ARTIFICIAL INTELLIGENCE (A.I.)

(DANIELE GROTTI)

The Evolution of A.I.

The 1st. Period 1950-1970

Trivial problem solving, no practicality, GOFAI - Good Old Fashioned Artificial Intelligence

1942 The 3 Laws of Robotics by Isaac Asimov. Other sets of laws have been proposed by researchers since then.

1950 **The Turing Test -** proposed by Alan Turing

1952 The first self learning game program

1956 **Dartmouth Conference** First Use of the term "**Artificial Intelligence/A.I.**"

1957 General Problem Solver (GPS) (by Newell)

1958 McCarthy developed **Lisp** programming language

1959 **The MIT AI Lab** (McCarthy and Minsky)

1959 The term "**Machine Learning**" by Samuel

1961 **First Industrial Robot** (Unimate) working at GM

1961 **SAINT** - the first expert system by Slagle (MIT)

1964 **STUDENT** The first A.I. program which understands natural language

1965 **ELIZA -** The first A.I. based chatbot and expert system

1966 **Shakey** - the first locomotive and intelligent robot (SRI)

1966 **MAC HACK-** chess-playing program (by Greenblatt, MIT)

1968 **SHRDLU**, an early natural language understanding computer program

1970 **WABOT-1** the first anthropomorphic robot (Waseda University)

1972 **Prolog** logic programming language

1973 **Lighthill Report** The poor progress report caused the **First A.I. winter** (Reduced funding for AI research)

1974 **MYCIN** - The first rule based AI expert system for medical diagnostics

1974 The first **autonomous vehicle**, a mechanical "slider" (Stanford)

1980 LISP based machines developed and marketed

1980 **INTERNIST-I** The first Commercial Expert System

1986 A **driverless van by Mercedes-Benz**, with cameras and sensors

1988 **Bayesian Network** (BNs or belief nets) is invented by Pearl

1988 The chatbots, Jabberwacky and Cleverbot invented by Carpenter

1989 The first **autonomous vehicle** created by CMU using **neural network**

1993 **Polly**, the tour guide robot; behavior-based robotics (MIT)

The 2nd. Period 1980-2000

Researchers feeding machines with labeled data. Projects: ICOT – Japan '82, MCC – US '83, Alvey – UK '84. Algorithms began to appear as parts of larger systems. AI solutions proved to be useful throughout the technology industry, such as data mining, industrial robotics, logistics, speech recognition, banking software, medical diagnosis and search engines

1997 IBM's Deep Blue beats Gary Kasparov in chess

1998 **Furby** – The first "pet" toy robot for children

1999 **Kismet** - Emotional AI, (MIT AI Lab)

1999 **AIBO** introduced The first AI domestic robot by Sony

2000 ASIMO, humanoid robot released by Honda

2002 Roomba, autonomous robot vacuum is released by i-Robot

2004 The first challenge for autonomous vehicles by DARPA

2004 NASA rovers **Spirit** and **Opportunity** exploring Mars

2005 AI based recommendation engines

2006 "**Machine reading**" unsupervised autonomous understanding of text

2007 **ImageNet** – visual database for object recognition software research

2007 NVIDIA launches **CUDA**, a parallel computing platform and programming interface

2009 Self Driving Car built by Google. By 2014 it passed Nevada's self-driving test.

2009 AI researchers discover **GPU** (Graphics Processing Unit) for DL

2010 Democratize Data Access begins for Image Recognition

2010 Narrative Science's AI demonstrates ability to write reports

2011 Apple released **Siri**

2011 IBM's Watson wins Jeopardy clash

2013 **NEIL** by CMU, a semantic image analyzer ML system

1913 "**Vicarious**" passes first Turing test - CAPTCHA

2014 Microsoft - **Cortana** Amazon – **Alexa**

2015 Google Brain releases **TensorFlow**, ML Library, (TPU)

2015 **Open AI-** open source initiative to develop AI benefit of all humanity

2016 Google released **Google Home**

2016 Google's Deepmind AlphaGo has defeated Go's No1. champion

2016 NVIDIA announces supercomputer for DL and AI

The 3rd. Period 2010-

The age of machine learning. Computers acquire knowledge from data, not humans. Large tech companies invest in commercial applications of AI/ML.

2016 **Sophia** humanoid robot by Hanson Robotics, the first "robot citizen"

2016 **PyTorch** Open source ML Library

2017 The Facebook AI Research Lab trained two chatbots to communicate with each other in order to learn how to negotiate. The chatbots diverged from human language and invented their own language to communicate with one another

2017 **Caffe** Open source DL framework

2018 **BERT** (Google), the first bidirectional, unsupervised language representation

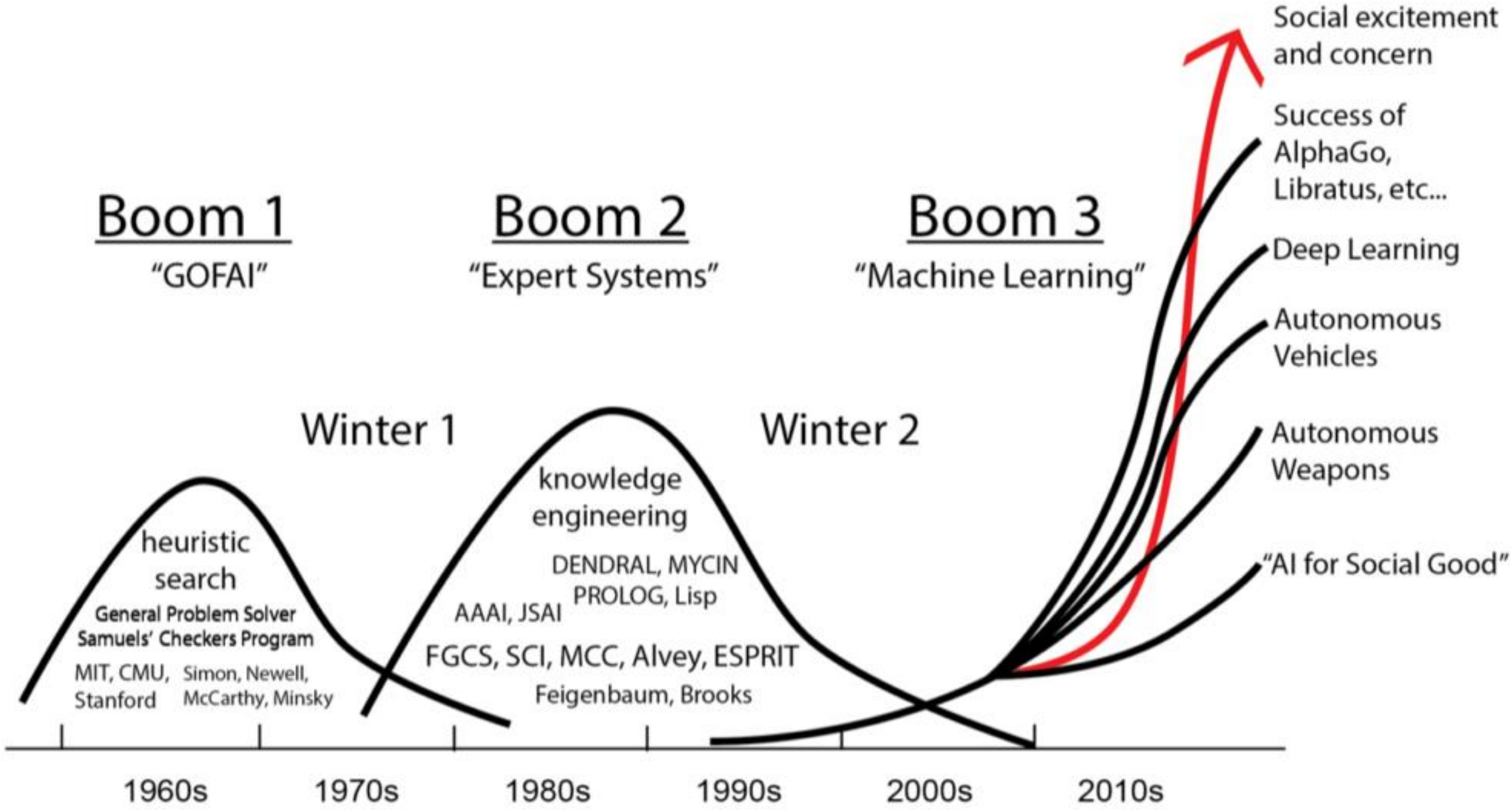
2018 Samsung introduces **Bixby**

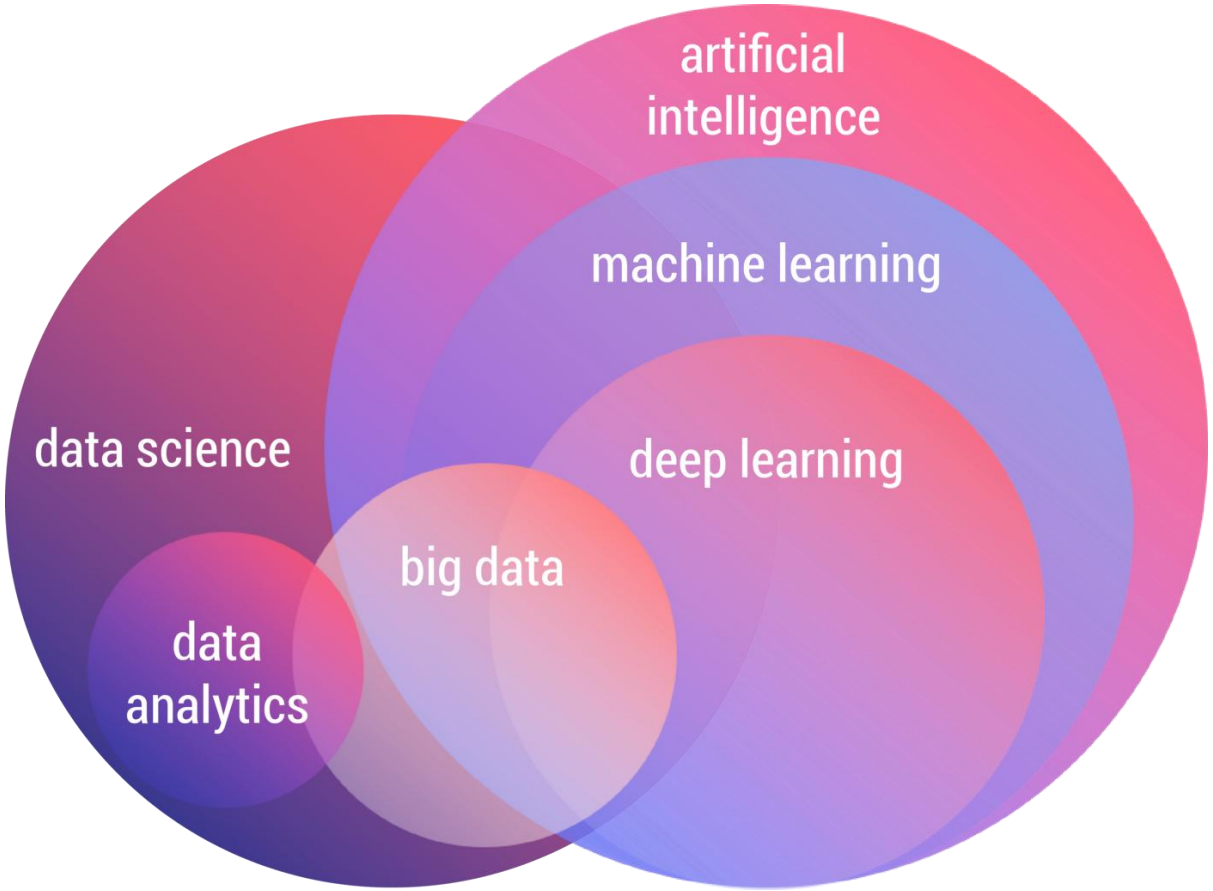
2018 Facebook detects faces and shares photos with friends to whom those photos belong

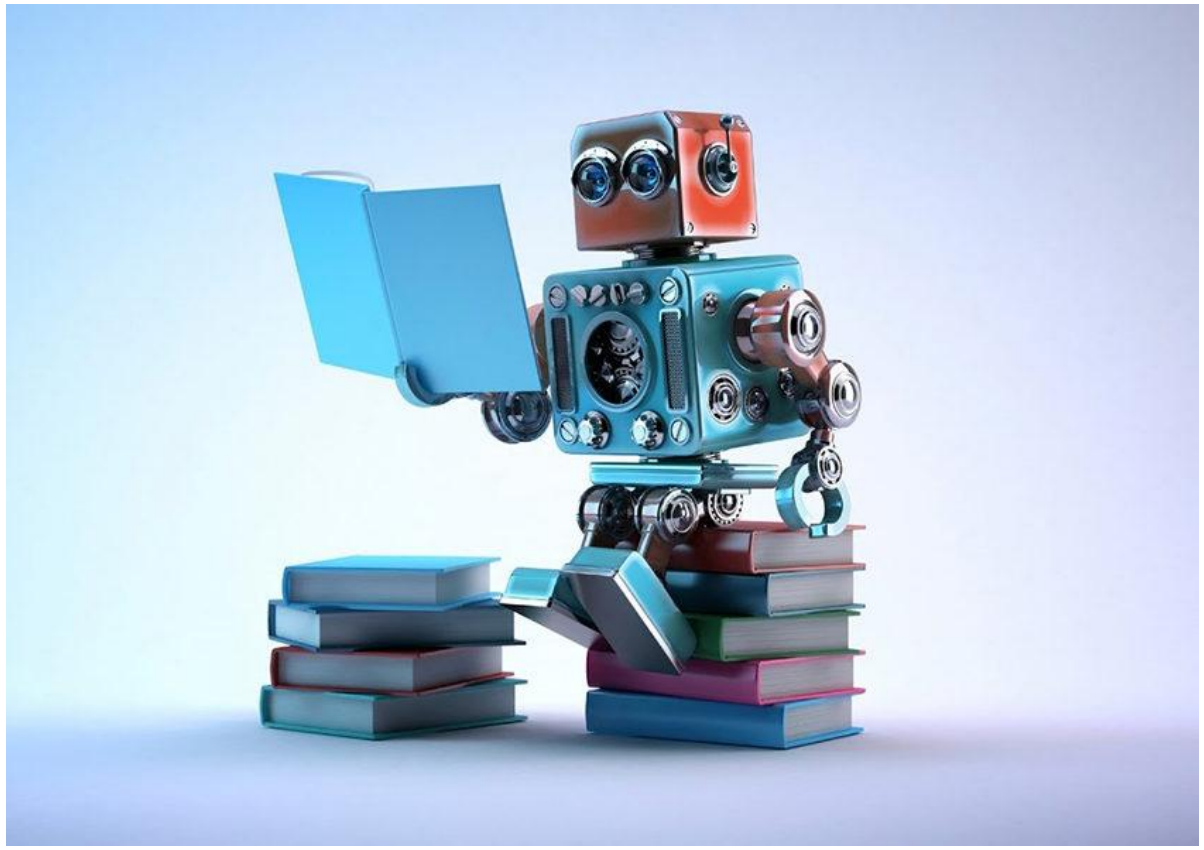
2018 Alibaba language processing AI outscored human intellect at a Stanford reading and comprehension test

2020 DeepMind team uses DL algorithms (Agent57) that outperforms humans at Atari games with deep reinforcement learning

2020 Widespread **5G** network deployments worldwide


Boom 1
"GOFAI"
Boom 2
"Expert Systems"
Boom 3
"Machine Learning"
Winter 1
Winter 2
heuristic search
General Problem Solver
Samuels' Checkers Program
MIT, CMU, Stanford
Simon, Newell, McCarthy, Minsky
knowledge engineering
DENDRAL, MYCIN
PROLOG, Lisp
AAAI, JSAI
FGCS, SCI, MCC, Alvey, ESPRIT
Feigenbaum, Brooks
Social excitement and concern
Success of AlphaGo, Libratus, etc...
Deep Learning
Autonomous Vehicles
Autonomous Weapons
"AI for Social Good"
1960s
1970s
1980s
1990s
2000s
2010s


artificial intelligence
machine learning
data science
deep learning
big data
data analytics



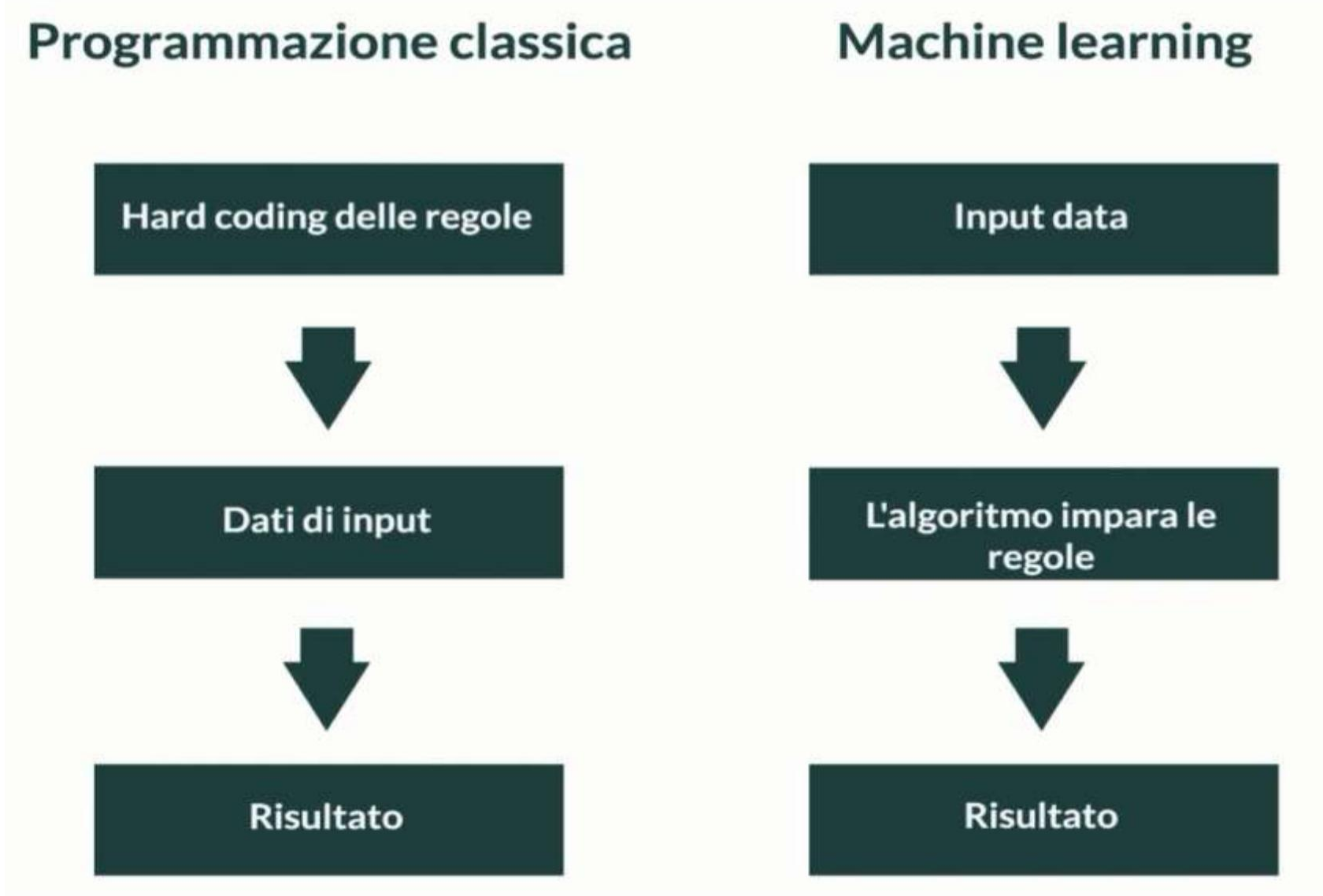
Cosa e' il machine learning

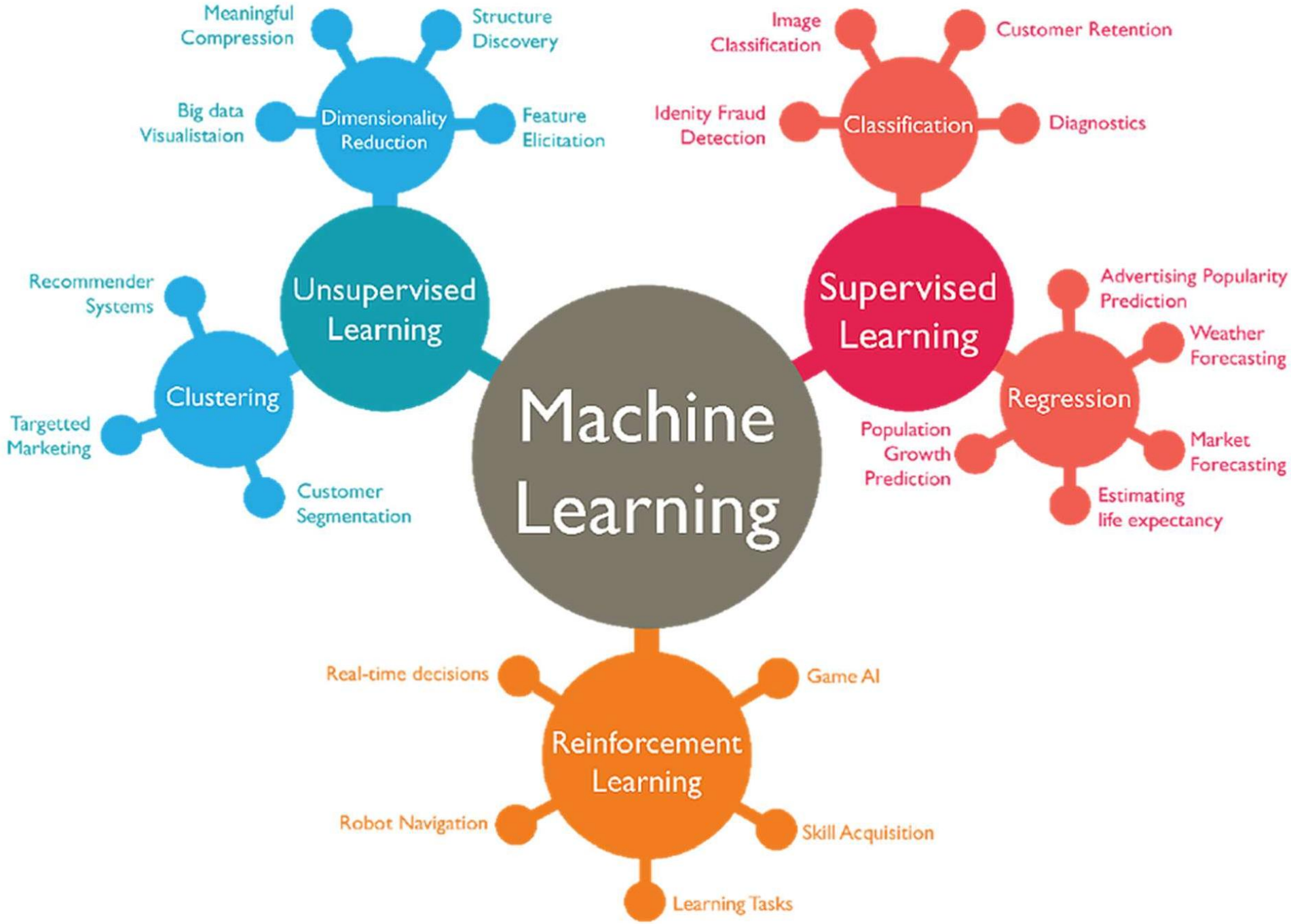
"E' il settore dell'intelligenza artificiale che studia come dare ai computer l'abilità di imparare senza essere esplicitamente programmati" - 1959

ARTHUR SAMUEL

Pioniere dell'AI

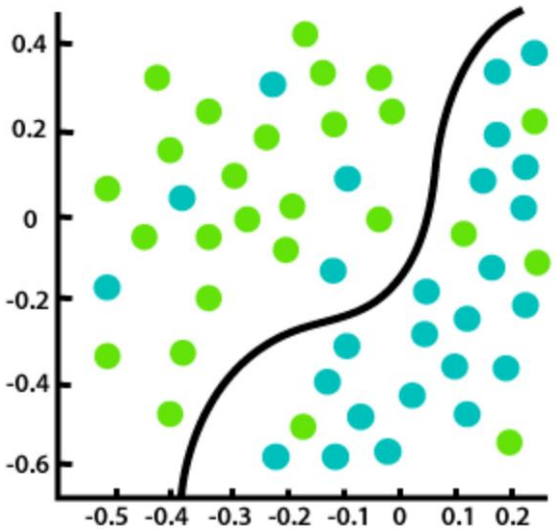
Inventore del termine "Machine learning"


Programmazione classica
Hard coding delle regole
Dati di input
Risultato
Machine learning
Input data
L'algoritmo impara le regole
Risultato

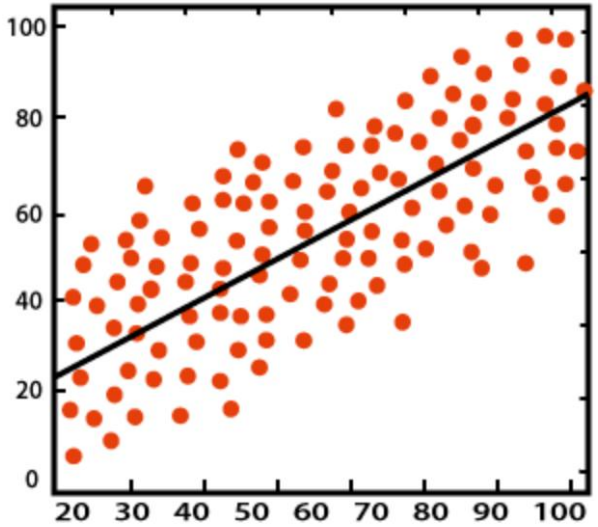

Machine Learning
Unsupervised Learning
Dimensionality Reduction
Meaningful Compression
Structure Discovery
Big data Visualistaion
Feature Elicitation
Clustering
Recommender Systems
Targetted Marketing
Customer Segmentation
Supervised Learning
Classification
Image Classification
Customer Retention
Idenity Fraud Detection
Diagnostics
Regression
Advertising Popularity Prediction
Weather Forecasting
Population Growth Prediction
Market Forecasting
Estimating life expectancy
Reinforcement Learning
Real-time decisions
Game AI
Robot Navigation
Skill Acquisition
Learning Tasks

SUPERVISIONATO

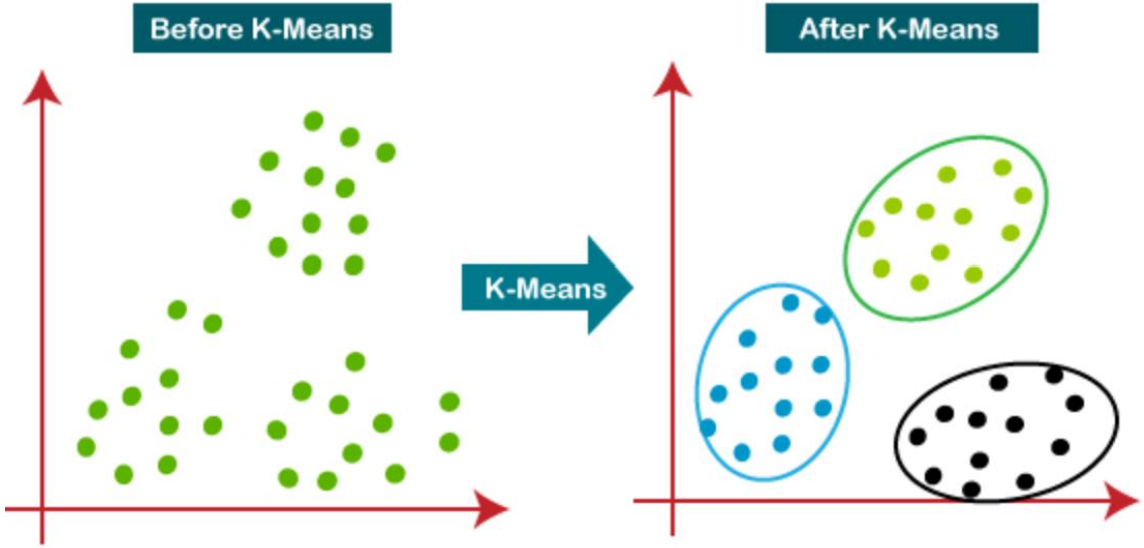
Classification



Regression



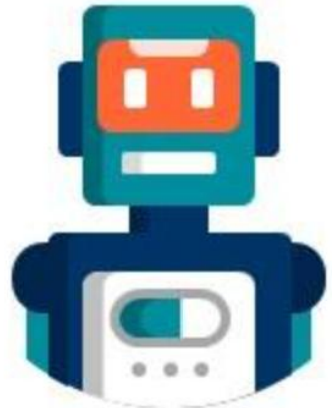
NON SUPERVISIONATO



MACHINE LEARNING

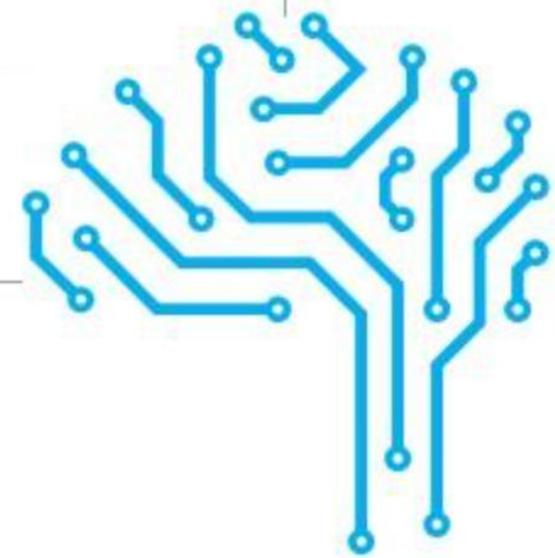
INPUT DATA

Information *(+ Answers)*



OUTPUT

optimum Model



Relationships | ***Patterns***

Dependencies | ***Hidden Structures***

Algorithms + Techniques

PERCHE' OGGI ?

MAGGIORE POTENZA DI CALCOLO DISPONIBILE

DISPONIBILITA' DI ENORMI QUANTITA' DI DATI

Energy, Feedstock & Utilities

- *Power usage analytics*
- *Seismic data processing*
- *Smart grid management*
- *Energy demand & supply optimization*

Manufacturing

- *Predictive maintenance or condition monitoring*
- *Demand forecasting*
- *Process optimization*
- *Telematics*

Financial Services

- *Risk analytics & regulation*
- *Customer segmentation*
- *Your text here*
- *Credit worthiness evaluation*

Retail

- *Predictive inventory planning*
- *Recommendation engines*
- *Your text here*
- *Customer RoI & lifetime value*

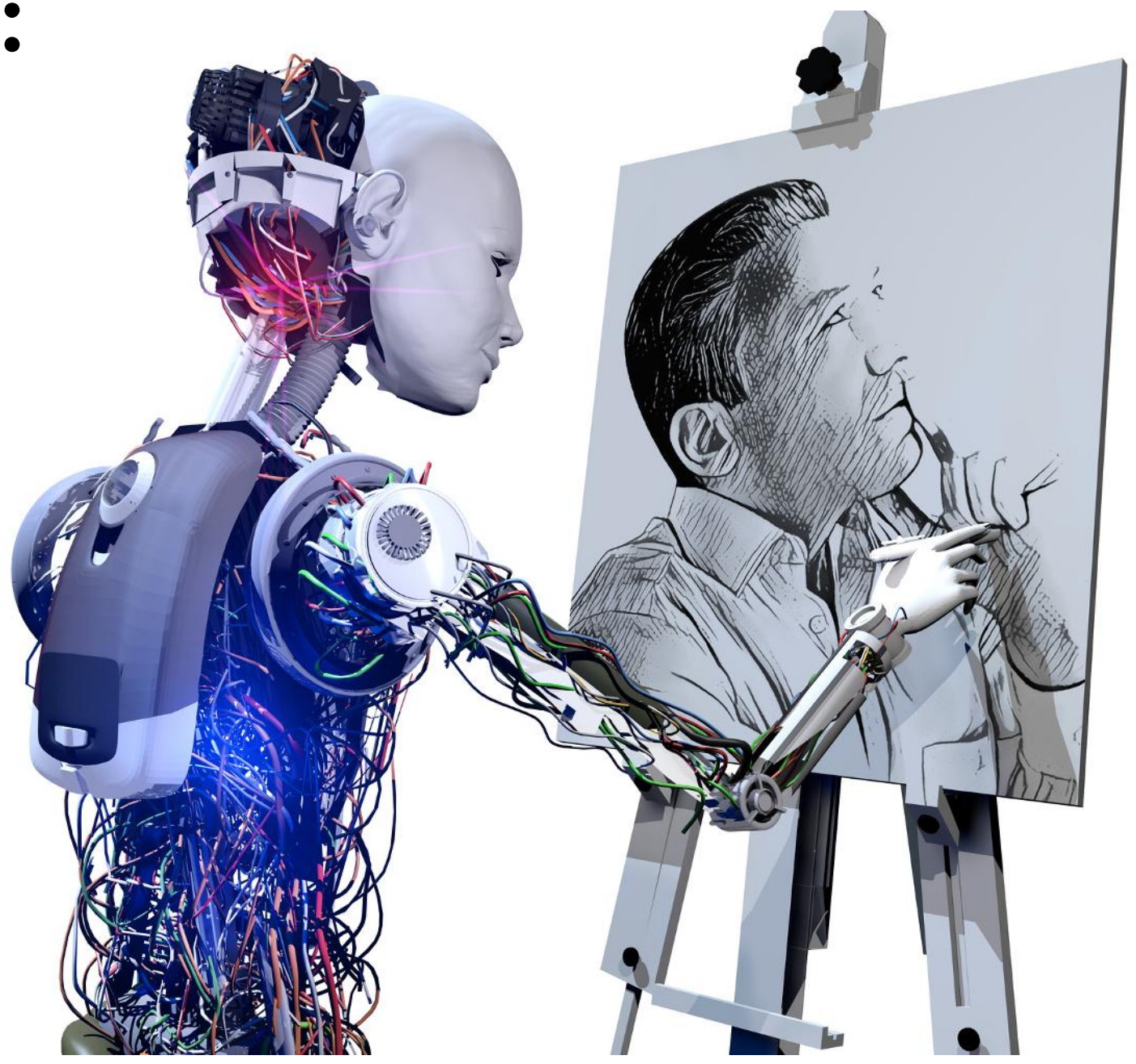
Travel & Hospitality

- *Aircraft scheduling*
- *Dynamic pricing*
- *Your text here*
- *Traffic patterns & congestion management*

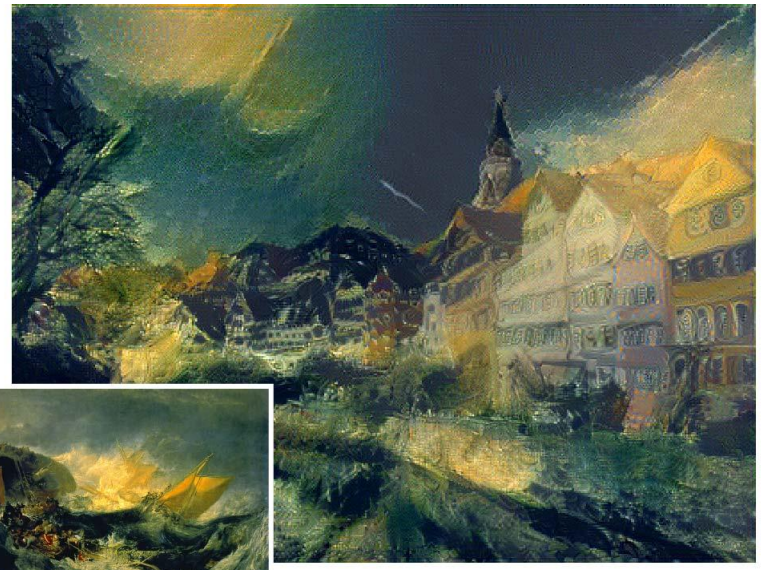
Healthcare & Life Sciences

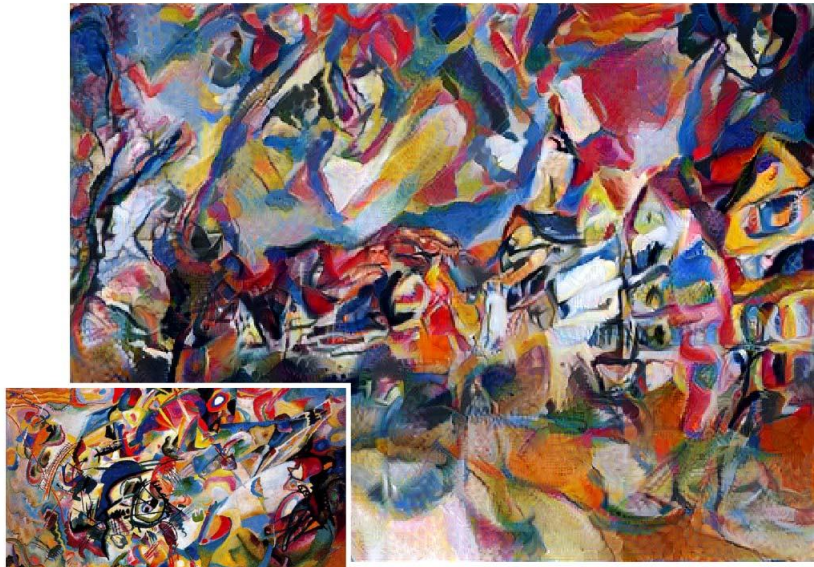
- *Alerts & diagnostics from real-time patient data*
- *Your text here*
- *Proactive health management*
- *Healthcare provider sentiment analysis*

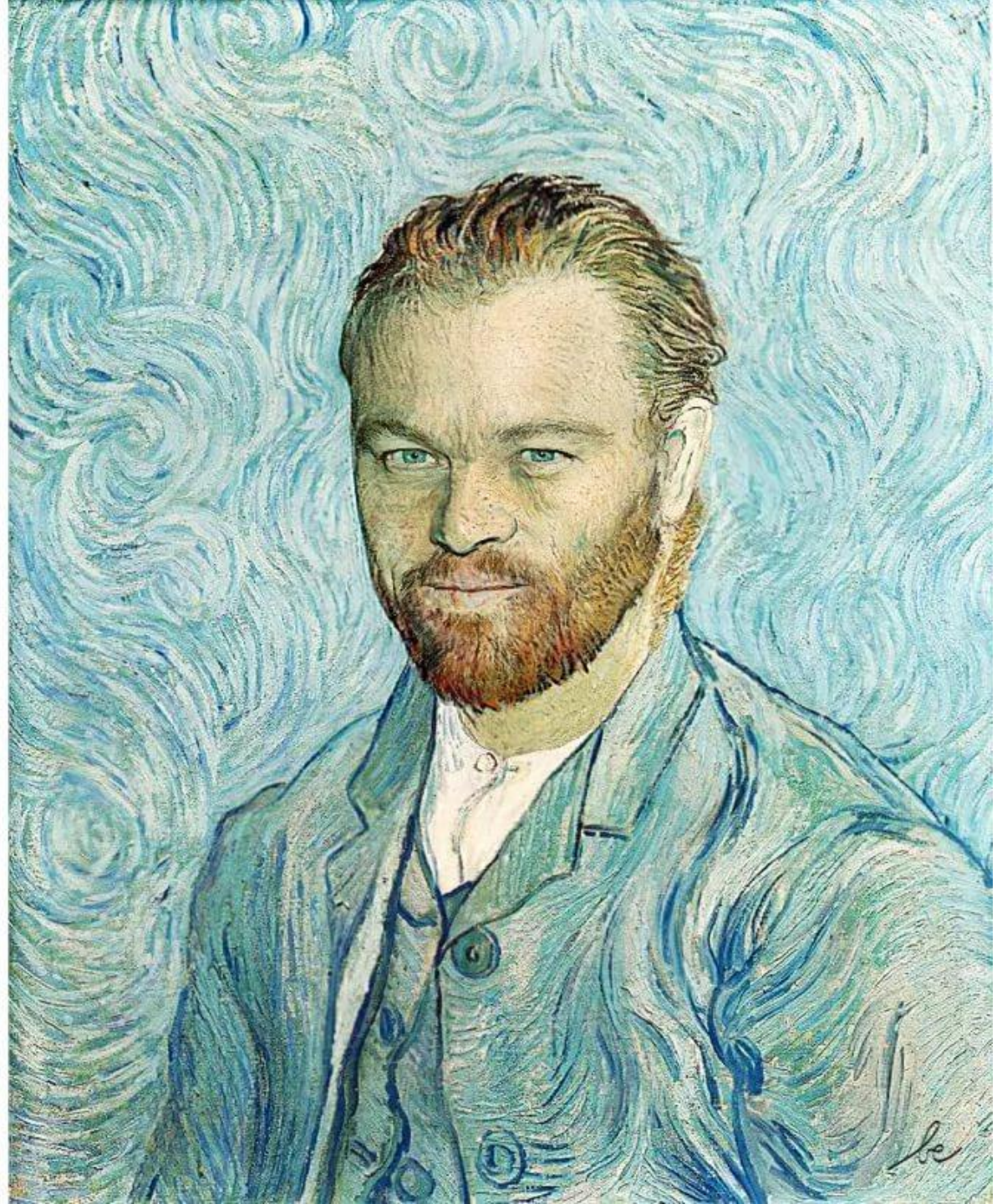
AI FOR ARTS:

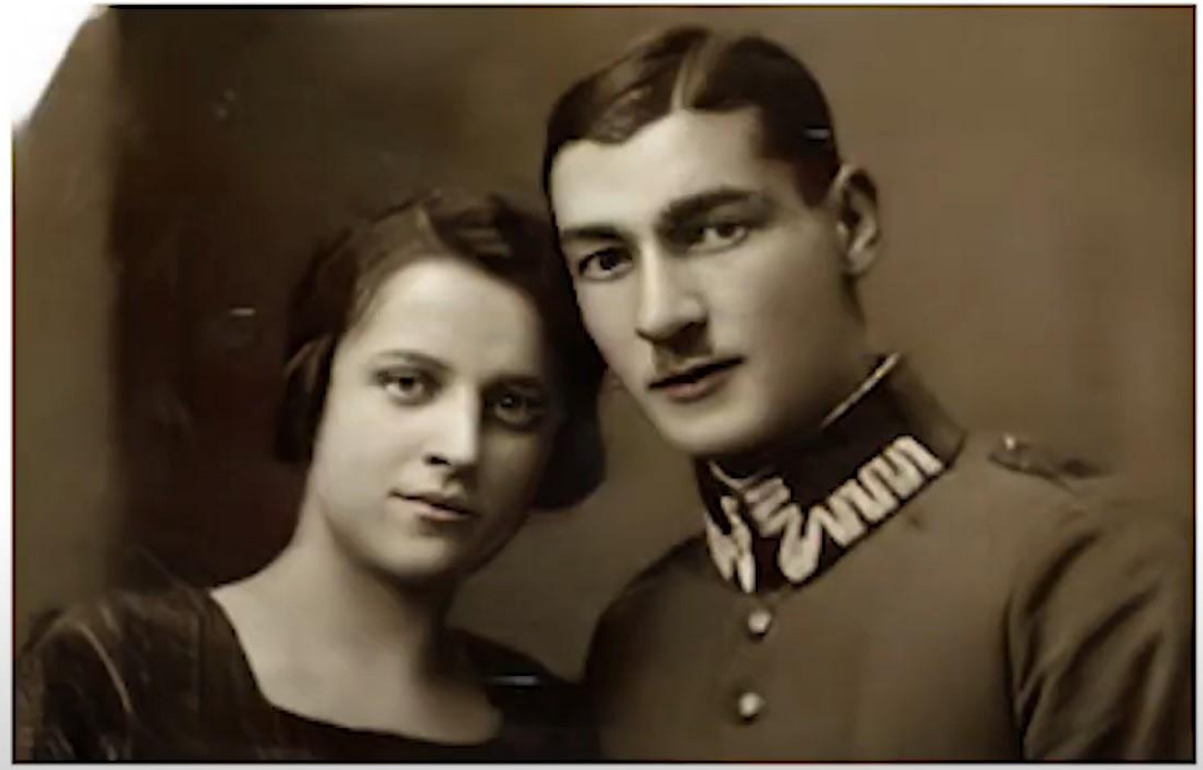


STYLE TRANSFER

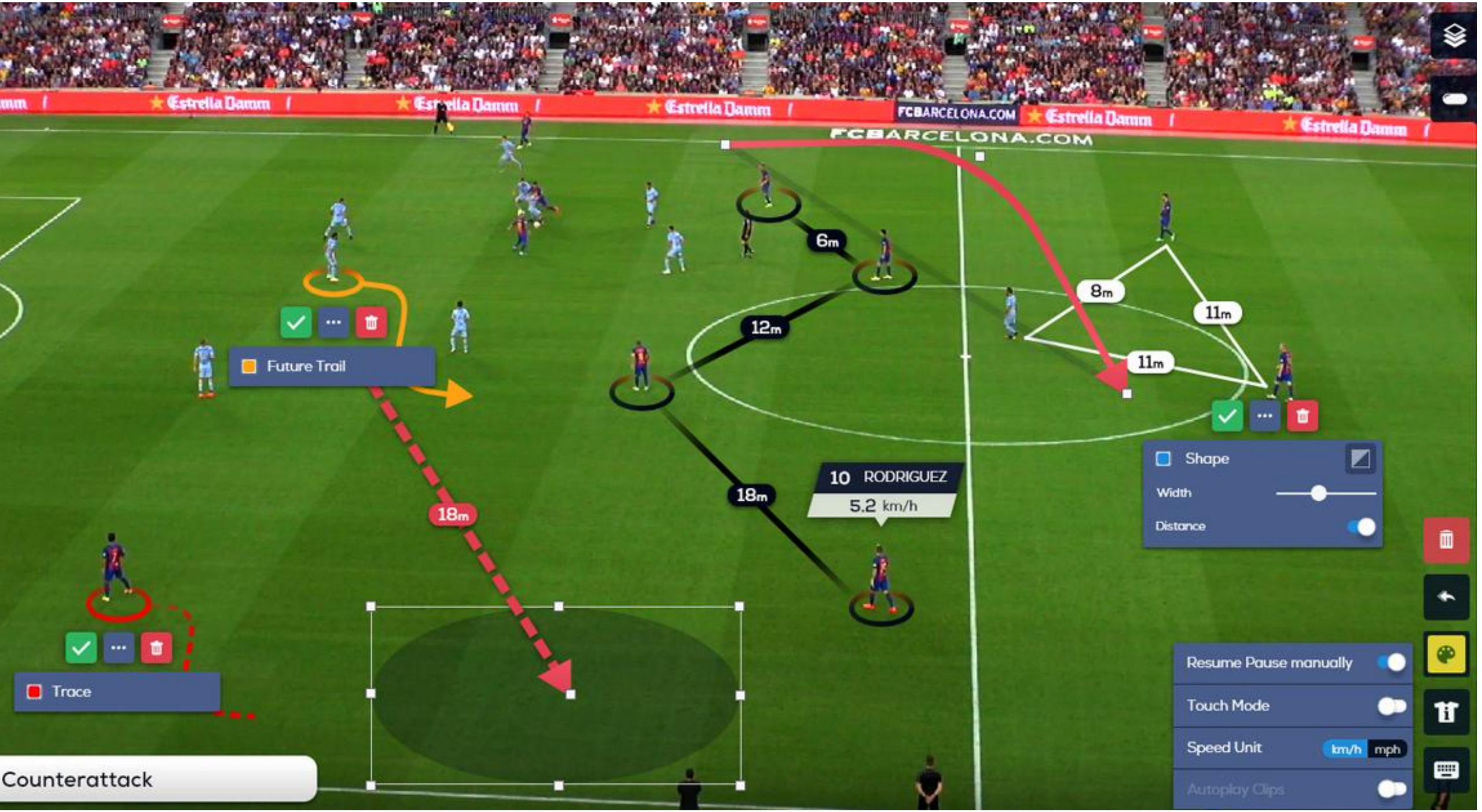


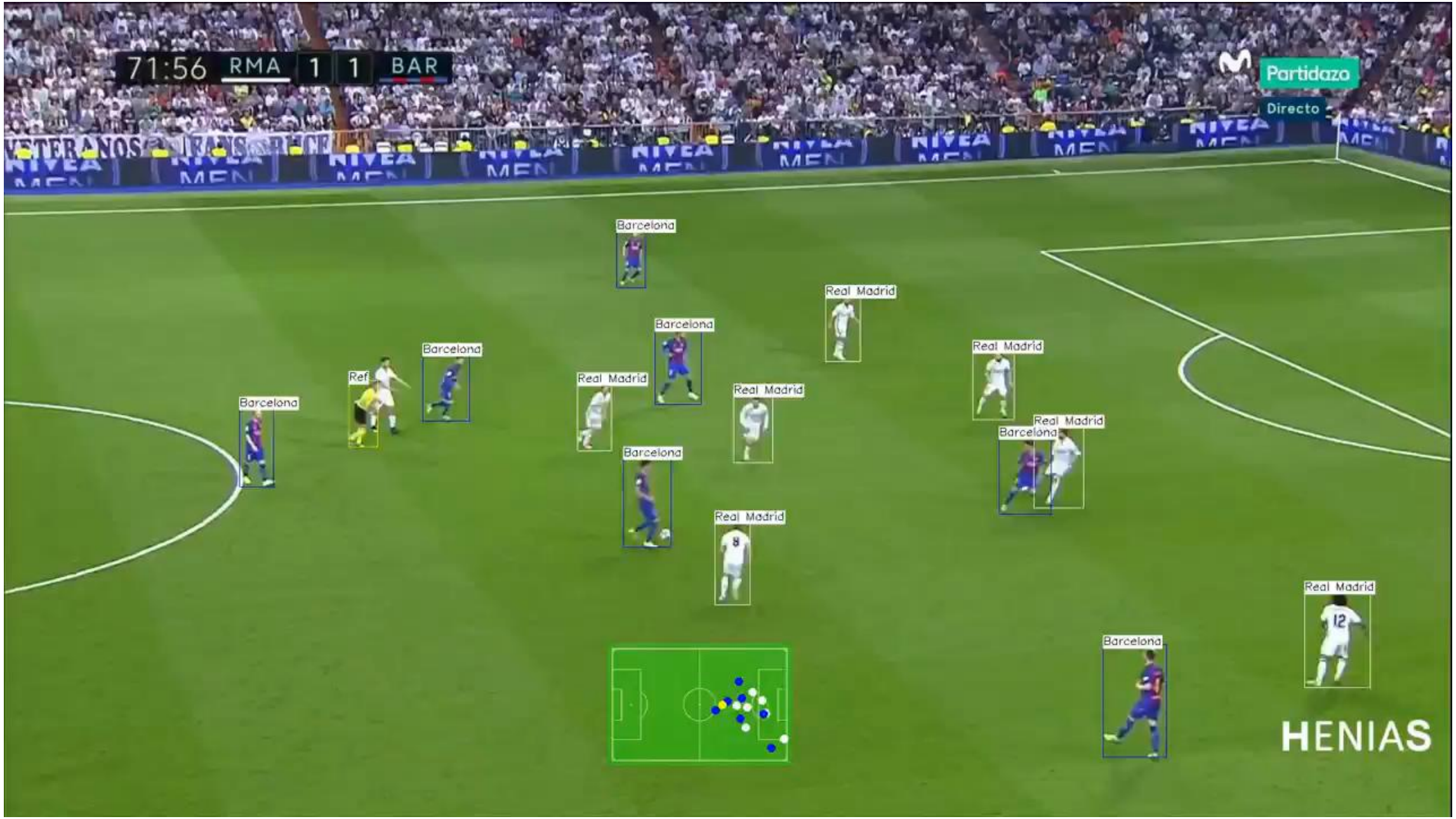






AI FOR SPORT:


Estrella Damm
FCBARCELONA.COM
6m
12m
18m
8m
11m
11m
Future Trail
10 RODRIGUEZ
5.2 km/h
Shape
Width
Distance
Trace
Counterattack
Resume Pause manually
Touch Mode
Speed Unit
km/h
mph
Autoplay Clips


71:56 RMA 1 1 BAR
Partidazo
Directo
Barcelona
Real Madrid
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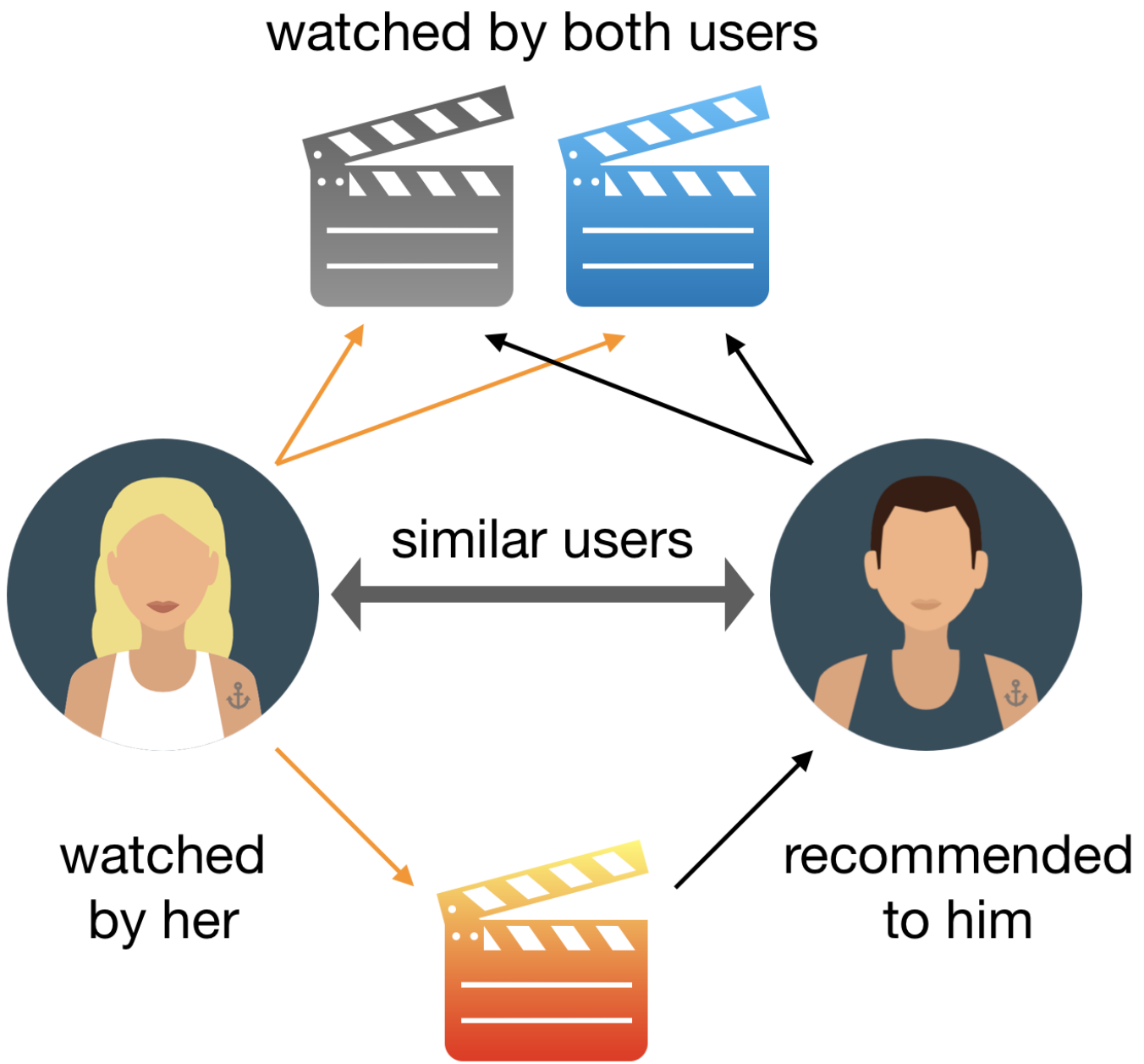
Barcelona
HENIAS

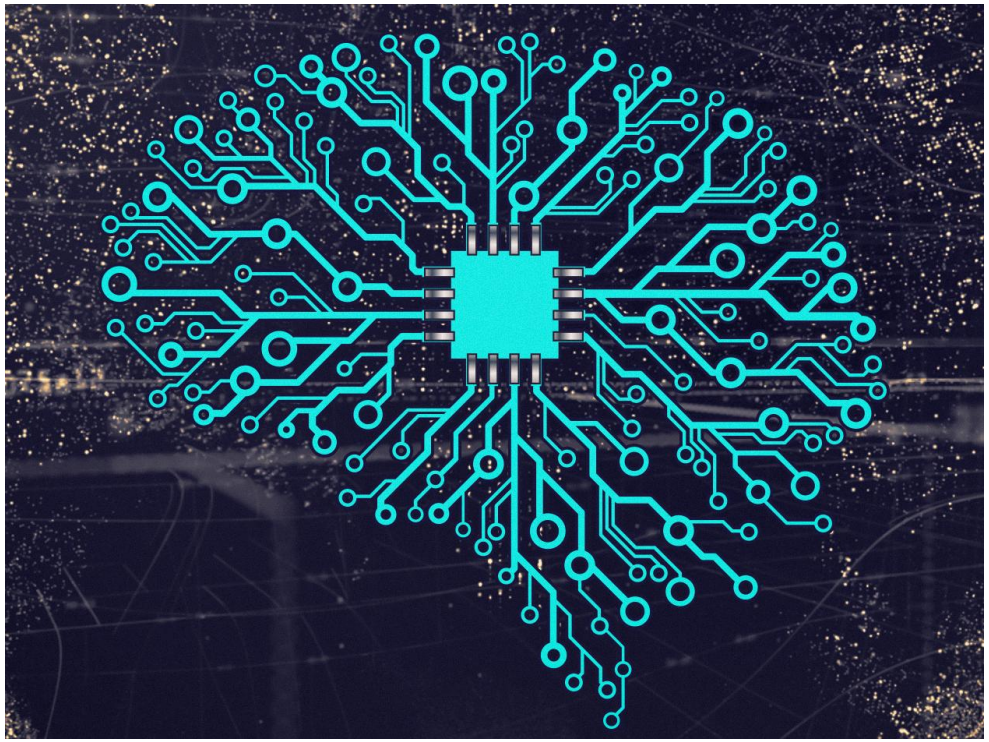
AI FOR RETAIL:

E-COMMERCE
DROP SHIPPING

RECOMMENDER SYSTEM



AI FOR COMPUTER VISION:



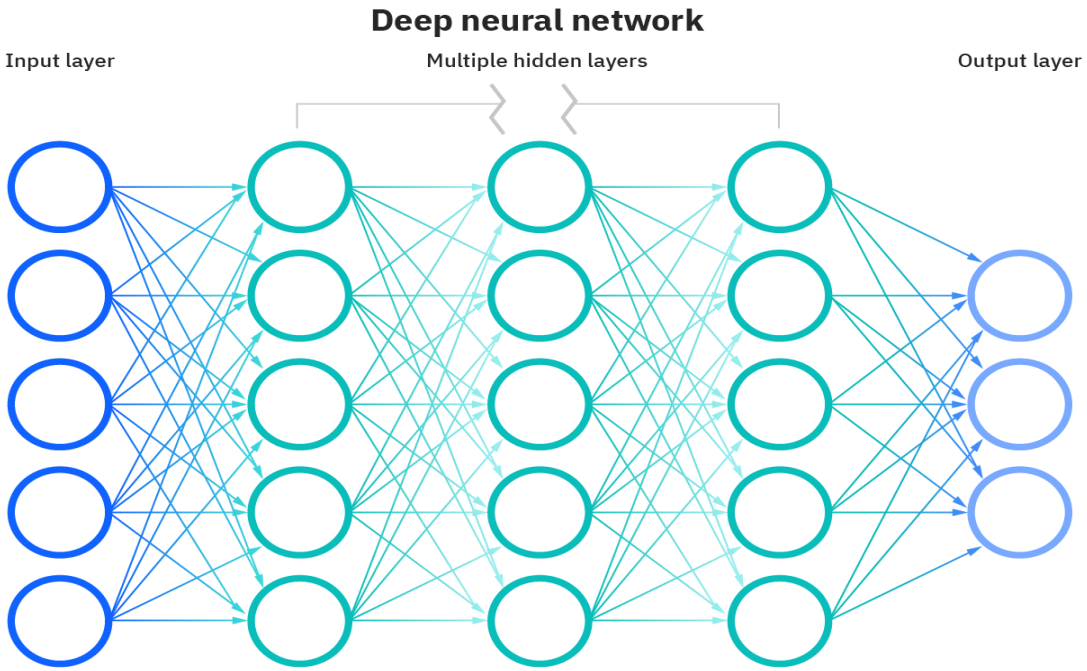
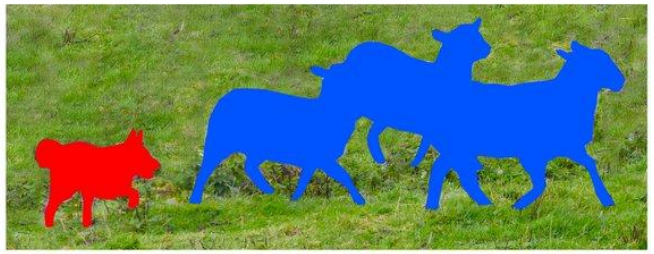
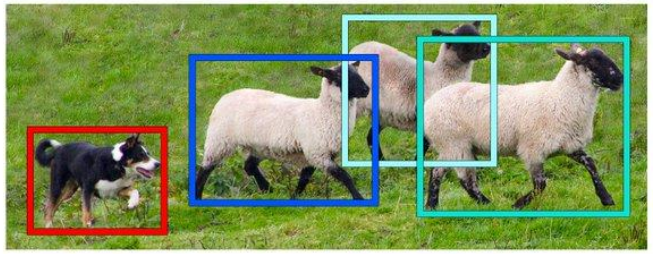


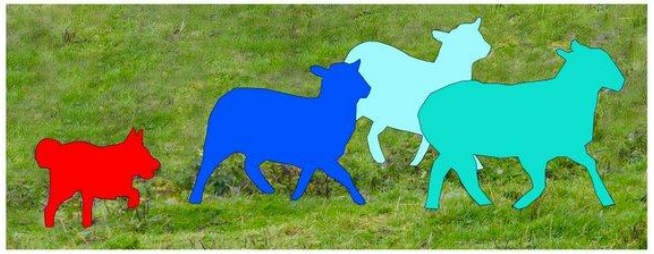
Image Recognition



Semantic Segmentation



Object Detection



Instance Segmentation

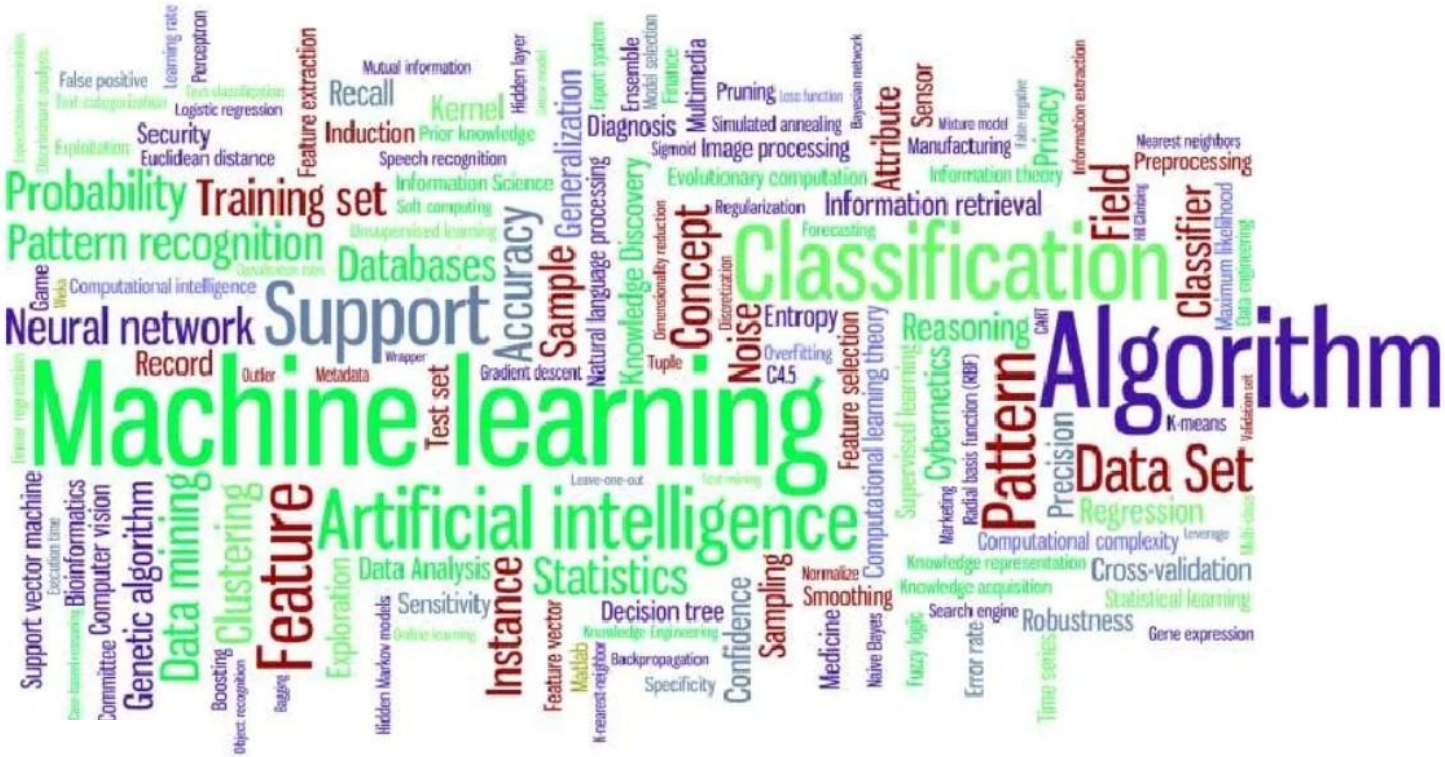
a man wearing a white shirt and blue shorts riding a surfboard

a yellowish surfboard carrying a man with long brown hair


sky
tree
person 99%
person 100%
backpack 90%
person 67%
91%
person 69%
person 56%
person 93%
person 99%
person 74%
person 97%
person 99%
person 69%
bicycle 91%
bicycle 62%
person 100%
bottle 77%
bicycle 98%
bicycle 96%
road


SELF DRIVING
MODE
40

AI FOR NATURAL LANGUAGE:



COME FUNZIONA
GOOGLE TRADUTTORE

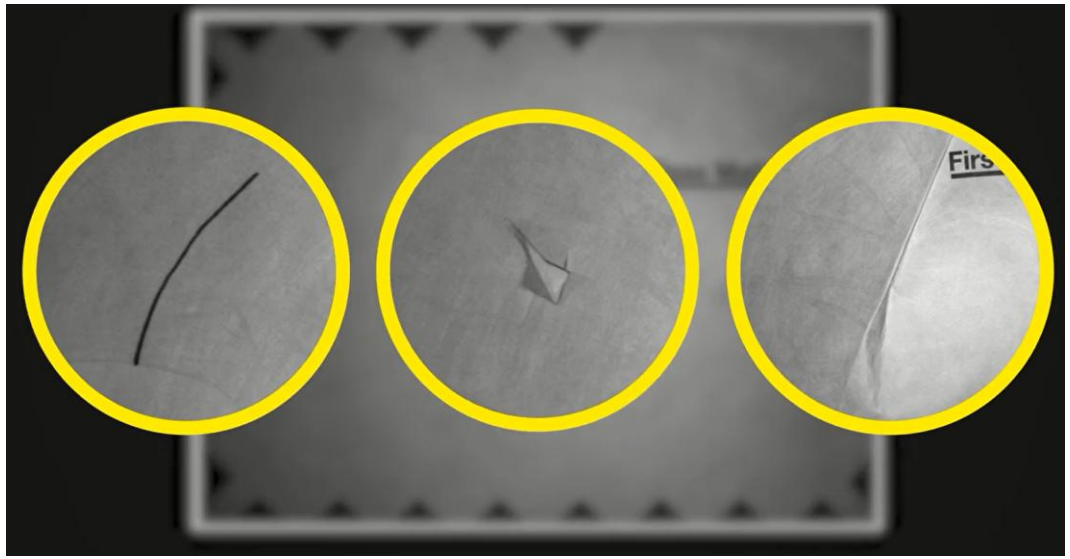
Google Translate

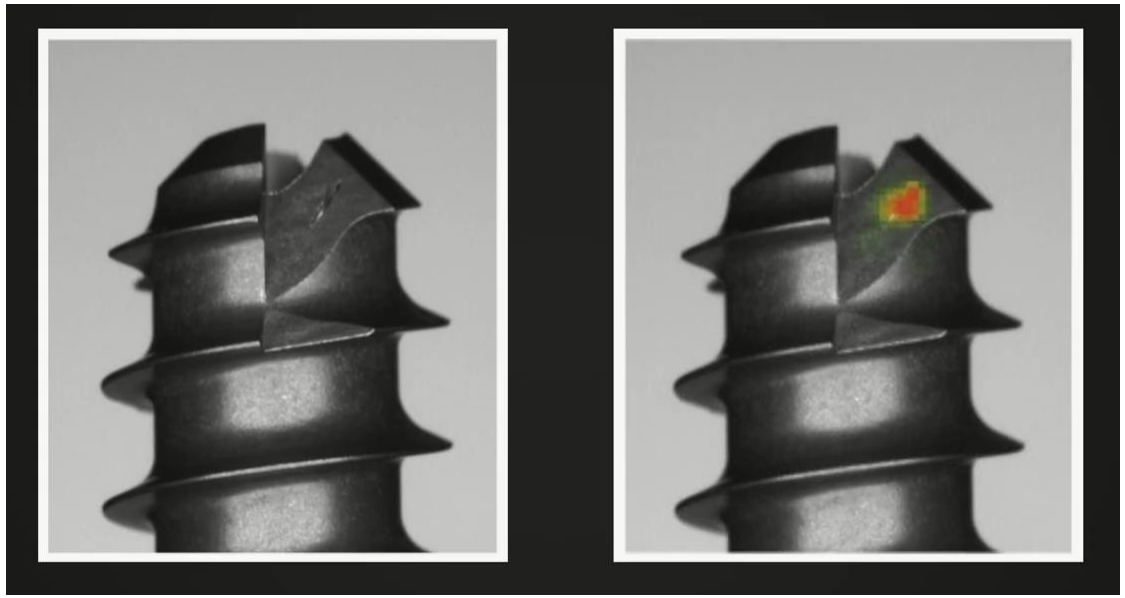

Powered by Synthesia

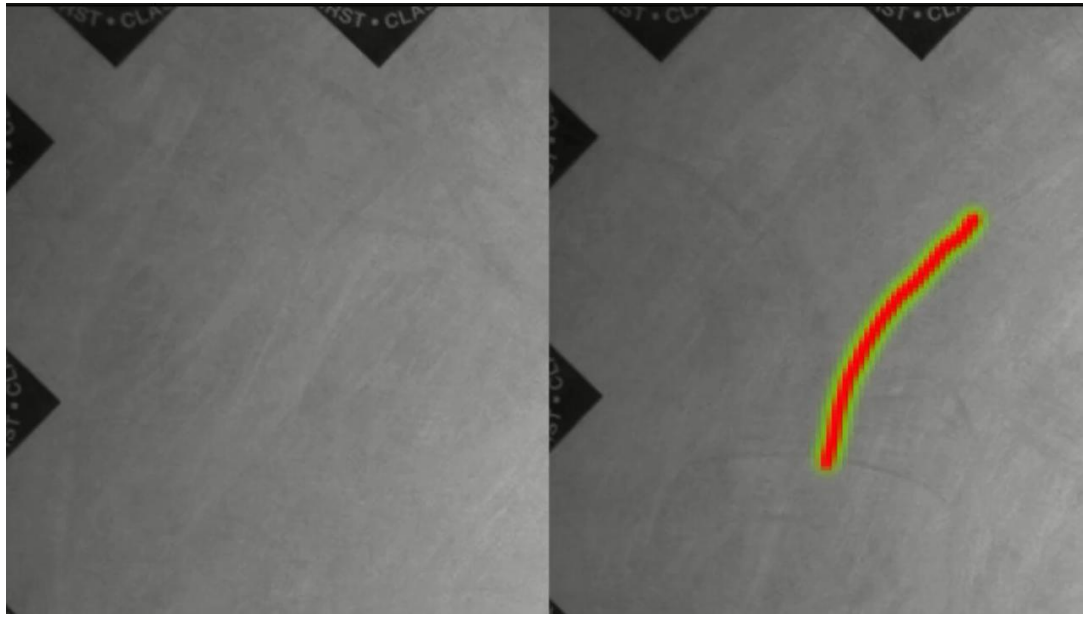
AI FOR INDUSTRY 4.0:


KUKA

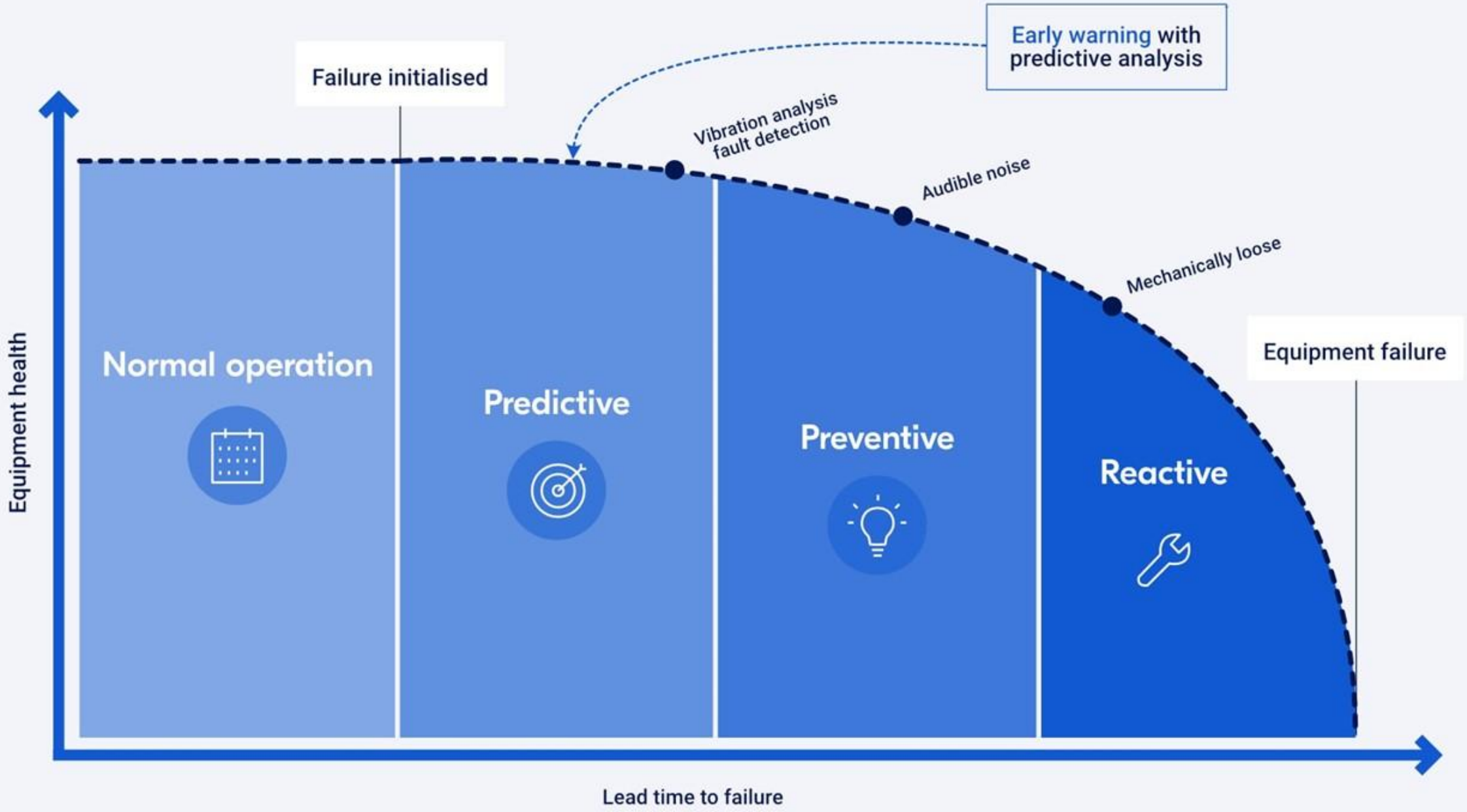
Anomaly Detection







Predictive maintenance



AI FOR SECURITY:

ACI Proactive Risk Manager™

Financial Crime Management

ACI ReD Shield®

Merchant Fraud Protection

UP PAYMENTS RISK MANAGEMENT®

1. PASSWORD PROTECTION & AUTHENTICATION

AI is helping developers make biometric authentication even more accurate.

2. PHISHING DETECTION & PREVENTION CONTROL

AI & ML can be used to detect, track, react to & resolve phishing issues much more quickly than humans can.

3. VULNERABILITY MANAGEMENT

Systems based on AI & ML are proactive instead of reactive.

4. NETWORK SECURITY

AI is expediting the creation of security policies & determining organizations' network topographies.

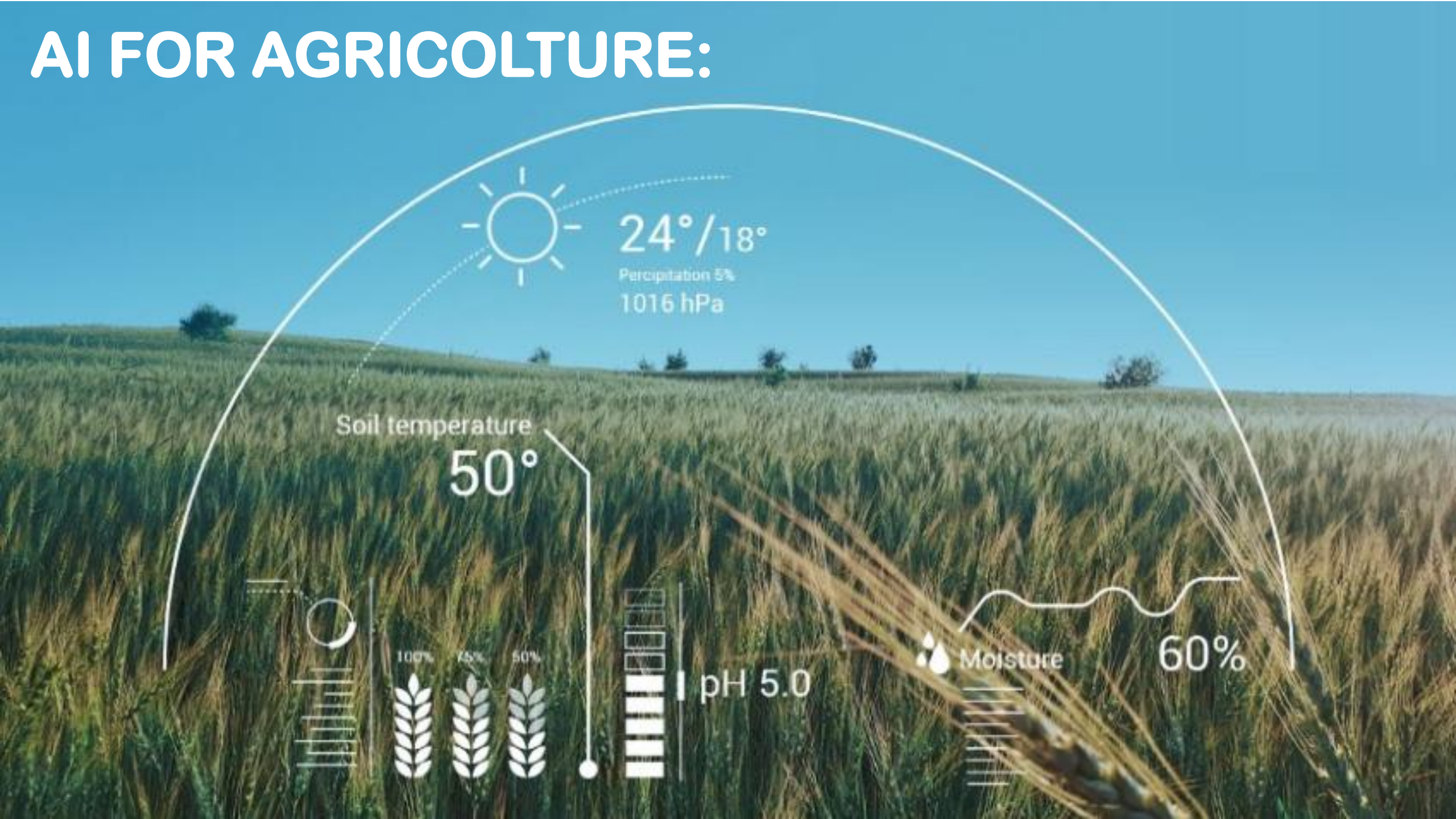
5. BEHAVIORAL ANALYTICS

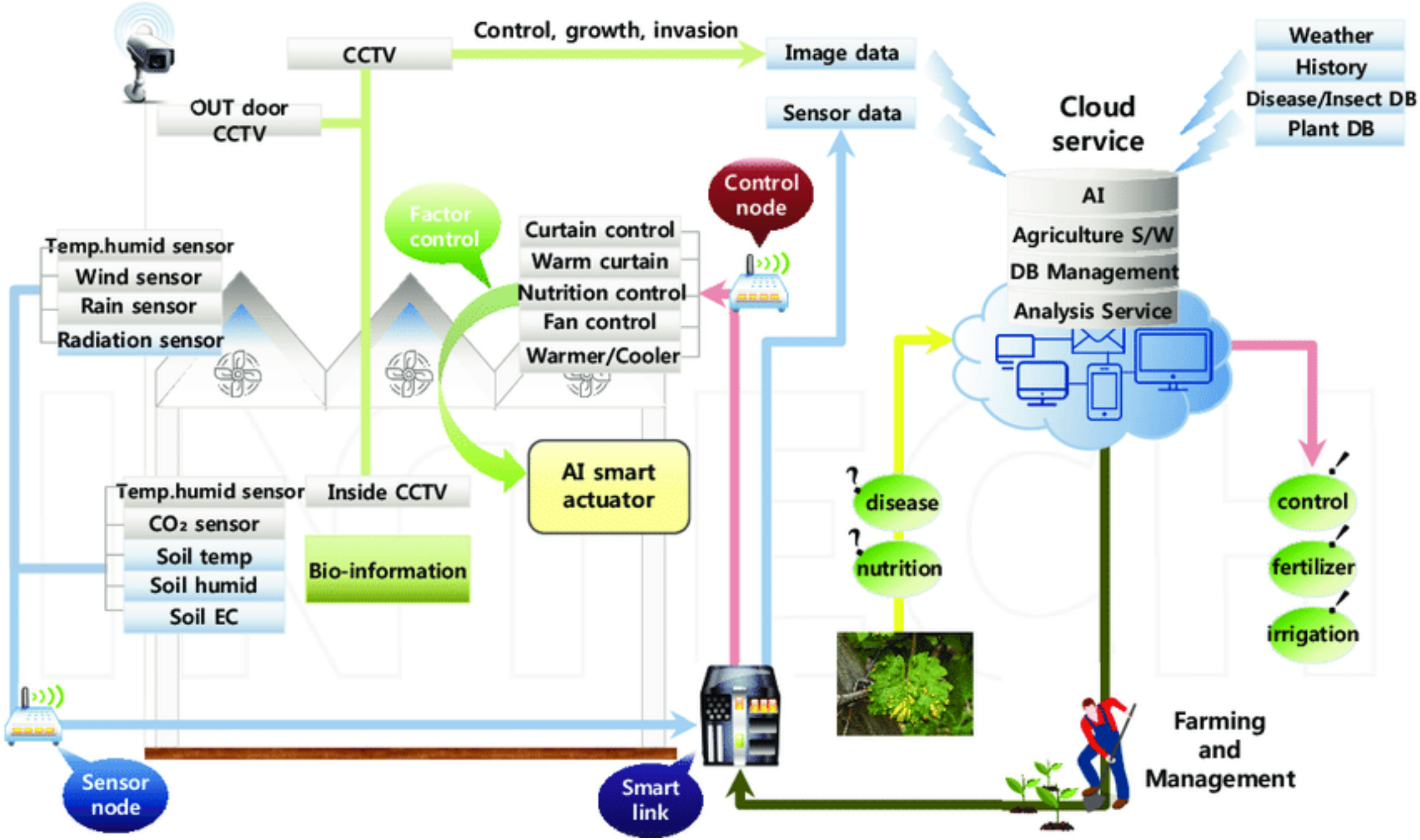
ML algorithms can learn & create a pattern of a user's behavior.

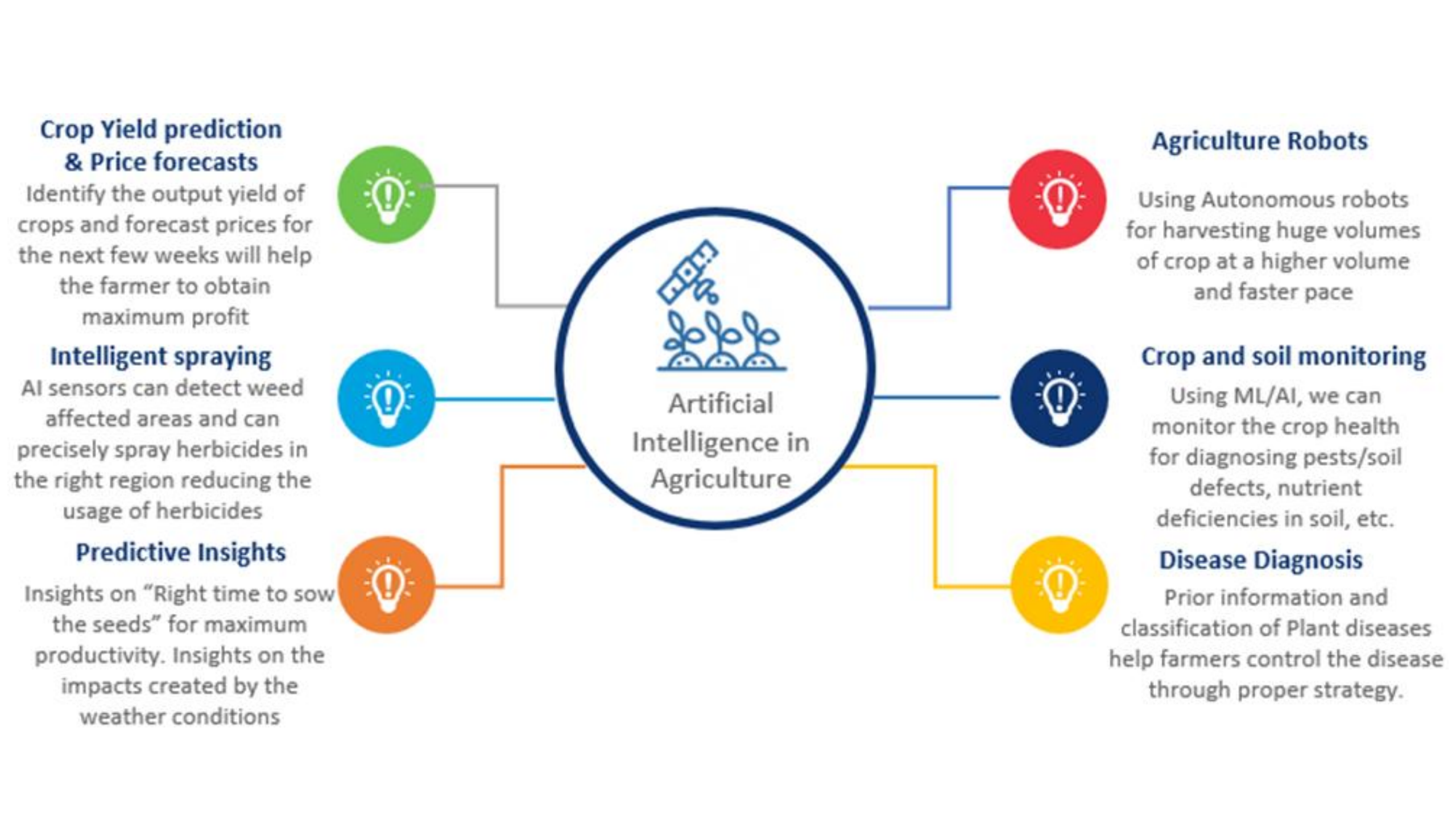
AI FOR FINANCE:


Stock Market Predictions
Sales Forecasting
Risk Management
Trading
Anti Fraudery System
Personalized Banking
AI in Finance
Credit Card and Loan Decisions
Process Automation

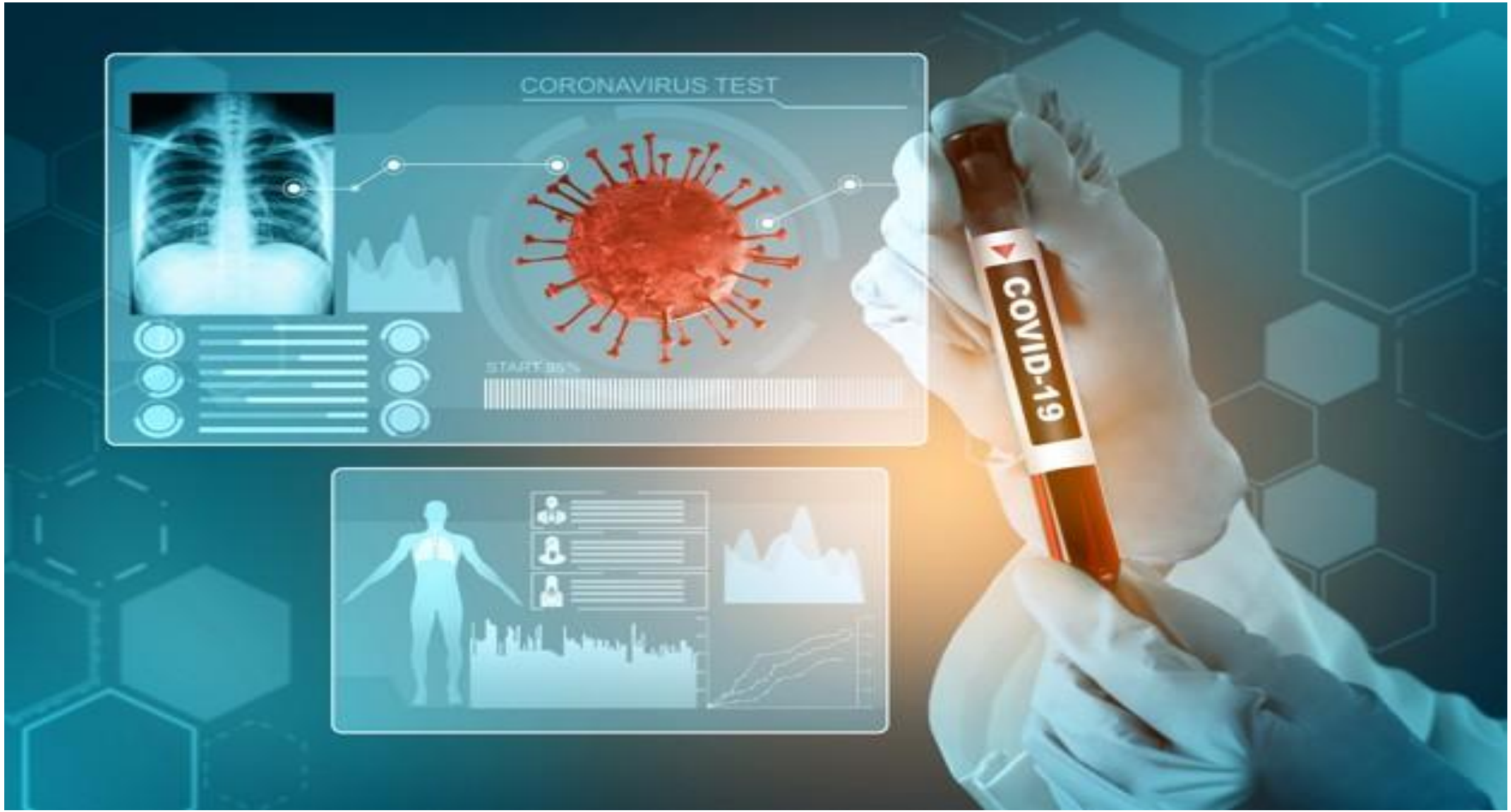
AI FOR AGRICOLTURE:

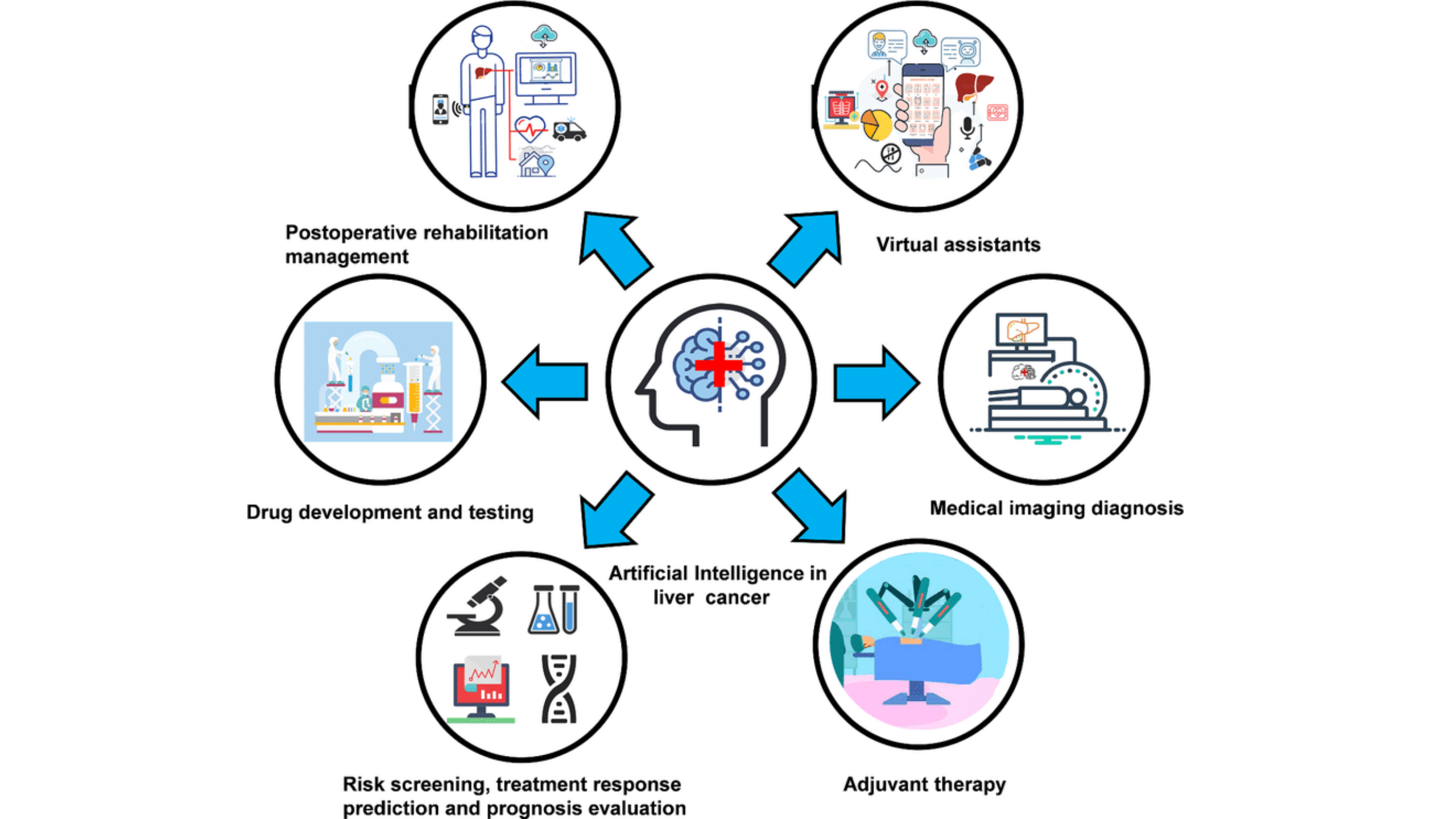


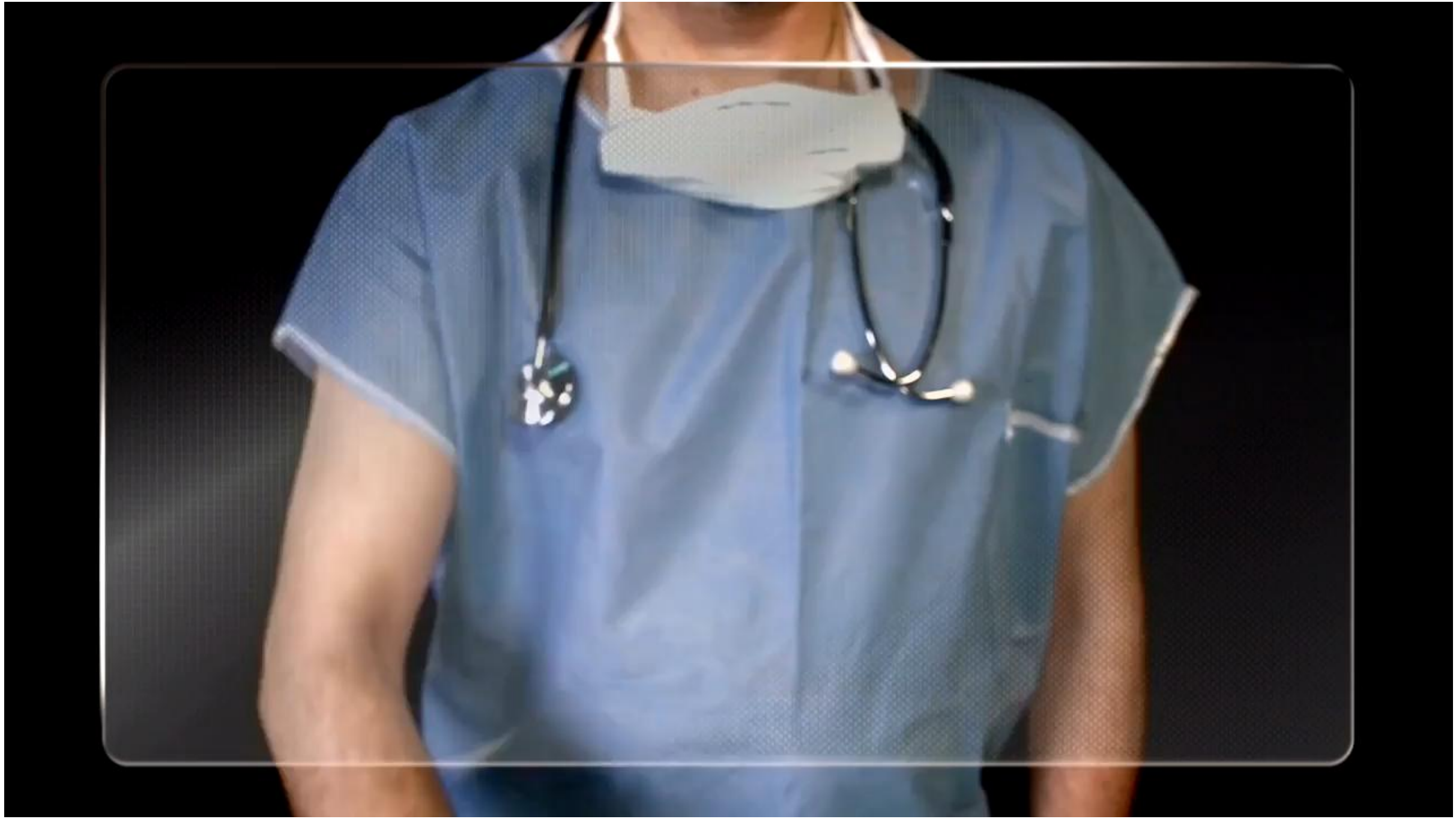

CCTV
Control, growth, invasion
Image data
OUT door CCTV
Sensor data
Weather
History
Disease/Insect DB
Plant DB
Cloud service
AI
Agriculture S/W
DB Management
Analysis Service
Control node
Factor control
Curtain control
Warm curtain
Nutrition control
Fan control
Warmer/Cooler
Temp.humid sensor
Wind sensor
Rain sensor
Radiation sensor
AI smart actuator
Temp.humid sensor
Inside CCTV
CO2 sensor
Soil temp
Soil humid
Soil EC
Bio-information
disease
nutrition
control
fertilizer
irrigation
Sensor node
Smart link
Farming and Management


Crop Yield prediction & Price forecasts
Identify the output yield of crops and forecast prices for the next few weeks will help the farmer to obtain maximum profit
Intelligent spraying
AI sensors can detect weed affected areas and can precisely spray herbicides in the right region reducing the usage of herbicides
Predictive Insights
Insights on "Right time to sow the seeds" for maximum productivity. Insights on the impacts created by the weather conditions
Artificial Intelligence in Agriculture
Agriculture Robots
Using Autonomous robots for harvesting huge volumes of crop at a higher volume and faster pace
Crop and soil monitoring
Using ML/AI, we can monitor the crop health for diagnosing pests/soil defects, nutrient deficiencies in soil, etc.
Disease Diagnosis
Prior information and classification of Plant diseases help farmers control the disease through proper strategy.

AI FOR HEALTHCARE:


CORONAVIRUS TEST
COVID-19


Postoperative rehabilitation management
Virtual assistants
Drug development and testing
Artificial Intelligence in liver cancer
Medical imaging diagnosis
Risk screening, treatment response prediction and prognosis evaluation
Adjuvant therapy




David
Bravo-1


Relaxed?
Relaxed?
1%
43%
0%
6%
0%
96%
0%
35%
9%
1%
19%
7%
0%
100%
0%
Activity
Eating
Drinking
Smoking
Apparel:
Dressed
Pose context:
Lying on floor

RADIOLOGY

the algorithm helps perform radiological tests with outstanding accuracy, which means that artificial intelligence in medicine can reduce medical professionals' workload

DERMATOLOGY

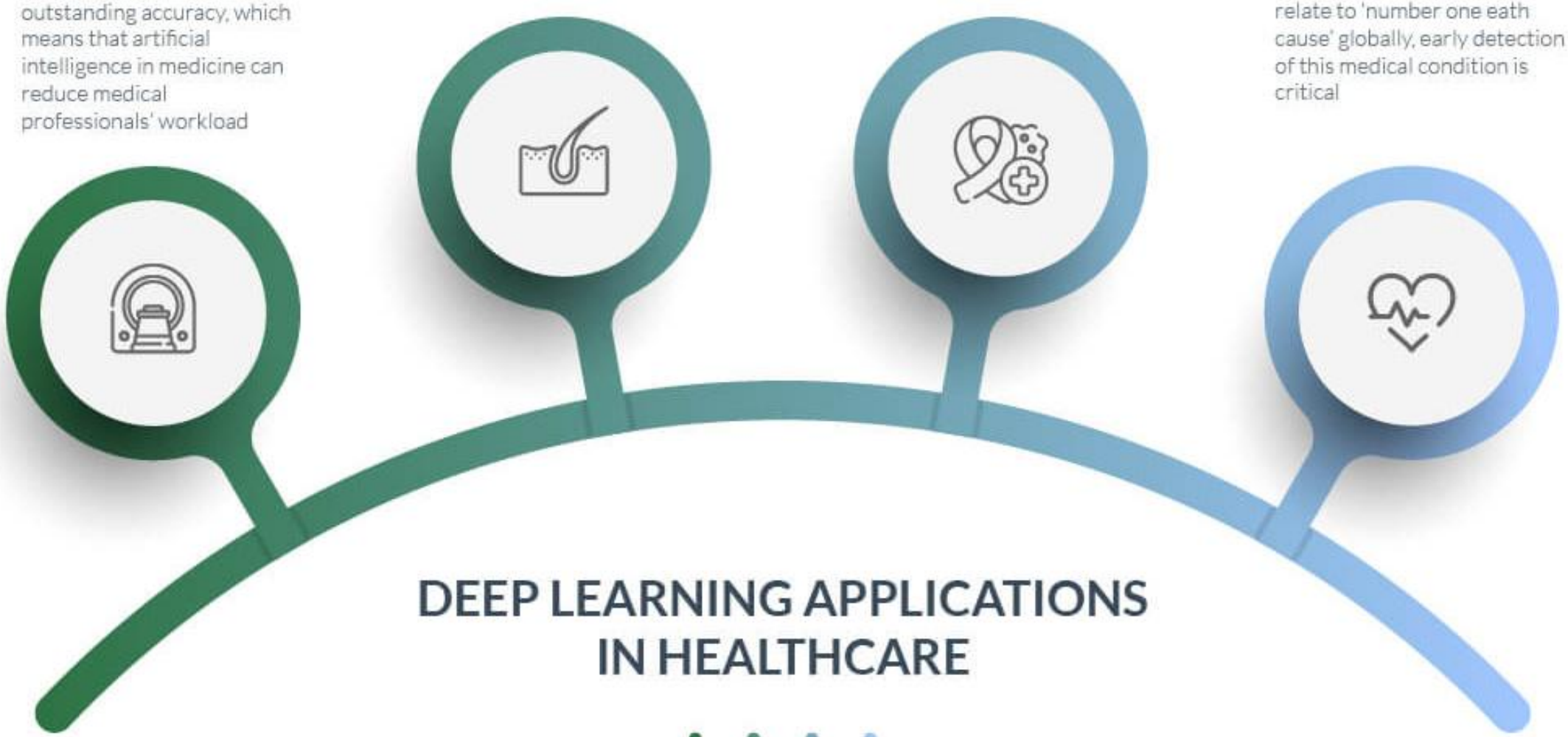
AI-powered tools are designed to identify skin cancer by feeding a vast number of images of malignant melanomas and benign moles

ONCOLOGY

AI is forecast to assist in decoding individualized cancer diagnosis and developing a treatment plan

CARDIOLOGY

Since cardiovascular diseases relate to 'number one eath cause' globally, early detection of this medical condition is critical

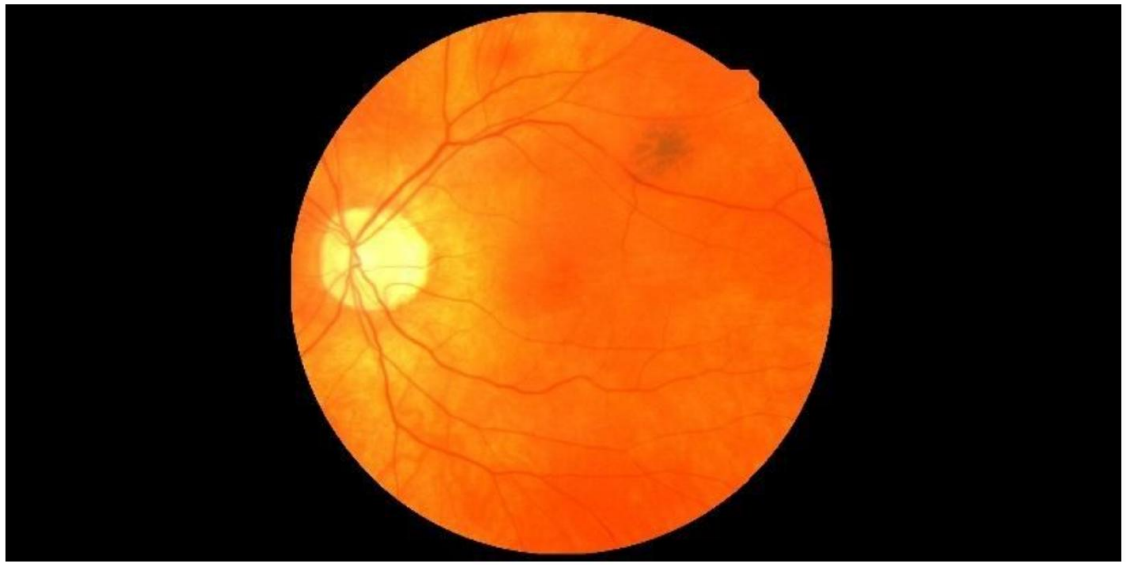


DEEP LEARNING APPLICATIONS IN HEALTHCARE

AI can identify heart disease from an eye scan

Technology news

25 January 2022



- **Scientists have developed an artificial intelligence system that can analyse eye scans taken during a routine visit to an optician or eye clinic and identify patients at a high risk of a heart attack.**

Il Sole 24 ORE

Quotidiano

Data 08-02-2022
Pagina 19
Foglio 1

Gli algoritmi per predire la gravità del Covid studiando le radiografie

Intelligenza artificiale
Studio Bracco imaging

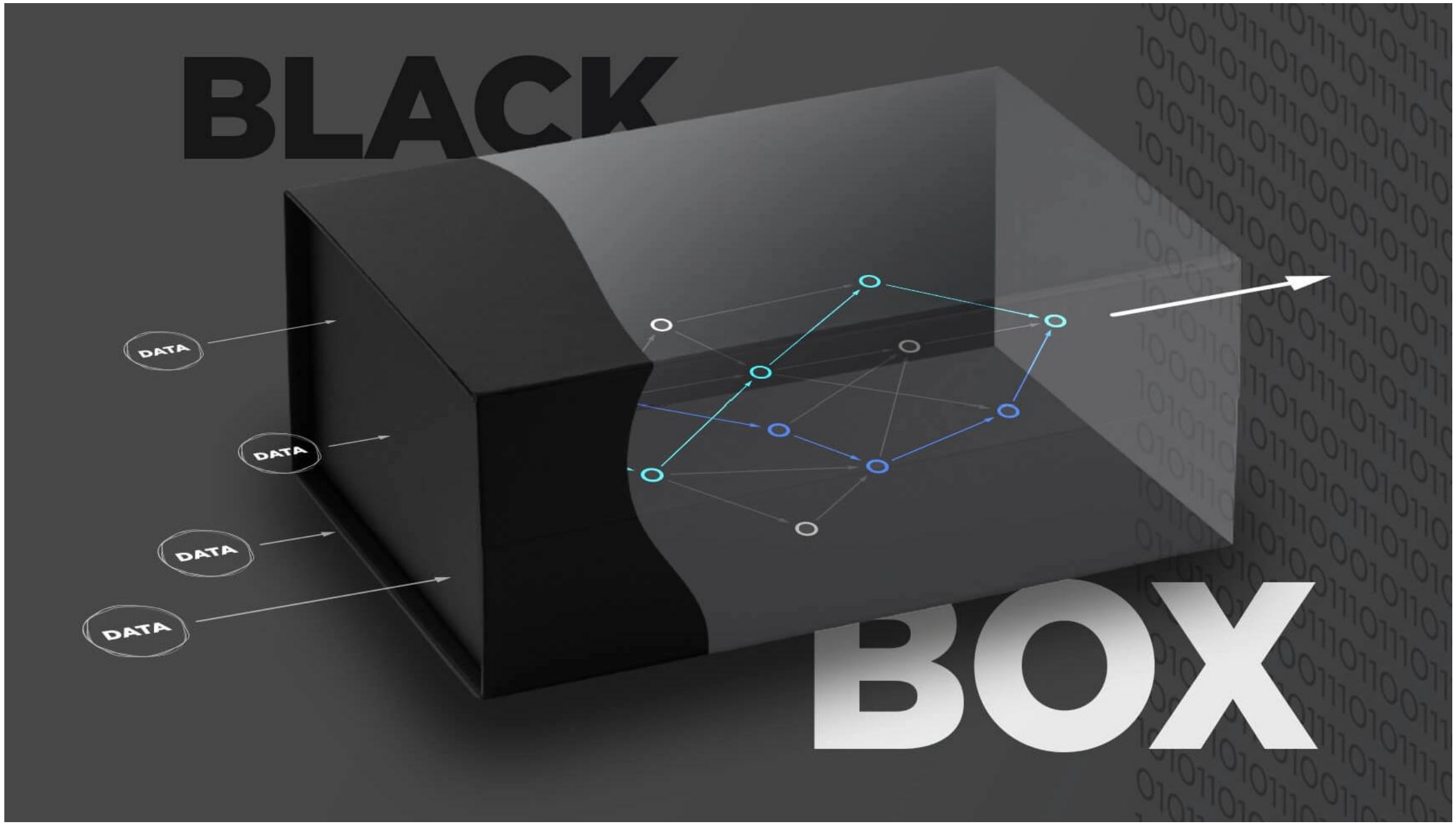
Natascia Ronchetti

Il progetto è in fase sperimentale ma ha già attirato l'attenzione della comunità scientifica internazionale. Per ora è utilizzato per l'infezione provocata dal Covid-19. Ma presto sarà possibile estenderlo anche ai tumori e alle malattie degenerative come il morbo di Alzheimer.

Il metodo infatti è sempre lo stesso. Applica gli algoritmi dell'intelligenza artificiale alla diagnostica per immagini per migliorare la formulazione della prognosi e sviluppare analisi predittive sull'evoluzione della malattia. Si chiama «Ai-For-Covid» lo studio che dall'inizio della pandemia ha impegnato Bracco Imaging, società del gruppo Bracco, e il Centro Diagnostico italiano, la struttura sanitaria ambulatoriale (sede a Milano) per la prevenzione, la diagnosi e la cura in regime di day hospital, che da tre anni sviluppa algoritmi predittivi. Tutto nato quasi per caso con l'inizio della pandemia, quando i ricercatori hanno iniziato a raccogliere negli ospedali italiani le radiografie toraciche di circa 1300 pazienti, all'esordio della malattia, che presentavano polmonite interstiziale.

«Volevamo capire se in certi stati patologici è possibile dare indicazioni su una determinata evoluzione migliori delle prognosi che vengono fatte dal medico», dice Sergio Papa, direttore della diagnostica per immagini del centro milanese. «Oggi – prosegue Papa – siamo in grado di dire che il sistema migliora la capacità del medico di qualche punto percentuale in più». I risultati dello studio sono stati pubblicati sulla rivista scientifica «Medical Image Analisys» e poi caricati su un portale a disposizione degli scienziati di tutto il mondo: in poco tempo sono arrivate un centinaio di richieste di download. Un successo che ha portato i ricercatori a cimentarsi con i tumori alla mammella e alla prostata. «Abbiamo già iniziato a raccogliere casi clinici», conferma Papa.

E siccome gli algoritmi sono dei medical device è stato avviato anche l'iter per ottenere il via libera dagli enti regolatori, dalla Food and Drug Administration degli Usa a Ema, l'agenzia del farmaco europea. Le prospettive che si aprono sono innumerevoli. L'intelligenza artificiale può infatti essere applicata non solo a radiografie ma anche a risonanze magnetiche, Tac, ecografie. Lo studio è stato presentato all'Expo di Dubai dal gruppo Bracco, la multinazionale (vanta un patrimonio di oltre duemila brevetti e investe ogni anno in R&S il 10% del fatturato di riferimento nell'imaging) specializzata nella diagnostica per immagini. Il Centro diagnostico italiano, che ogni anno serve circa 400 mila pazienti, ha messo a disposizione know-how e competenze. «Adesso vogliamo anche valutare il long Covid», spiega Papa, precisando che tutto è partito dalla considerazione che due pazienti possono avere destini differenti anche se uguali dal punto di vista clinico. «Se facciamo leggere le immagini a un esperto – aggiunge Papa - vediamo che il si-


BLACK
DATA
DATA
DATA
DATA
BOX

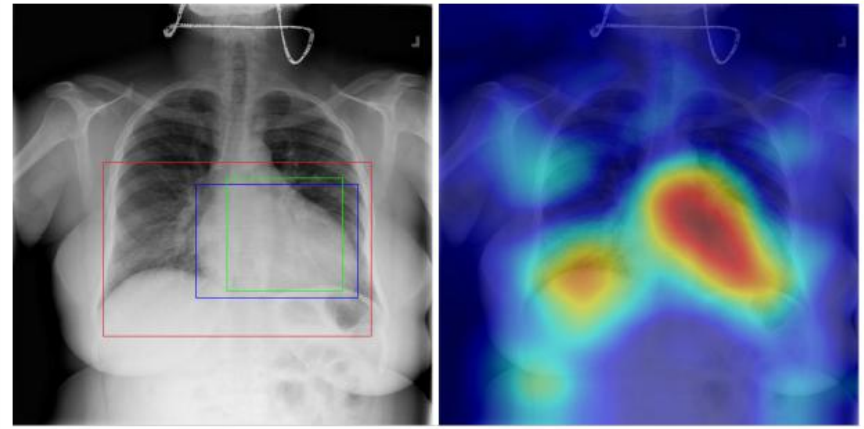
Radiology report	Keyword	Localization Result
findings include: 1. cardiomegaly (ct ratio of 17/30). 2. otherwise normal lungs and mediastinal contours. 3. no evidence of focal bone lesion. dictating	Cardiomegaly	

Table 9. *A sample of chest x-ray radiology report, mined disease keywords and localization result from the "Cardiomegaly" Class. Correct bounding box (in green), false positives (in red) and the ground truth (in blue) are plotted over the original image.*

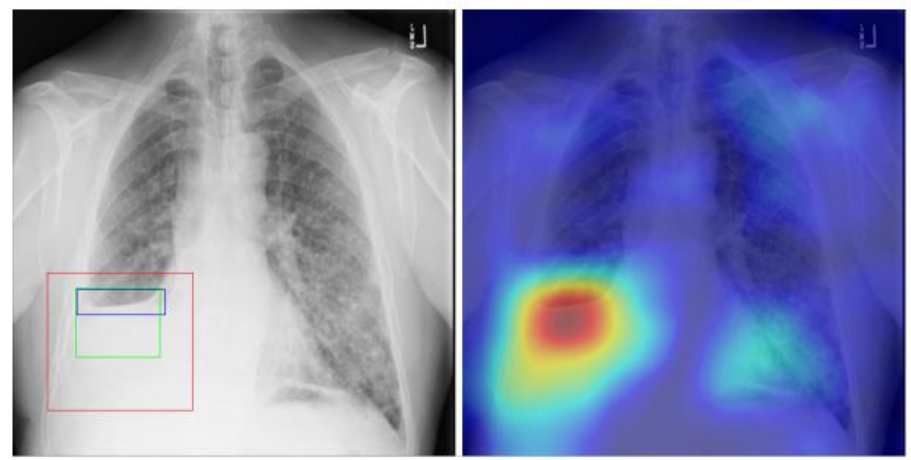
Radiology report	Keyword	Localization Result
findings: no appreciable change since XX/XX/XX. small right pleural effusion. elevation right hemidiaphragm. diffuse small nodules throughout the lungs, most numerous in the left mid and lower lung. impression: no change with bilateral small lung metastases.	Effusion; Nodule	

Table 10. *A sample of chest x-ray radiology report, mined disease keywords and localization result from the "Effusion" Class. Correct bounding box (in green), false positives (in red) and the ground truth (in blue) are plotted over the original image.*

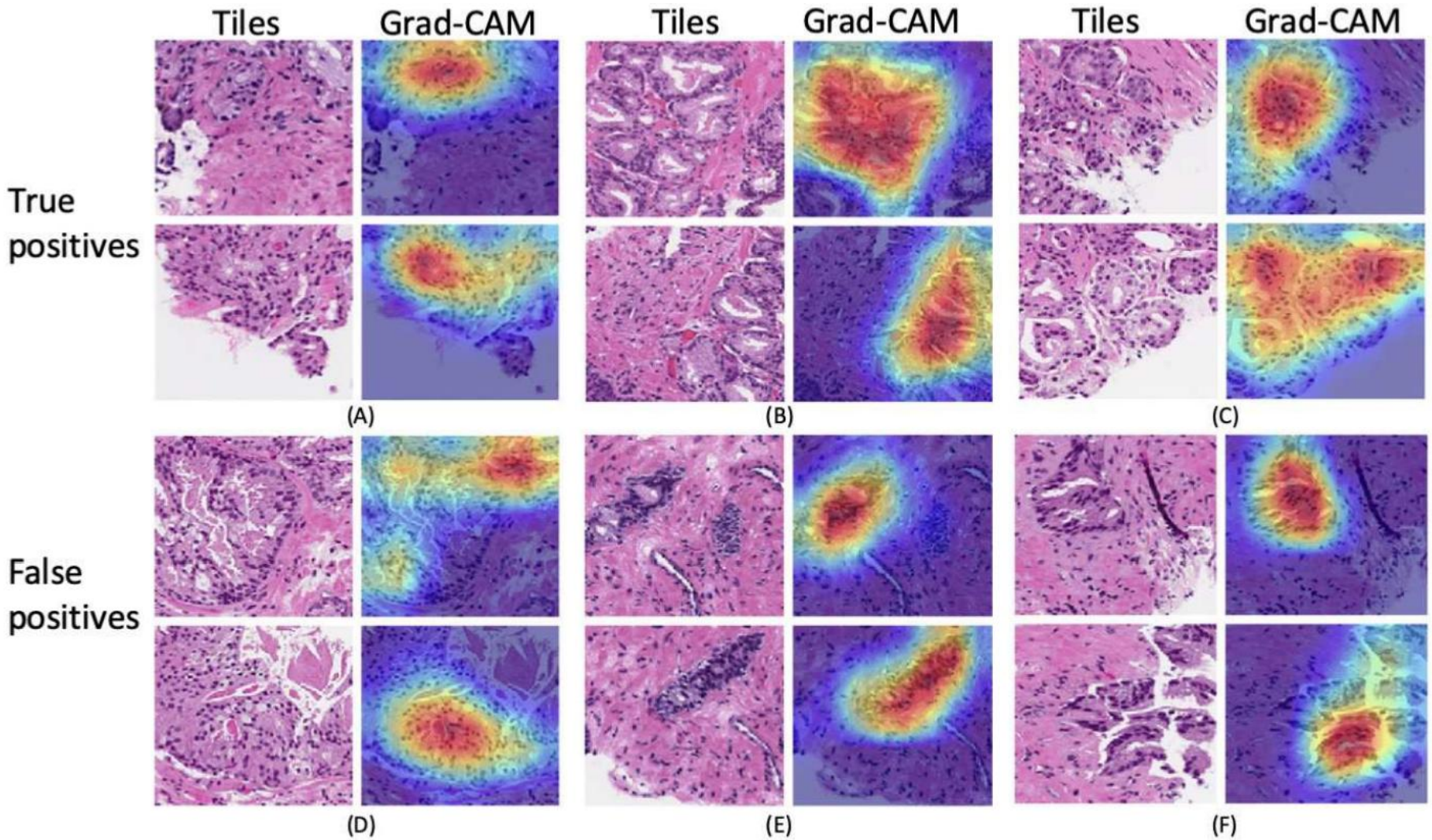
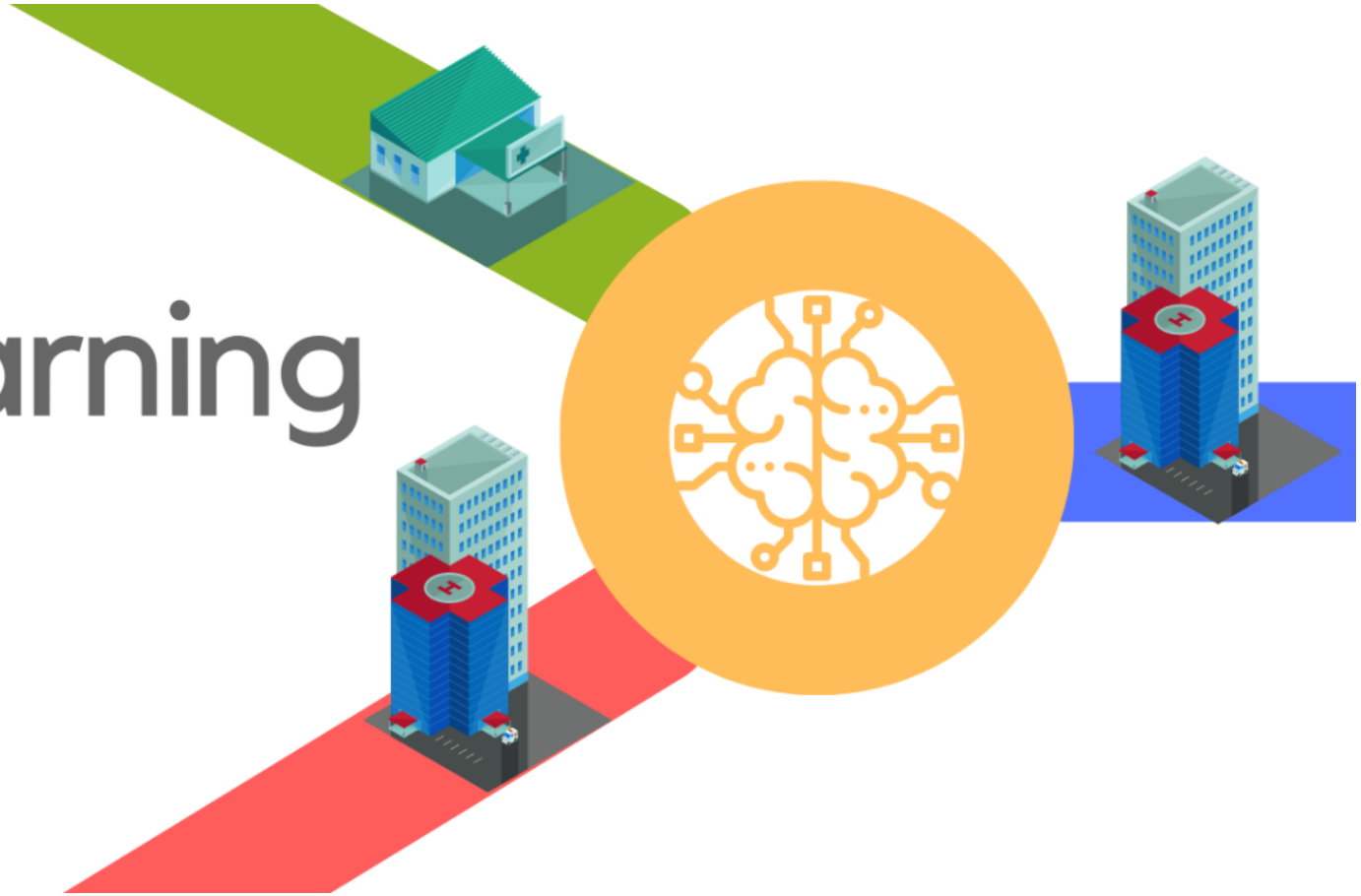
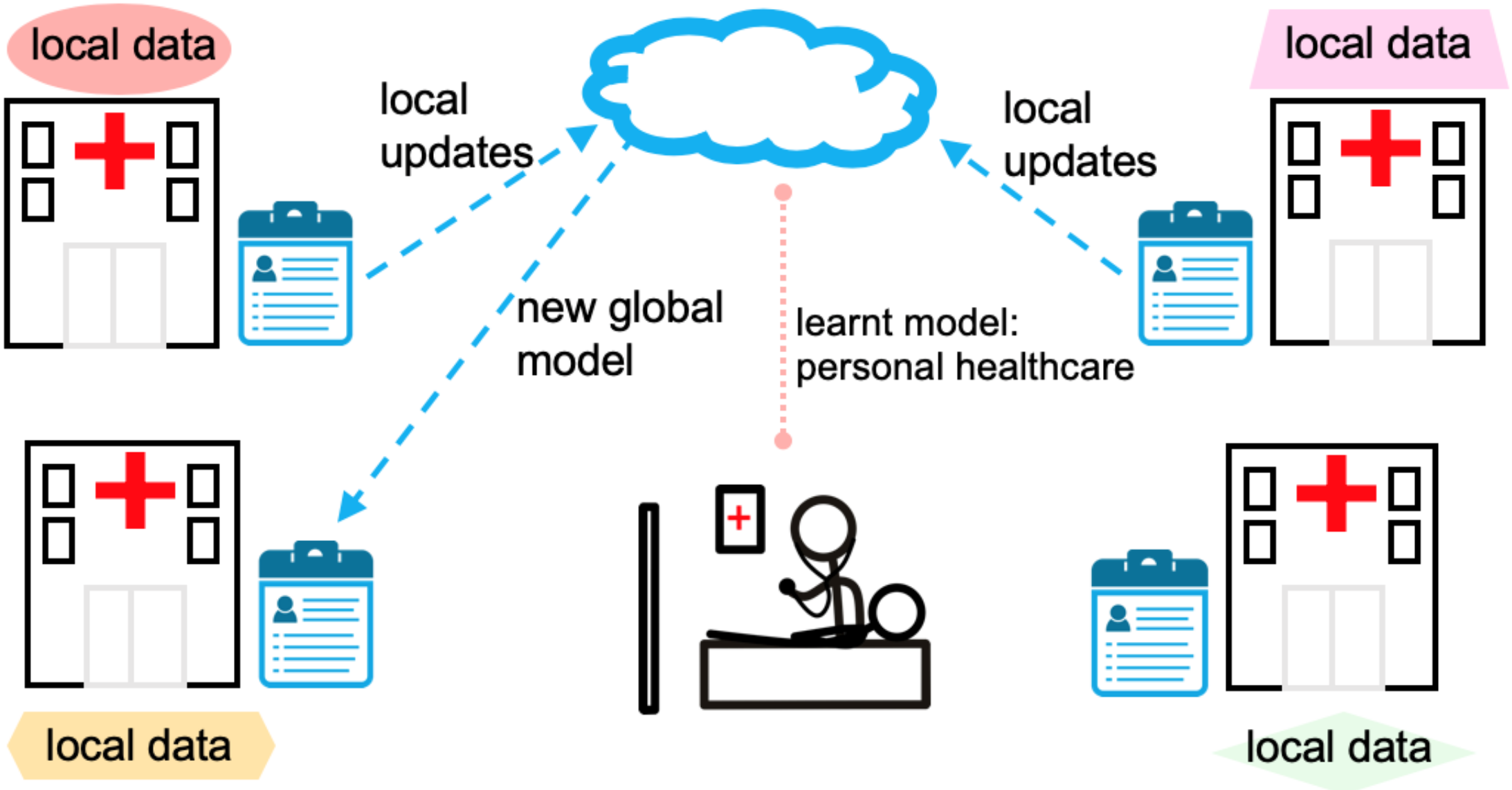
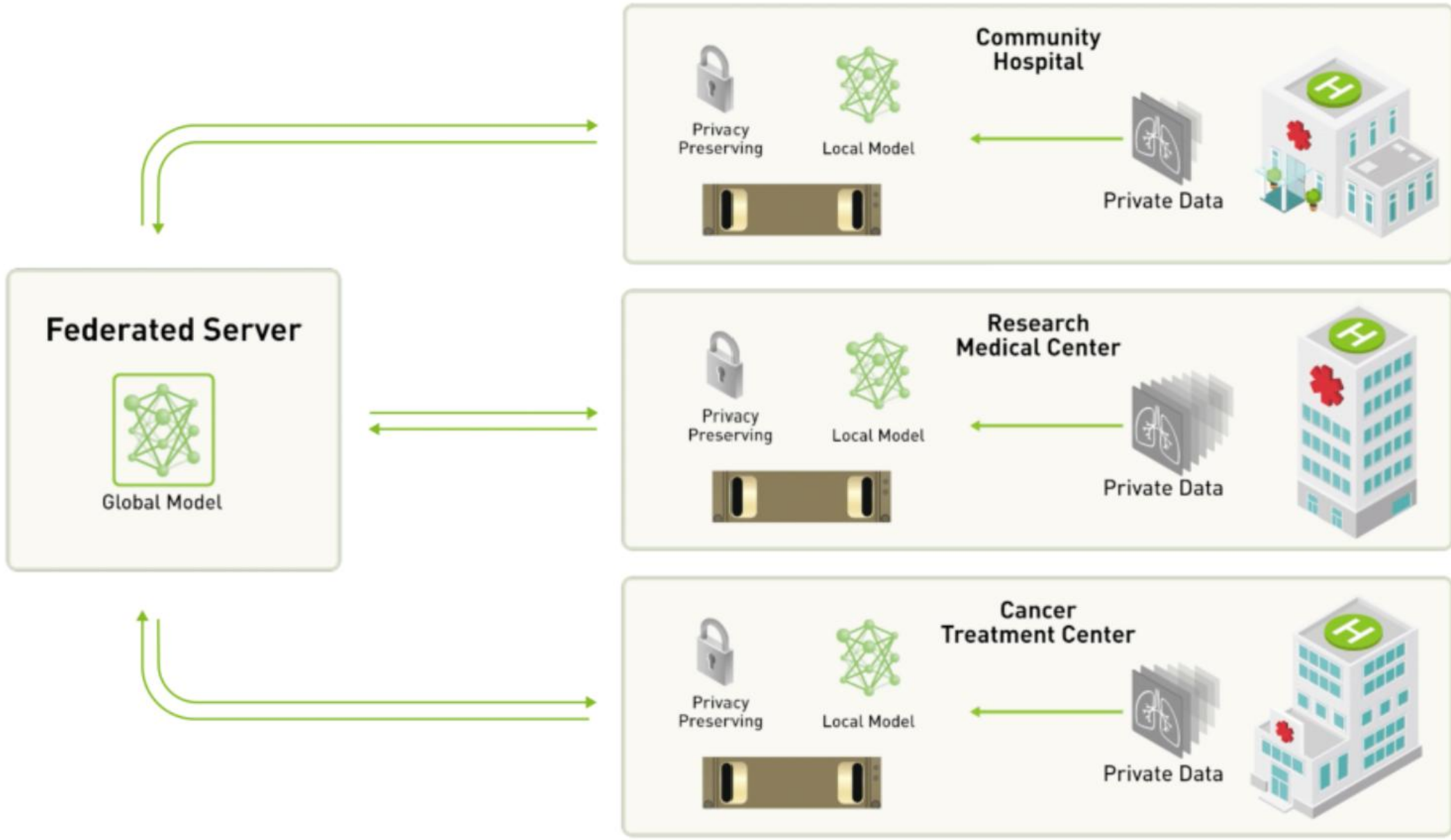


Fig. 5. Visualization of discriminative regions within tiles for TP and FP predictions. For each slide (A)-(F), we selected the top two tiles with the highest attention weights from the model, which were then forwarded to the model to generate activations and gradients for Grad-CAM.

Federated Learning in Healthcare



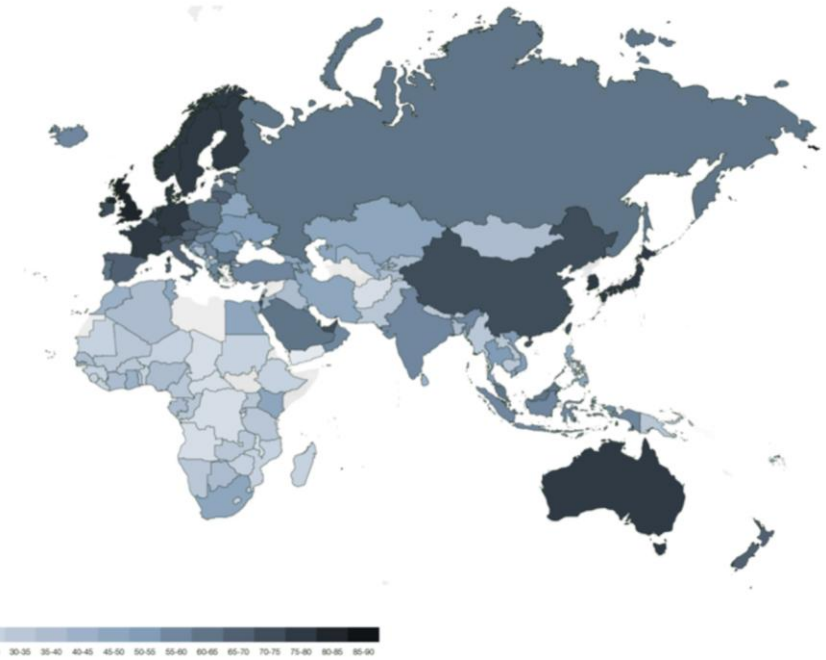

local data
local updates
local updates
local data
new global model
learnt model: personal healthcare
local data
local data


Federated Server
Global Model
Community Hospital
Privacy Preserving
Local Model
Private Data
Research Medical Center
Privacy Preserving
Local Model
Private Data
Cancer Treatment Center
Privacy Preserving
Local Model
Private Data

The Global Artificial Intelligence Indexes 2021

Show: Rank

Country	Implementation: Talent	Implementation: Infrastructure	Implementation: Operating Environment	Innovation: Research	Innovation: Development	Investment: Government Strategy	Investment: Commercial	Total rank
United States of America	1	1	6	1	2	13	1	1
China	18	3	3	2	1	1	2	2
United Kingdom	5	8	1	3	11	7	4	3
Canada	4	23	5	8	10	4	5	4
Germany	9	12	7	4	12	5	9	5
France	8	30	2	12	9	6	7	6
Singapore	2	4	39	16	15	30	6	7
South Korea	28	5	30	22	3	31	25	8
Japan	26	16	16	6	7	12	8	9



Country	Rank	Score
Singapore	1	9.186
United Kingdom	2	9.069
Germany	3	8.810
United States of America	4	8.804
Finland	5	8.772
Sweden	6	8.674
Canada	6	8.674
France	8	8.608
Denmark	9	8.601
Japan	10	8.582
Australia	11	8.126
Norway	12	8.079
New Zealand	13	7.876
Netherlands	14	7.659

Limiti e Punti Deboli AI:

- Bad Data
- Materia Difficile
- Applicazioni ancora molto sperimentali
- Alfabetizzazione digitale italiana molto bassa
- Gap tecnologico Università ed esigenze del mercato
- Grow Rate tecnologico molto frenetico
- Etica
- Privacy dei dati

La formula del futuro: giovani e aziende alleati nell'innovazione

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AGO 2020

pubblicato in: Progetti, Rassegna stampa | 0

Domande?

(Daniele Grotti)