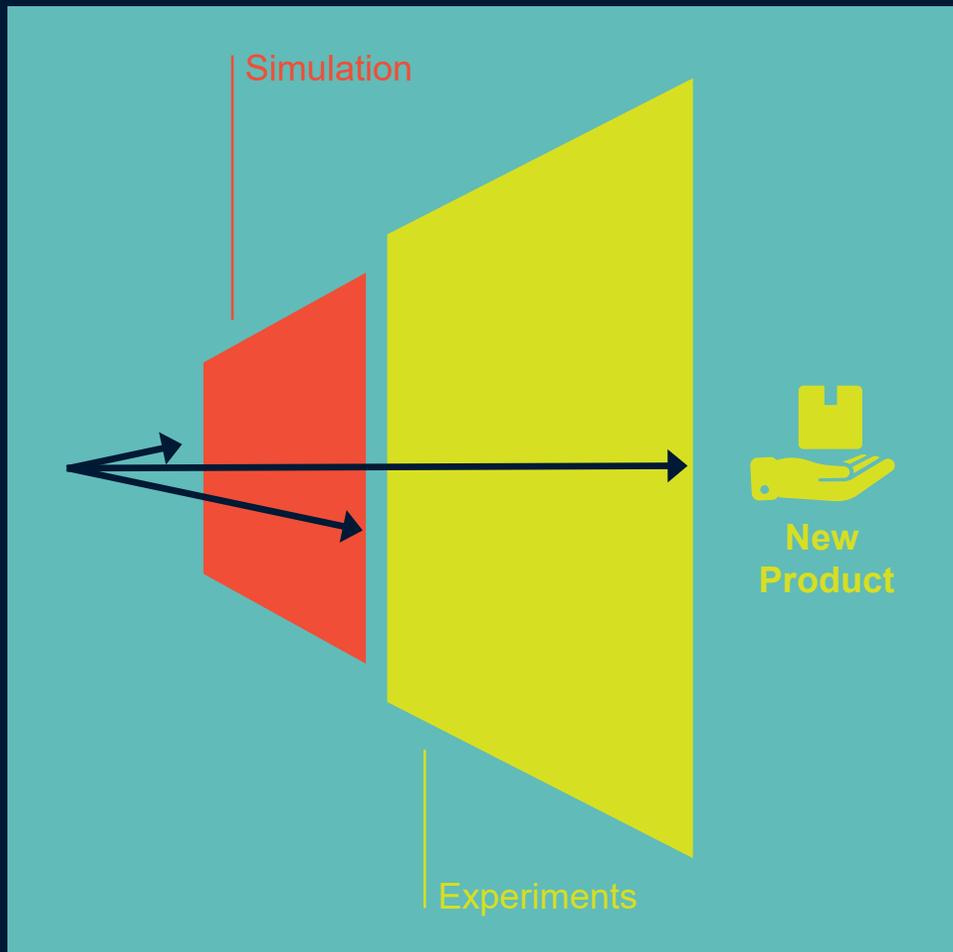
Inference & Simulation

Domain related inference is largely missing. Setting up and deploying the right simulations is very hard.

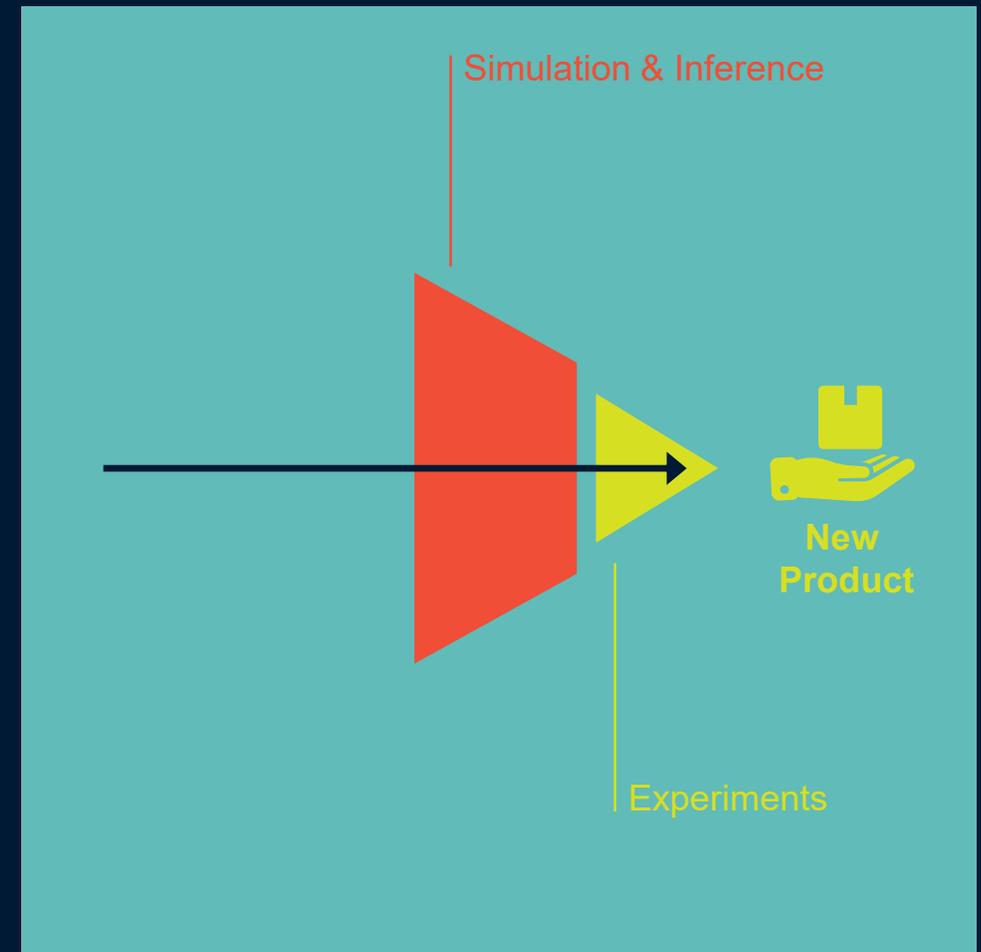
Human capital intensive, non scalable

Technical R&D today: Disruption opportunity

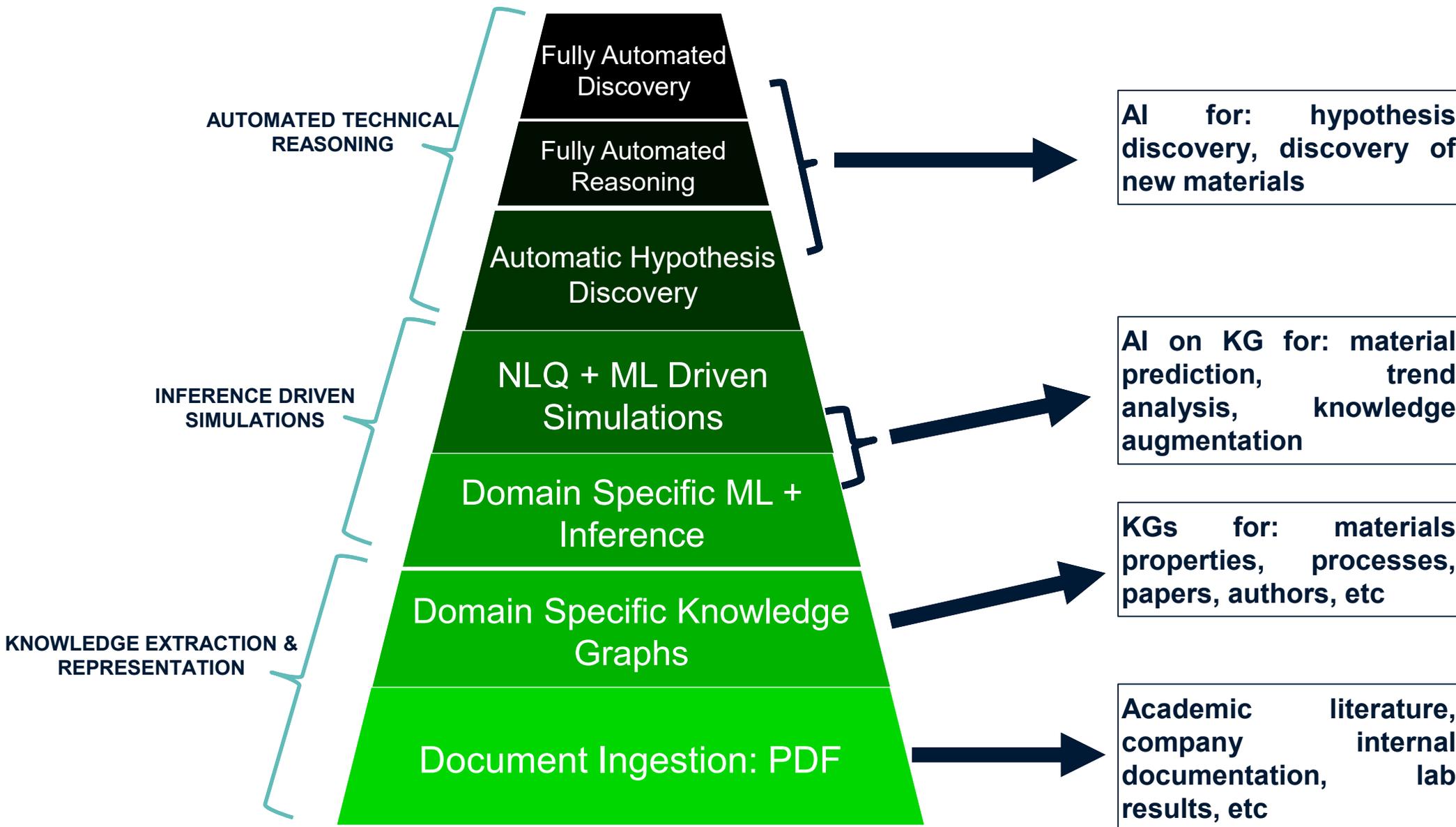
Today



Cognitive Discovery



AI for R&D Reimagined: Holistic View



Knowledge Discovery Pipeline

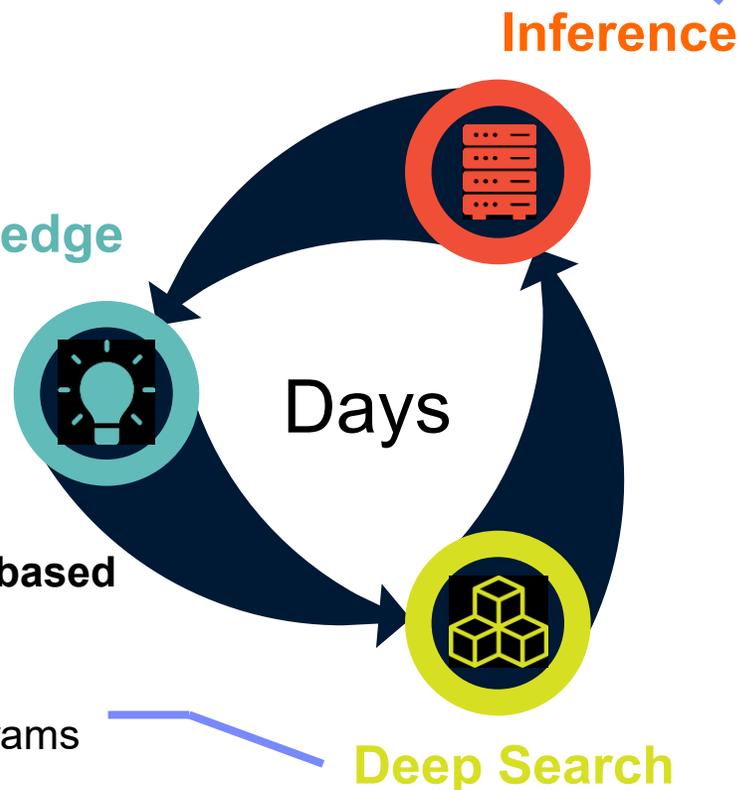
Ingest structured and unstructured data to create massive knowledge spaces

- Complex documents (literature, lab-books)
- Structured DBs
- Public and proprietary

Knowledge Space

Enable contextual based search, based on meaning, not keywords

- Tables, Images, Formulas, Diagrams
- *“What are all the properties of a chemical” – “List all chemical reactions of a certain type. Who, what, where, when?”*



Get deep insights by ML/DL on the Knowledge Space

- Identify trends:
 - Run historical queries
- Discover gaps in the knowledge
 - What is known v.s. what is not known (or reported)
- Explore “what if” scenarios
 - Suggest hypotheses:
“Increasing Cu by 2% will likely increase tensile yield strength”
- Perform composite queries:
 - *“How has the use of copper in alloys in the auto industry evolved in the last 20 years?”*
 - *“What is the most likely use of a certain chemical by-product of an organic synthesis route next year? Which company is the most likely to want to buy it?”*

Knowledge Discovery Pipeline: Key APIs SaaS & On Prem.

Corpus Conversion

- PDF Smart annotator. Any type of document. PDF is key here. Minimal and trivial annotation needed
 - Advanced OCR for scanned

NLP: Facts extraction

- Smart Reader: **non supervised** extraction from text
 - Chemicals, materials, properties, relationships
- *Work in progress*: Diagram Ingestion. Extracts data from diagrams, scientific plots, schematics
 - Chemical formulas, phase diagrams, etc
- Tables extraction and semantic representation

Knowledge Space

Knowledge Graph Store & Engine

- High performance in memory graph DB and query engine, that implements deep and complex queries

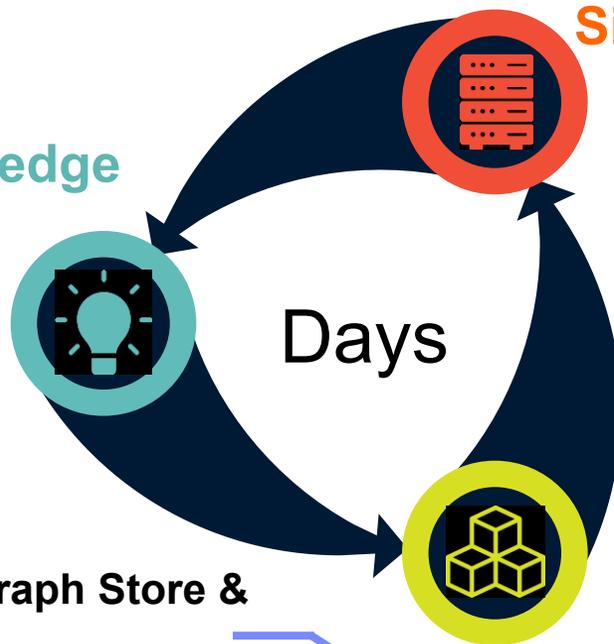
Days

Inference & Simulation

Inference Engines/Knowledge Analysis/HPC Simulation

- Inference for materials properties prediction
- Prediction of the output of organic chemical reactions
- Low cost & scalable graph analytics and inference algorithms for hypothesis discovery
- High performance, inference based, materials and chemicals simulations

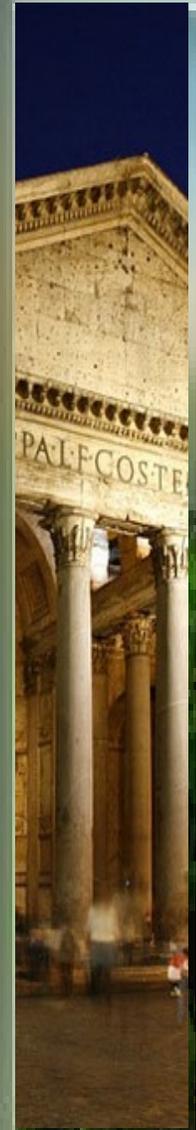
Deep Search



Research&Business Unit IBM Italia = IBM INNOVATION + OPEN INNOVATION

Bring **IBM INNOVATION** to clients and public organizations and tackles complex real-world industrial problems in the areas of human well being

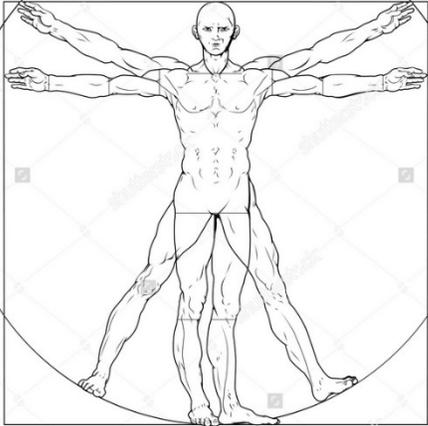
Act as a catalyzer to capture **OPEN INNOVATION**: fostering partnerships and joint collaborations with the Italian University & Research Ecosystem in Italy and abroad



Identified addressable new research&business areas for IBM italia

IBM Italy Research & business Unit global positioning

Well-being



Driven by data and technology

1. Health & Nutrition

2. Human assistive solutions for learning, cultural, well-being

3. Proactive Cyber Intelligence & Security

4. New sustainable Energy & manufacturing

A hundreds million set of public/client commitments that will catalyze Italian market growth next years

Human Technopole (post EXPO), Genomics, Life Sciences, nutrition,

Regione Emilia active intelligence center

Cybersecurity,

Italia 4.0 (Ricerca, Big Data, Robotics, Digital Manufacturing),

European Union Flagship/H2020/ MIUR PON

New Generation Networks 5G, tech quantum, social

INNOVATIVE BUSINESS/NEWCO MODELS WITH CLIENTS

Our vision: pioneering an innovative operating model.



(after 3 years incubation we are graduating to fully operational model)

1. Top Universities & Research centers in Italy and abroad



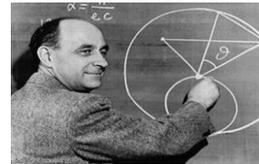
2. Venture capitalist, Investors, Incubators, Startups/newco



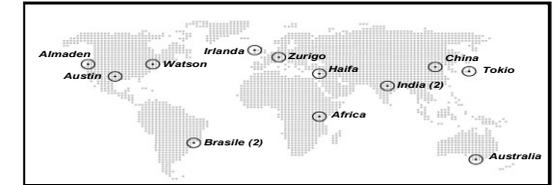
3. Funded Projects European Union, Italian Government, Regions



CURATE, DEVELOP & ADAPT
Inventions and Solutions



Global IBM Research & Labs



CAPTURE
Complex Problems & Challenges

R&b Innovation Projects

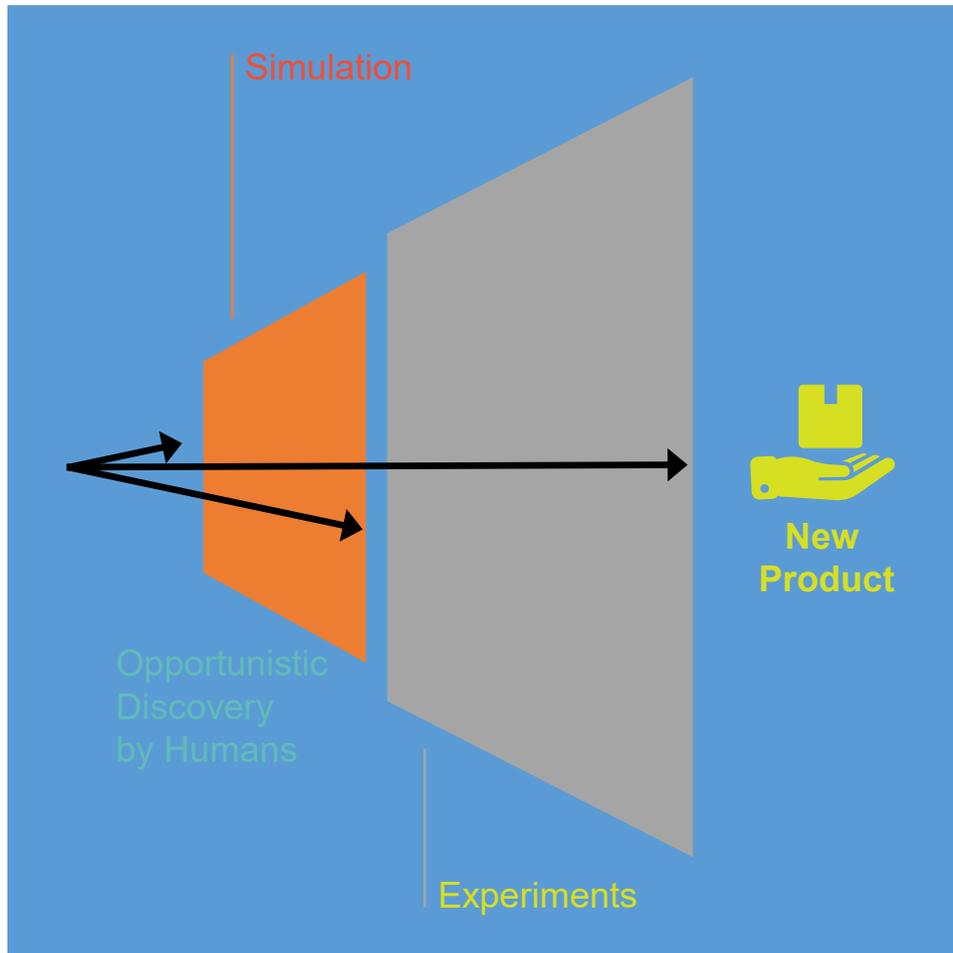
R&b current **Active Intelligence** engagements & selected anchor Clients

Health & Nutrition	Healthcare Research	Pharma	Nutrition	Wellness
Human assistive solutions for learning, cultural, wellbeing	Aging & Accessibility	Active Education	Culture Tourism	
New Sustainable Energy & manufacturing	Research Oil & Green Energy	Utility	New Materials	
Proactive Cyber Intelligence & Security	Research Cyber Security National Lab	Banking	Insurance	
New Foundational technologies	Social Robotics Laboratory	New Generation of 5G Networks	WW IBM Cryptocards Development	Quantum Computing

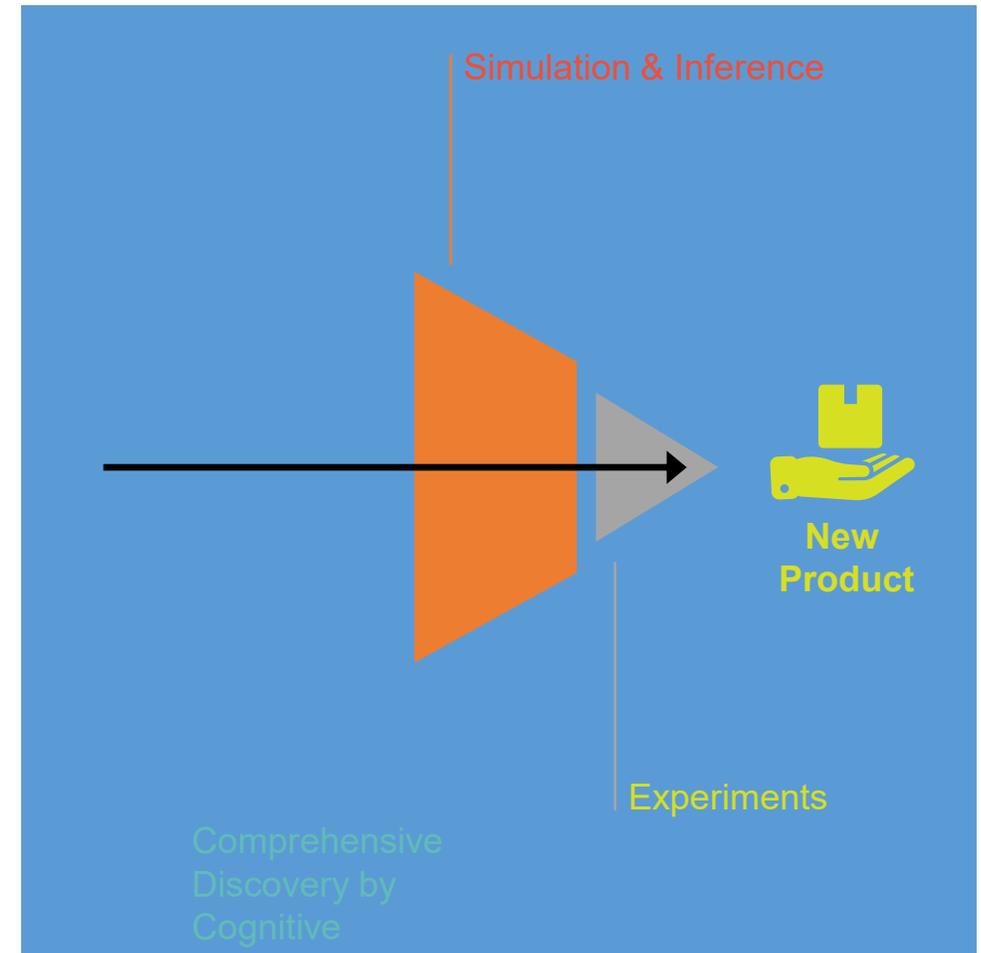
IBM Italy Customers

R&D a Disruption opportunity with augmented intelligence

Today

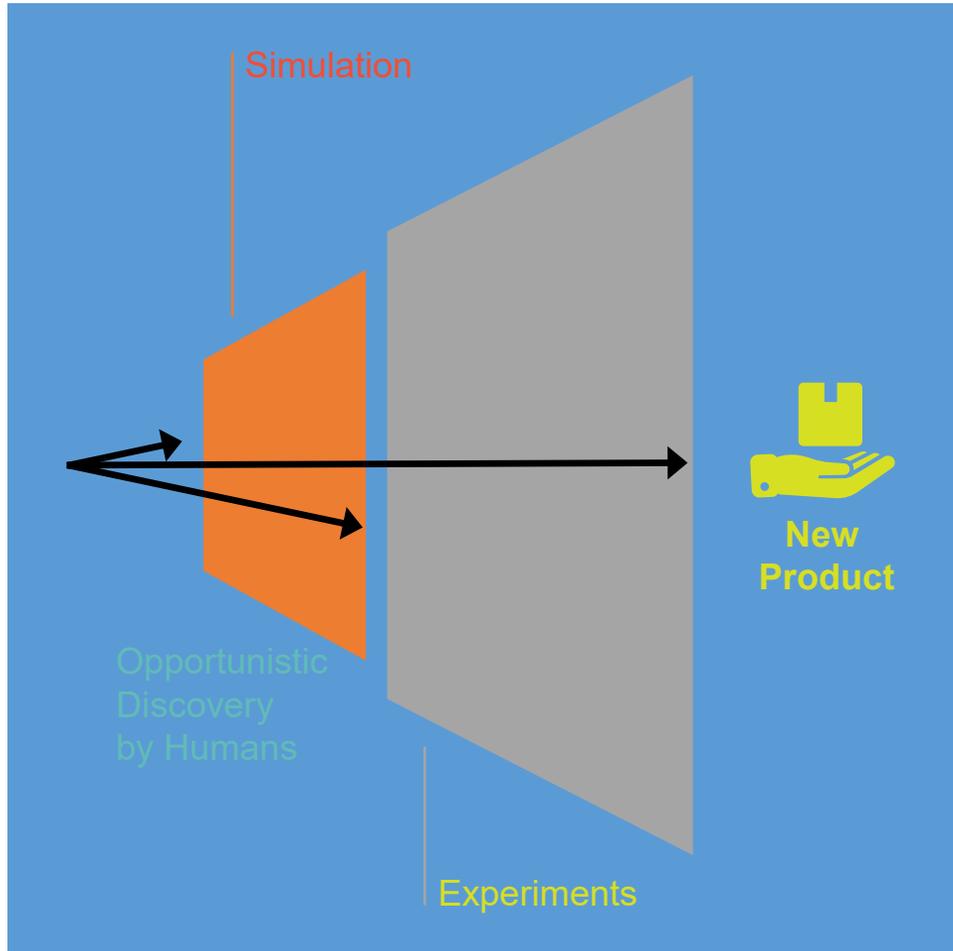


Cognitive Discovery

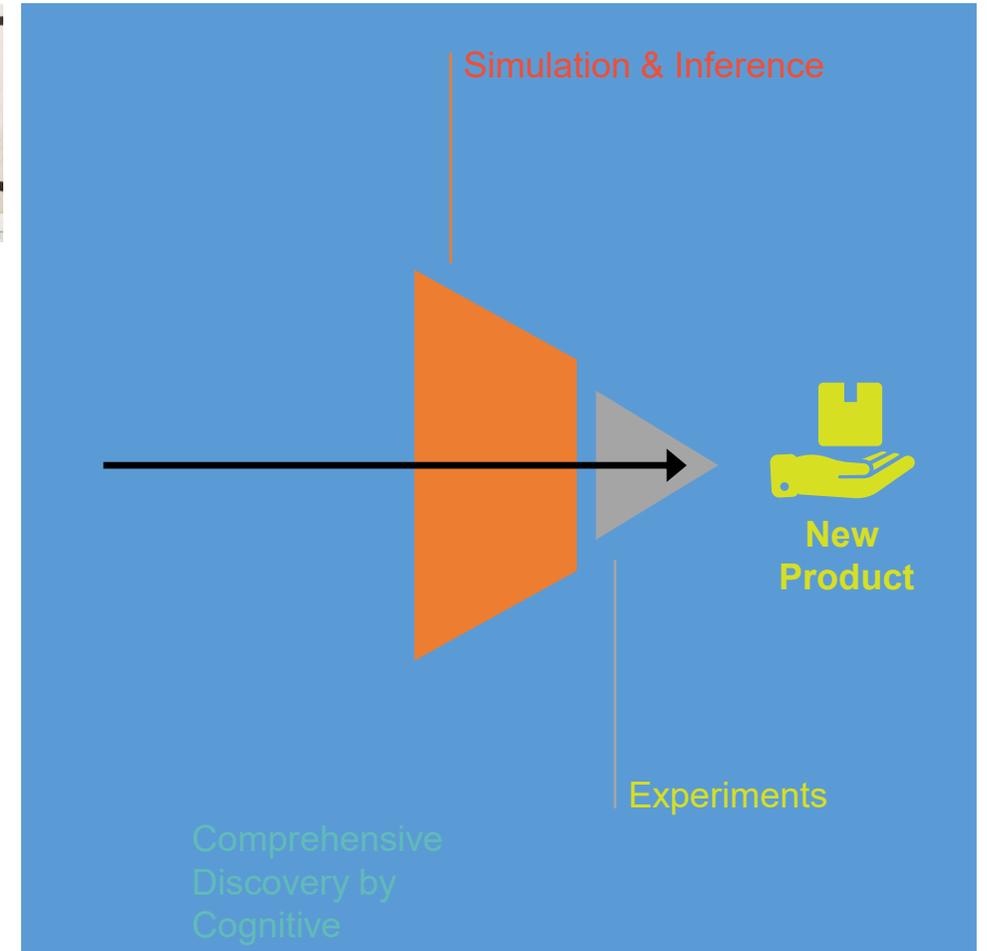


Technical R&D today: Disruption opportunity

Today

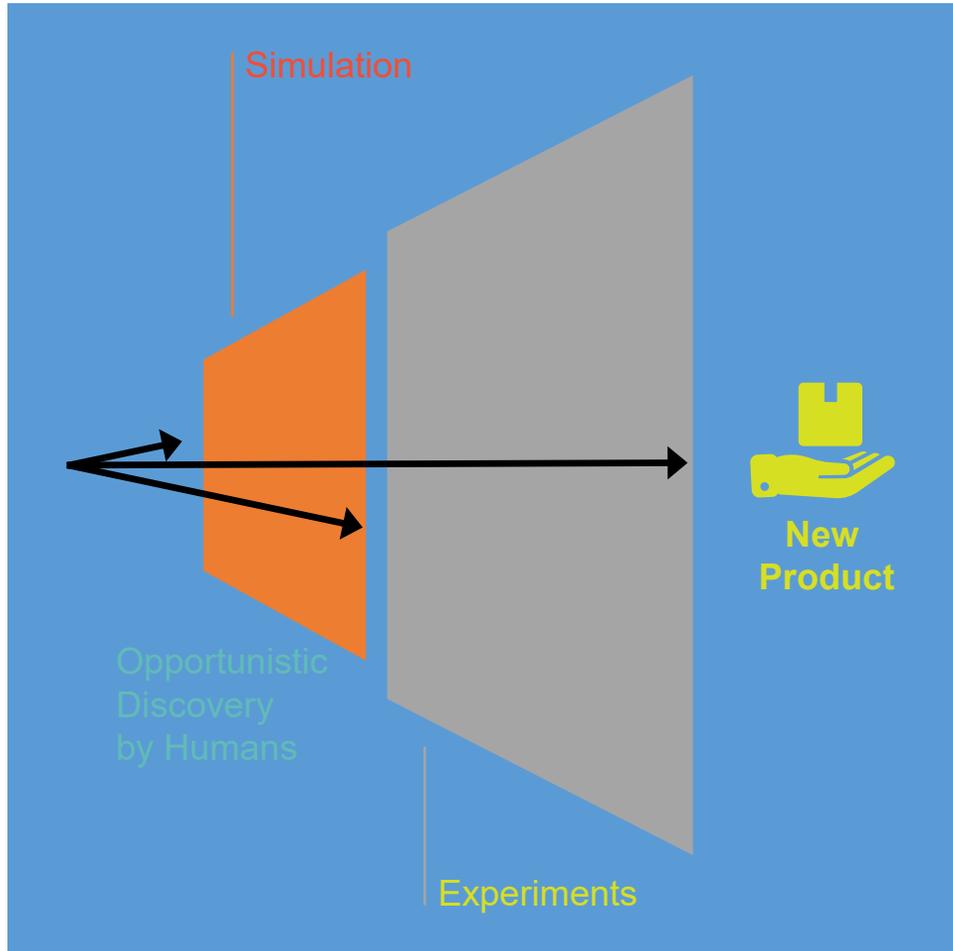


Cognitive Discovery

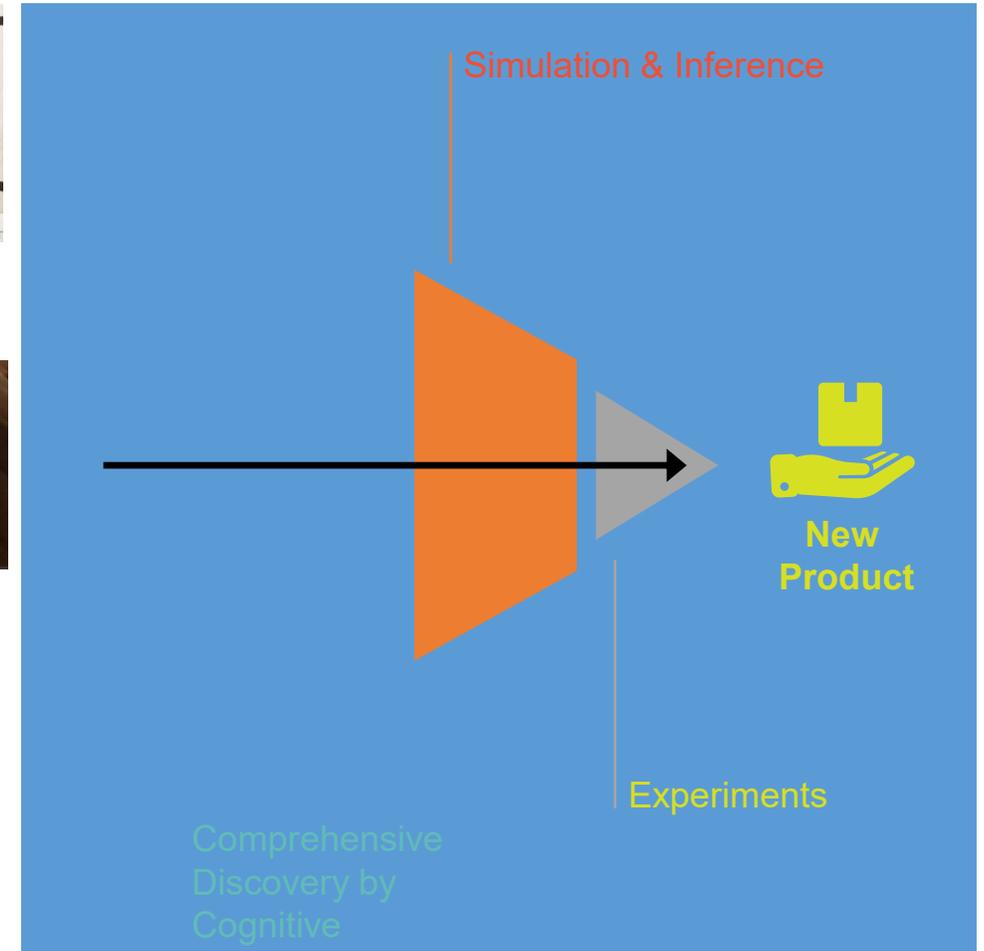


Technical R&D today: Disruption opportunity

Today

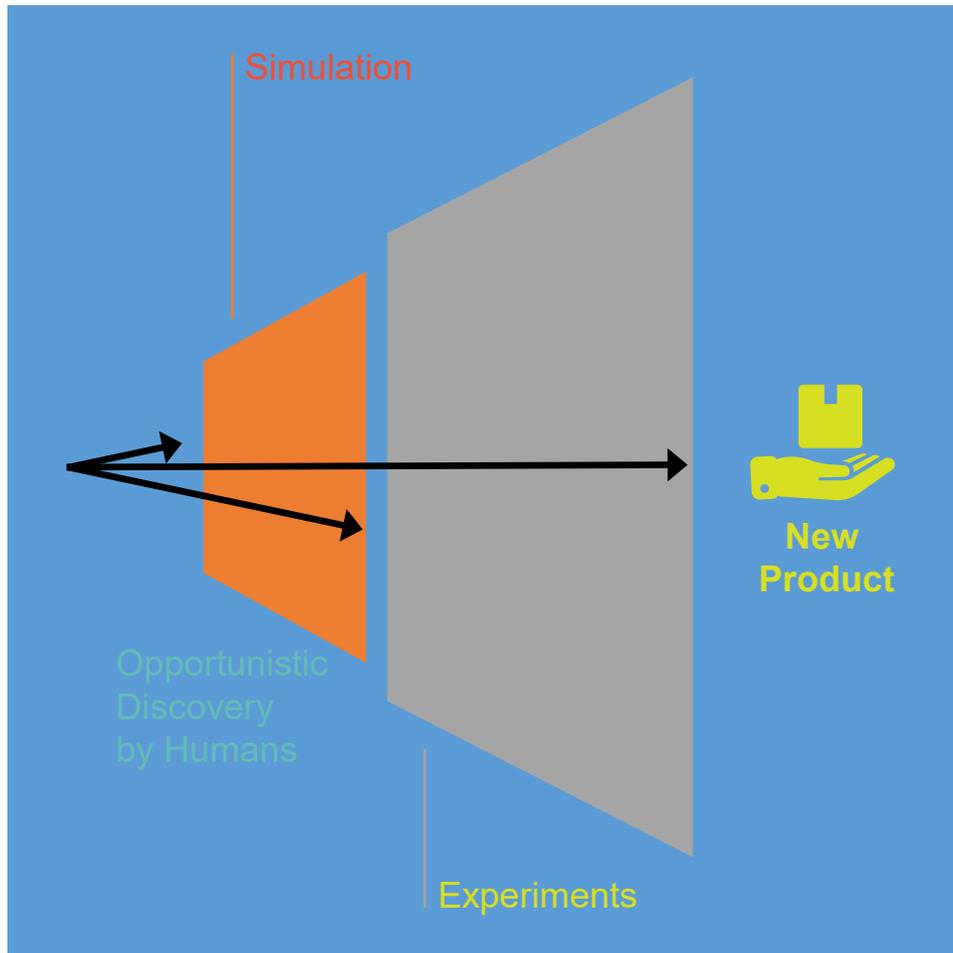


Cognitive Discovery

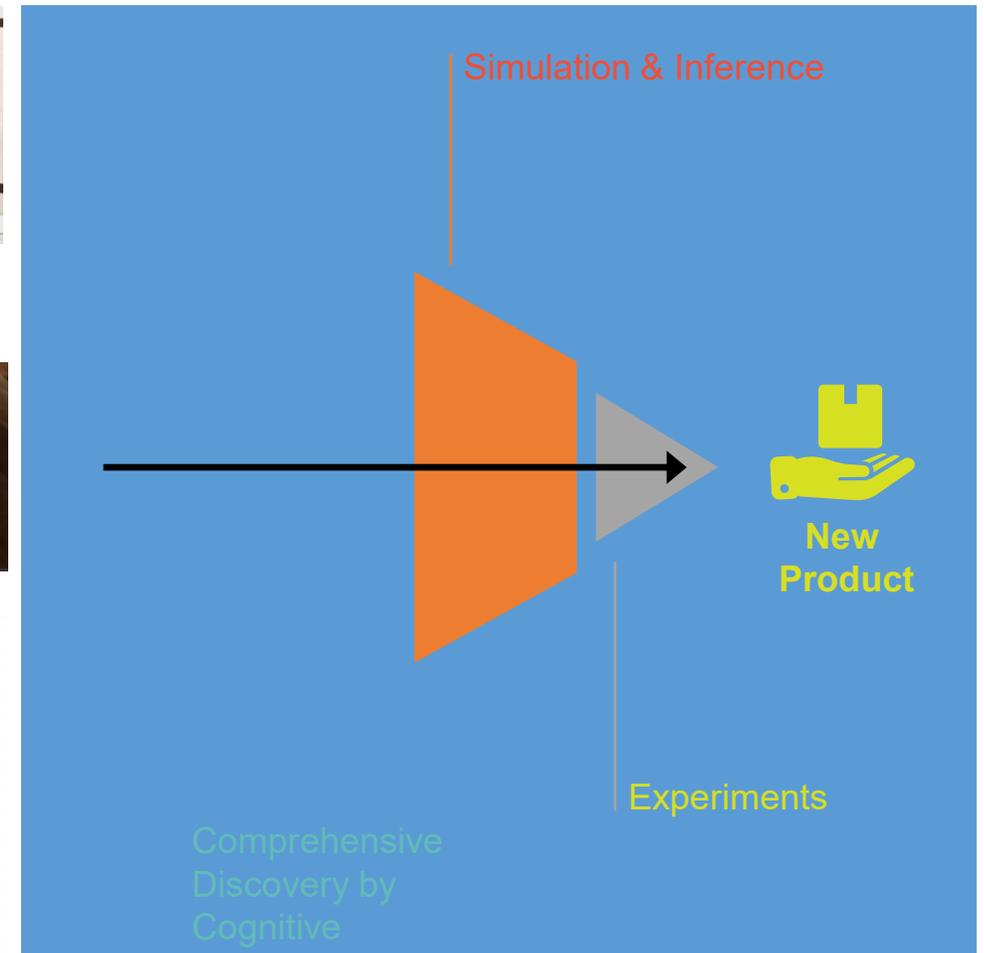


Technical R&D A Disruption opportunity w Augmented intelligence

Today



Cognitive Discovery



Thanks!



Fabrizio Renzi

Director of Research Innovation Technology
IBM Italy



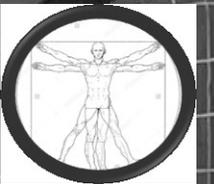
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<https://it.linkedin.com/fabriziorenze>



IBM Italy Research

R&b