Joan Mas

Director Àrea Tecnologies Digitals

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WORKSHOP 4

INTEL·LIGÈNCIA ARTIFICIAL APLICADA A LA INDÚSTRIA: MITE O REALITAT?

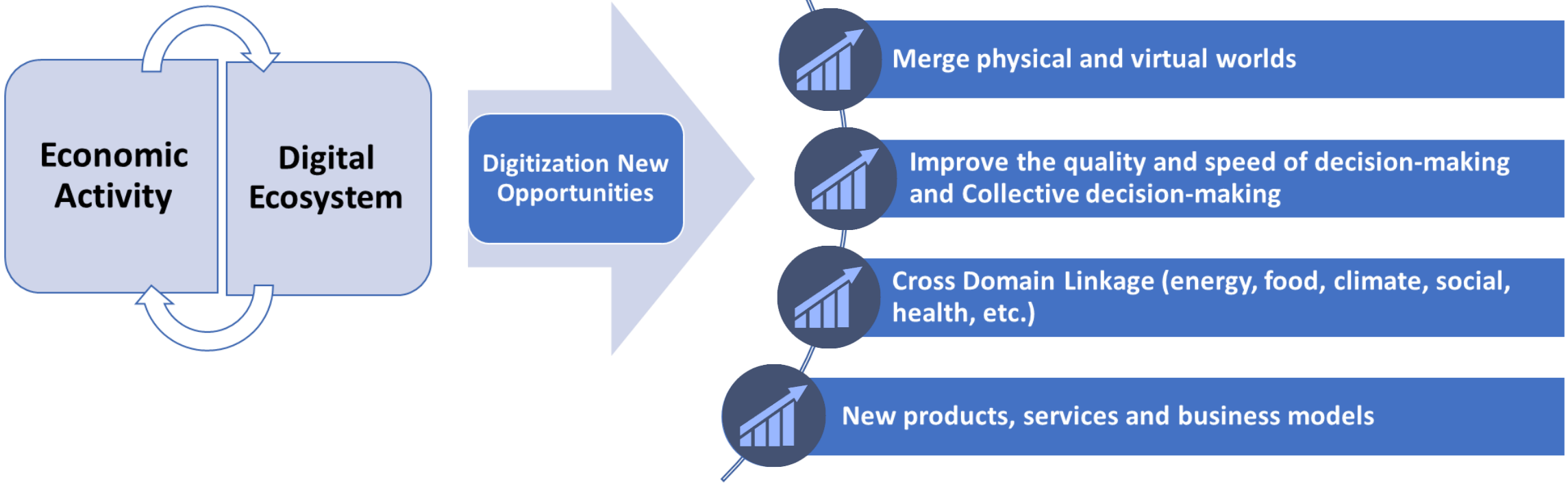
Joan Mas | EURECAT

Director Àrea Tecnologies Digitals

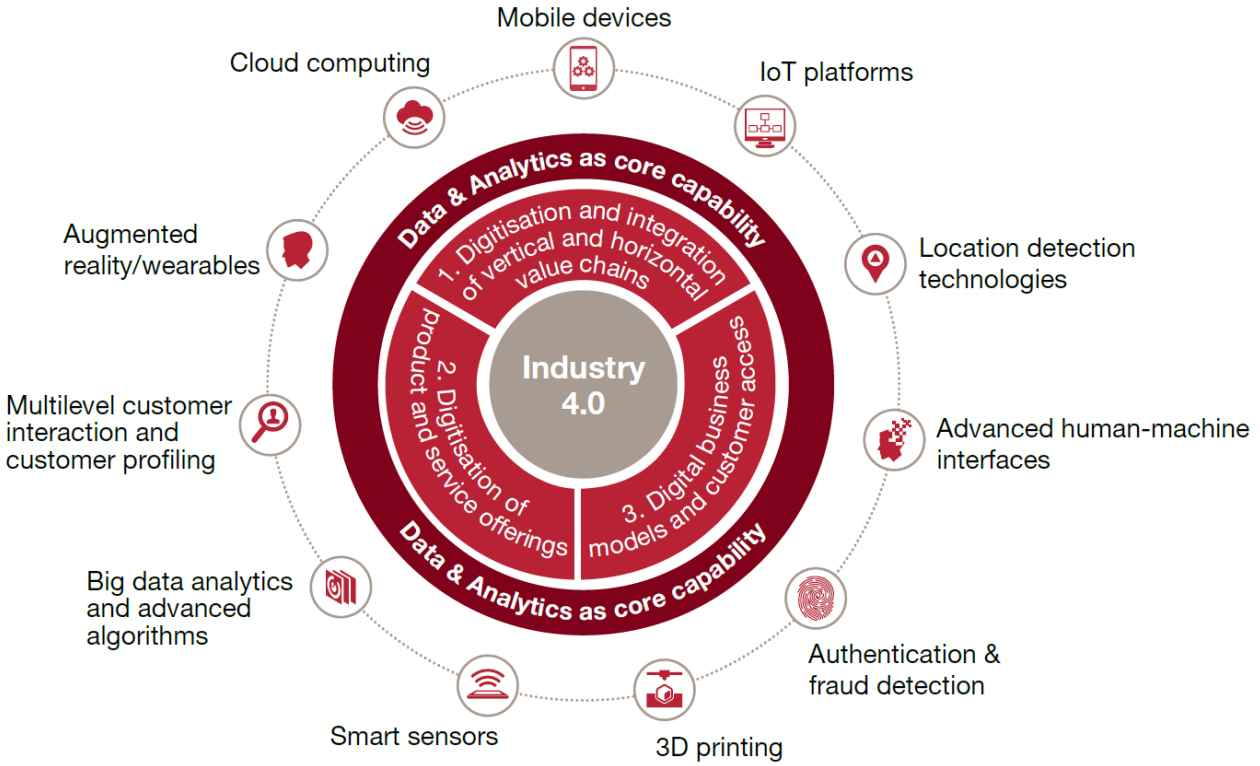
Challenges


Flexible Production
Zero Defect
Linking Physical-Virtual
Zero Waste
Autonomous Production
Predictive Management
Knowledge Sharing

Digital Opportunity



Industry transformation powered by 4.0

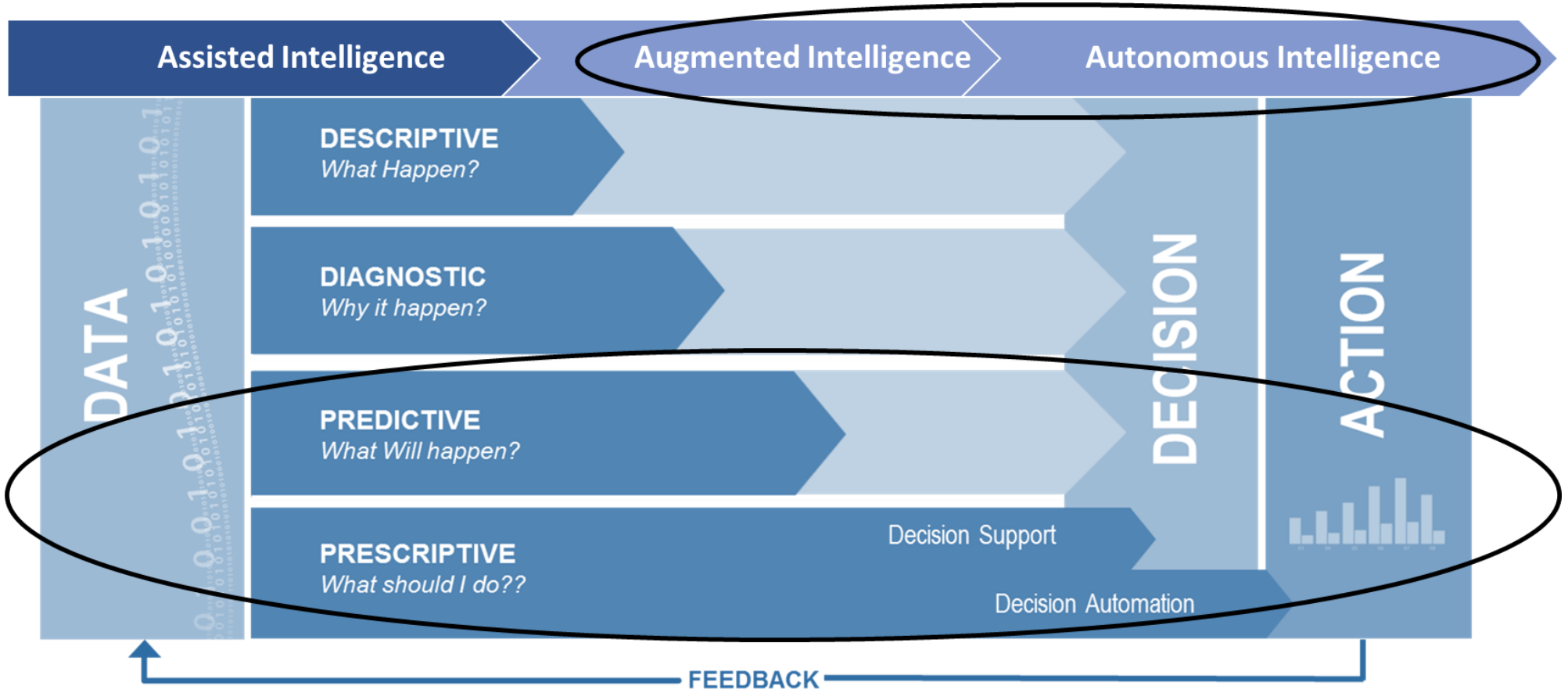


Principles

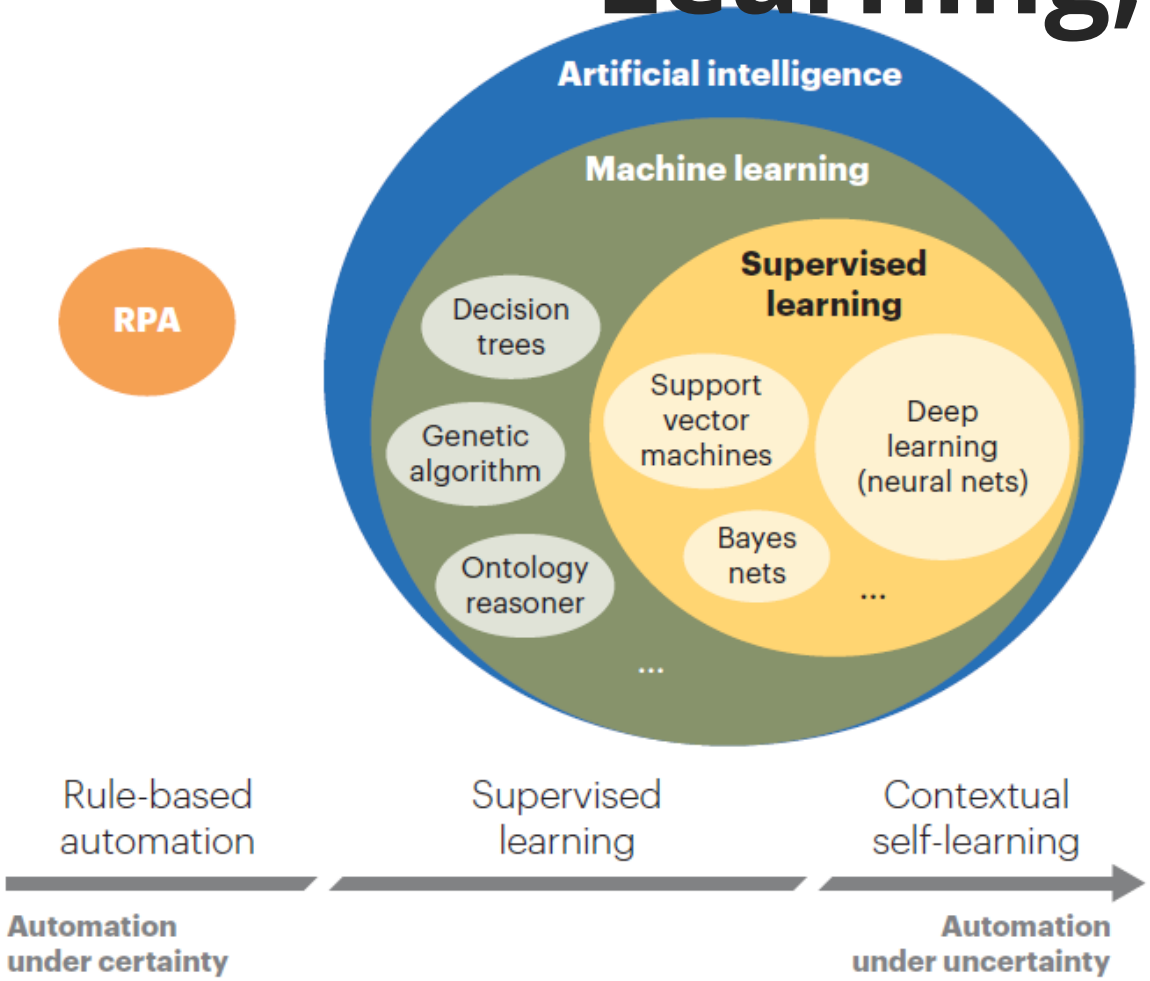
- Interoperability
- Decentralization
- Virtualization
- Real time
- Service oriented
- Modularity

(*) pwc, 2016 Global Industry 4.0 Survey

Self-Diagnosis, Optimization, Organization



Artificial Intelligence, Machine Learning,...



Robotic process automation (RPA):
Virtual resources that can automate highly repetitive, structured tasks with very specific, linear decision criteria

Artificial intelligence (AI):
The discipline of making analytical machines intelligent, enabling an entity to function appropriately and with foresight in its environment

Machine learning:
Techniques for learning and performing cognitive functions (examples include algorithms for supervised and unsupervised learning)

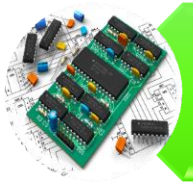
Deep learning:
A statistical machine-learning approach based on deep neural networks that attempts to mimic brain architecture for learning

(*) Source: A.T. Kearnet analysis

New surge in AI development

Computer power

Increases in computing speeds enable systems to collect and process rapidly vast amounts of data. **Computers process 10 to 100 times** faster, powering growth in neural network computational models



Costs

Costs are falling as computing speeds accelerate (costs of 1 million transistors are dropping 33% annually). **Capital requirements are down and potential returns up**

Talent availability

Growing interest in AI among minded students has led universities to create programs focused on the technology. Graduates from them expand talent pool for companies building autonomous systems

Cultural acceptance

Cultural barriers to AI are crumbling as **consumers grow more comfortable with "smart"** features in a range of everyday items.

AI has expanded fast

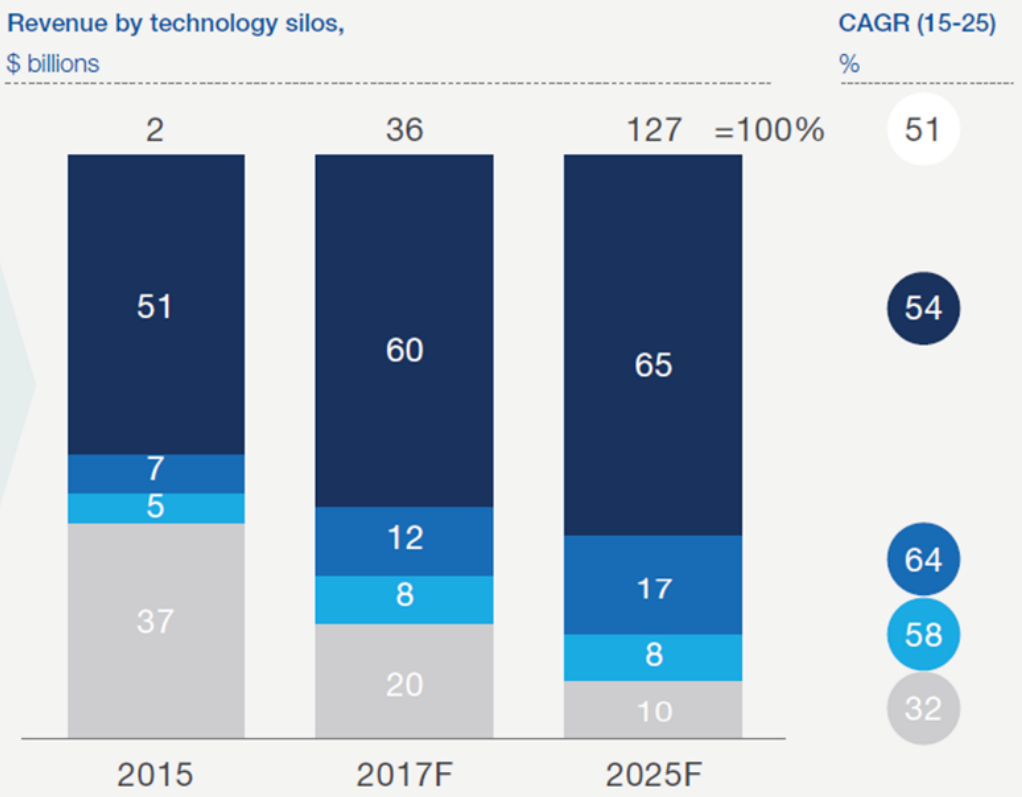
Major Investments are being made in AI…

External Investment in AI-focused companies, 2016

$ billions

Technology	Investment amount
Machine / Deep learning	5.0-7.0
Computer vision	2.5-3.5
Natural language	0.6-0.9
Smart robotics	0.3-0.5
Autonomus vehicles	0.3-0.5
Virtual agents	0.1-0.2

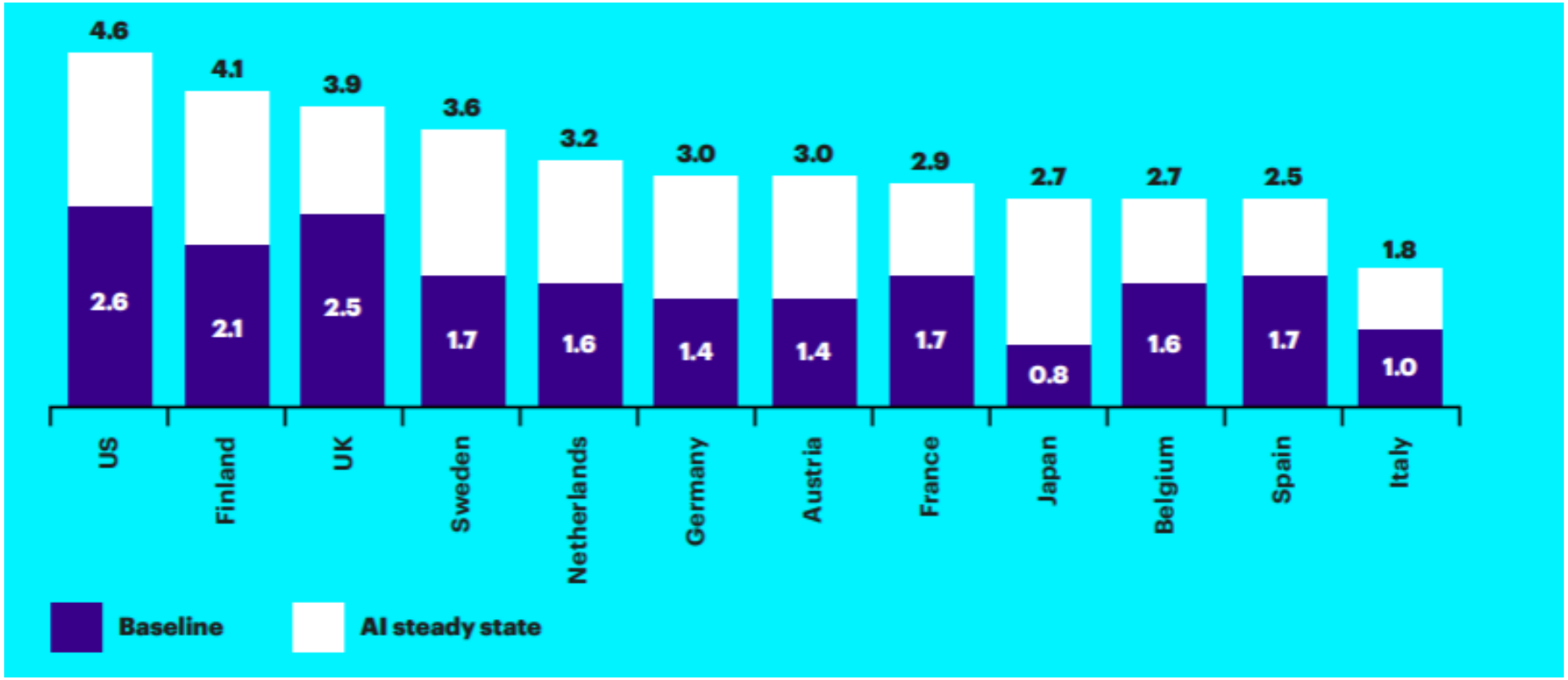
…Leading to an impressive growth of AI



- Deep learning
- Cognitive computing
- Predicitve API's
- Others

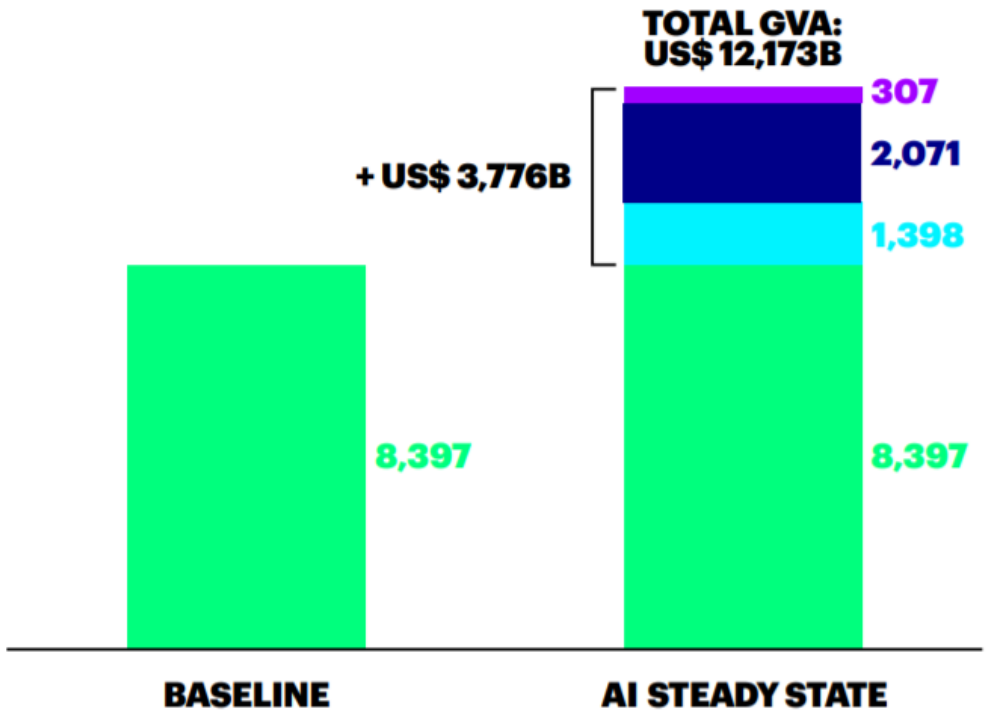
(*) Source: World Economic Forum, based on data from capital IQ, Pitch book, Dealogic, McKinsey

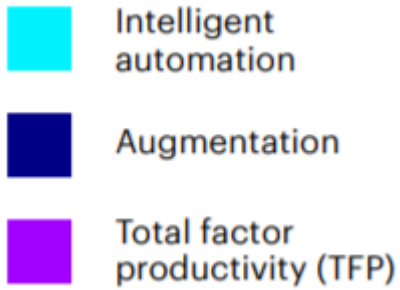
The economic impact of AI on countries



(*) Source: Accenture and Frontier Economics

Manufacturing GVA in 2035 (US$ billion)



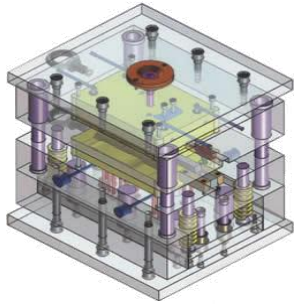


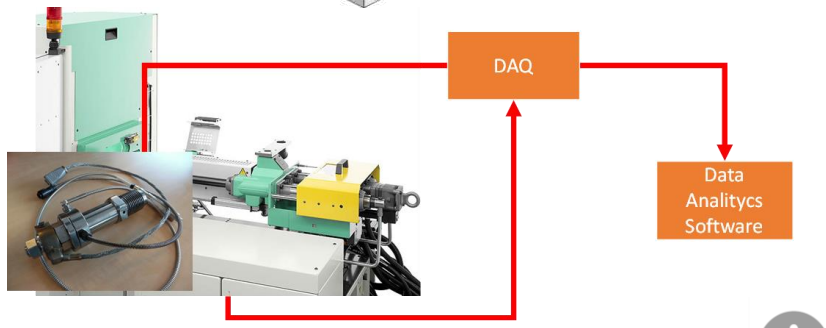
Growth rates in 2035 of gross value added (a close approximation of GDP), comparing baseline growth in 2035 to an artificial intelligence scenario where AI has been absorbed into the economy.

(*) Source: Accenture and Frontier Economics

AI Industrial Services

Predictive Quality: Plastic Injection



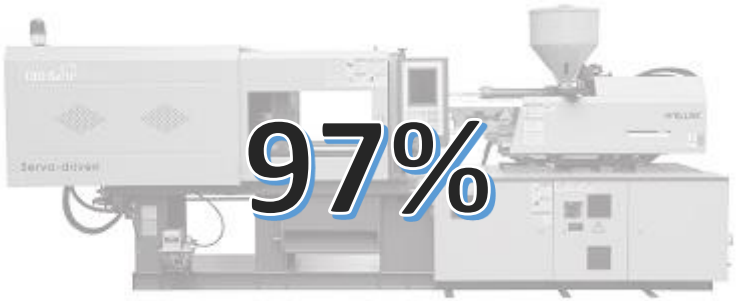


- Supervised Machine Learning
- Signal Processing techniques
- Data Fusion
- Soft Real time Performance (time cycle)
- Flexible:
  - Binary problems, multiclass problems
  - User defined defects, parameters
- Automated: Controls de production of different machines in parallel without required major user inputs

Success Story: KPIs

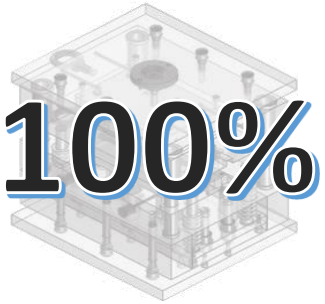
Prediction processing time:

- Objective: within cycle-time : 22s
- Measured: 3 machines running in parallel
  - Receiving data (4 sensors) : 243ms
  - Processing and predicting: 823ms
  - Total = 1.066s



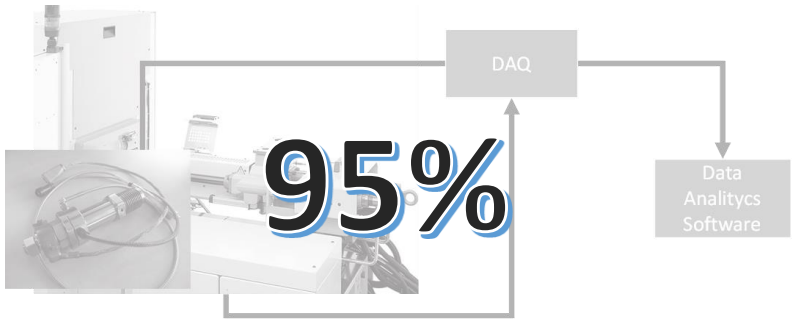
Prediction accuracy:

- Defect detection > 95% for the PCS in the 4 demonstrations
- 10 samples of preventive alarms
- >80% over 40 machine configurations

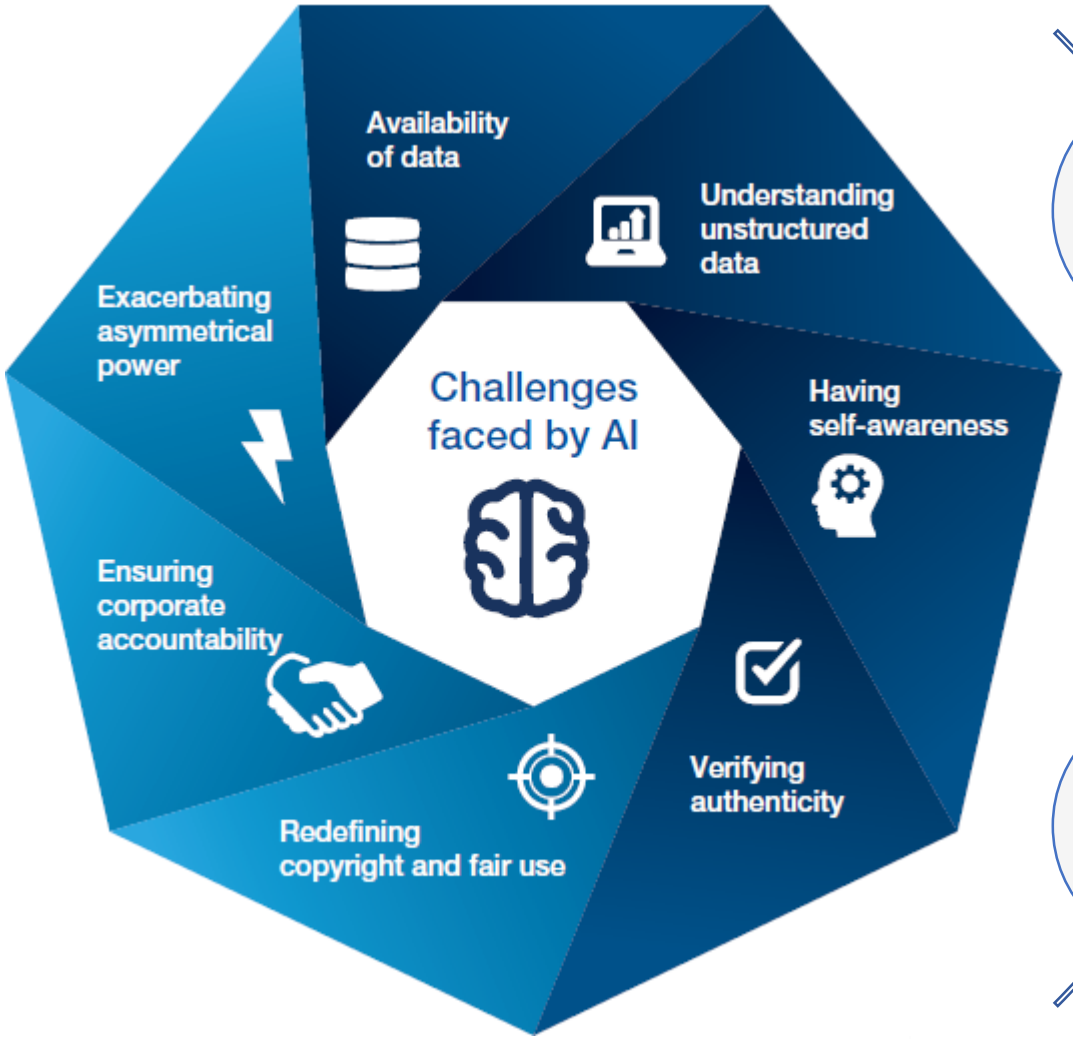


Scalability:

- On an i7 laptop
- Max scenario tested 5 injection machines
- Scale up well up to 20 machines
- Single threat approach

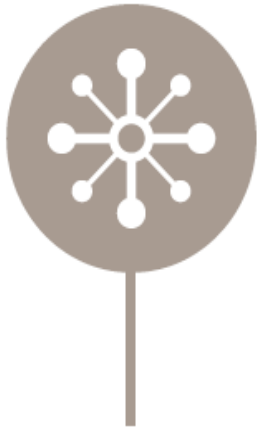


Challenges Faced by AI



- Introduce intelligent automation
- Augment labor productivity
- Accelerate development of new services

The Pathway



Map your Digital Strategy

1

Create Initial Pilot Projects

2

Define the capabilities you need

3

Become a virtuoso in data analytics

4

Transform into a data driven company

5

Actively plan an ecosystem approach

6

WORKSHOP 4

INTEL·LIGÈNCIA ARTIFICIAL APLICADA A LA INDÚSTRIA: MITE O REALITAT?

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Ricardo Simon Carbajo | CeADAR

Fernando Vilariño | CVC

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"innovating for business"

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tecnio catalonia
ACCIÓ Generalitat de Catalunya
Fins a 31/12/2019

Àngel Freixó

Gerent

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Createch
intelligent control solutions 360°

Nueva generación de estaciones de tratamiento de aguas inteligentes

Angel Freixó
General Manager

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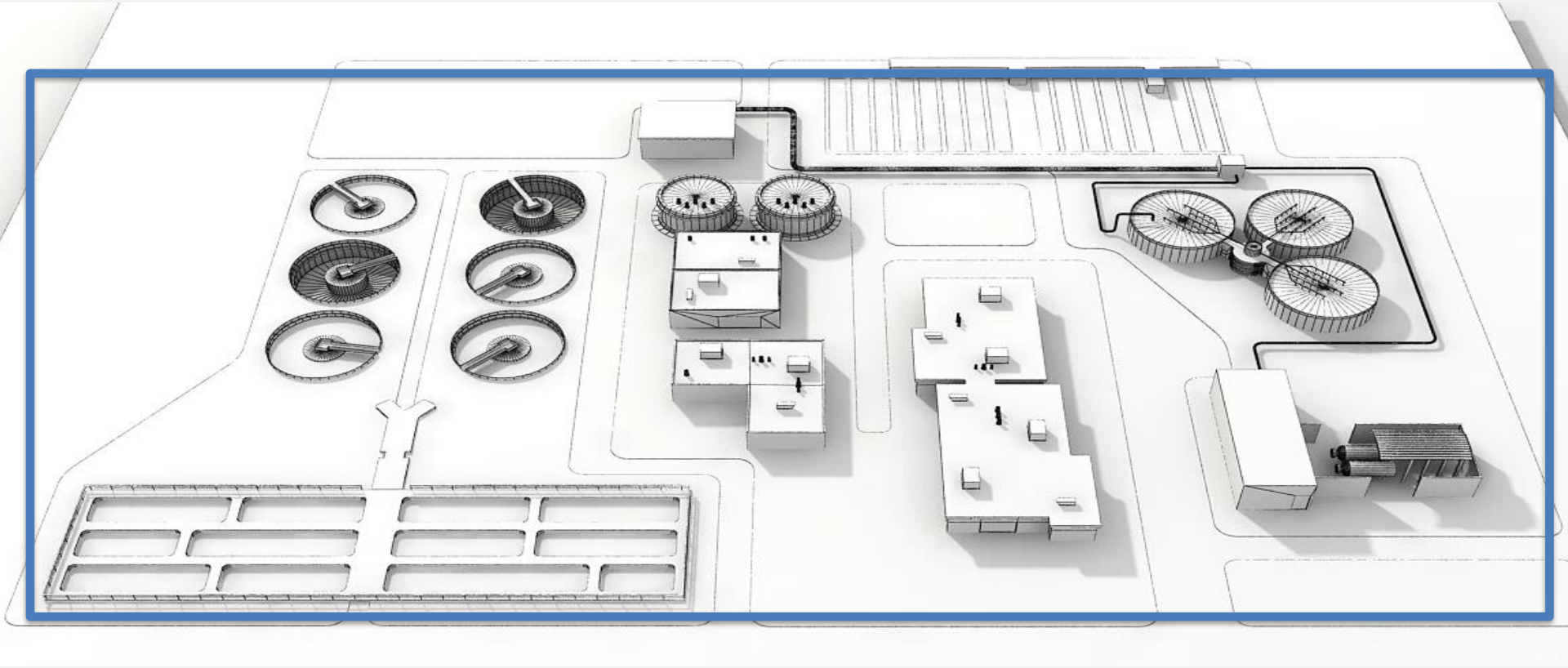
Especialistas en soluciones de **control inteligente** para la **optimización de procesos y ahorro energético** en depuradoras

EXPERIENCIA

- Más de 150 instalaciones a nivel global
- Plantas urbanas e industriales
- Proveedor de los principales operadores de aguas

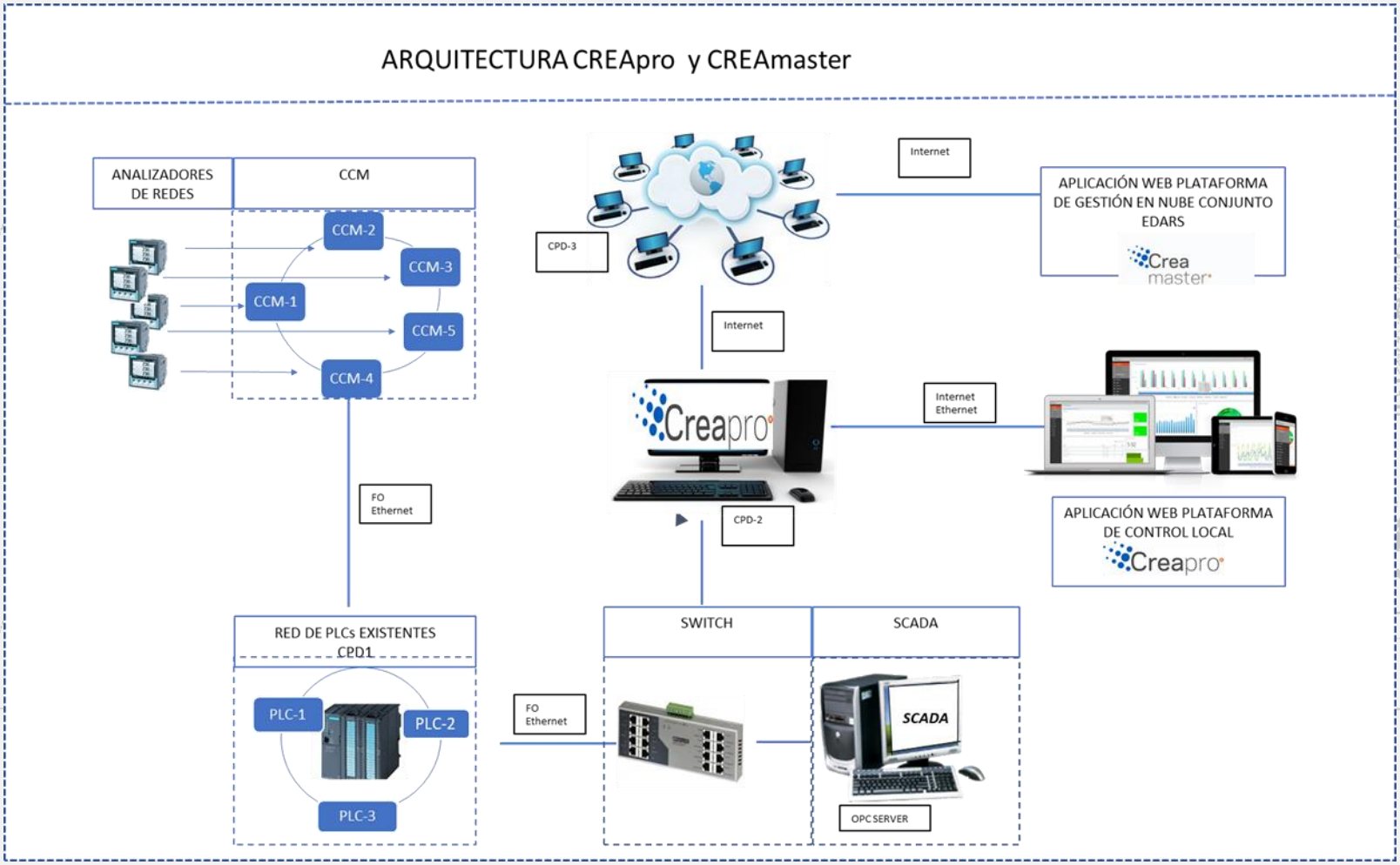
CREA® Platform



Visión integral 360º

Visión 360º

Visión 360º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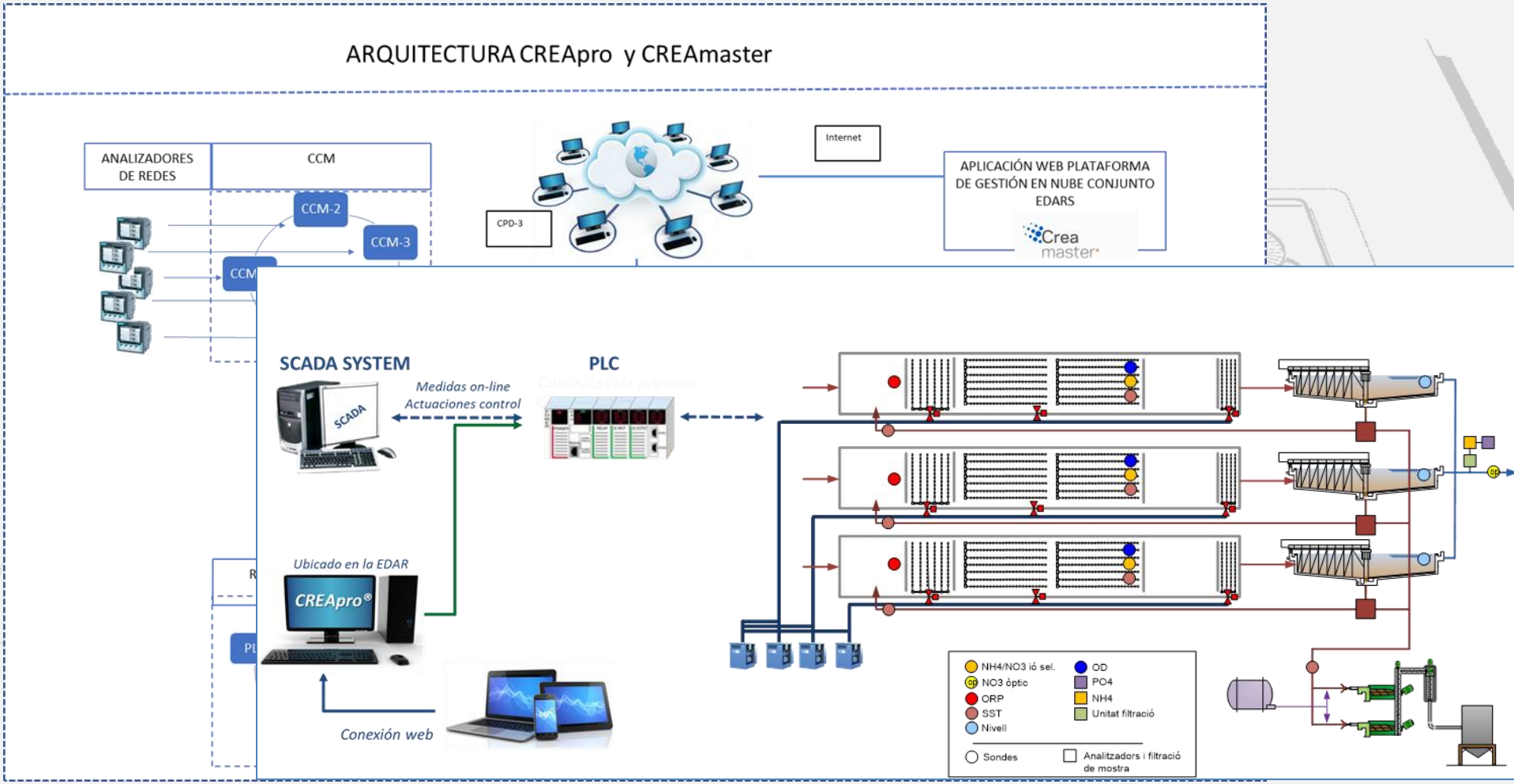
CCM-2
CCM-3
CCM-4
CCM-5
FO Ethernet
RED DE PLCs EXISTENTES
CPD1
PLC-1
PLC-2
PLC-3
CPD-3
Internet
APLICACIÓN WEB PLATAFORMA DE GESTIÓN EN NUBE CONJUNTO EDARS
Crea master
Internet
Creapro
CPD-2
Internet Ethernet
APLICACIÓN WEB PLATAFORMA DE CONTROL LOCAL
Creapro
SWITCH
SCADA
FO Ethernet
SCADA
OPC SERVER

Visión 360º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NO3 òptic
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SST
Nivell
OD
PO4
NH4
Unitat filtració
Sondes
Analitzadors i filtració de mostra

Visión 360º

BENEFITS

INTEGRAL MANAGEMENT
Key processes optimization: aeration, sludge line, anaerobic digestion, cogeneration, etc.

CONTROL STRATEGIES
Feed-back, Feed-forward, adaptive - predictive, energy tariff, equipment management

REAL-TIME DATA MONITORING
Quality parameters, equipment performance, energy cost evolution, weather forecast.

PROCESS INTELLIGENCE
Decision support dashboards, automatic reporting based on advanced data analytics and Key Performance Indicators (KPIs)

INTELLIGENT CONTROL LOGICS
Classical mathematical models + Expert knowledge based on fuzzy logic, pattern recognition and machine learning.

TRAINING & SUPPORT
Full assistance, training and after-sale service to platform users

- **100%** Treated water qualiy guaranteed
- Up to **40%** Reduction in kWh consumption
- Up to **50%** Reduction in energy cost
- Up to **35%** Reduction in chemicals consumption
- Up to **10%** Reduction in sludge treatment cost

Average payback 1-3 years!

Createch360º

Mayor exigència ⇨ Nuevas herramientas

SENSÓRICA

- Análisis de la calidad de las medidas on-line
- Menor dependencia instrumentación
- Virtualización de sensòrica
- Mayor fiabilidad procesos
- Mayores ahorros energéticos

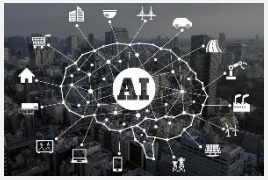
PROCESOS Y EQUIPOS

- Optimización lazos de control automático
- Solución a problemas complejos
- Uso de la experiencia de casos anteriores
- Mayor fiabilidad procesos
- Mayores ahorros energéticos

GESTIÓN DE LA INFORMACIÓN

- Obtención de indicadores de rendimiento de gran volumen de datos
- Análisis cruzados de datos determinar rendimientos o deficiencias de equipos

ARTIFICIAL INTELLIGENCE + DATA ANALYTICS



Proyecto IDM4water – Intelligent Data Management for Up-graded Smart Control in Wastewater Treatment Plants

OBJETIVOS

- Asegurar la fiabilidad de los sistemas de control inteligente minimizando el riesgo de toma de decisiones erroneas debida a la mala calidad de señales on-line
- Dotar al control de capacidad de aprendizaje
- Empaquetar estas capacidades de IA en un módulo IDM que pueda se incorporado en nuevas Plataformas de control y en Plataformas existentes

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Dr. Ricardo Simon

Head of Innovation & Development

CeADAR (Dublin, Ireland)

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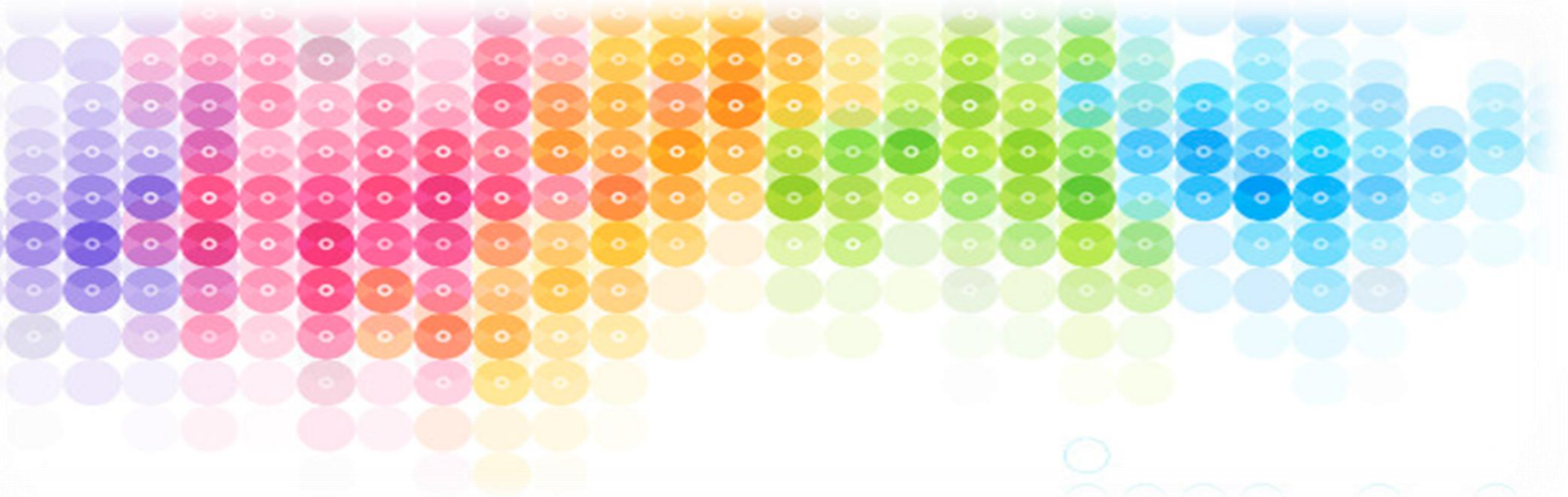

CeADAR
Centre for Applied Data Analytics Research

CeADAR

National Centre for Applied Data Analytics and Machine Intelligence

Dr. Ricardo Simon Carbajo
Head of Innovation & Development
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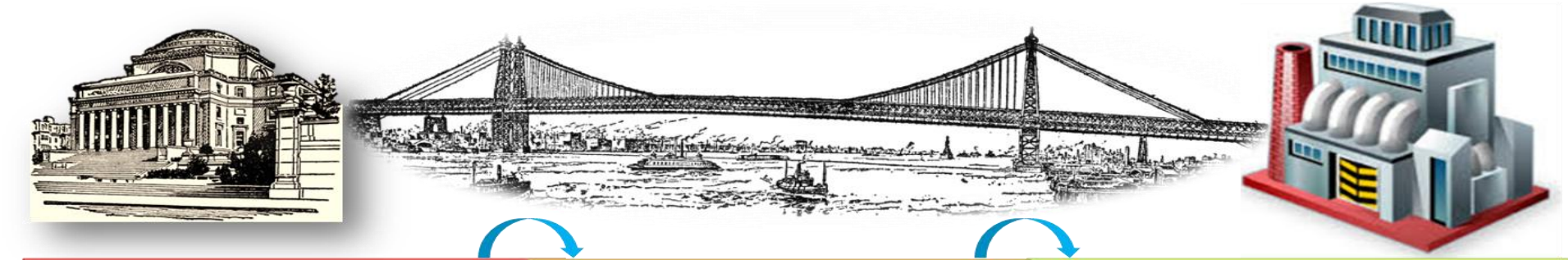
TECHNOLOGY CENTRE
ENTERPRISE IRELAND
IDA IRELAND SUPPORTED

CeADAR

- The National Technology **Centre for Applied Data Analytics and Machine Intelligence**
- Funded by Enterprise Ireland (**EI**) and the Industrial Development Authority (**IDA**)
- **Universities**:
  - University College Dublin (UCD)
  - Dublin Institute of Technology (DIT)
- **Senior** R&D staff
- **Applied R&D** exclusively directed at **industry** challenges
- **Development and deployment** of AI & Big Data Analytics for the **competitive advantage** of **Industry in Ireland**
- **Machine Learning | Big Data | Predictive Analytics | Real time analytics | Deep Learning | Blockchain**

CeADAR – bridging the gap



University → CeADAR → Enterprise

- Basic research & technology creation
- Market push
- Technology driven

- Application development & proof of concept
- Business-value driven
- Market pull/need-driven

Product development and commercialisation

TRL 1 → TRL 2 → TRL 3 → TRL 4 → TRL 5 → TRL 6 → TRL 7 → TRL 8 → TRL 9

Basic principles observed

Technology validated in lab

System prototype demo'ed in operational environment

System proven through full commercial application

CeADAR Member Companies

- 80+ Member Companies
- SMEs & Large Enterprises
- Members Only Events

1. Core-Funded Open-Innovation Service

- **Demonstrators funded** from CeADAR core funds
- **Applied R&D** exclusively directed at **industry challenges**
- Approx. **8 demonstrators** delivered per year
- Demonstrator **rapid prototyping** delivered in 6 months
- **No-charge trials** of existing CeADAR technologies
- Quick wins with **CeADAR's extensive IP catalogue**
- **Each project delivers:**
  - ✓ State-of-the-art review
  - ✓ Technical specification
  - ✓ A demonstrator
  - ✓ Industry evaluated demonstrator performance

2. Bespoke Service

As well as the core-funded engagement model, companies also engage with CeADAR in:

- **Collaborative research**
- **Consultancy**
- **Training**

Leveraging:

- **National Funding**
  - EI & IDA instruments (Innovation Partnerships)
- **EU Horizon 2020** instruments

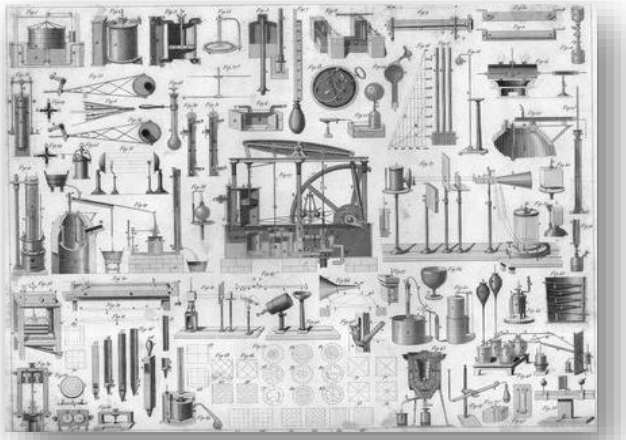
CeADAR Offering

CeADAR
Centre for Applied Data Analytics Research

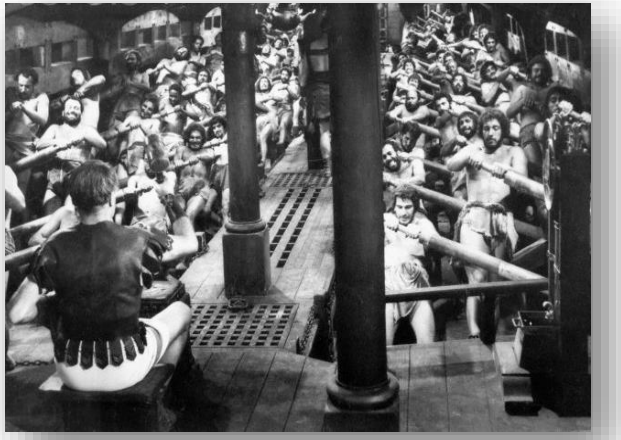
advisory

bespoke solutions

demonstrators



business seminars



collaborative work

flagship projects

CeADAR
Demonstrators & Projects

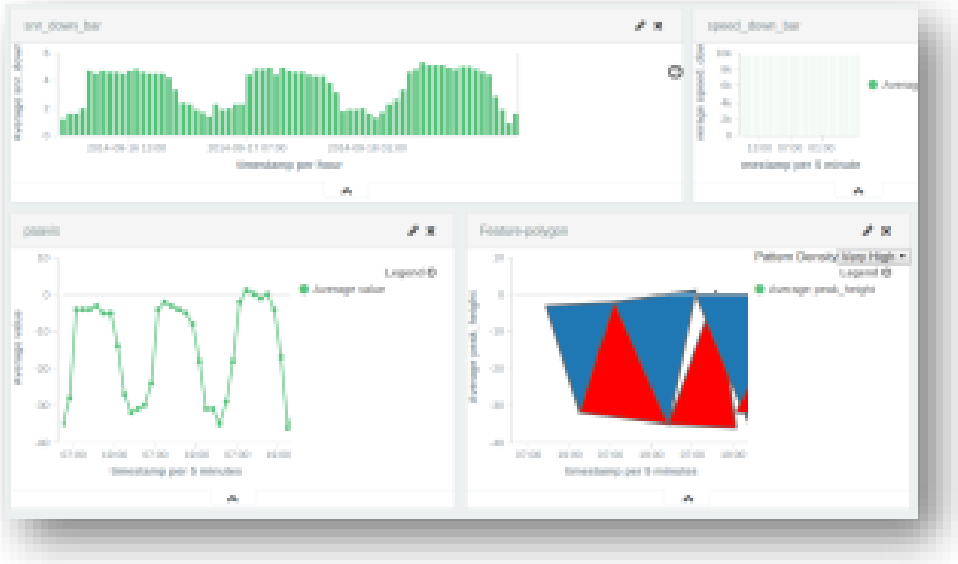
Expertise & 50+ Demonstrators

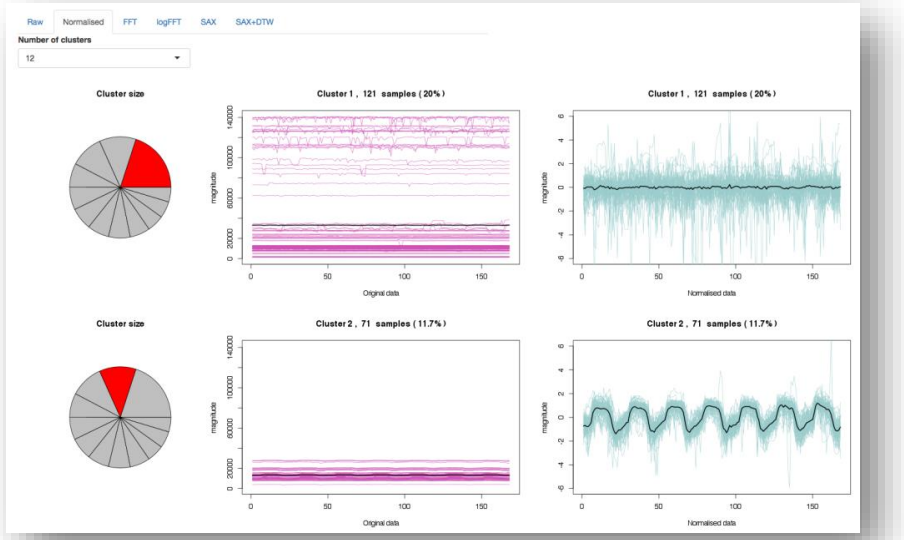
- Machine Learning
- Big Data
- Predictive Analytics
- Real time analytics
- Deep Learning
- Blockchain

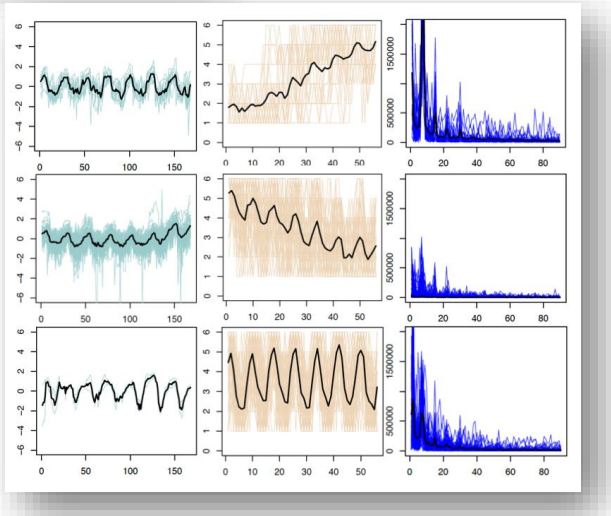
- Contact Centre Analytics
- Customer Analytics
- Fraud Behaviour Analytics
- Social Media Analytics
- Location-based Analytics
- NLP & Text Analytics
- Sentiment Analytics
- Video & Image Analytics
- Precision Agriculture
- Predictive Maintenance

...

Time Series Analytics

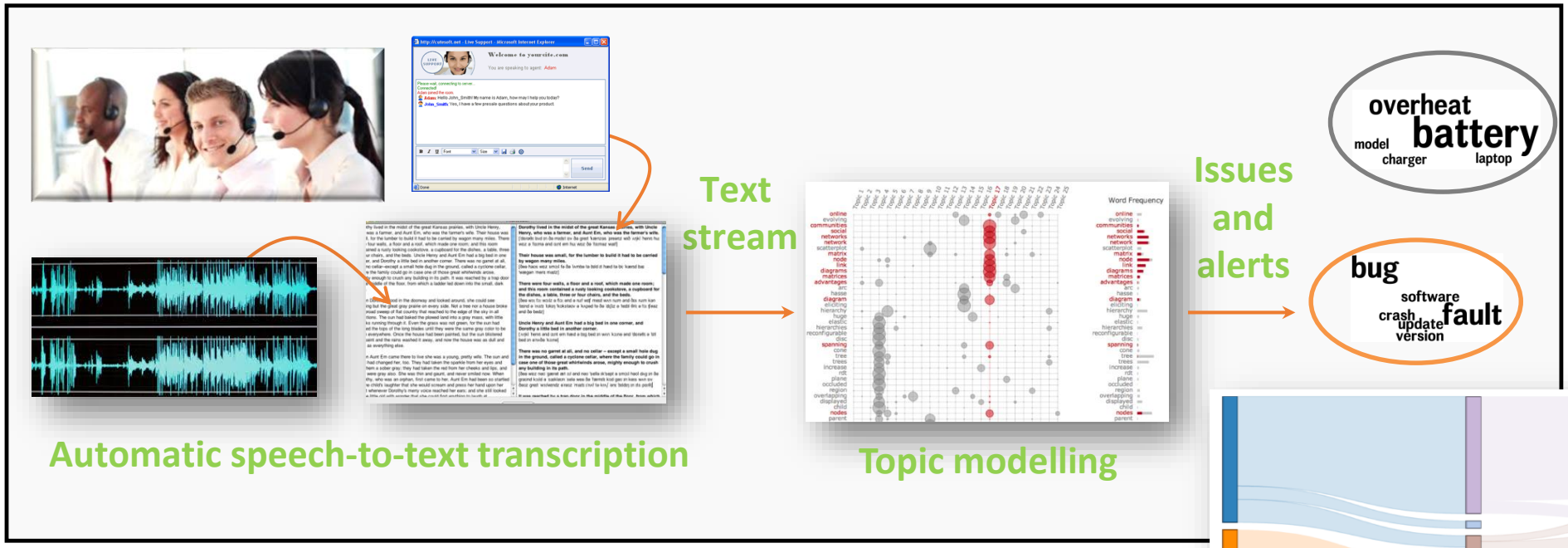


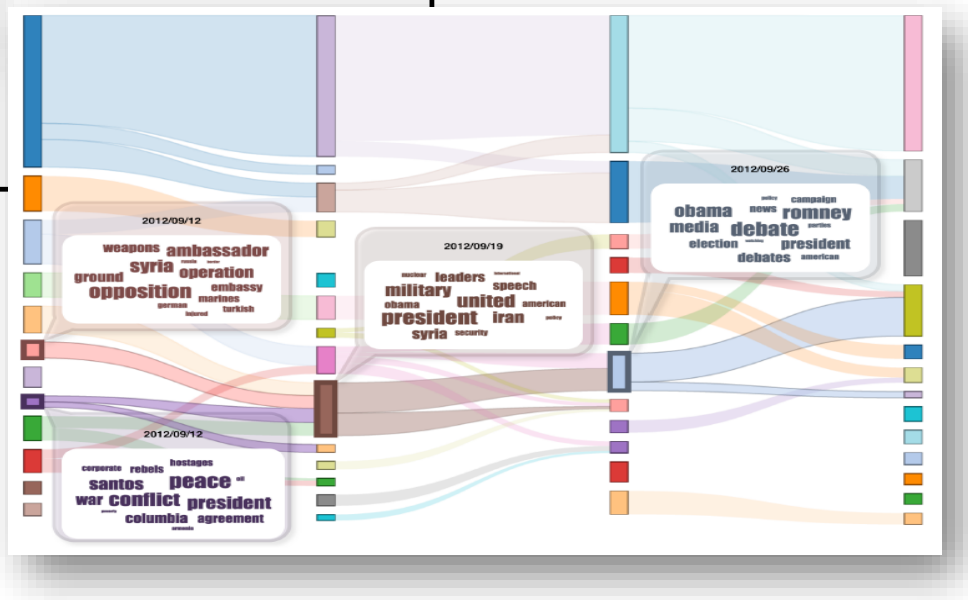




- **Telecommunications Analytics**
  - This tool enables the user to **extract *patterns/events*** from time series data and to search for *patterns/events* that are approximately similar to a **search pattern** or to **cluster** search patterns across multiple time series
  - Router's Network Traffic Issues

Text Analytics / NLP





- **Contact Centre Analytics**
  - **Automatic topic and issue extraction** over large volume audio dialogue
  - Alerting to **new and trending** topics and **tracking of known topics**
  - **Applications**
    - contact centre data
    - online video transcription data
    - large-volume speech audio domains

Image/Video Analytics

- **Logo Recognition**
  - Track **brand** mentions
  - Improved sentiment analysis
  - Measure **sponsorhip ROI**
  - Find visual influencers
  - Identify moments of **consumption**

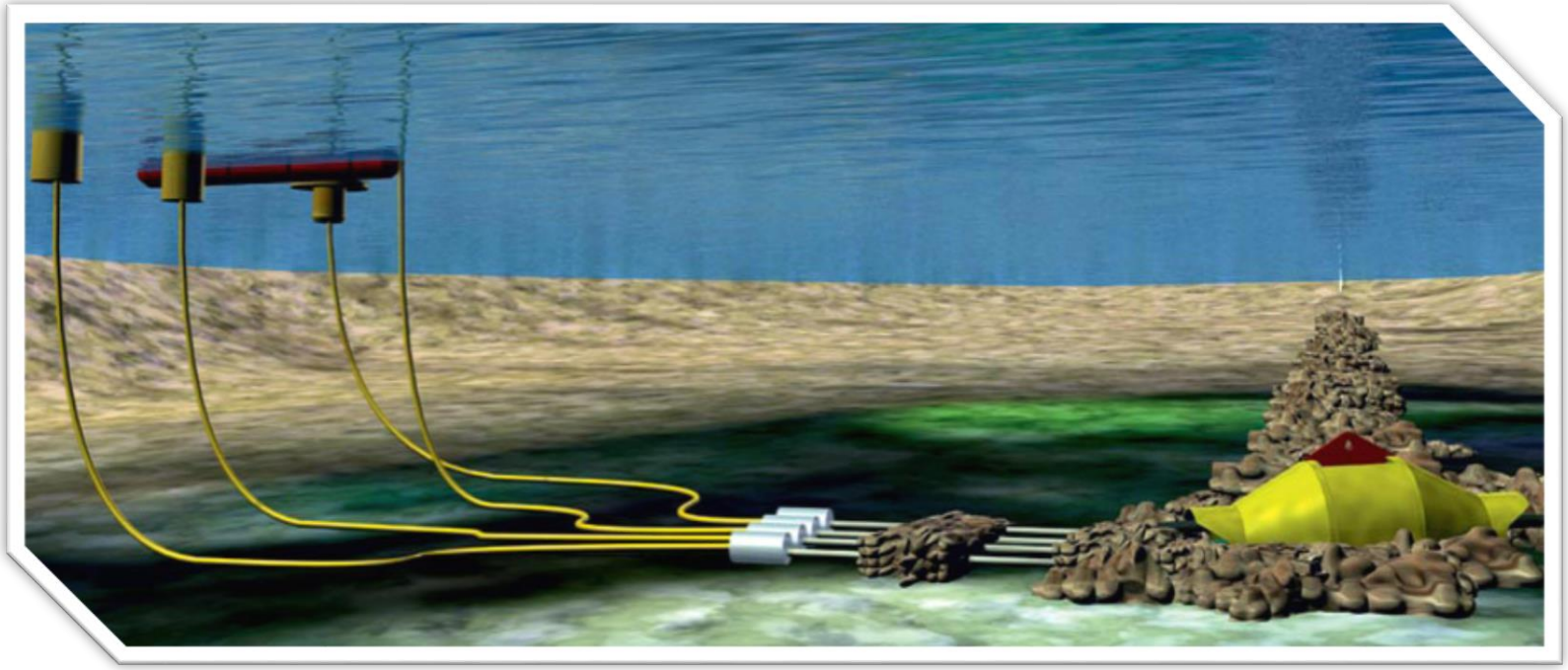
- **Precision Agriculture**
  - Major player in infrastructure for the **poultry & livestock** industry
  - **Real-time analysis** of livestock metrics from multiple distributed and networked sensors

Industry 4.0: Wind Energy

- **Wind Turbine Predictive Maintenance**
  - Reduced inspection, intervention and maintenance costs
  - Early Fault Detection
- **Wind Turbine Power Output Optimization**
  - Wind Turbine Configurable Parameters (Blade, Nacelle)
- **Wind Turbine Farm Power Forecast**
  - Accurate Energy Production (weather, historical)

Industry 4.0: Oil & Gas

- **Pump & Valve Predictive Maintenance**
  - Degradation, Schedule Maintenance
  - Maintenance of Subsea Pipeline in Oil & Gas



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Computer Vision Center

Imaging Knowledge

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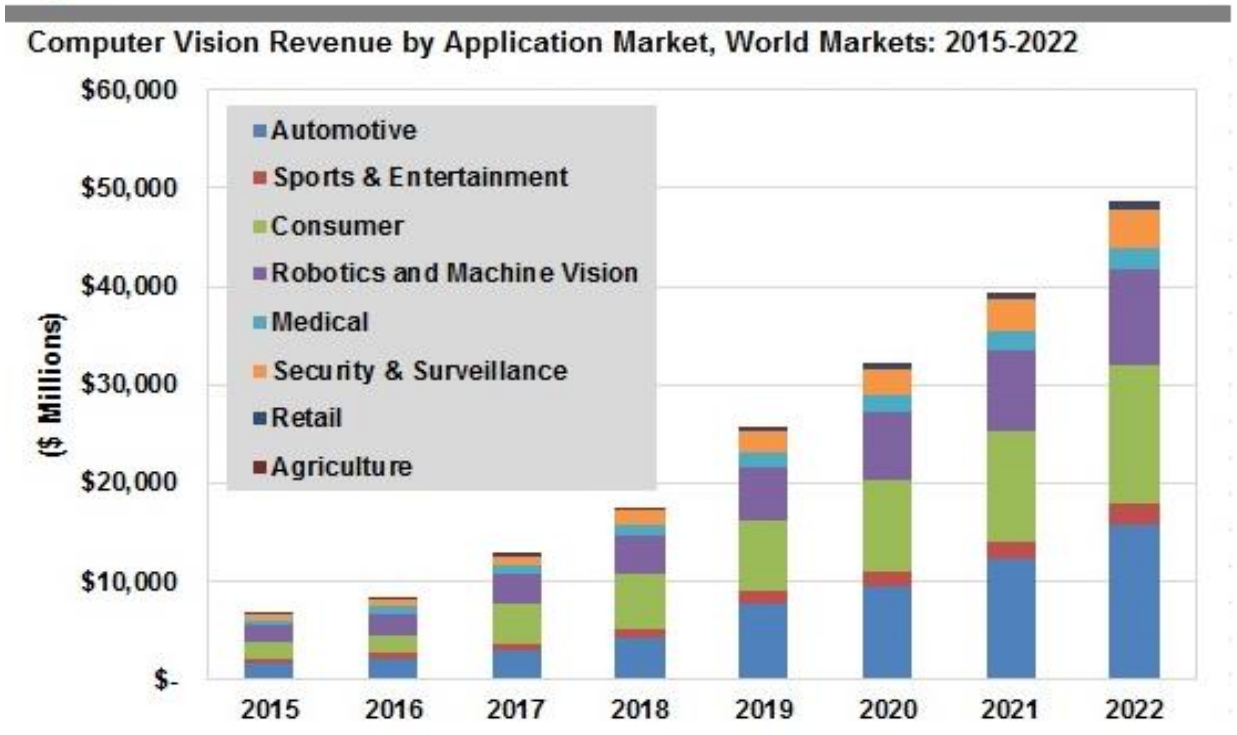
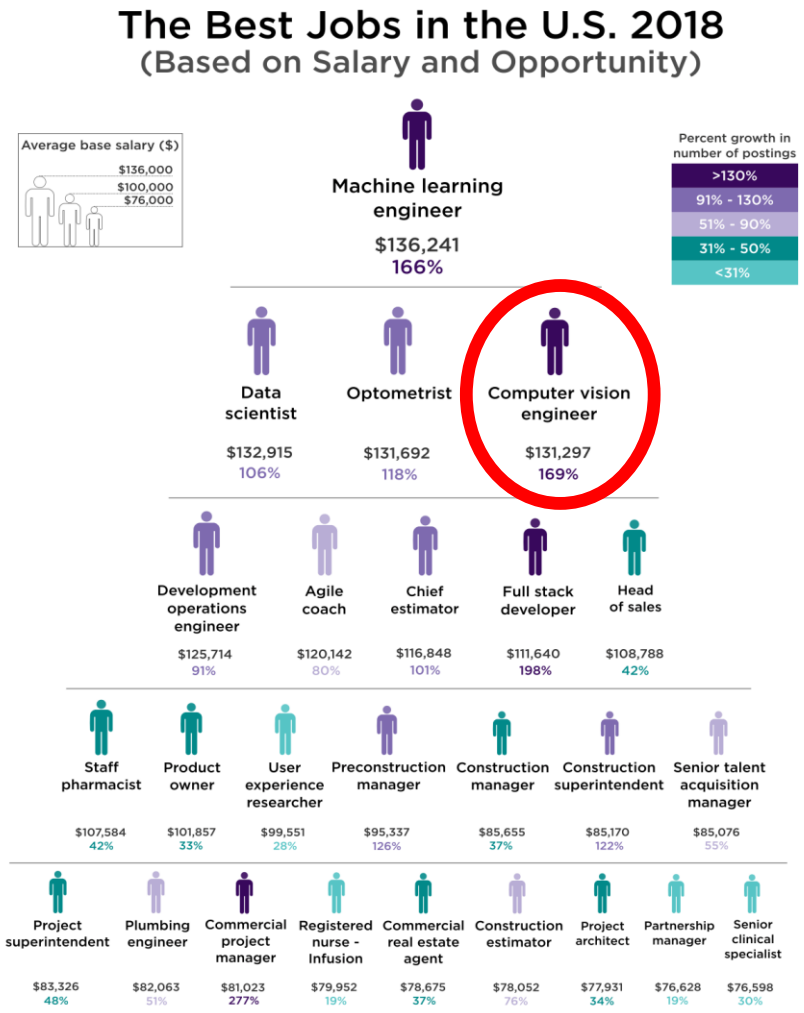
27th November 2018

Computer Vision Market

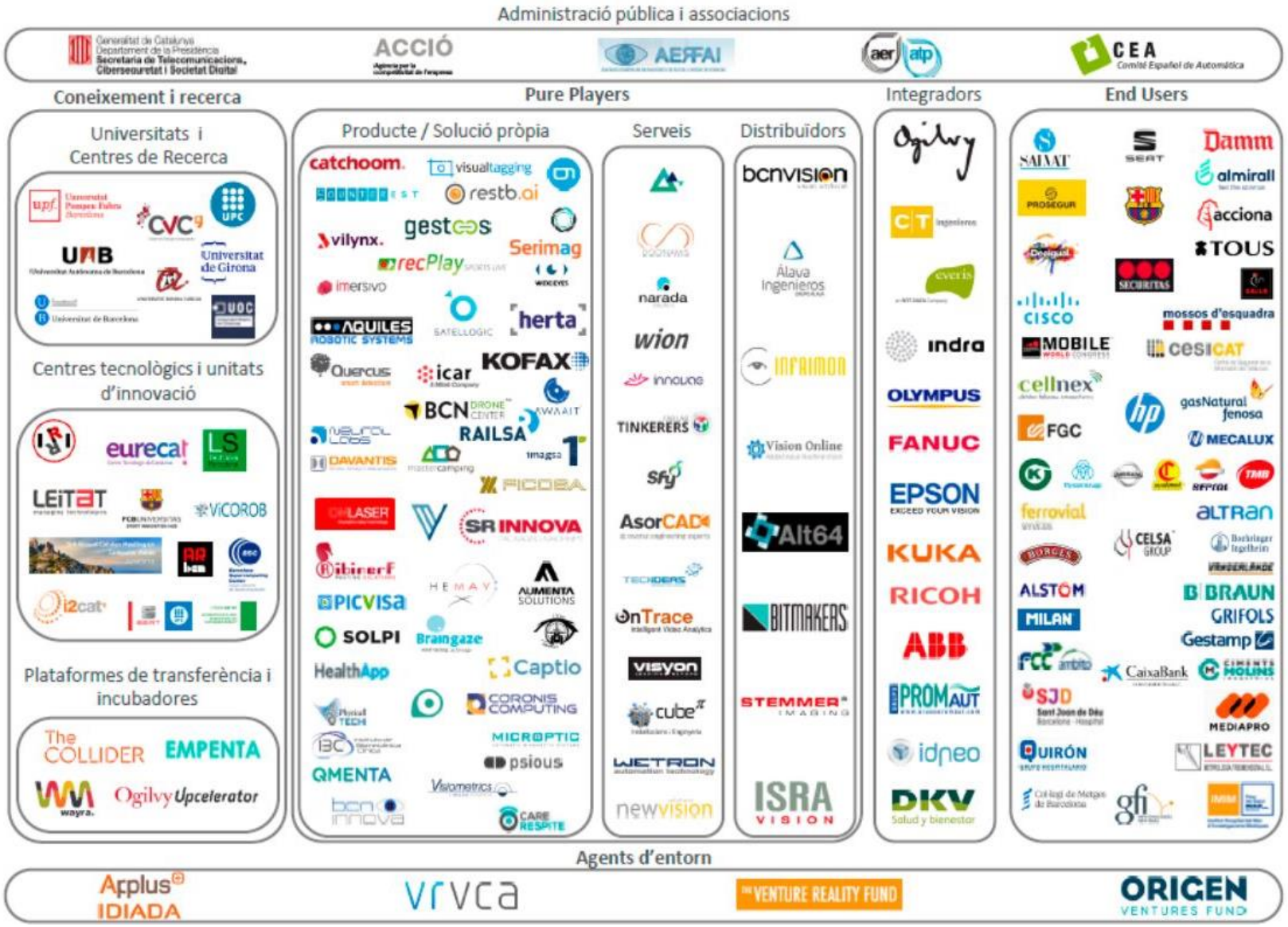
Tractica





Article & Sources:
https://howmuch.net/articles/the-best-jobs-in-usa-2018
https://www.indeed.com

Catalan Computer Vision Ecosystem



Catalan Computer Vision Ecosystem

Ecosystem of Computer Vision in Catalonia **2017**

+700 professionals

75 Pure Player companies

+ 1 M€ Incomes

+90 M€ Total incomes

+ 250 Publications in high impact index journals

+ 130 Funded projects

+ 50 Thesis

Incomes per market sector:

Health & Wellbeing **3 M€**

Security & control **26 M€**

Advanced processes (Industry 4.0) **33 M€**

Marketing/ Retail **11 M€**

Dealers **25 M€**

Only Center in Europe fully devoted to Computer Vision

23 Years

+64 Staff

€2,8 M€/year Income

CVC Model


New ideas
Competitive grants
Research
Research
Publications
CVC
Knowledge | Know-How
Marketing actions
Private funds
Technology transfer
Development
Prototypes

Facts & Figures 2017

Research

21 Competitive projects obtained:

- **5** R+D projects of national calls (255 K€)
- **1** R+D project of european calls (18 K€)
- **3** R+D of other calls (233 K€)
- **12** HHRR grants (FI, DI, FPI, FPU, Cofund).

CVC is partner of the **Marie Curie Cofund P-Sphere** project within the UAB hiring 6 post-doctoral researchers in 2017.

Facts & Figures 2017

Scientific Production

40 JCR indexed Journal articles

54 Papers in International Conferences

7 book chapters

4 books (3 thesis)

PhD Thesis

6 defended Thesis, within the Informatics PhD programme of the UAB. One of them co-directed with the Caen-Basse University.

59 ongoing PhD Thesis. 2 in co-supervision with the Université de Monastir and the Chinese NPU. **12** industrial PhDs.

Media

29 Articles in national and International press

4 clips in TV – national and regional broadcasters

5 Radio interviews

10 web publications

+ 2.000 Social network followers

Human Resources

49 Post-doc and senior researchers

59 PhD students

We have been granted with the **HR Excellence in Research** distinction in the year 2015.

Facts & Figures 2017

Tech Transfer

36 **new contracts** signed, with a total budget of 752.000 €.

50 **active projects** with a total budget of 1.098.000 €.

4 **license contracts** granted for a total amount of 110 K€.

dormity.com · Applus IDIADA · TTL · SAMSUNG · Boston Scientific · Volkswagen · SEAT · CAPE · FICOSA · Scytl Innovating Democracy · HUAWEI · HEWLETT PACKARD · QIDENUS TECHNOLOGIES · CaixaBank · intel · iTESOFT · Audi · LEAR CORPORATION · Yandex · gasNatural fenosa · xerox · B BRAUN 25 SHARING EXPERTISE · BERGER GROUP INNOVATIONS FOR SEATBELTS · ONCE · DOONAMIS · FLAMAGAS · ALSTOM · Continental · eurecat Centre Tecnològic de Catalunya · GLOBEN IMAGING · 44 screens aplicaciones móviles y realidad aumentada 3D · LEAR CORPORATION

Spin-offs

Year	Spin-offs
1998	VISIÓ I ROBÒTICA APLICADA (VyRA) Computer Vision Solution
2001	VISUAL CENTURY Video Indexing
2002	ICAR VISION SYSTEMS Systems for personal document
2003	INSPECTA Cork quality Control
2005	DAVANTIS Smart surveillance
2012	CLOUD SIZING SERVICE Sizing clothing
2012	VISUAL TAGGING SERVICES Mobile apps
2014	CROWDMOBILE, SL Crowd Sourcing Solutions (Knowxel)
2015	CARE RESPITE Indoor Intelligent Visual System for Dependence
2016	ORAIN TECHNOLOGIES Intelligent Vending Machines

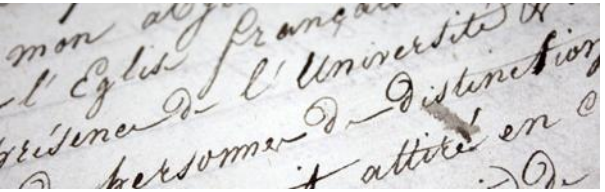
Research

Health and well-being

Computer assisted diagnosis, intervention and planning;
Augmented modelling;
Well-being and ambient assisted living.

Mobility and transport

Advanced driving systems and autonomous driving;
Virtual worlds for ADAS;
Unmanned Aerial Vehicles.

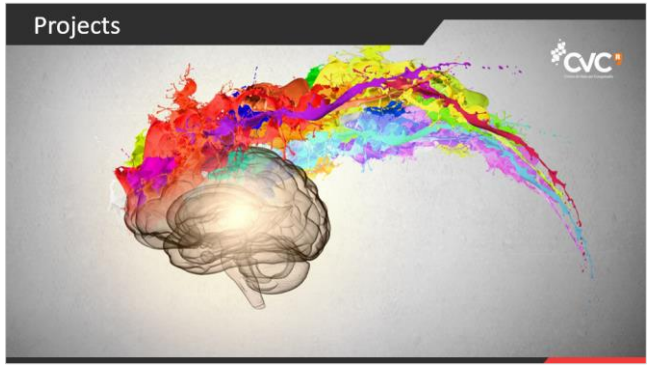


Culture & Experience-based technologies

Cultural heritage (AR/VR)
Reading Systems – Document analysis
Surveillance

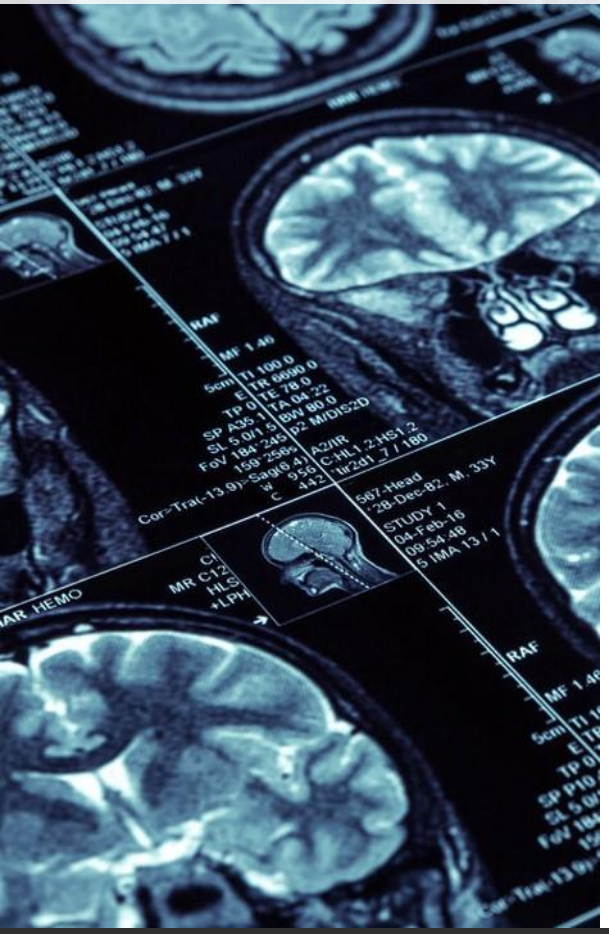
Industry 4.0

Quality control
AR/VR technologies for industry 4.0
Robotic Vision

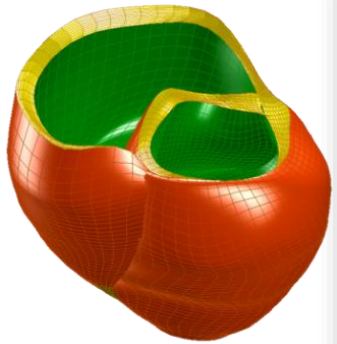


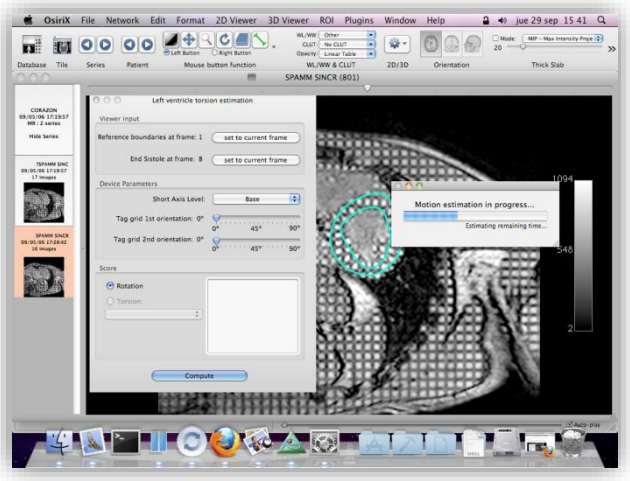
Health

Decision Support Systems



Cardiac Anatomy and Function (MR)

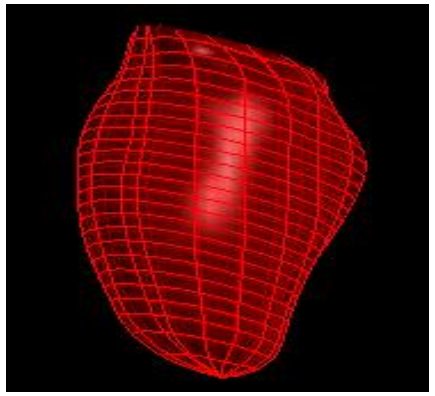




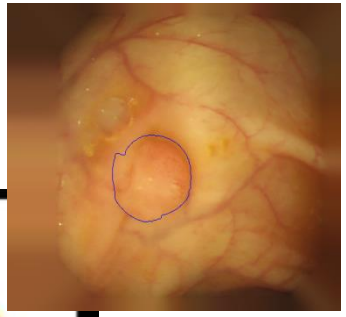
HOSPITAL DE LA SANTA CREU I SANT PAU
UNIVERSITAT AUTÒNOMA DE BARCELONA

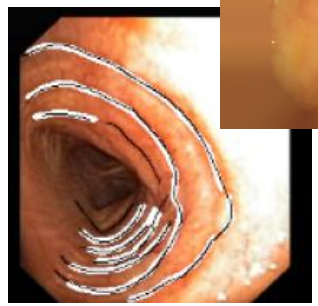
BSC

OXFORD BIOTECH
TRANSLATING INNOVATIVE SCIENCE INTO DISRUPTIVE BUSINESS.



Bellvitge Hospital Universitari
Institut Català de la Salut

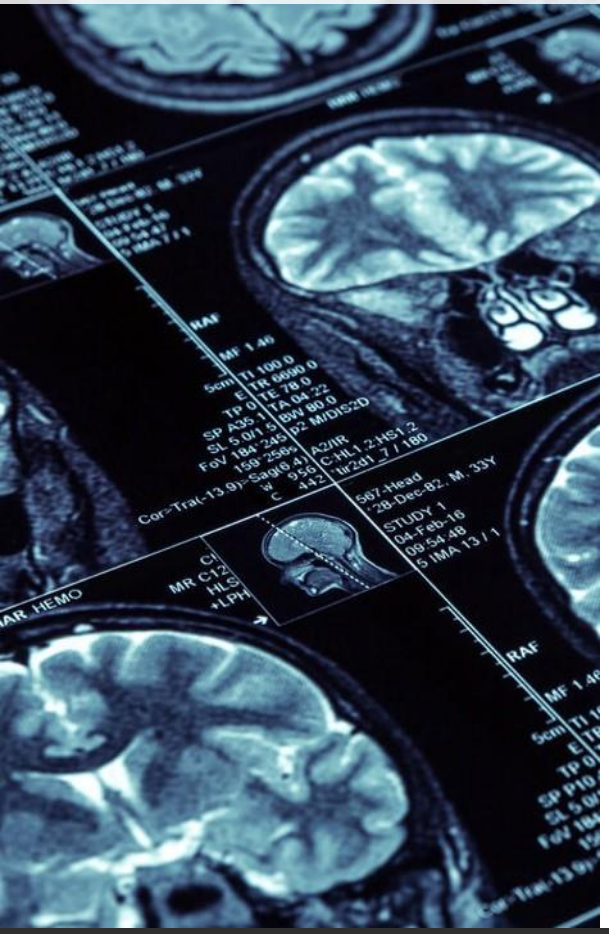




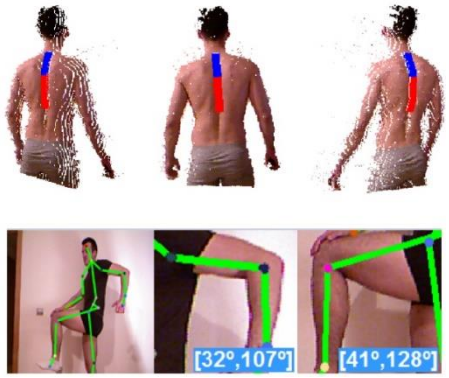
On-line Endscopy Processing

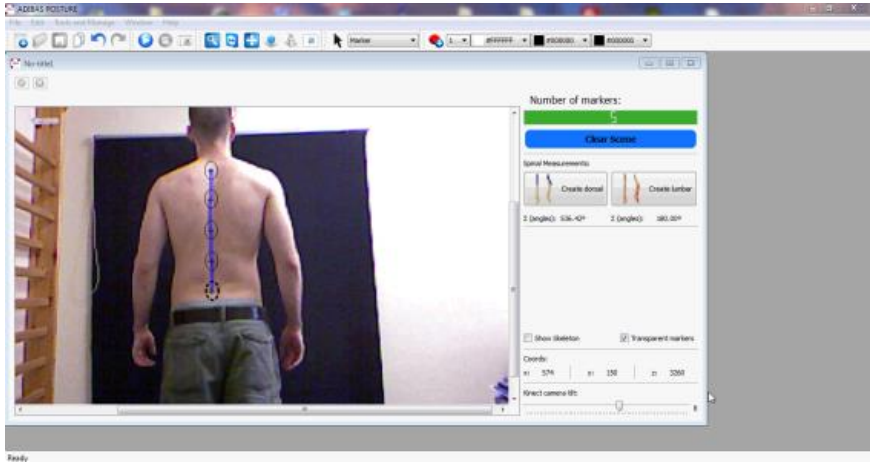
Well-being

Rehabilitation & Ambient Monitoring

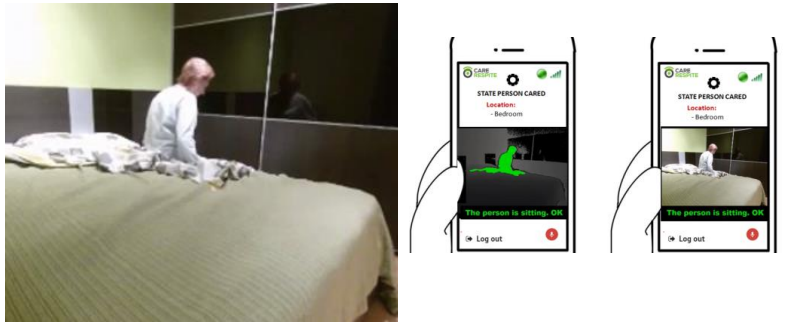


Body posture



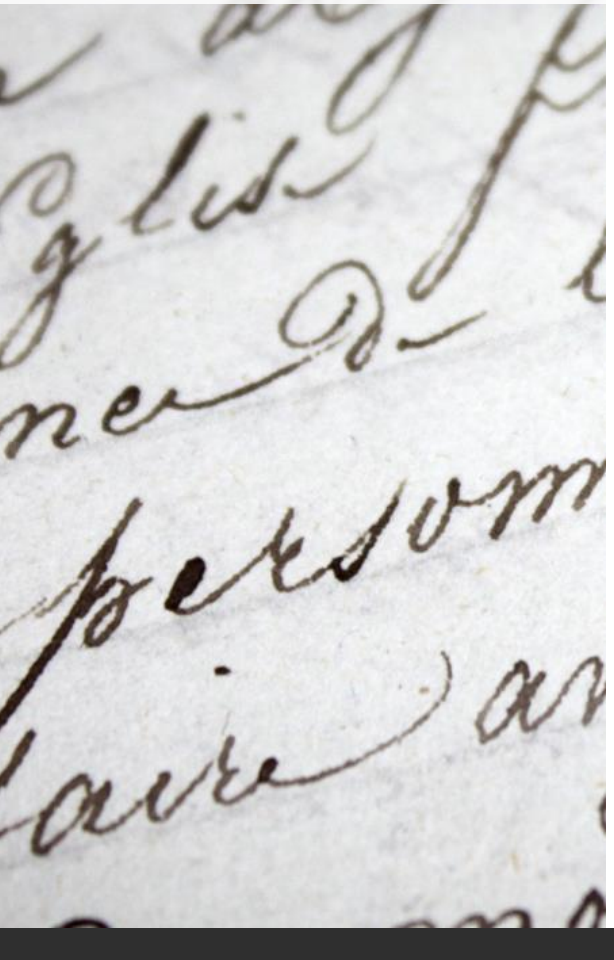


Person identification



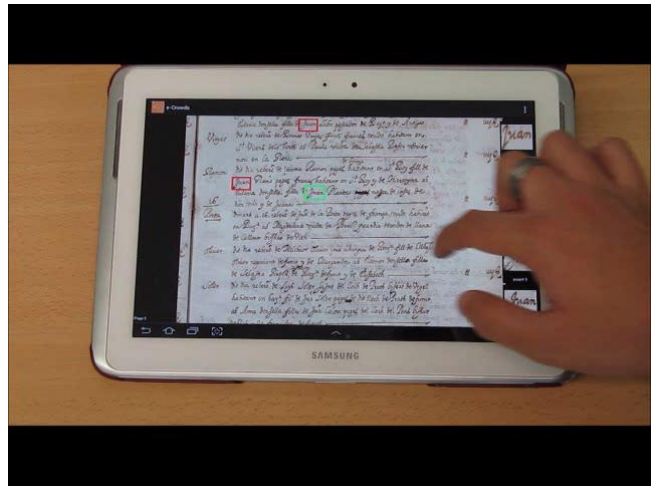
Culture and Experience-based Technologies

New User Experiences in Cultural Heritage

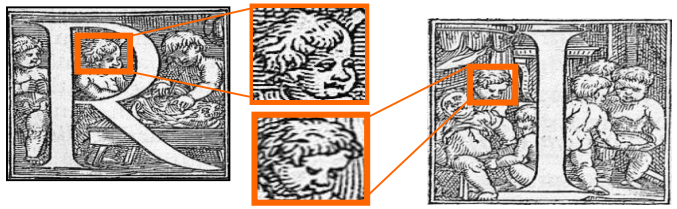


Virtual reconstruction

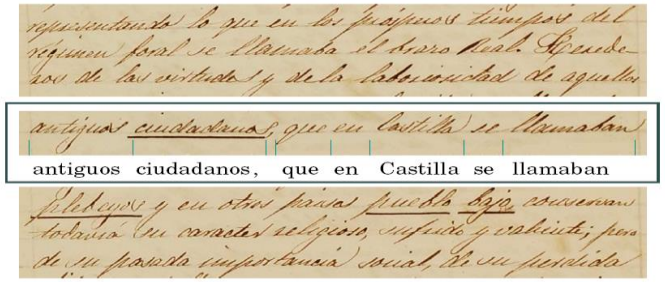
Word spotting



Engraving Analysis

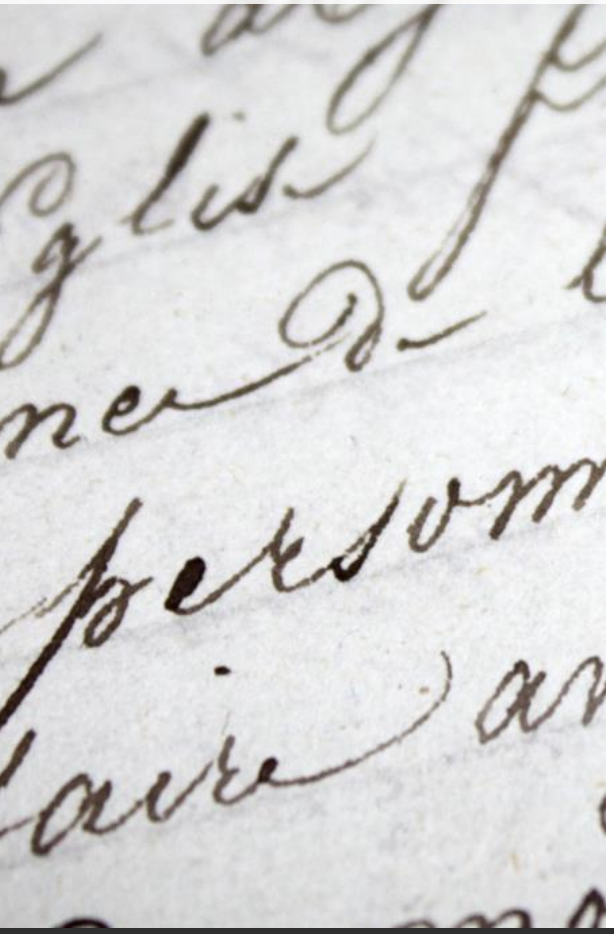


Handwriting Recognition

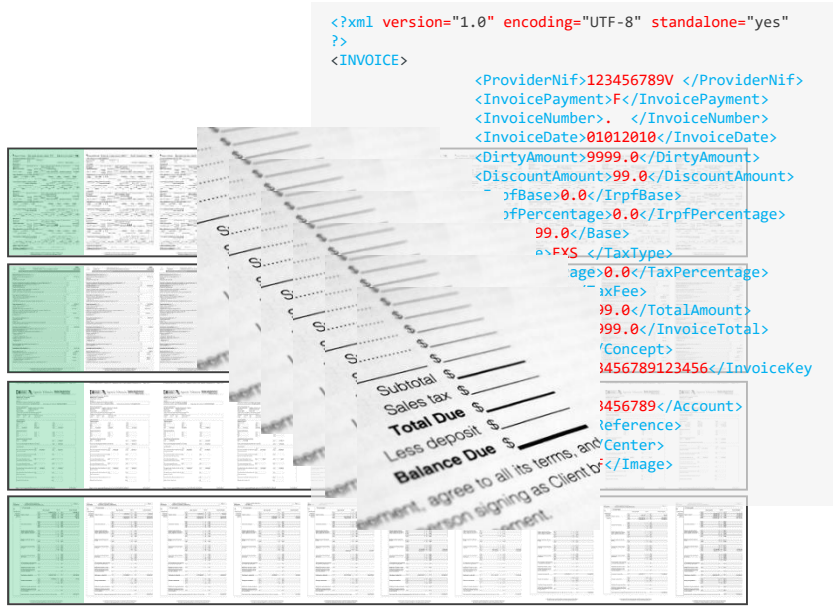


Intelligent Content & Media

Intelligent Content & Media



Document Capture and Analysis

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                  fPercentage>0.0</IrpfPercentage>
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                      EXS </TaxType>
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                          axFee>
                          9.0</TotalAmount>
                          999.0</InvoiceTotal>
                          Concept>
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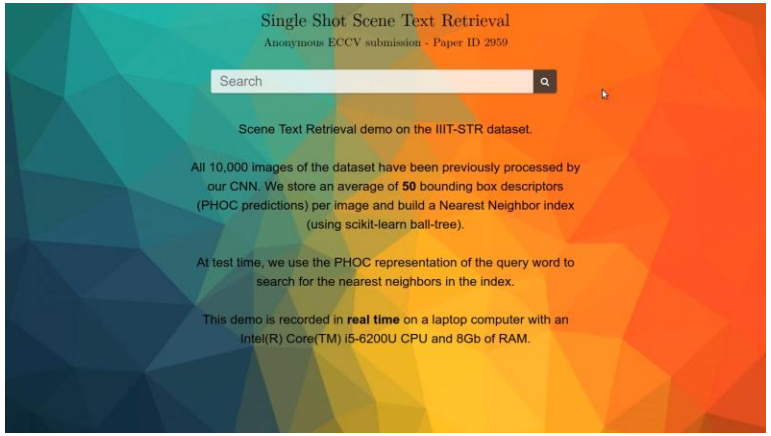
                          3456789</Account>
                          Reference>
                          Center>
                          </Image>
```

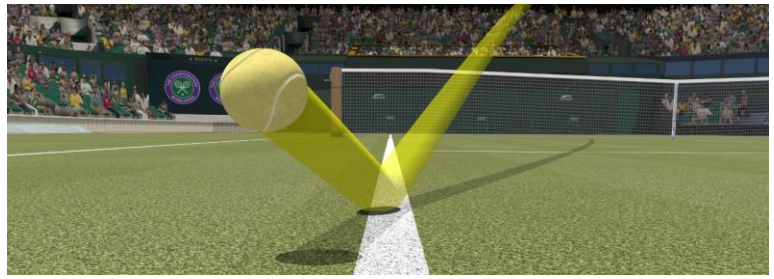
Large scale indexing and retrieval



Intelligent Content & Media

Intelligent Content & Media

Trajectory and game reconstruction



Body posture analysis

Player tracking

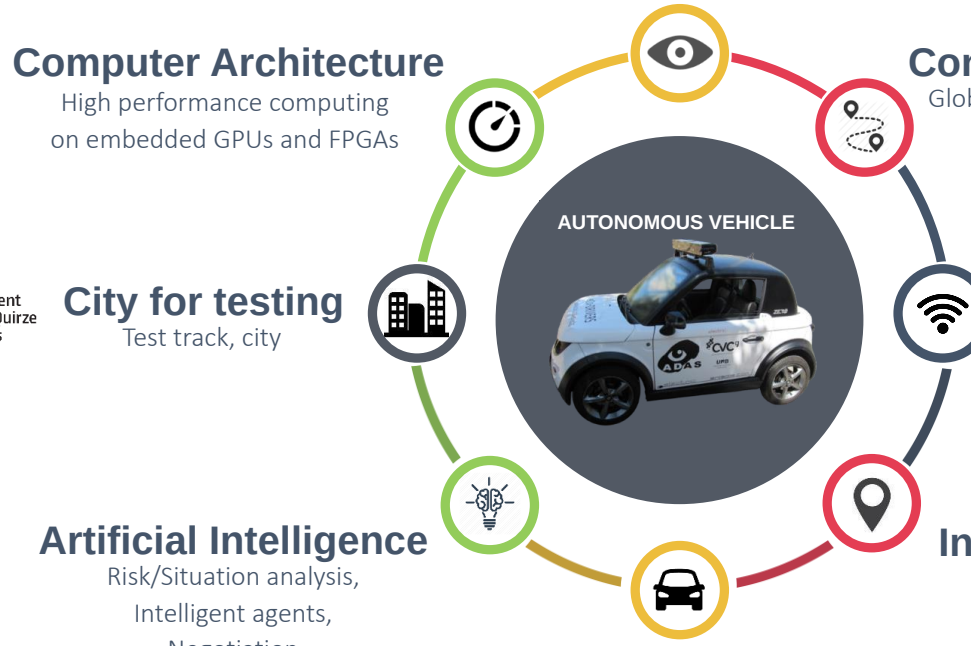
Mobility and Transport

Advanced Driver Assistance Systems

Environment perception
Vision based perception

Computer Architecture
High performance computing on embedded GPUs and FPGAs

Control and Planning
Global planning, Local planning and Control



City for testing
Test track, city

Communications
V2V and V2I

Artificial Intelligence
Risk/Situation analysis, Intelligent agents, Negotiation

Information Fusion
LIDAR, Radar, IMU, FIR, Ultrasound, GNSS

Vehicle Engineering
Electronics, Mechanics, Power supply, CAN bus, Maintenance

Mobility and Transport

Simulators for ADAS

SYNTHIA

A synthetic collection of annotated images of driving scenarios

CARLA

End-to-end driving open source simulator for research in autonomous driving

CARLA

Mobility and Transport

Pedestrian protection systems

Day and night time pedestrian detection from a mobile platform in an Outdoor scenario. Aspect-changing class targets.

Industry 4.0

Industry 4.0

CASA TARRADELLAS

i2cat

eurecat
Centre Tecnològic de Catalunya

RIS3CAT

LEITAT
managing your technologies

CIMENTS MOLINS INDUSTRIAL

[L*]ProCareLight
Light and Laser Safety Solutions

CETaqua
CENTRO TECNOLÓGICO DEL AGUA

SADAKO
TECHNOLOGIES

gasNatural fenosa

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AUMENTA SOLUTIONS

Industry 4.0

Cyber Physical Systems

Collaborative Robotics

Augmented Reality

ALSTOM

Industry 4.0

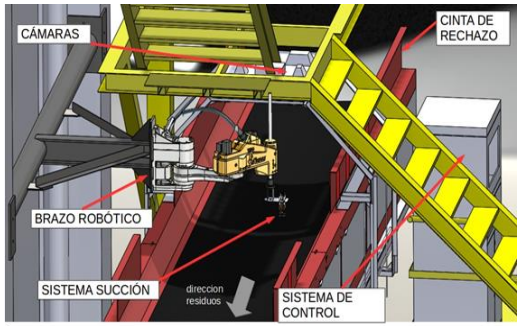
Industry 4.0

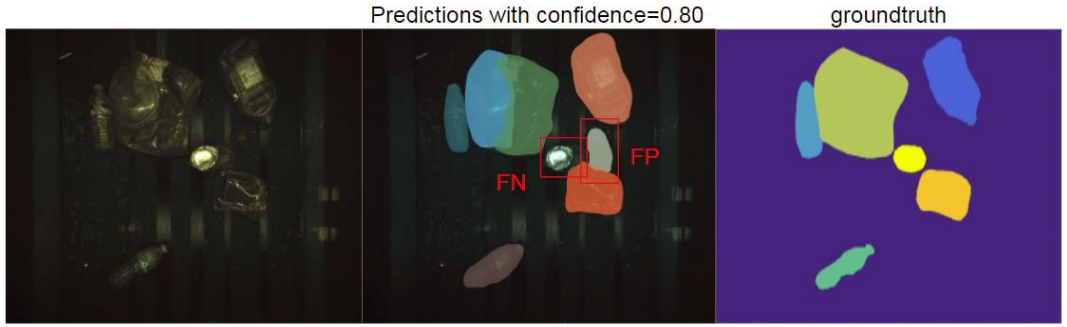
AR technologies for training in processes

AUMENTA SOLUTIONS

ALSTOM

Deep learning for selective sorting





SADAKO TECHNOLOGIES

Industry 4.0

SADAKO TECHNOLOGIES

RUBSEE: AI REVOLUTION IN THE WASTE FIELD BEYOND SORTING

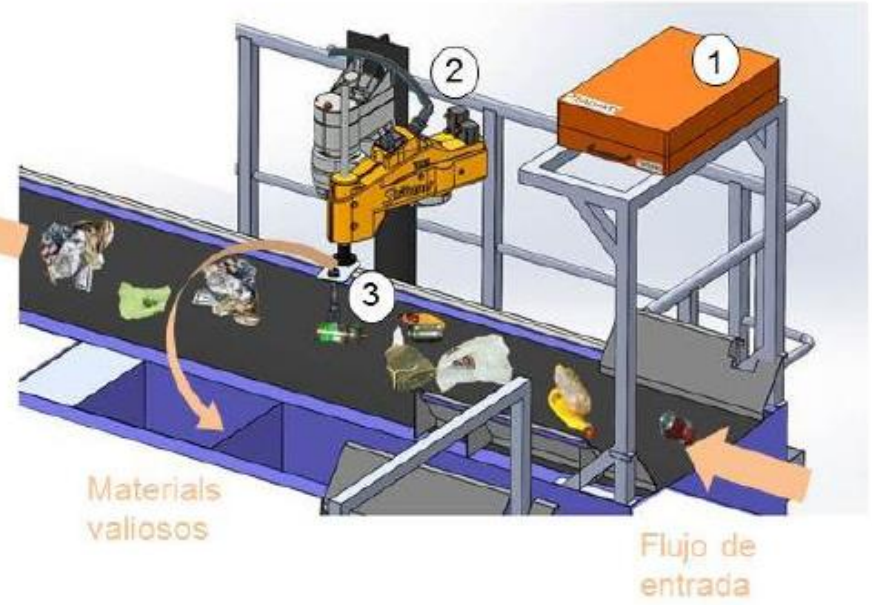
Current manual classification

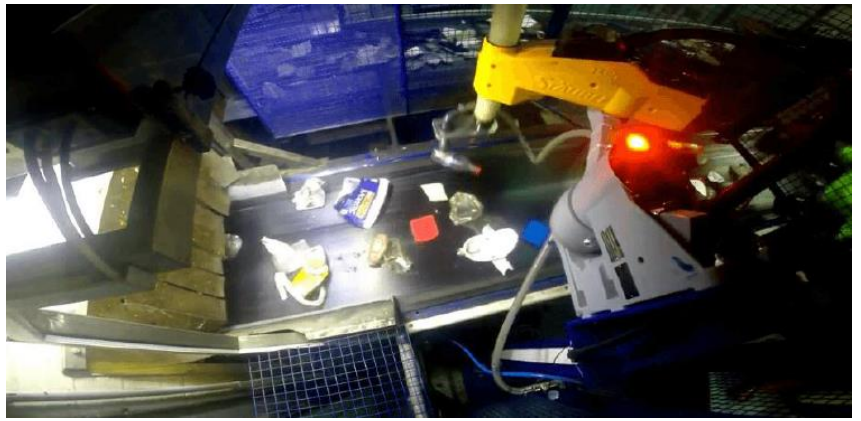
Industry 4.0

SADAKO TECHNOLOGIES

Computer vision and robotics for specific intelligent sorting:

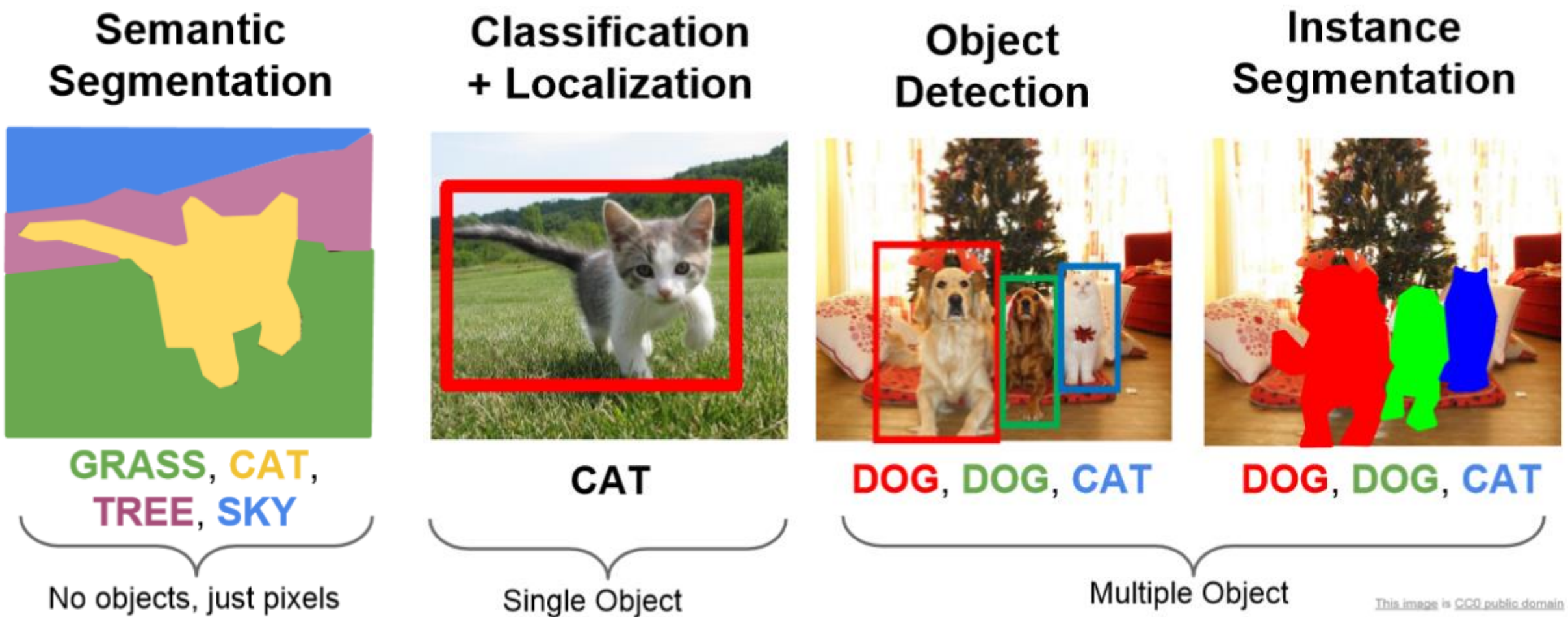
COMPONENTES
1. Caja de cámaras
2. Brazo robótico
3. Herramienta de agarre
4. Inteligencia Artificial para hacer que todo funcione (no mostrado en el diagrama)





Industry 4.0

Specific training of Neural Networks for instance segmentation:



Industry 4.0

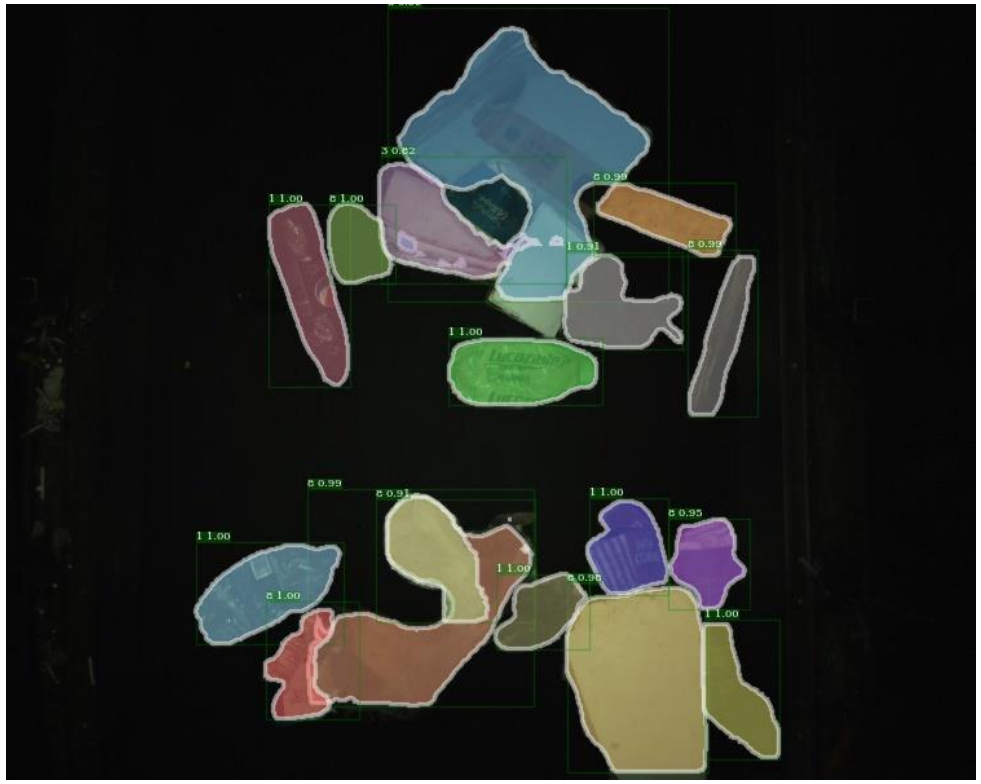
Object Classification

Semantic segmentation

Instance Semantic segmentation

Industry 4.0

Neural Network: MaskRCNN



Training

MASTER IN COMPUTER VISION

Master in
Computer Vision
Barcelona

- Master designed to offer students an **updated program of cutting edge methods and foundations of computer vision**.
- This master degree program attempts to tackle the need for qualified personnel in this field, with an **agile approach** and an **emphasis in Deep Learning techniques.**
- Possibility for third-parties to offer **MSc studentships**:
  - MSc project focused on challenges from company
  - Internship at the company premises

Entrepreneurship

AI4ALL

The objective is to bring the participants closer to AI technologies, generate new market ideas and help promote the competitiveness of the region in this field.

CSIC IRTA UAB Parc de Recerca UAB

UAB Universitat Autònoma de Barcelona Escola d'Enginyeria

CVC Computer Vision Center

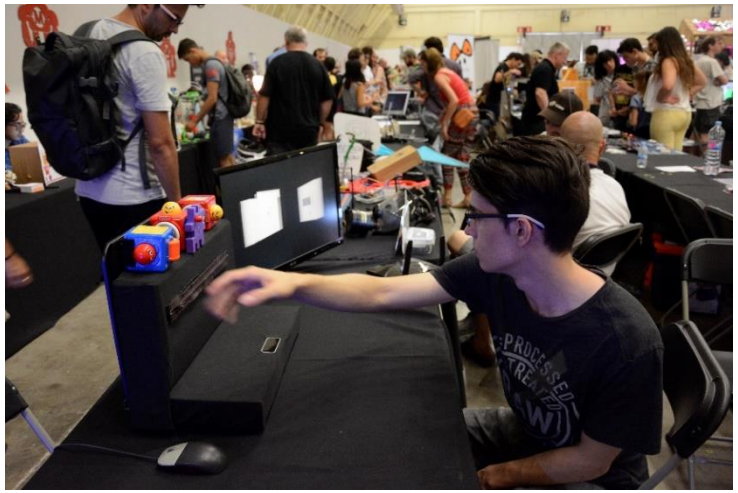
With the support of:

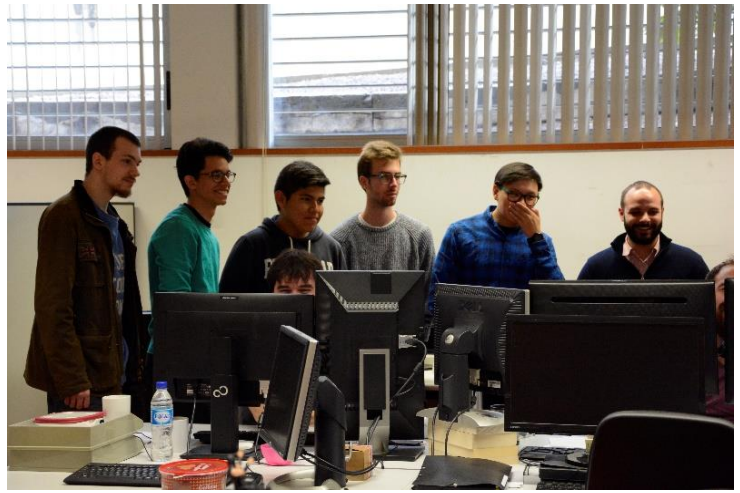
catalunya emprèn

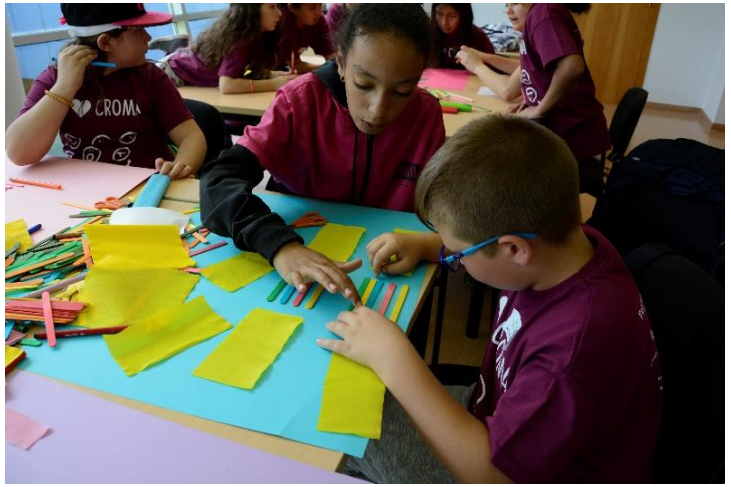
Generalitat de Catalunya Departament d'Empresa i Coneixement

Unió Europea Fons social europeu L'FSE inverteix en el teu futur

School Visits & Fairs







INVESTIGA AMB RECERCAIXA

MAKER FAIRE

ESCOLAB

PROGRAMA CROMA

FESTA DE LA CIÈNCIA

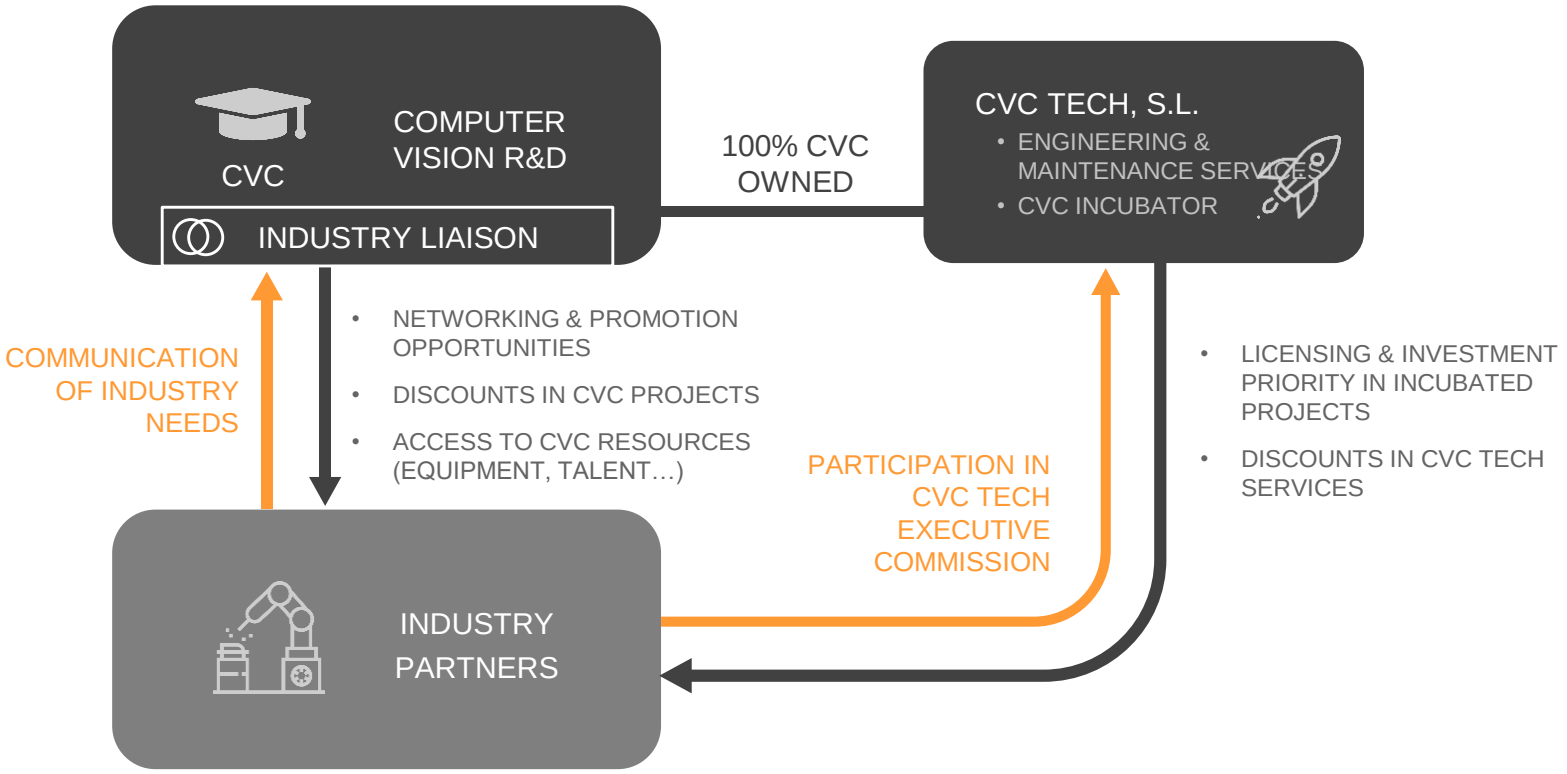
High Impact Events

smart city expo
WORLD CONGRESS

How to collaborate with us

INDUSTRY LIAISON PROGRAMME (CVC-ILP)

CVC-ILP has been defined to **streamline industry collaborations** with the CVC and put new technologies in the market, leveraging CVC's know-how.



Thank You

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Direct Line: +34 93 581 3073
Fax: +34 93 581 1670
www.cvc.uab.cat

Lali Soler

Data Analytics Business Manager

EURECAT

@eurecat_events | @eurecat_news

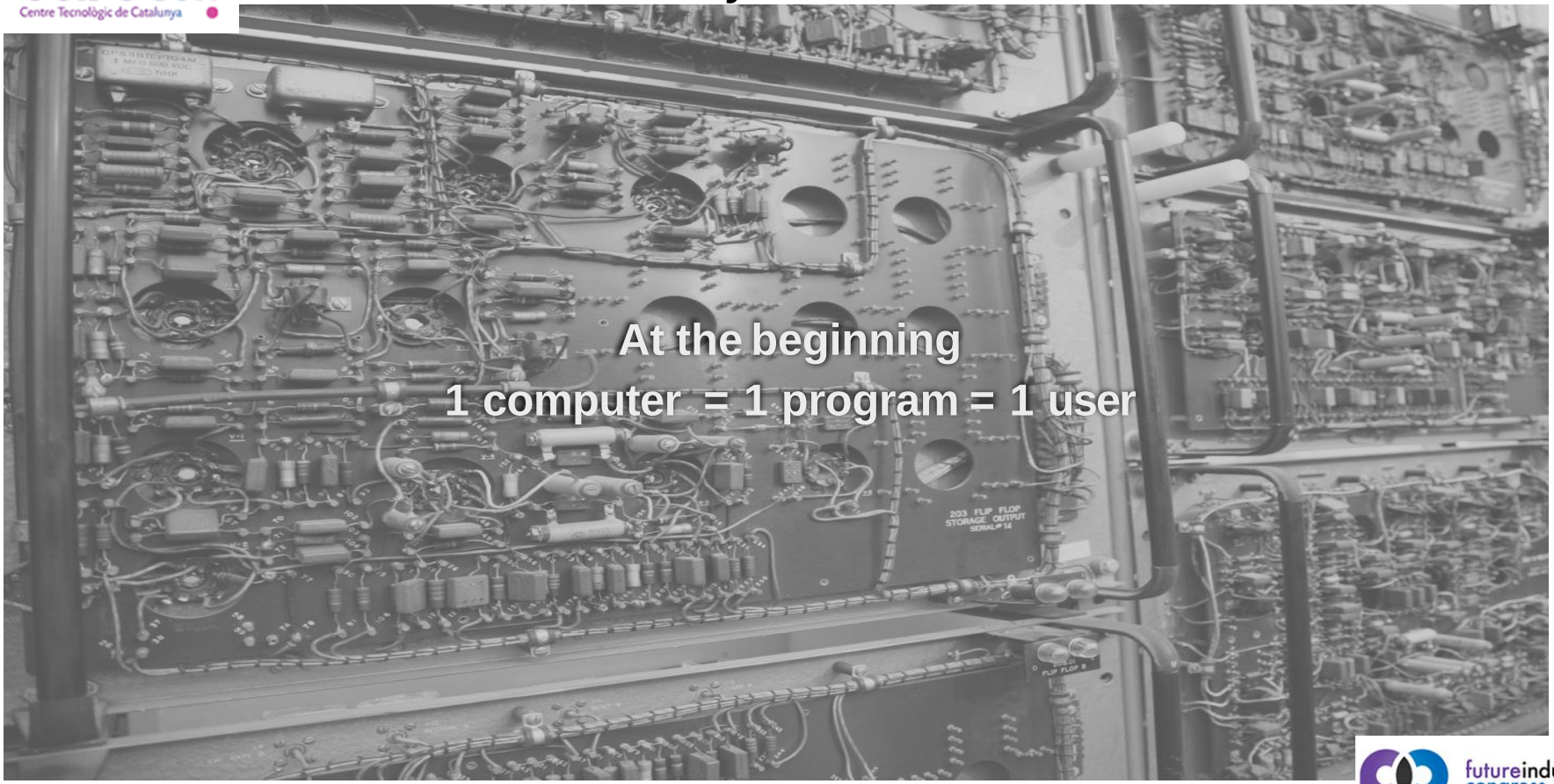
Reshaping Business with Artificial Intelligence

Lali Soler Data Analytics Business Manager, Eurecat
lali.soler@eurecat.org

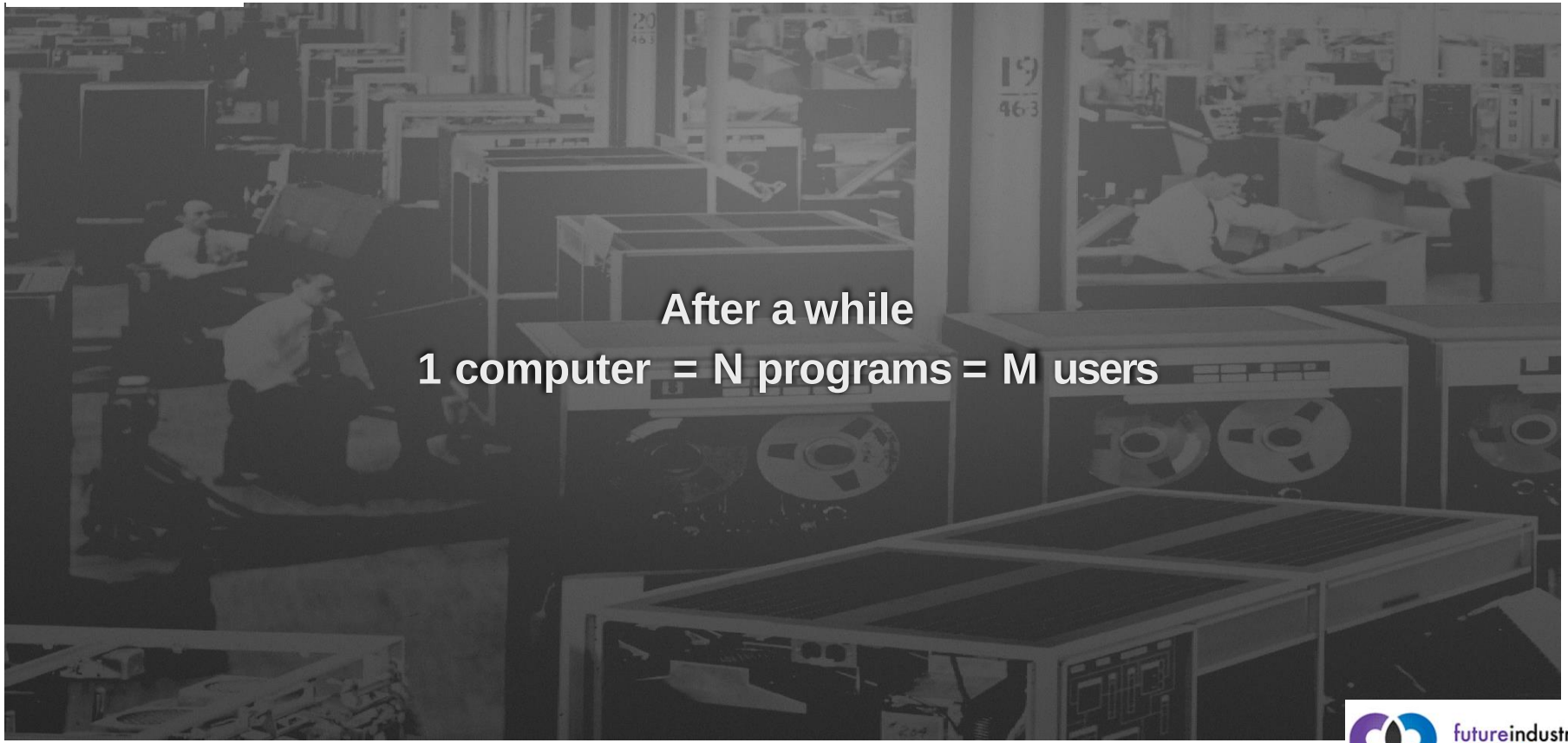
01

Introduction

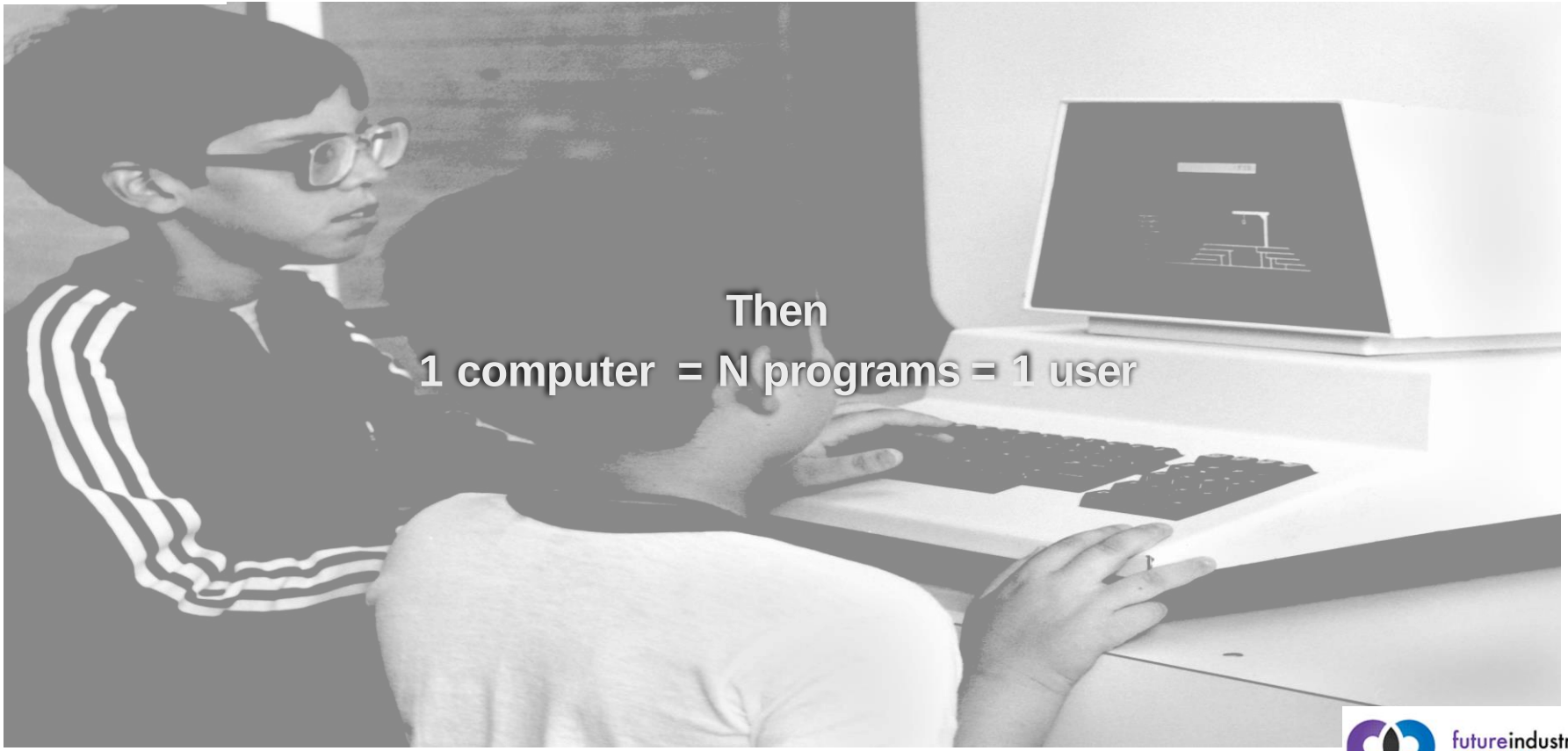
Why now?



Why now?



Why now?



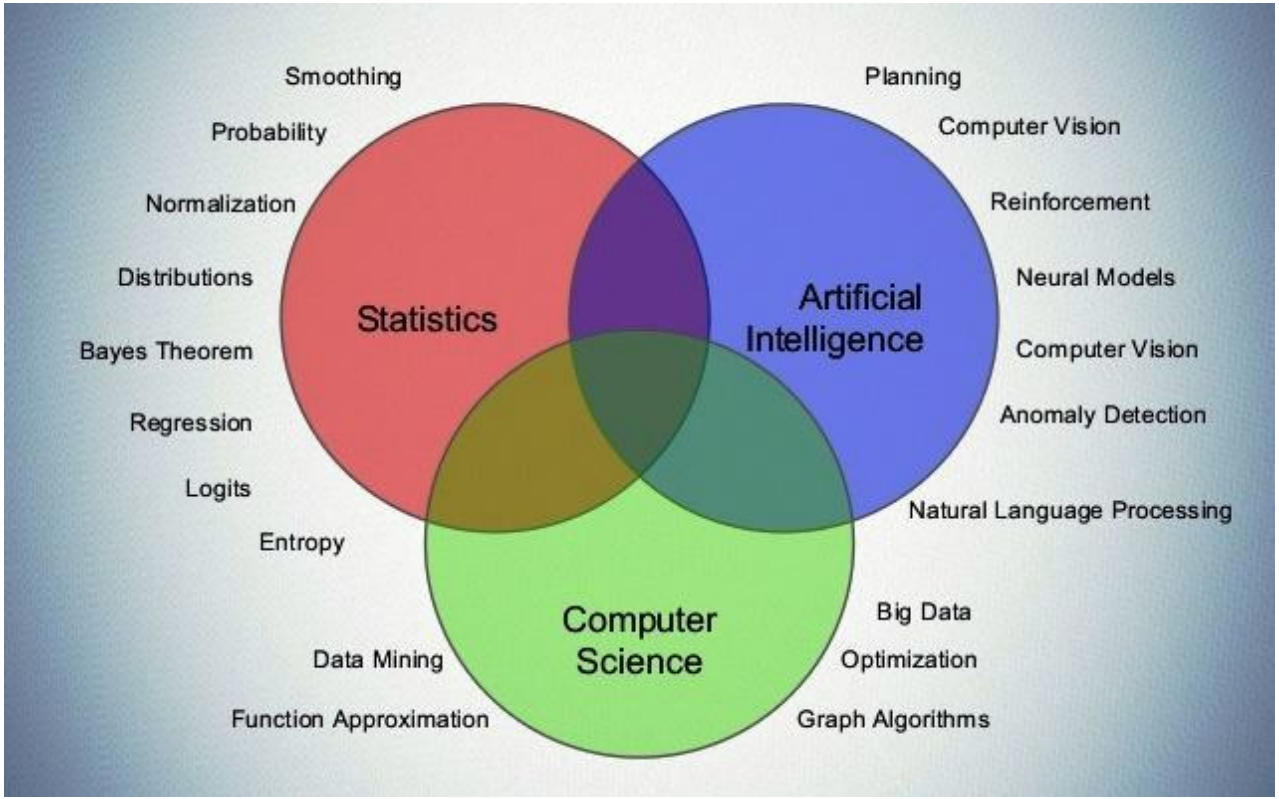
Why now?

A few years ago we reach the present situation.

From a user perspective:

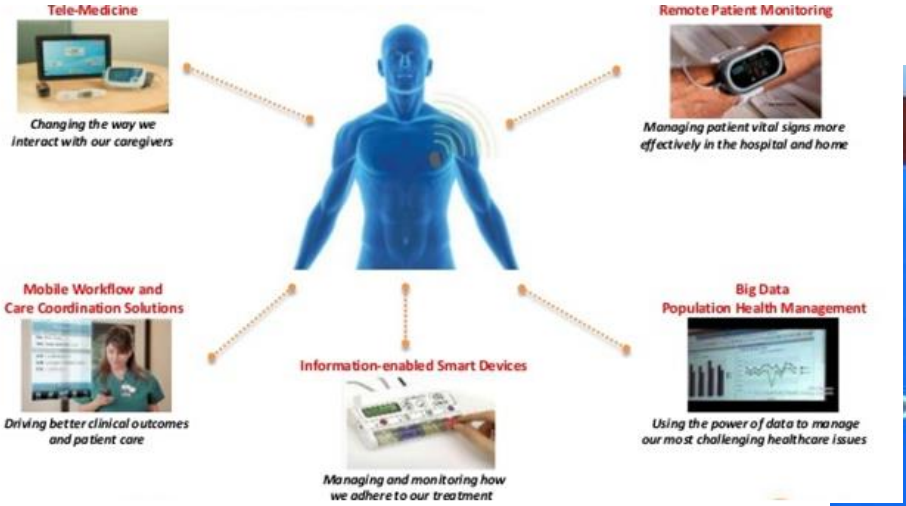
M computers = N programs = 1 user

A bit of terminology



Big Data

Wal-Mart handles over one million customer transaction per hour, the information is stored on a database sized in excess of 2.5 Petabytes ($2{,}0 \times 10^{16}$ bits).



By 2016 it is likely that a typical hospital will create 665 terabytes (5.32×10^{15} bits) of data a year.

Big Data

With a personal computer:

- You can find an element in a 1 MB file in less than a second.
- You can find an element in a 1 GB file in less than a minute.
- You can find an element in a 1 TB file in less than sixteen hours.
- You can find an element in a 1 PB file in less than two years.
- You can find an element in a 1 EB file in less than two thousa

Big Data

Big data is more than size.
It is commonly characterized with four V

Big Data

We are rendering into data many aspects of the world that have never been quantified before:

business networks
books I'm reading
location
physical activity
consumed food
purchases
physiological signals
straight thoughts
friendship
gaze
driving behavior

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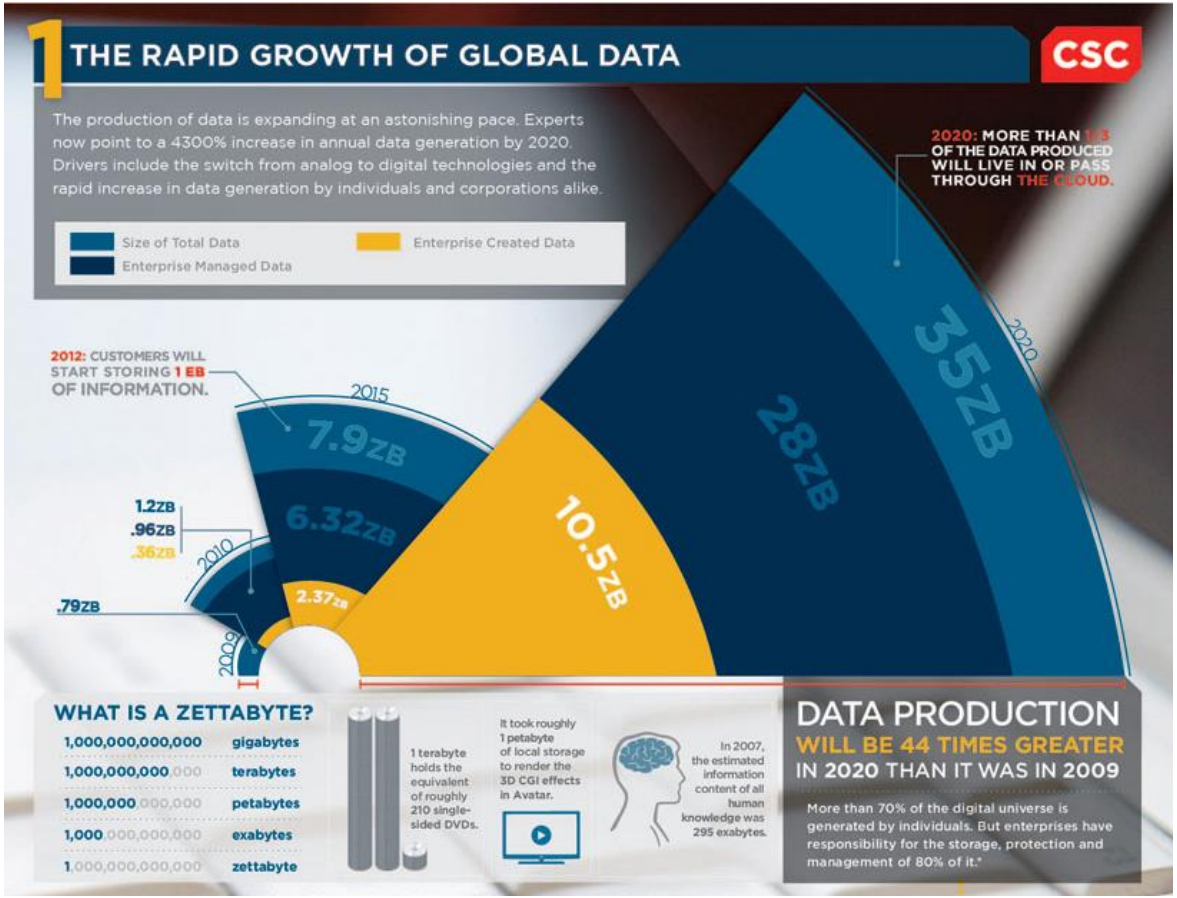

90% of world data was generated between 2012 and 2015

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02

Artificial Intelligence and Big Data

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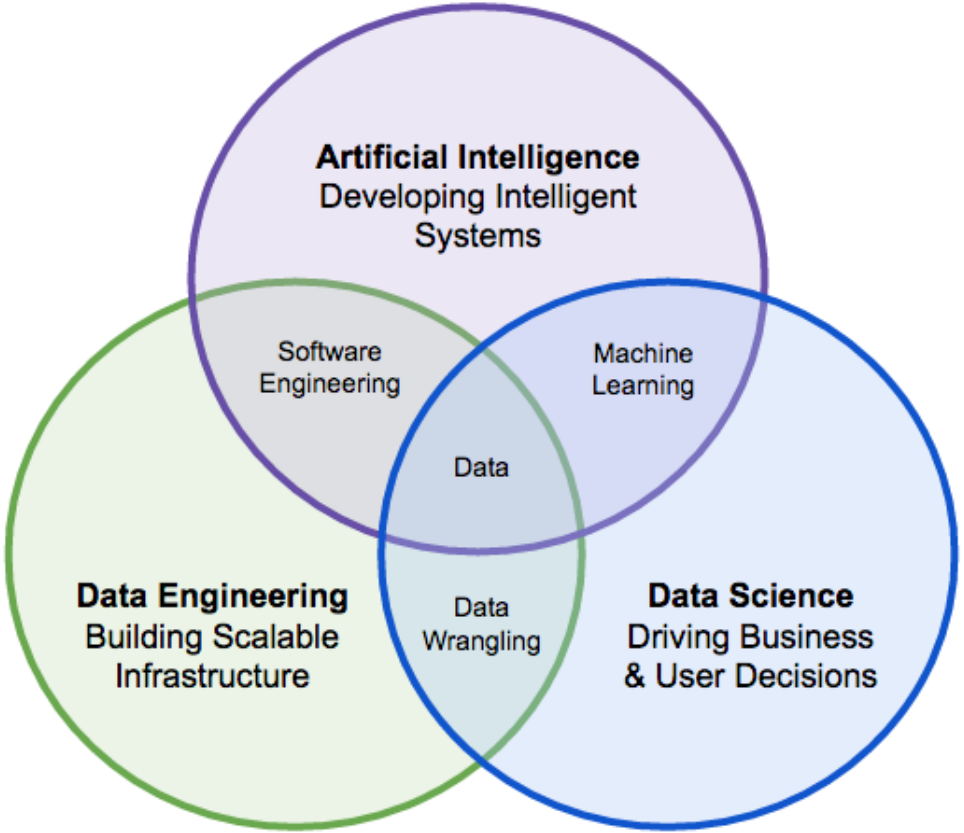
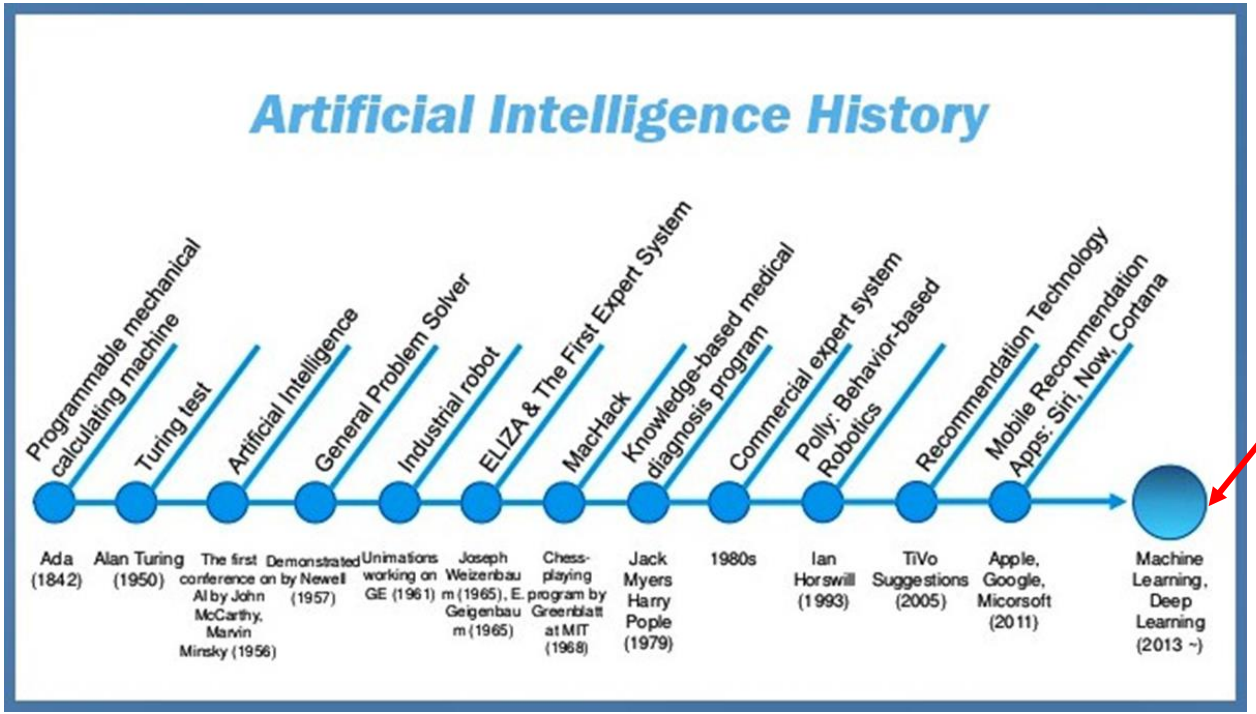
How is Artificial Intelligence related to Big Data?



Artificial Intelligence is nothing new

Artificial Intelligence is nothing new…



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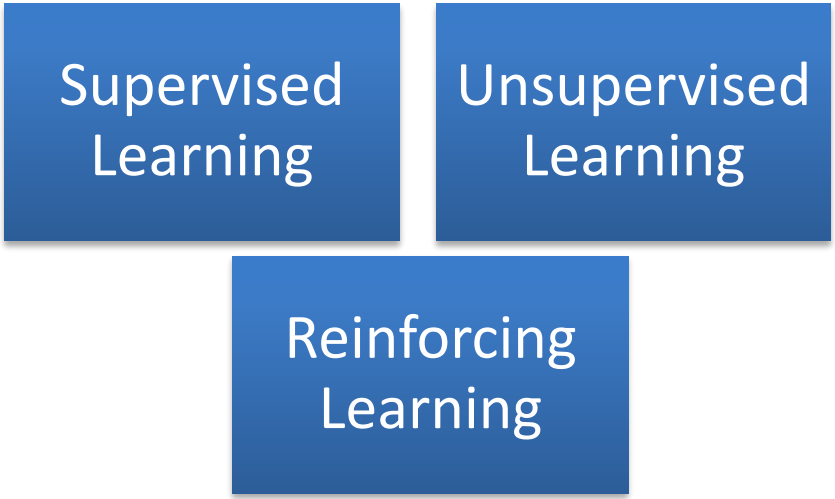
Machine learning



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The history…

Historical metaphors of the brain:
Hydraulic (blood cooler, spirits),
Mechanical (clock, steam machine),…

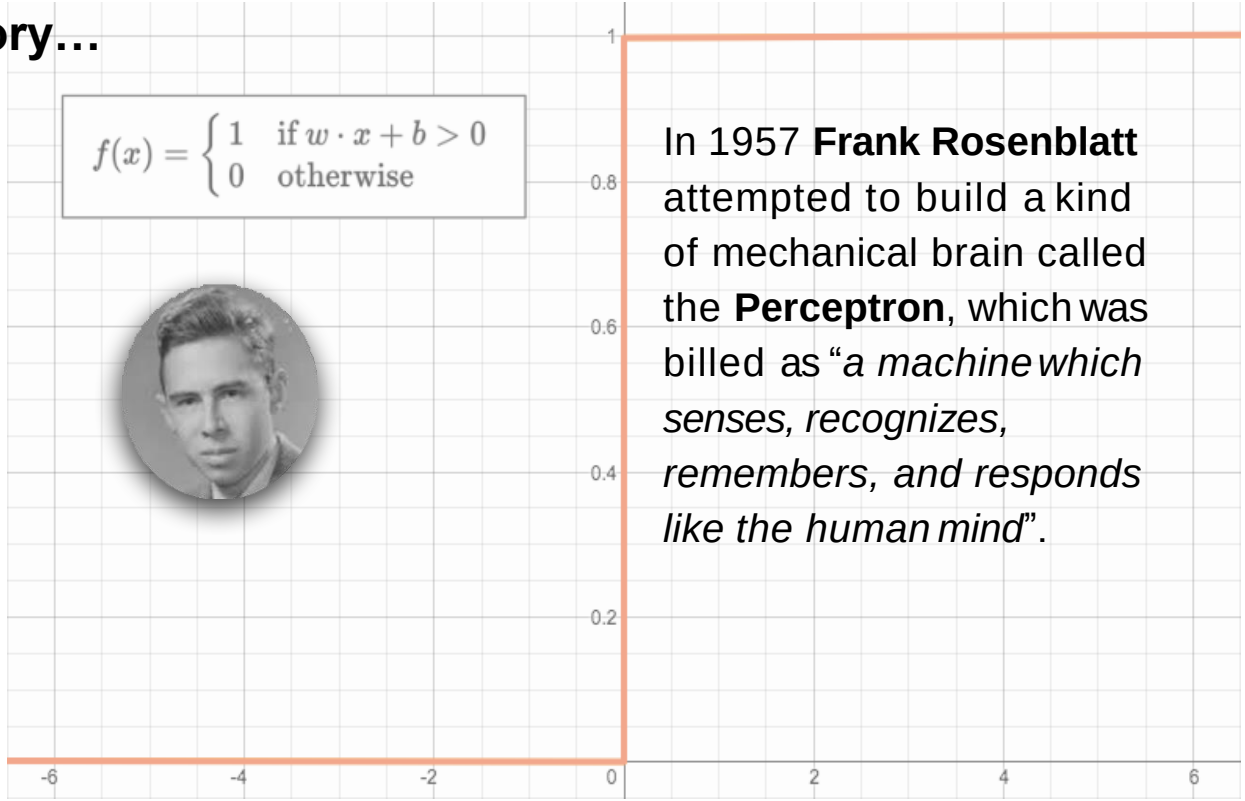
- In 1943, neurophysiologist **Warren McCulloch** and mathematician **Walter Pitts** wrote a paper on how neurons might work. In order to describe how neurons in the brain might work, they modeled a simple neural network using **electrical circuits**.

The history…

In 1949, Donald **Hebb** wrote *The Organization of Behavior*, a work which pointed out the fact that **neural pathways are strengthened each time they are used**, a concept fundamentally essential to the ways in which humans **learn**.

The history…

$$f(x) = \begin{cases} 1 & \text{if } w \cdot x + b > 0 \\ 0 & \text{otherwise} \end{cases}$$



In 1957 **Frank Rosenblatt** attempted to build a kind of mechanical brain called the **Perceptron**, which was billed as "*a machine which senses, recognizes, remembers, and responds like the human mind*".

The history…

A critical book written in 1969 by **Marvin Minsky** and his collaborator**Seymour Papert** showed that Rosenblatt's original system was **painfully limited**, literally blind to some simple logical functions like"*exclusive-or*".

70’s: First neural network winter

The history…

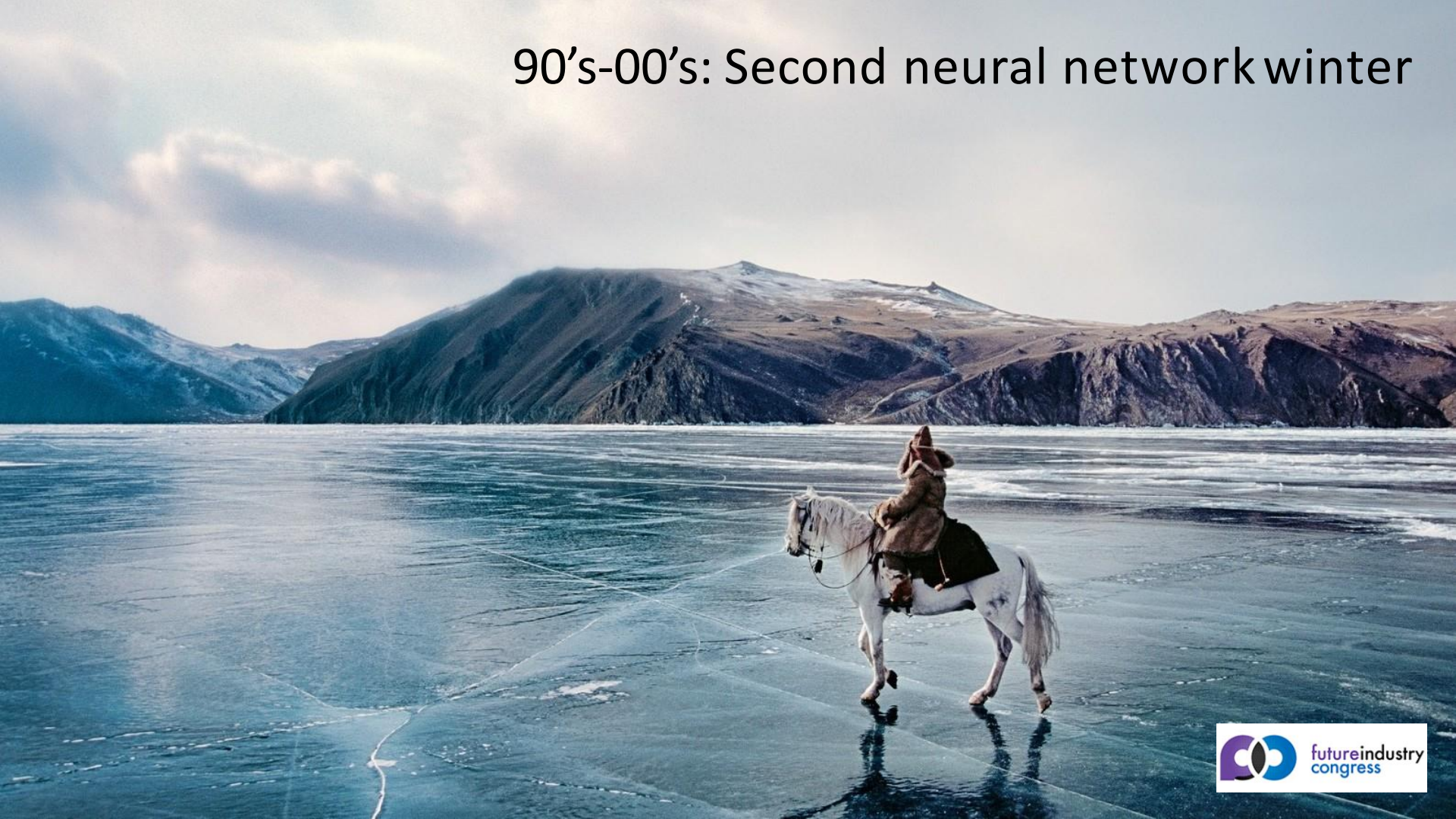
In 1982, interest in the field was renewed. **John Hopfield** of Caltech presented a paper to the National Academy of Sciences. His approach was to create more useful machines by using **bidirectional lines**. Previously, the connections between neurons was only one way.

In 1986, the problem was how to **extend the Widrow-Hoff rule to multiple layers**. Three independent groups of researchers, which included **David E. Rumelhart, Geoffrey E. Hinton** and **Ronald J. Williams**, came up with similar ideas which are now called **back-propagation** networks because it distributes pattern recognition errors throughout the network.

From 1986 to mid 90's new developments arised: convolutional neural networks (**Y.LeCun**), unsupervised learning (**Y.Bengio**), RBM(**G.Hinton**), recurrent networks (**J.Schmidhuber**), etc.

But, by this point **new machine learning methods** had begun to also emerge, and people were again beginning to be skeptical of neural nets since they seemed so intuition-based and since computers were still barely able to meet their computational needs.

90’s-00’s: Second neural network winter

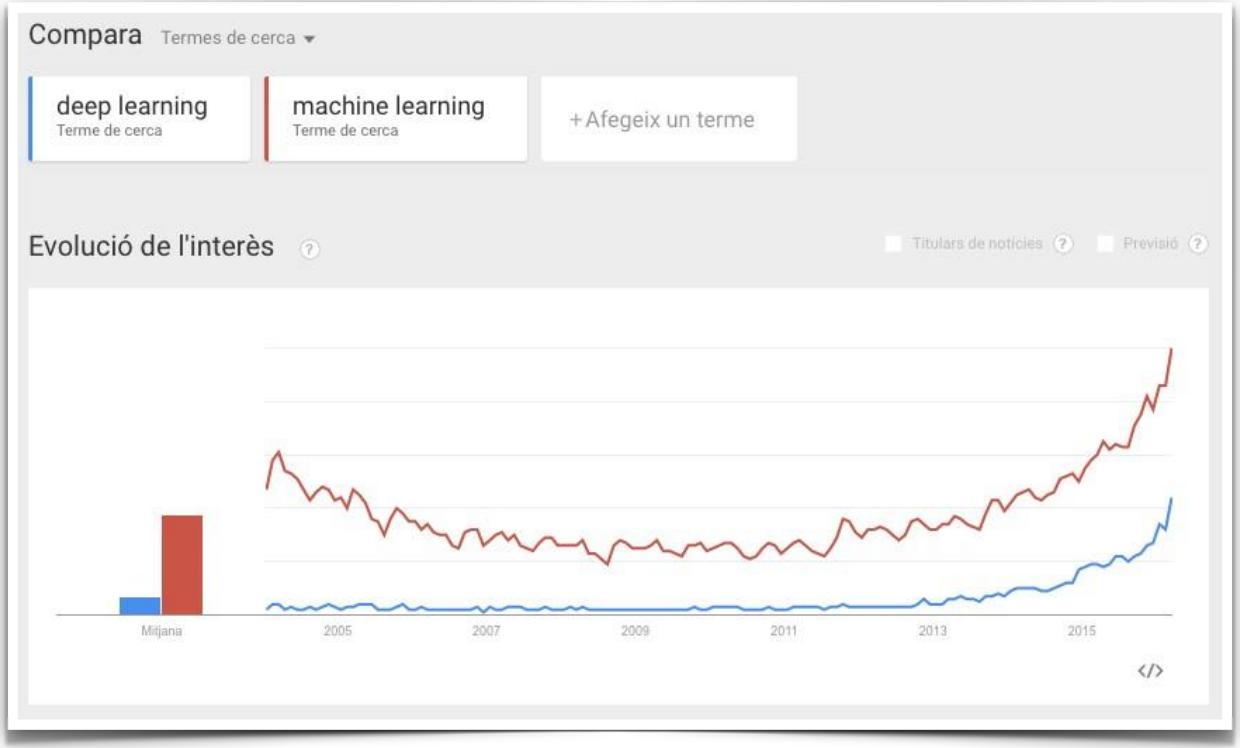


With the ascent of Support Vector Machines and the **failure of backpropagation**, the early 2000s were a dark time for neural net research.

- Then, what every researcher must dream of actually happened: G.Hinton, S.Osindero, and Y.W.Teh published a paper in 2006 that was seen as a breakthrough, a breakthrough significant enough to rekindle interest in neural nets: *A fast learning algorithm for **deep** belief nets.*

- After that, following Moore's law, computers got dozens of times faster (GPUs) since the slow days of the 90s, making learning with large datasets and many layers much more tractable.

Neural Networks Reborn



Google Trends

- NN and DL currently provide the best solutions to many problems in image recognition, speech recognition, and natural language processing.

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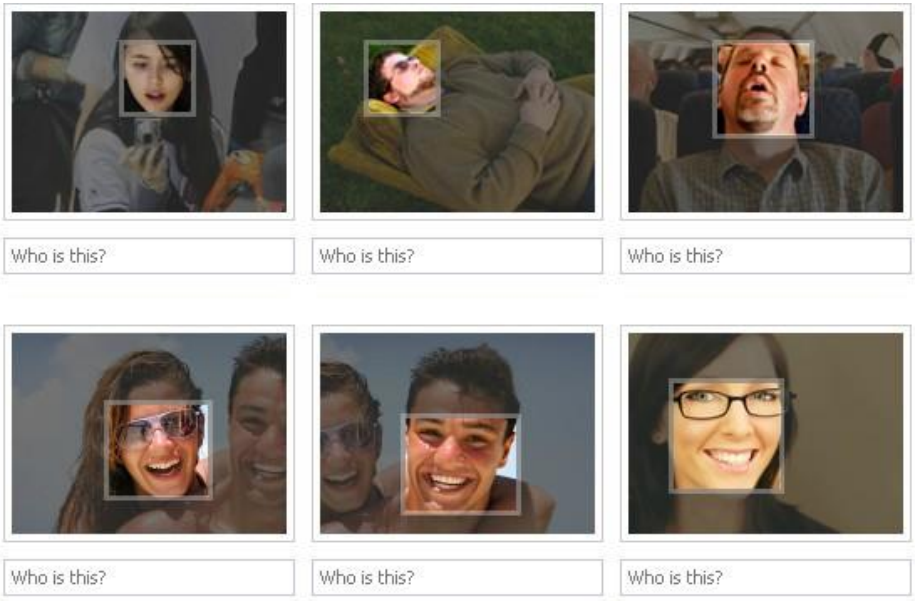
Face recognition.



DeepFace (Facebook): Accuracy of 97.35%

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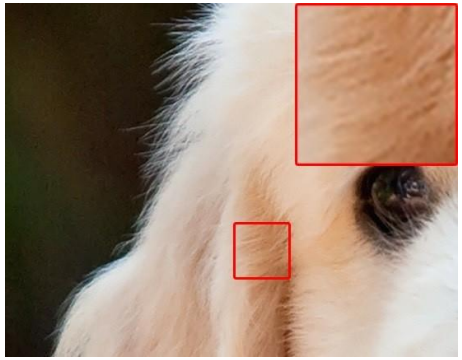
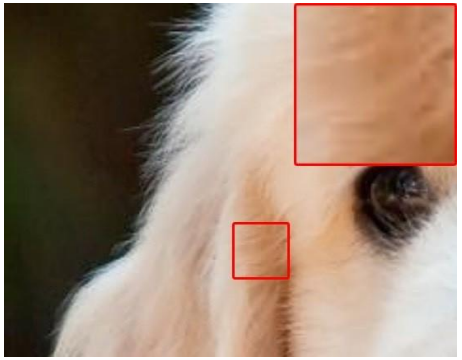
New applications: navigation and mapping.

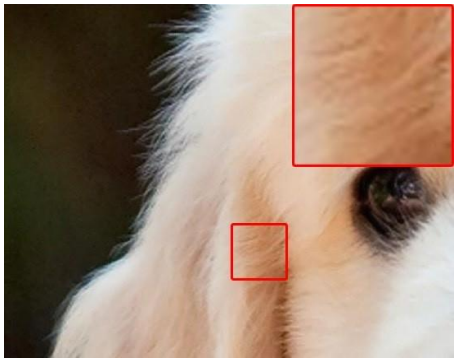
New applications: Image Upscaling (Flipboard)



Original



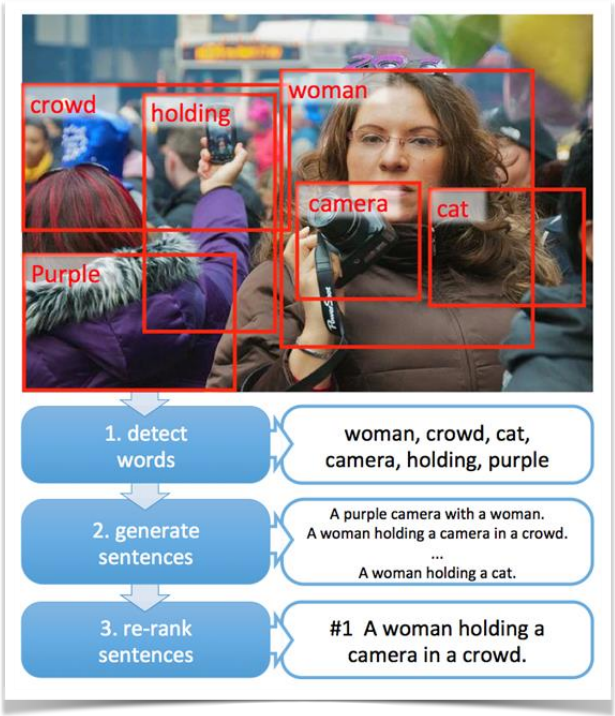
Bicubic



Model

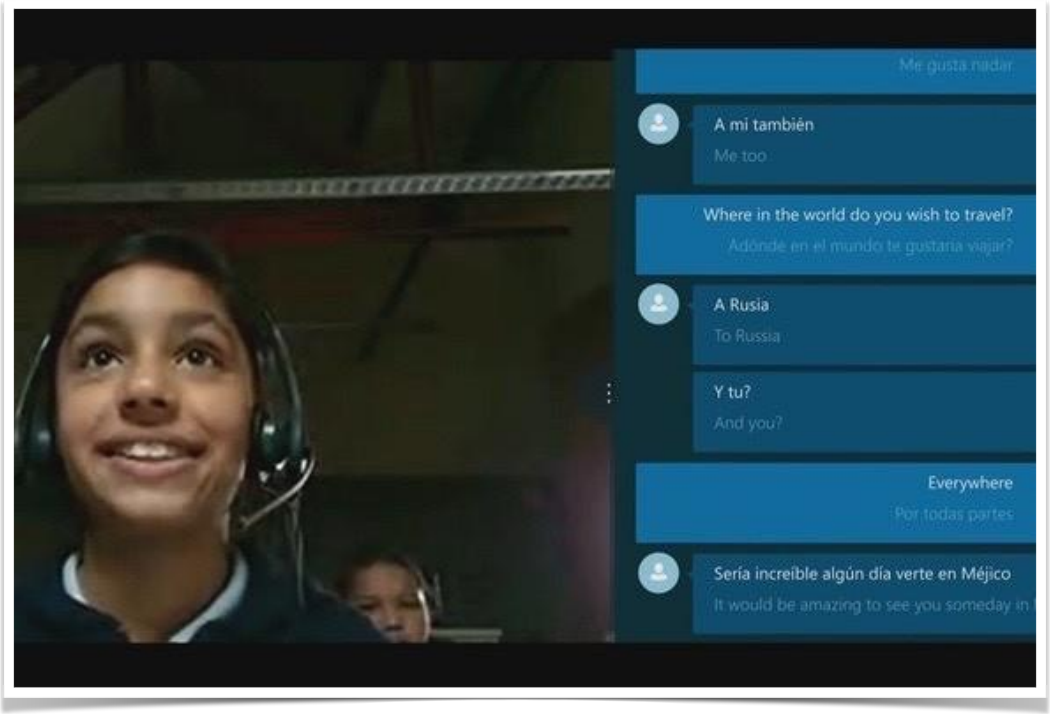
http://engineering.flipboard.com/2015/05/scaling-convnets/

New applications: Automatic Image Captioning



http://blogs.technet.com/b/machinelearning/archive/2014/11/18/rapid-progress-in-automatic-image-captioning.aspx

Speech translation



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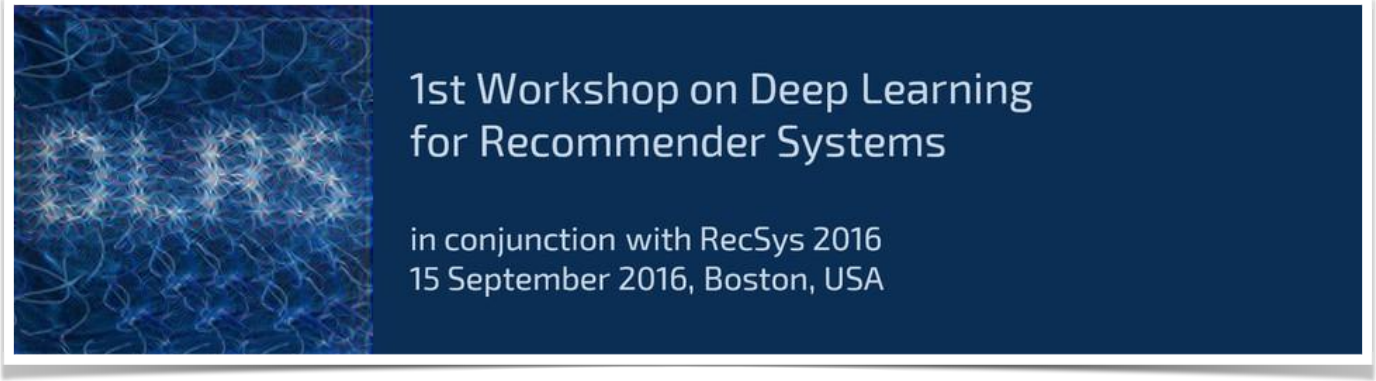
Recommenders



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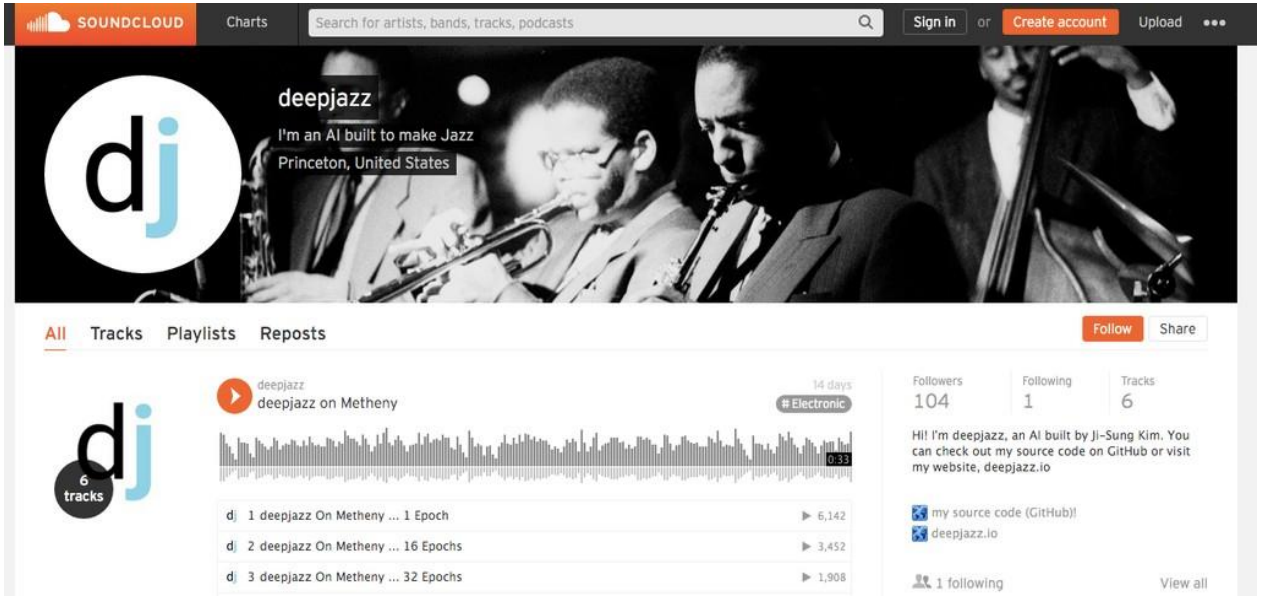
Music Generation



Go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Illegal harvest of millions of Mediterranean birds
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SAFEGUARD TRANSPARENCY
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Dawkins's calling card forty years on
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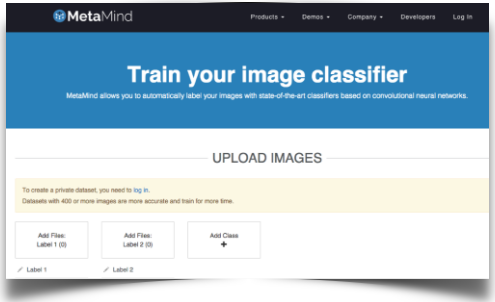
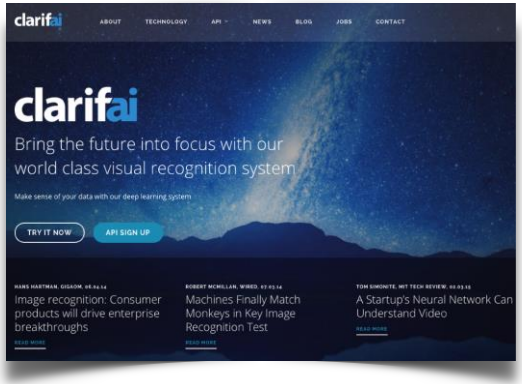
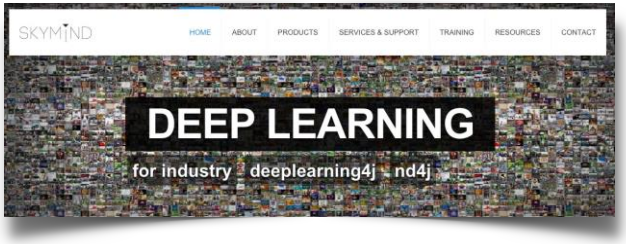
Start Ups







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03

Artificial Intelligence in Business

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The Effectiveness of Personalized Product Recommendations

MarketingSherpa Study, 1.5 billion shopping sessions, 2015:

The recommendations used a variety of different common phrases on a product page, home page, shopping cart, category page or site wide. The actual product recommendations were dynamic and personalized based on visitor data, behavior, and history.

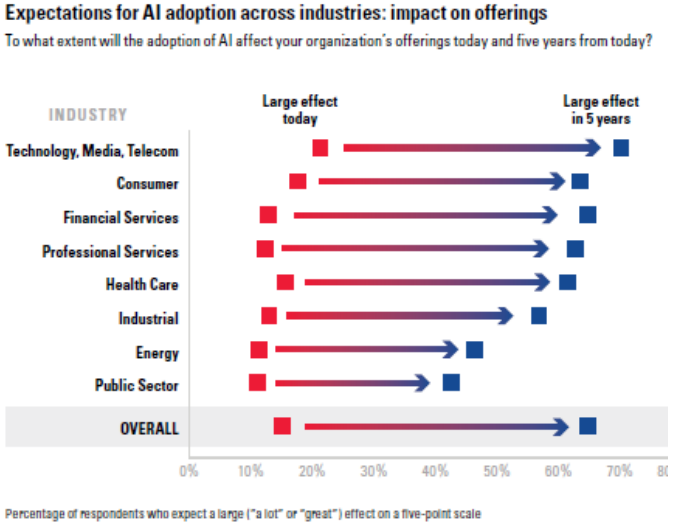
- On the whole, **11.5% of the revenue** (whether from more volume or higher value of products) generated in the shopping sessions was attributable to **purchases from the product recommendations.**
- The companies that used the most common **"visitors who viewed this product also viewed"** on the product page had the highest success, **with a remarkable 68% of all revenue of those companies coming from the product recommendations.**
- The phrasing **"you might also like, "** correlating to **16% of that group's revenue to the recommendations.**
- The popular phrasing **"customers also bought"** on the cart page generated only **8% of revenues from recommendation sales.**

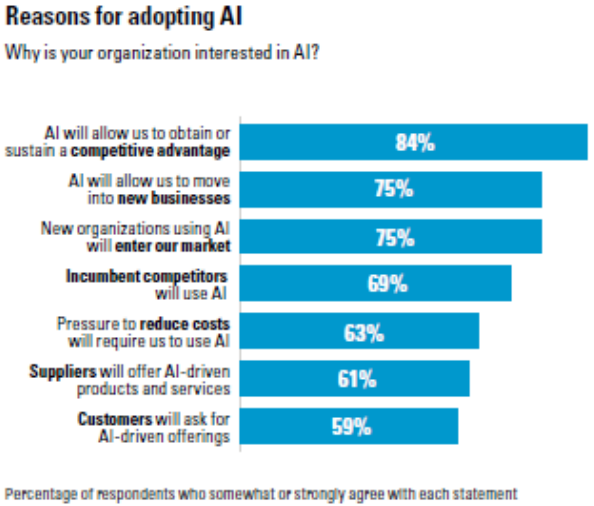
HMV, a British entertainment retailing company (music Retailer) realized that sending the same campaign message to all its customers is not appropriate anymore, as people start treating emails as spam and do not open them. The company uses **a recommendation system**, which analyses customer click streams and which products fits the customer's preferences. HMV sends out personalized recommendations, which increased the emails opening by over 70% on mobile phones, and PC mails by 50 %.

In 2013 **Item-to-Item collaborative filter:** 35% of all sales are estimated to be generated by the recommendation engine. In May 2016, Amazon opened up **DSSTNE** as open source software so that the promise of deep learning can extend beyond speech and object recognition to other areas such as search and recommendations

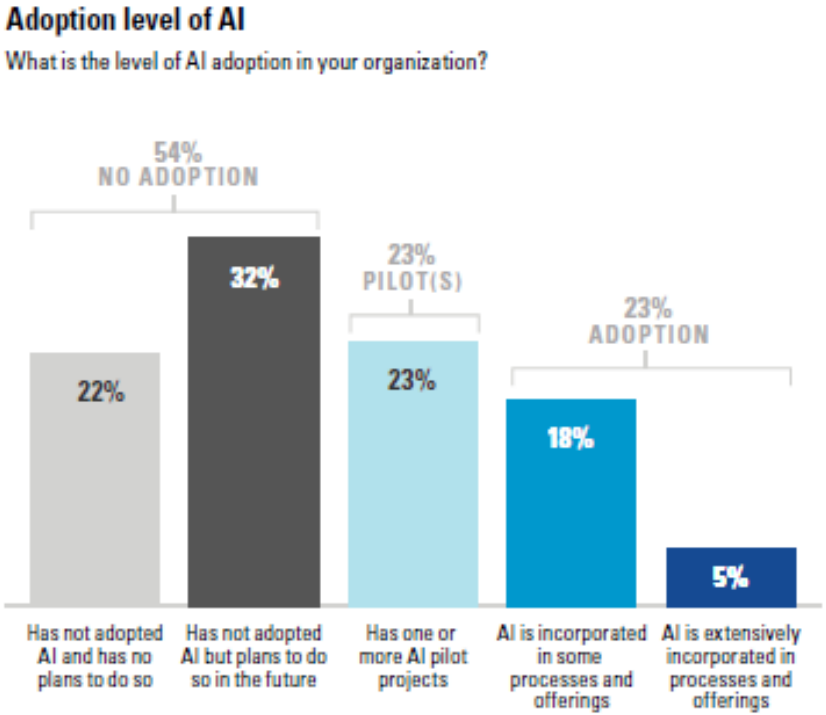
After a long refinement process, Netflix finally released its first "global" recommendation engine in December, 2016. Netflix will invest 1 billion of the total 5 billion of its budget in recommendation and personalization. Why?? Netflix estimates that only 20% of its subscriber video choices come from search, with the other 80% coming from recommendations

Adoption of AI in business





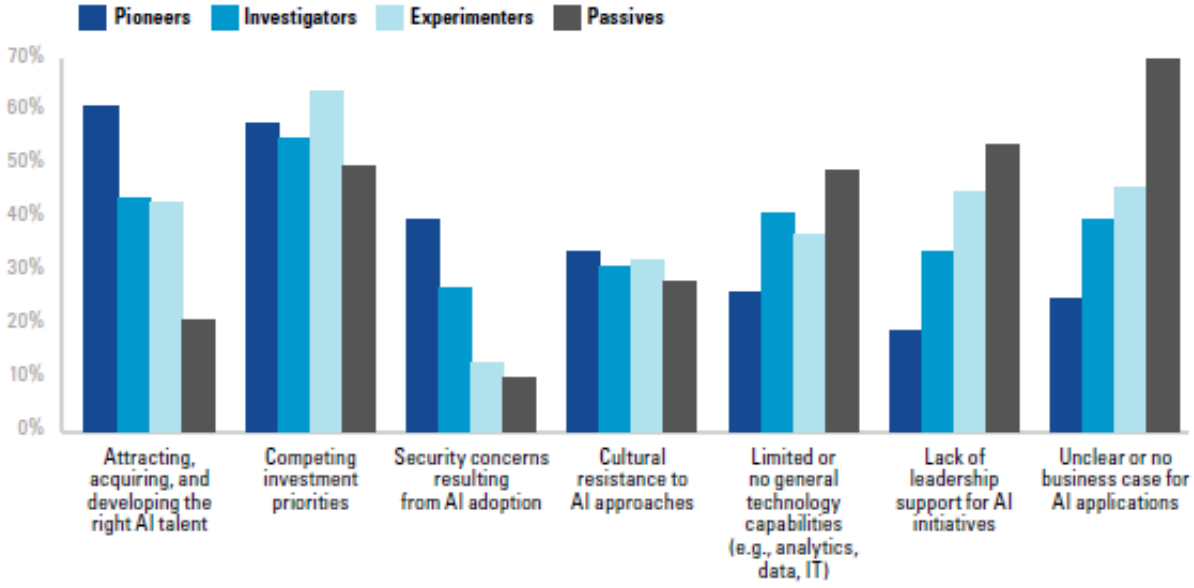
Adoption of AI in business



Adoption of AI in business

Barriers to AI adoption

What are the top three barriers to AI adoption in your organization?



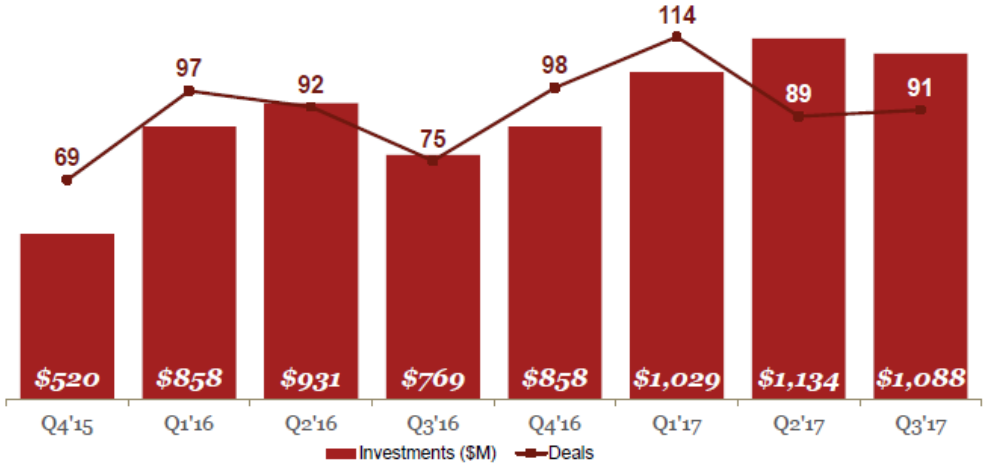
Percentage of respondents ranking the selection as one of the top three barriers

Is AI profitable?

AI: US funding over time

US artificial intelligence funding exceeds $1B for third quarter in a row

- Both deals and dollars to US AI companies showed continued momentum in Q3'17, with $1B invested across 91 deals. Quarterly funding was particularly healthy, nearly matching last quarter's high.
- The $1B quarter was led by companies such as NAUTO ($159M Series B), Indigo Agriculture ($156M Series D), and Cerebras Systems ($60M Series B).



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Thank you

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