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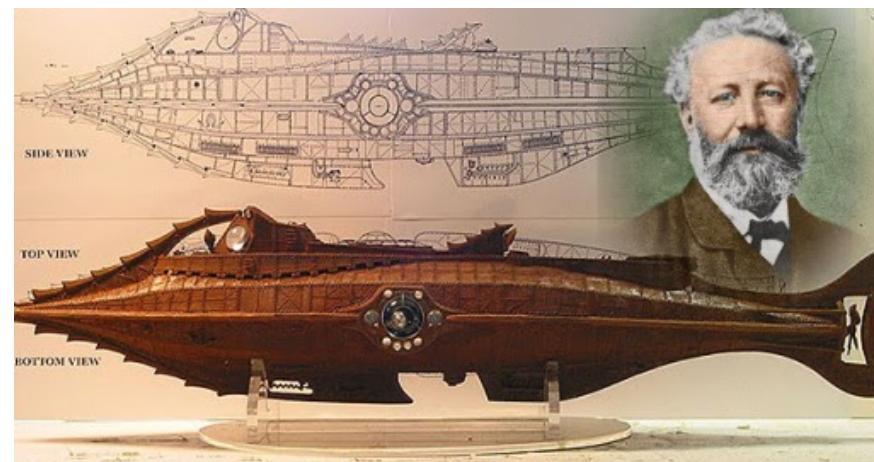


## Intelligenza Artificiale e IBM Watson

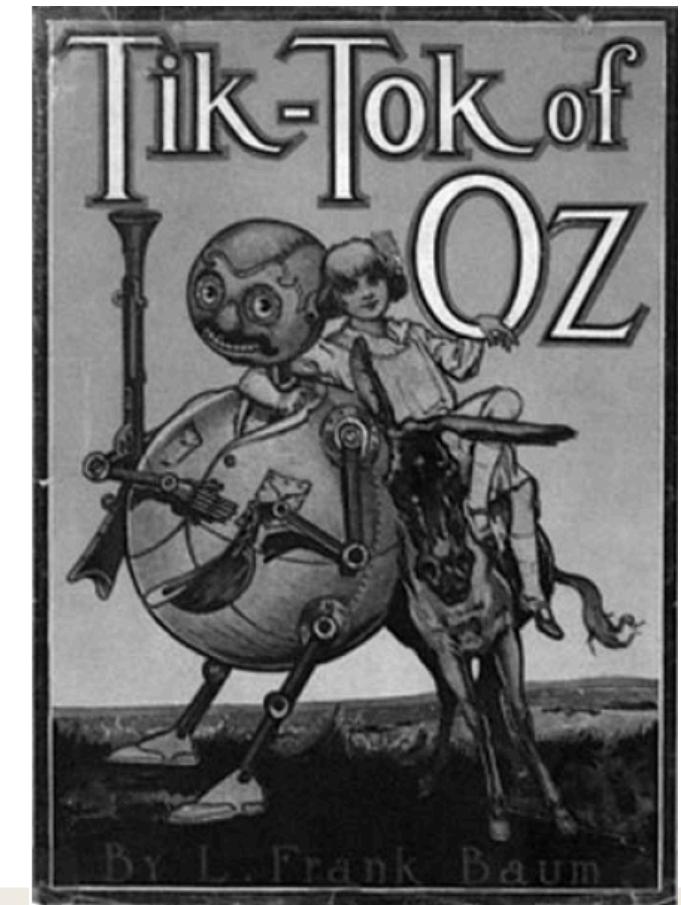
# I sogni, fin dall'antichità



Iliade, tripode automatico  
VI sec aC



Nautilus, Jule Verne, 1872



Il mago di Oz, Tik-Tok, 1907

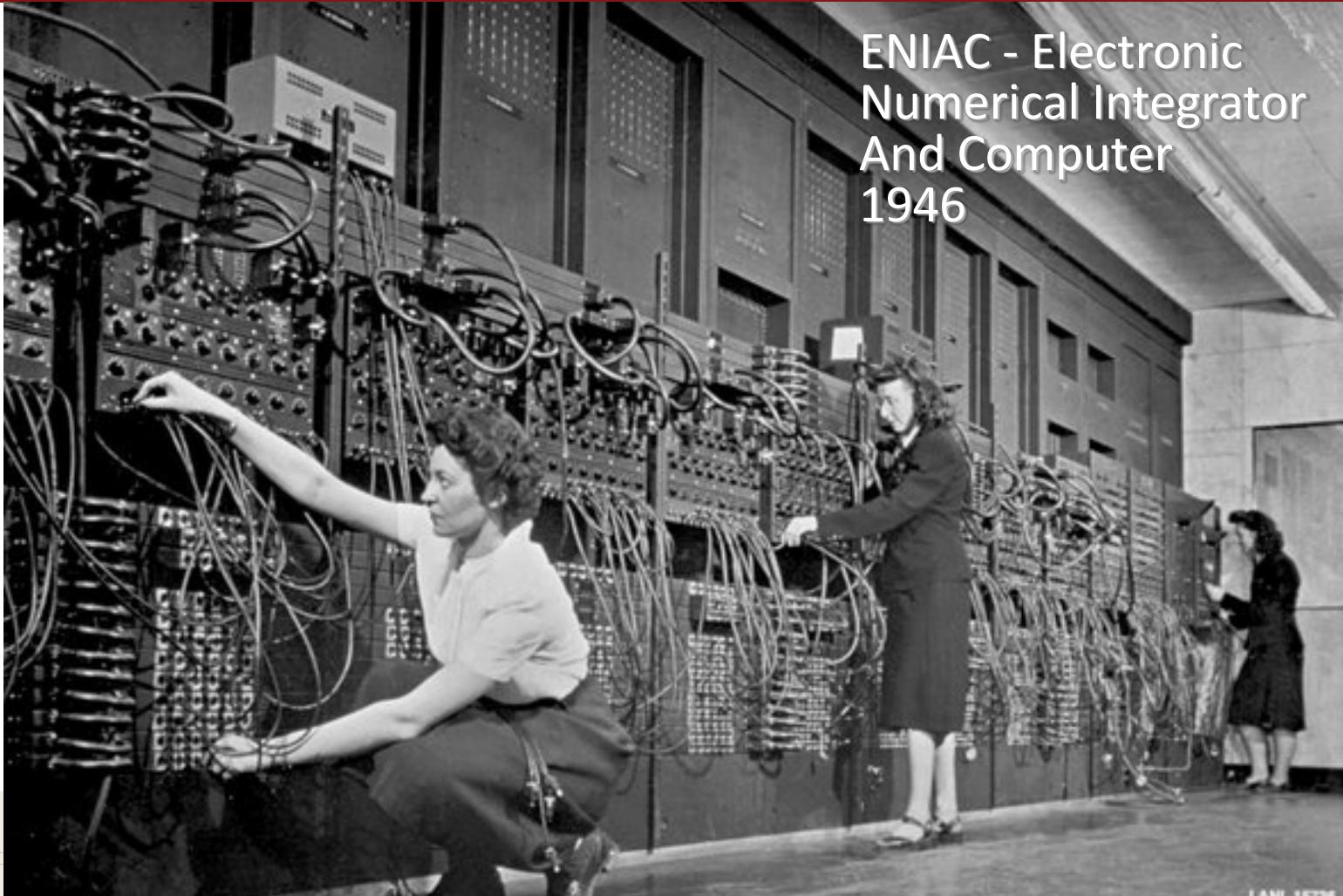
## L'era della meccanica



Blaise Pascal  
1642 – pascalina



# L'era dei computer



ENIAC - Electronic  
Numerical Integrator  
And Computer  
1946



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## Pionieri – i programmi che imparano



**Arthur Samuel**  
**IBM 704**  
**1950s**

## La nascita del AI - 1956



Trenchard More,  
John McCarthy,  
Marvin Minsky,  
Oliver Selfridge, and  
Ray Solomonoff

# I sogni

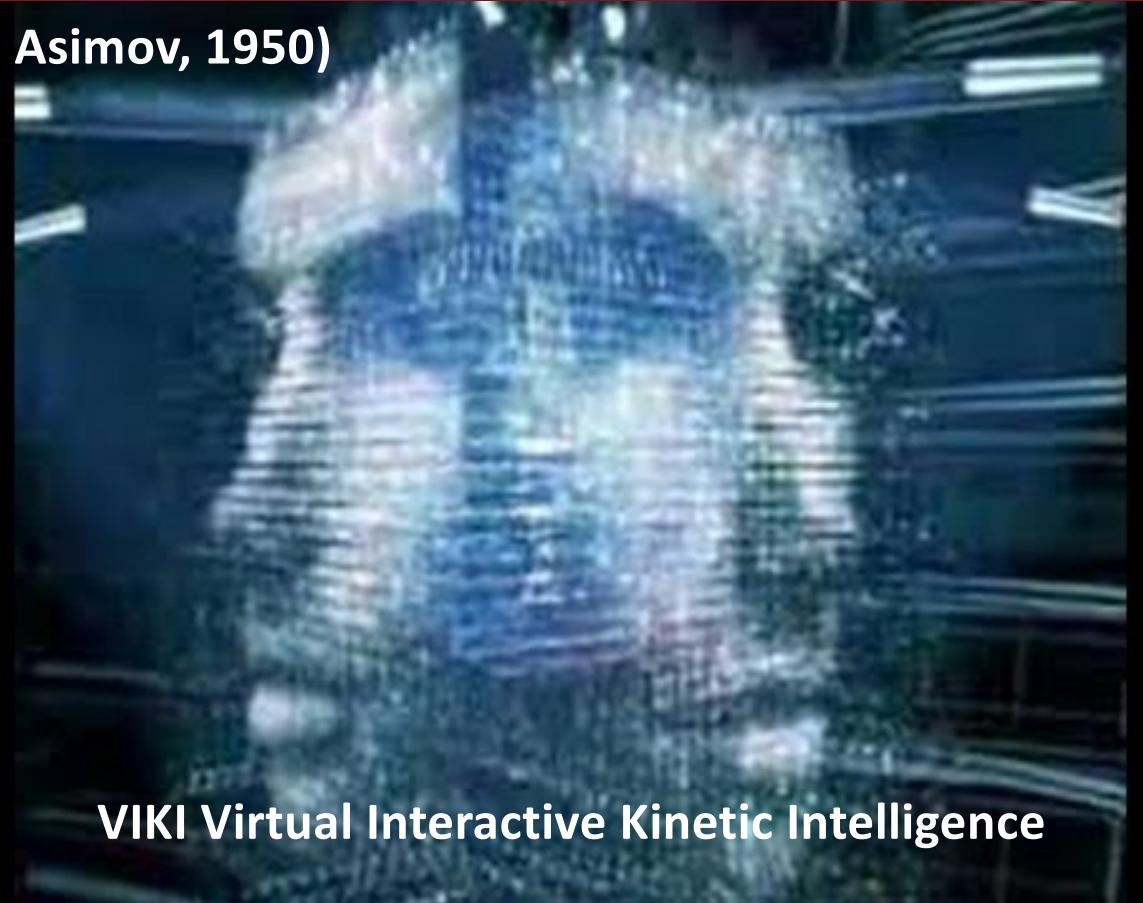
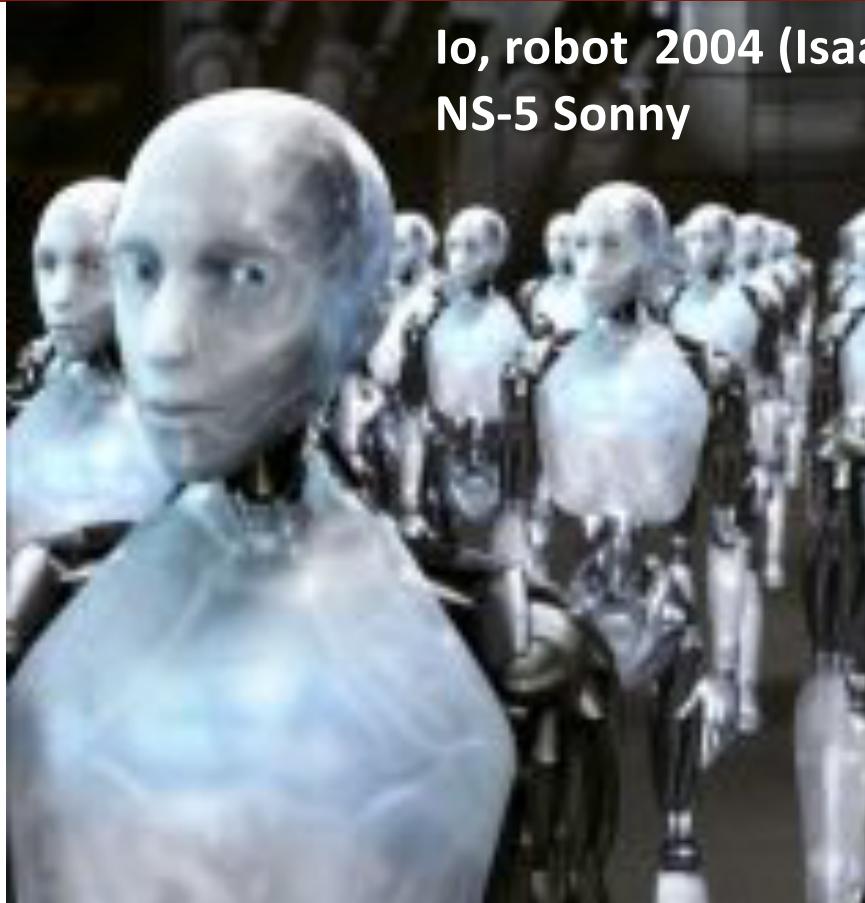


L'uomo bicentenario  
1999  
**NDR-114, Andrew**  
robot positronico  
Isaac Asimov  
1976



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di Salerno

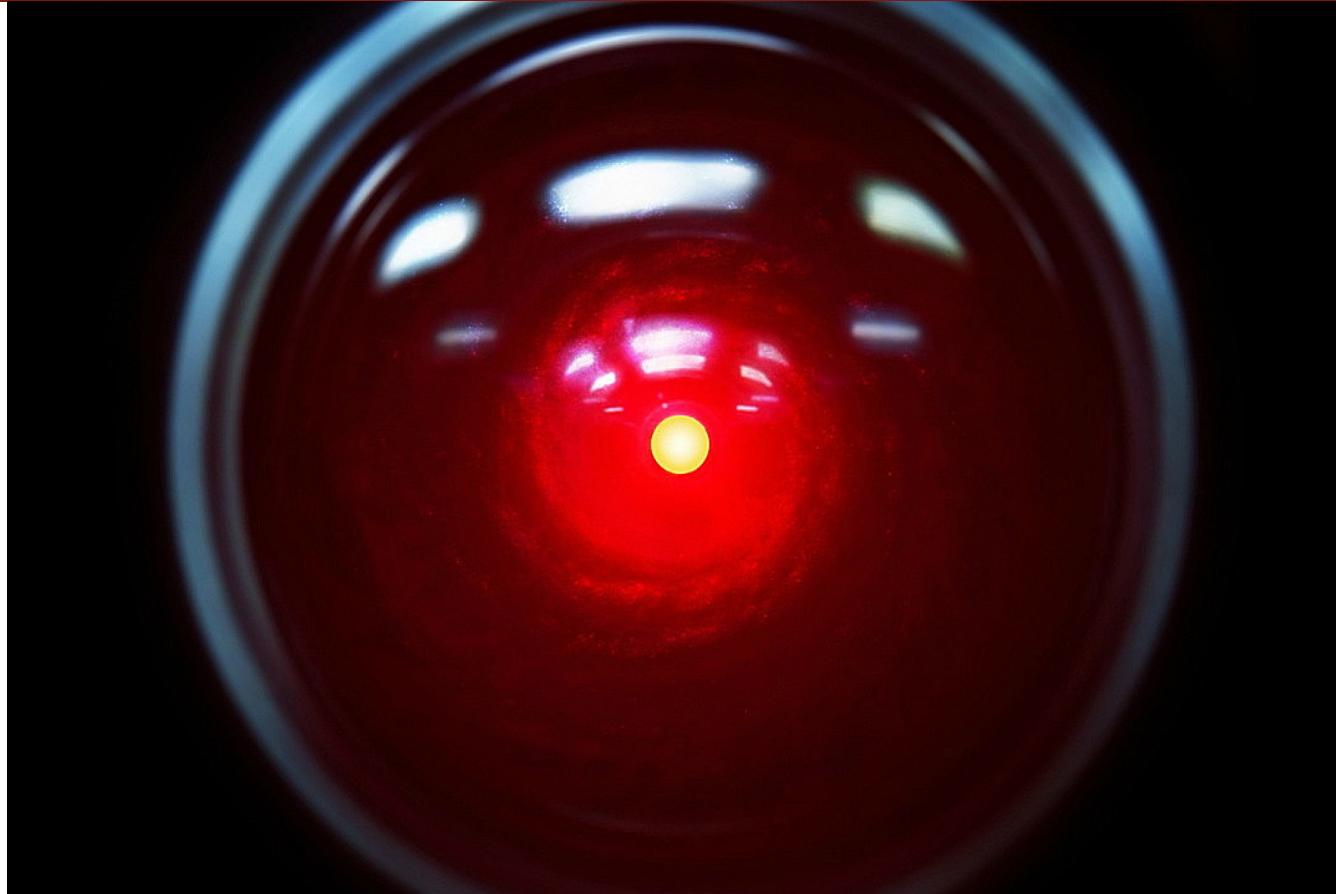
# I sogni



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I sogni



**HAL 9000  
2001 Odissea  
nello spazio  
1968**



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di ingegneria  
e architettura

# I sogni

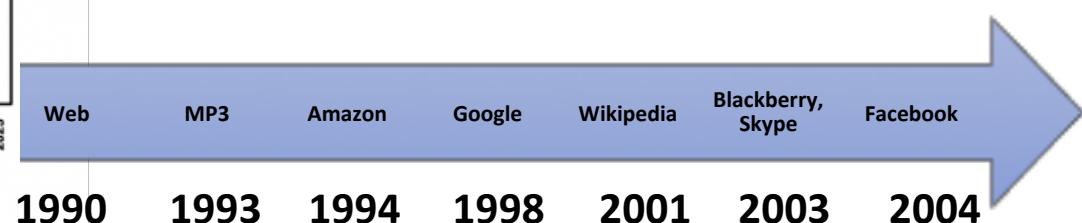
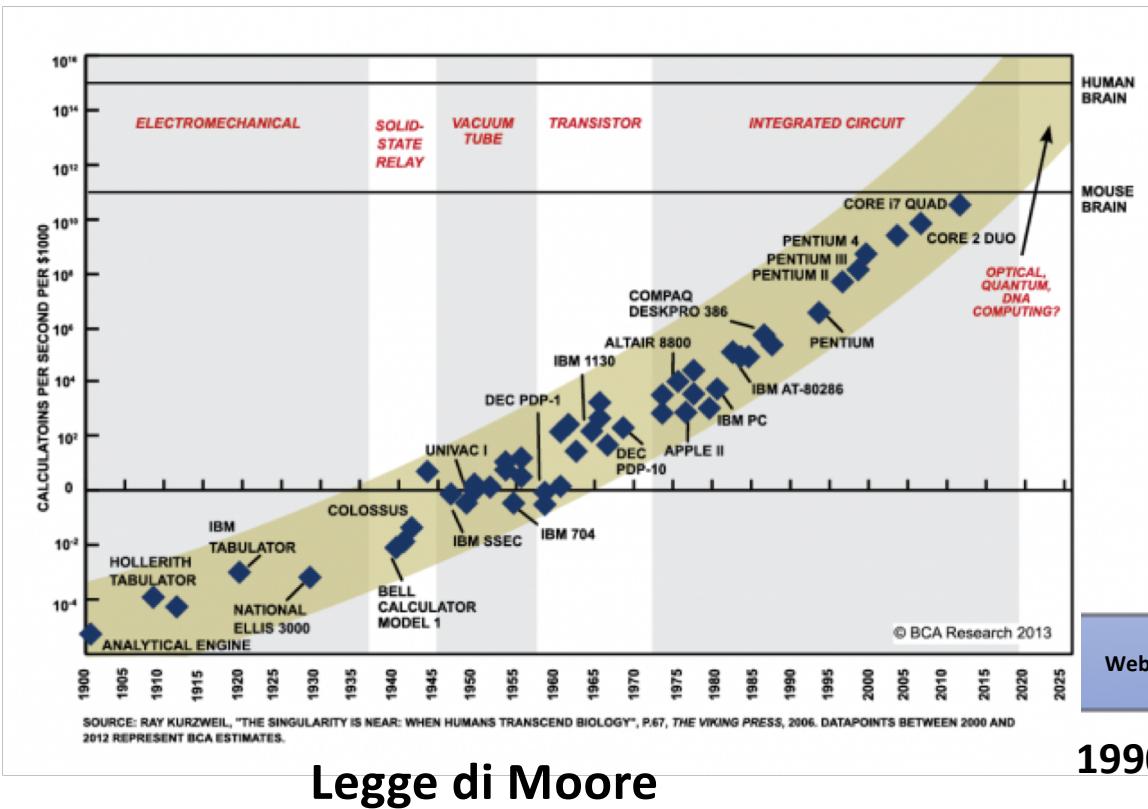


**Star wars**  
**1977**  
**1999**

**40 anni dopo...**



# Tecnologia e ICT



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## 2016: AlphaGO vs Lee Sedol



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# Rivoluzione



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di ROMA "LA SAPIENZA"

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di ingegneria  
e architettura

# Rivoluzione



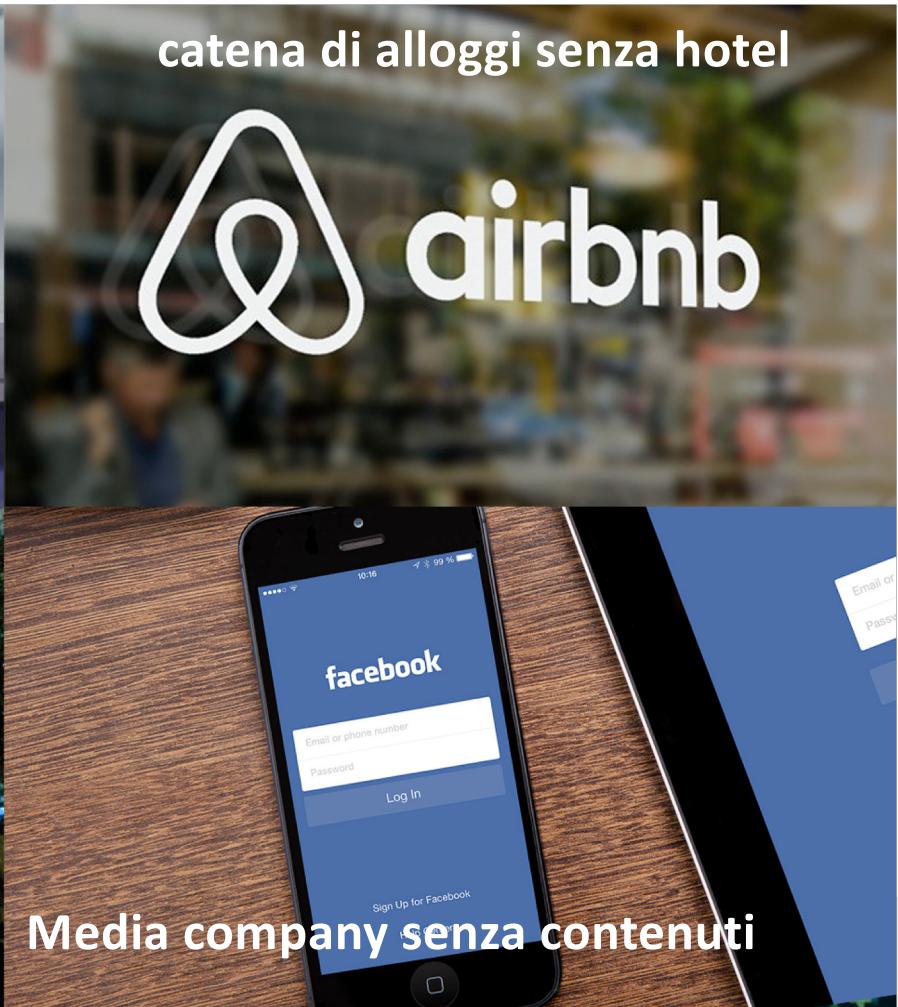
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# L'era mobile



## Data disruption



## 2016: AlphaGO vs Lee Sedol



# Cognitive systems

## IBM Watson – Jeopardy!



2011



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**IBM Watson Health**

# Welcome to the cognitive era of health

A 38-year-old male with hypertension is admitted to the Emergency Department with heart murmur, acute chest pain, and acute abdominal pain. The patient underwent a CT which is shown here. Which is most likely?

You answered

- a. Aortic Dissection
- b. Esophagitis
- c. Penetrating Atherosclerotic Ulcer
- d. Acute Myocardial Infarction

Watson Inference

- Aortic Dissection
- Esophagitis
- Penetrating Atherosclerotic Ulcer
- Acute Myocardial Infarction

Patient Case Analysis

- Age: 38 years
- Gender: male
- Sign or Symptom: heart murmur
- Sign or Symptom: pain abdominal
- Sign or Symptom: acute chest pain
- Modality: CT scan
- Question Type: Differential Diagnosis

Raw Data

3D Segmentation

Segmented Aorta

Dissected Slice

Image Analysis

Eyes of Watson

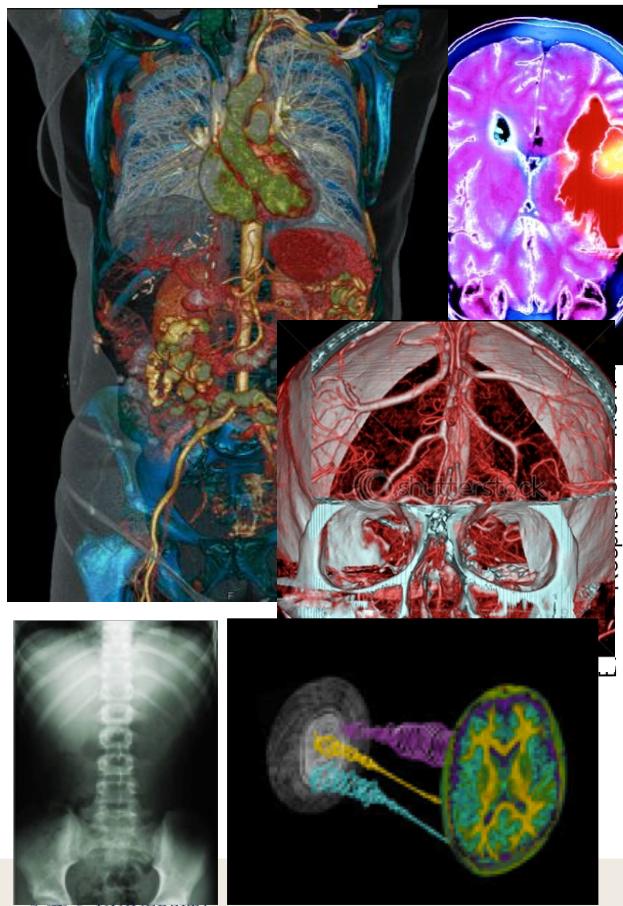
Analyzing Text

Analyzing Images

Reasoning

Selecting Answer

# Big data in healthcare: clinical data



BIODATA,  
BIOSIGNALS,  
BIOIMAGES

PERSONAL  
HEALTH  
RECORD

The screenshot shows the Kaiser Permanente Personal Health Record website. At the top, there's a navigation bar with links for "Find doctors & locations", "My profile", "Member assistance", "Español", "Sign on", "My health manager", "Health & wellness", "Health plans & services", "Locate our services", "My doctor", "My medical record", "Pharmacy center", "Appointment center", "My plan & coverage", and "My message center". Below the navigation, there's a banner for "Act for a family member" featuring two children playing. The main content area is divided into several sections: "My message center" (with a link to "Interactive symptom checker"), "Appointment center" (with a link to "interactive symptom checker"), "My medical record" (with a link to "interactive symptom checker"), "Manage my plan & coverage", and "Pharmacy center". A large image of a hand holding a tablet displaying a medical interface is positioned at the bottom right.

ELECTRONIC  
HEALTH  
RECORD

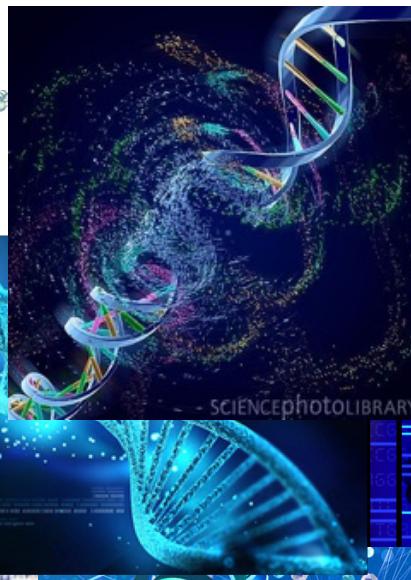
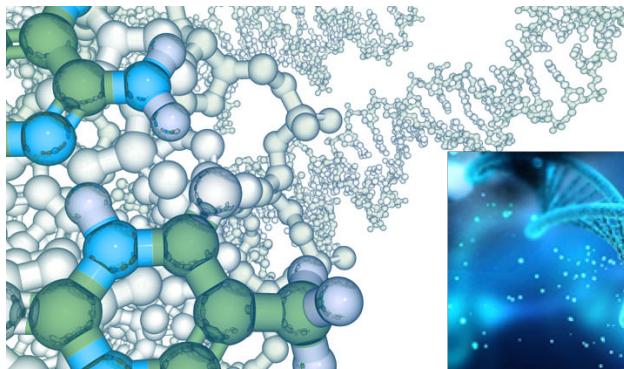
# Big data in healthcare: evidence based medicine

The image displays three screenshots of healthcare databases:

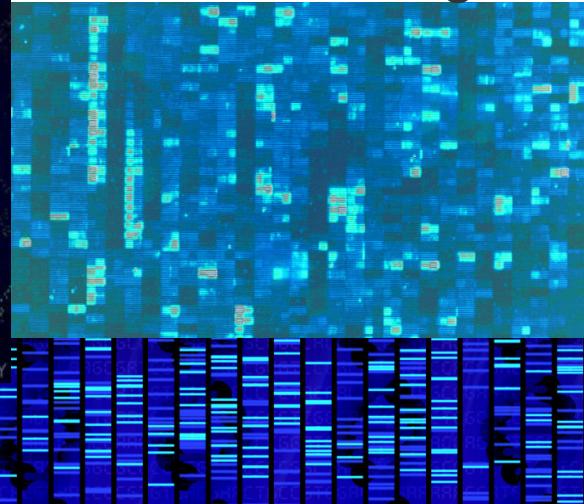
- PubMed:** The homepage features a search bar, navigation links for "Resources" and "How To", and a "Sign in to NCBI" button. It includes a sidebar for "Using PubMed" and "PubMed Tools".
- ClinicalTrials.gov:** The homepage highlights the availability of 271,017 research studies across 50 states and 203 countries. It features a search interface for finding studies based on recruitment status, condition or disease, other terms, and country.
- National Guideline Clearinghouse:** The homepage shows a search bar and a "Guidelines by Topic" section. It provides information about MeSH terms and their hierarchy, along with a "Create Topic E-mail Alerts" button.

# Big data in healthcare: -omics

**Genomics**



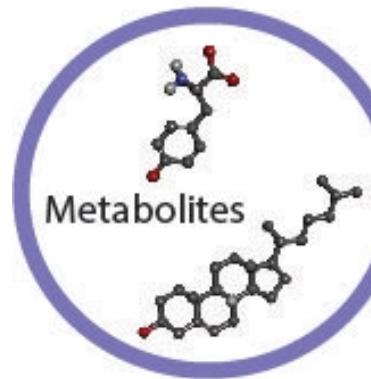
**Toxicogenomics**



**Transcriptomics**



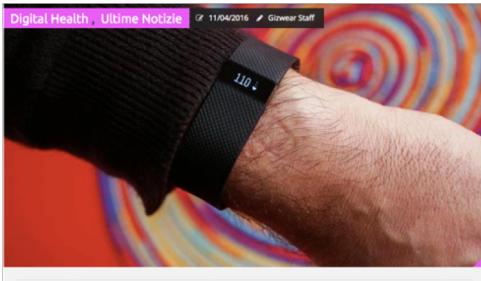
**Proteomics**



**Metabolomics**



# Big data in healthcare: wearable & implantable devices



Fitbit Charge HR salva la vita ad un malato di cuore!



GIZWEAR.net  
SOWATCH: lo smartwatch che previene l'ictus



GIZWEAR.net  
THIM, il primo wearable al mondo "migliora-sonno" | Video

The number of devices connected to the Internet was 12.5 billion in 2010, making the number of connected devices per person >1 (1.84) for the first time in history. Now they are 25 billions



Hodei Technology helps hospitals use Google Glass for surgical collaboration; rural telemedicine



Medtronic implantable device for treating chronic pain by delivering neurostimulation at the spinal cord is connected to a Samsung Galaxy Tab S2, to allow data capturing and IPG controlling

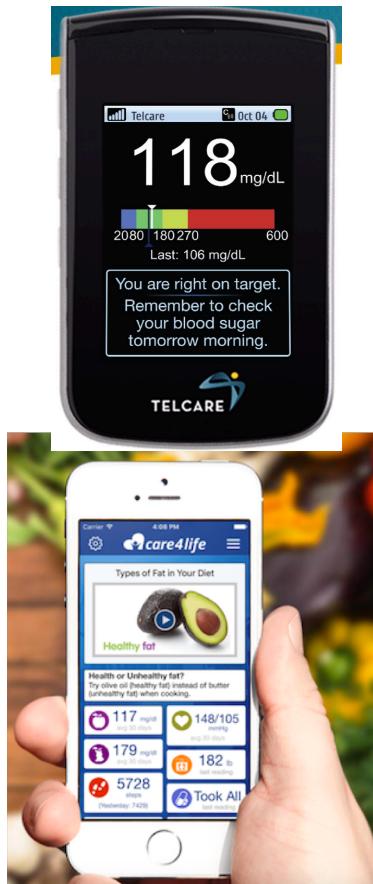
# Big data in healthcare: apps and social media

INTERACTIVE JOURNAL OF MEDICAL RESEARCH

Giordano et al

Original Paper

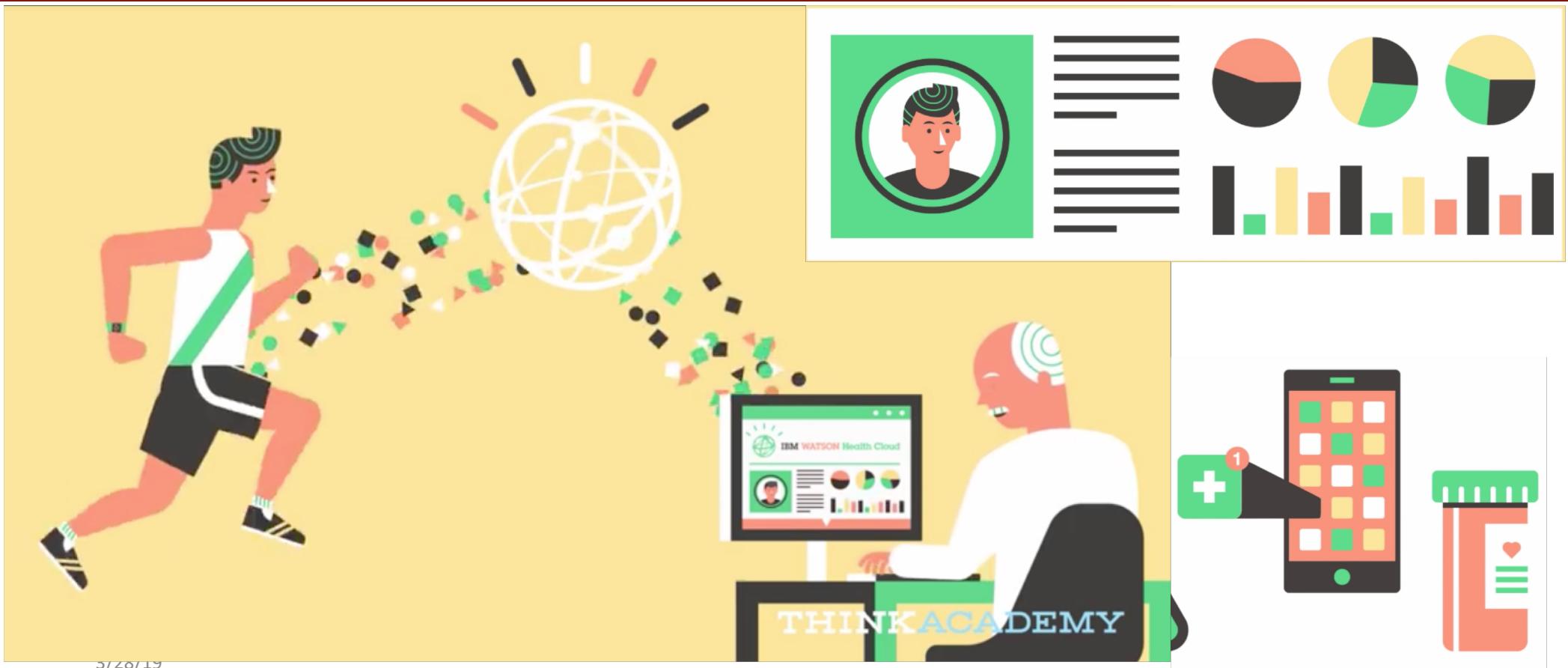
WhatsApp Messenger as an Adjunctive Tool for Telemedicine:  
An Overview



- There are more mobile connections than people
- Internet search engines like **Google** are the **3rd source of information** (51,4%), **Facebook** is the **fifth** (43,7%).
- Among younger people:
  - First: **Facebook** (71,1%)
  - Second: **Google** (68,7%)
  - Fourth: **YouTube** (53,6%)



# Big data in healthcare: scenario atteso



# Big data in healthcare: aspettative

## IMPROVING CLINICAL OUTCOMES

Comparative effectiveness research to identify the most cost-effective ways to diagnose/treat patients

## TELEMONITORING

Real-time monitoring at home and in-hospital to prevent acute episodes and adverse events

## PUBLIC HEALTH

Analyze disease patterns to improve public health surveillance, faster development of targeted vaccines, identify needs and provide targeted services

## DRUG DISCOVERY

Predictive modeling to identify candidate new drugs

## GENOMIC ANALYTICS

More efficient sequencing and analysis to make genomic analysis part of the regular medical decision making process

## CLINICAL RESEARCH

Improve clinical trial design, and improve data analysis to discover hidden information e.g., adverse effects

## FRAUD ANALYSIS

Automatic analysis of claim requests to reduce frauds, waste, and abuse

## PATIENT PROFILING

Segmentation, predictive modeling, to suggest lifestyle changes, and to evaluate risk profiles

## EVIDENCE-BASED MEDICINE

Extract valuable information from available heterogeneous clinical data

Raghupathi and Raghupathi Health Information Science and Systems 2014; 2:3

<http://www.hisjournal.com/content/2/1/3>



Open Access

REVIEW

Big data analytics in healthcare: promise and potential

Wullanur Raghupathi<sup>1\*</sup> and Viju Raghupathi<sup>2</sup>

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26

## Big data in the real world: le 4V

### VOLUME

- The size of data goes beyond the ability of common hardware/software
- Healthcare volume → z

### VELOCITY

- The rate of growth is very fast
- There is a constant flow of data often in real time

### THE BIG DATA 4Vs

### VARIETY

- Heterogeneous data (structured, unstructured, semi-structured)
- Different data types

### VERACITY

- Errors and inaccuracies are possible
- Error free outcomes are the goal

# Big data in healthcare: heterogeneity



Refertazione

Assistito	Nato	Sesso	N.
PROVA AZZURRA	01-12-1965	F	35653

Episodi	Data	Tipo Episodio	N. Cartella
20/02/2012 Ambulatorio Distrettuale Sassuolo N	20/02/2012	Ambulatorio Distrettuale Sassuolo N	35653
19/03/2012 Ambulatorio Distrettuale Sassuolo N	19/03/2012	Ambulatorio Distrettuale Sassuolo N	35653
09/05/2012 Ambulatorio Distrettuale Sassuolo N	09/05/2012	Ambulatorio Distrettuale Sassuolo N	35653

Cartella  
« POAG / OHT: Visita »  
Data: 02/10/2012 Medico:

POAG / OHT: Visita

Diagnosi:   
Data diagnosi:  00/0000  
Allergie:   
Spessore cornea OD:  Micron  
Spessore cornea OS:  Micron

Anamnesi:  
Terapia in atto: nessuna  
Effetti collaterali riferiti:   
Altri dati anamnestici: occhio rosso da 3-4 giorni  
Ultimo Campo Visivo:

Nuovo Inserimento

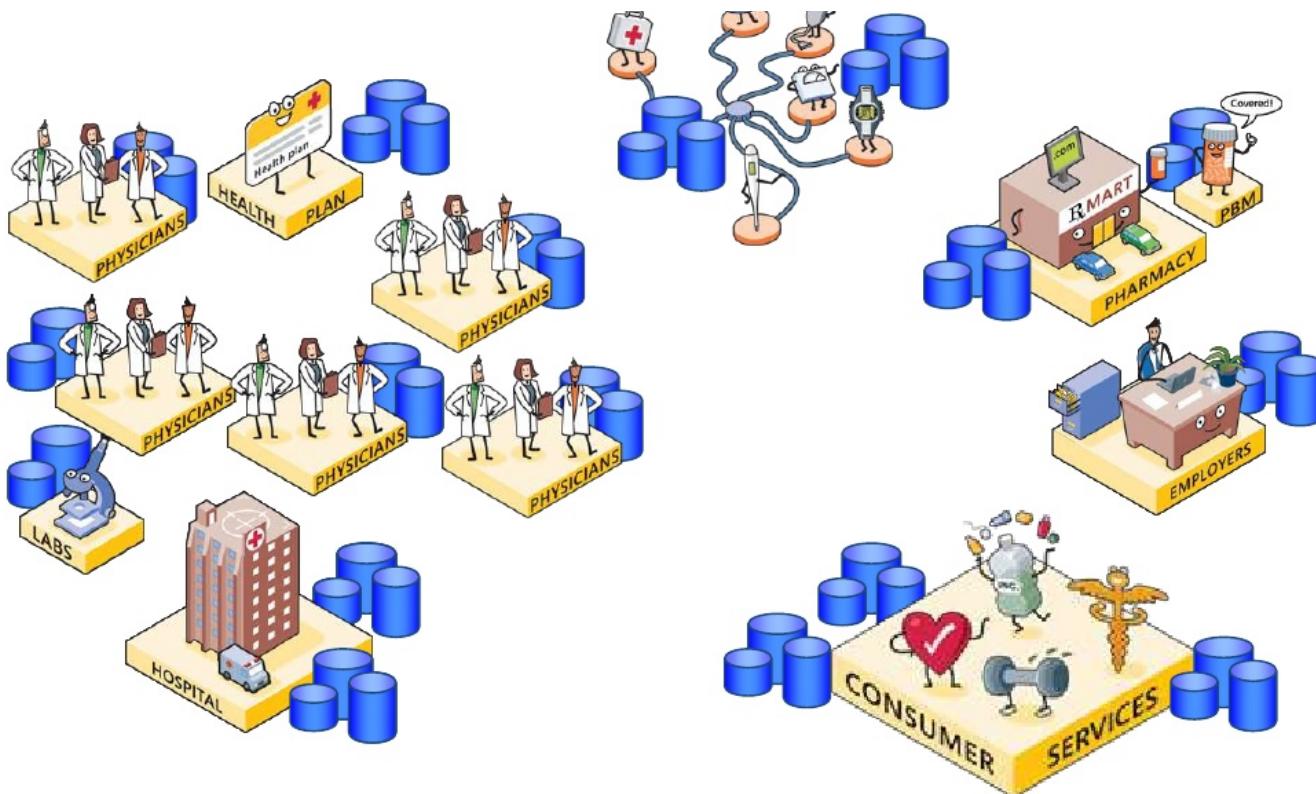
**STRUCTURED vs  
UNSTRUCTURED DOCUMENTS**



# Big data in healthcare: data silos

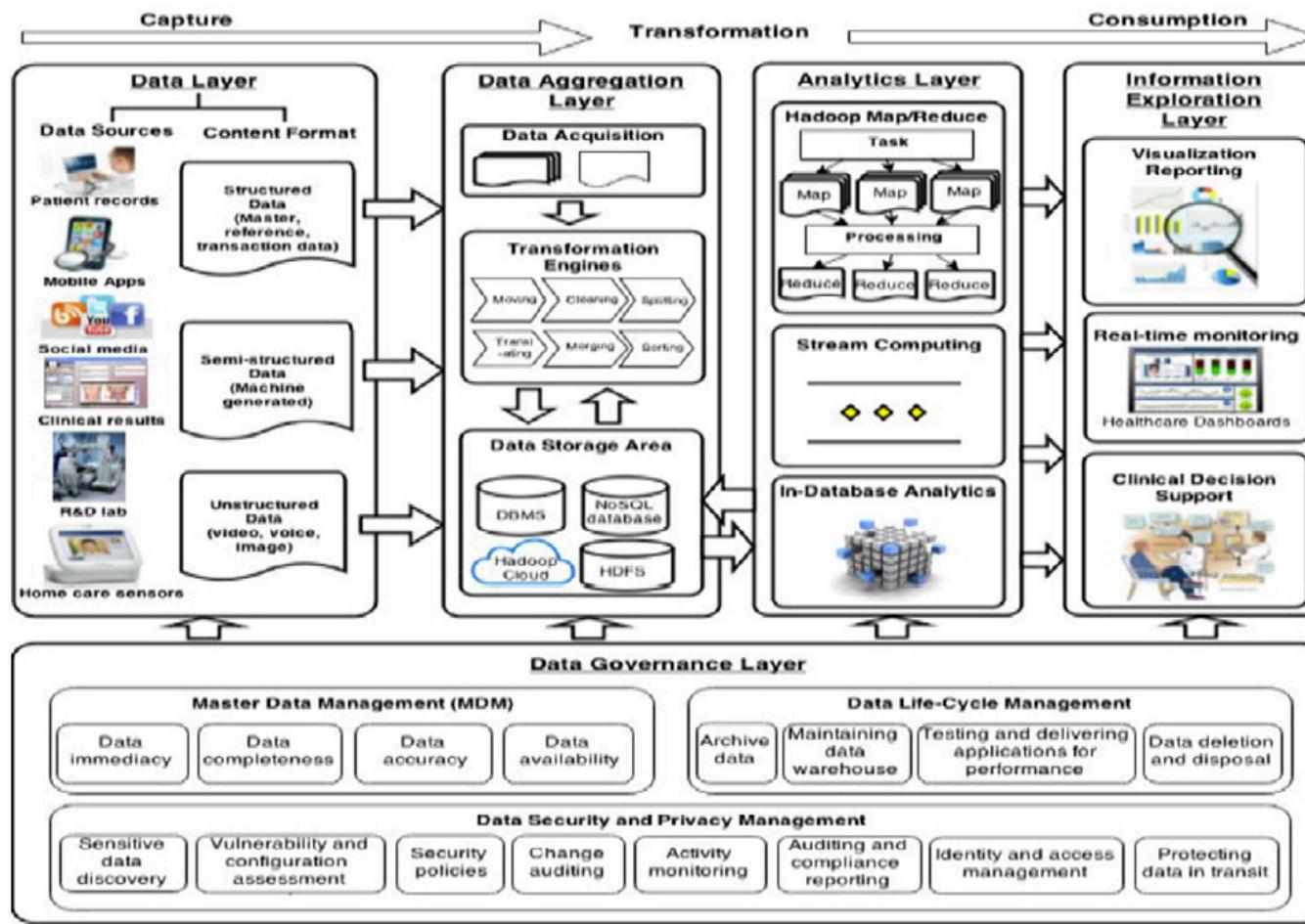
Healthcare data are stored in isolated “silos”

→ Interoperability is envisaged



Marceglia et al, JAMIA, 2015

# Big data in healthcare: analytics



**Four-step process:**  
1- Data collection  
2- Data aggregation  
3- Data analysis  
4- Information extraction

Technological Forecasting & Social Change 126 (2018) 3–13

Contents lists available at ScienceDirect



Technological Forecasting & Social Change

Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations

Yichuan Wang <sup>a,\*</sup>, LeeAnn Kung <sup>b</sup>, Terry Anthony Byrd <sup>a</sup>

<sup>a</sup> Raymond J. Harbert College of Business, Auburn University, 405 W. Magnolia Ave., Auburn, AL 36849, USA

<sup>b</sup> Rohrer College of Business, Rowan University, 201 Mullica Hill Road, Glassboro, NJ 08028, USA

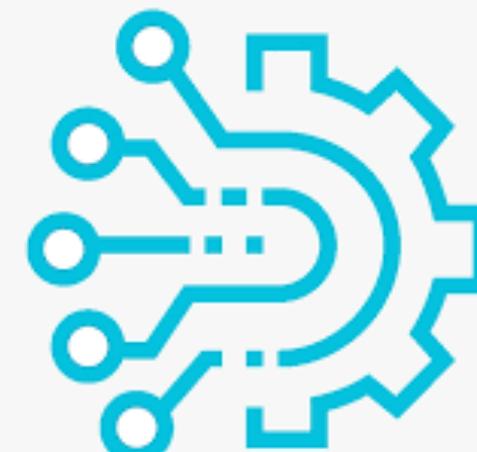


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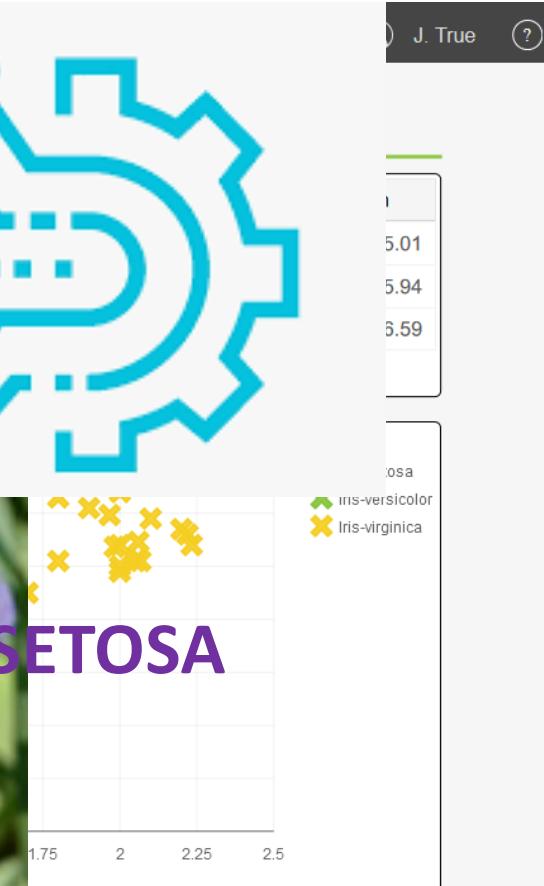
# Machine learning



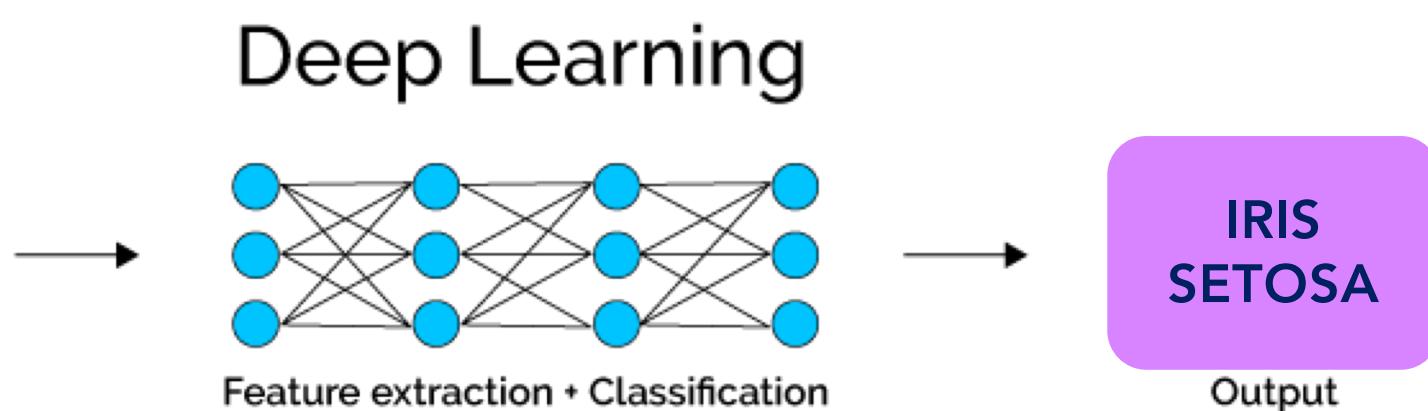
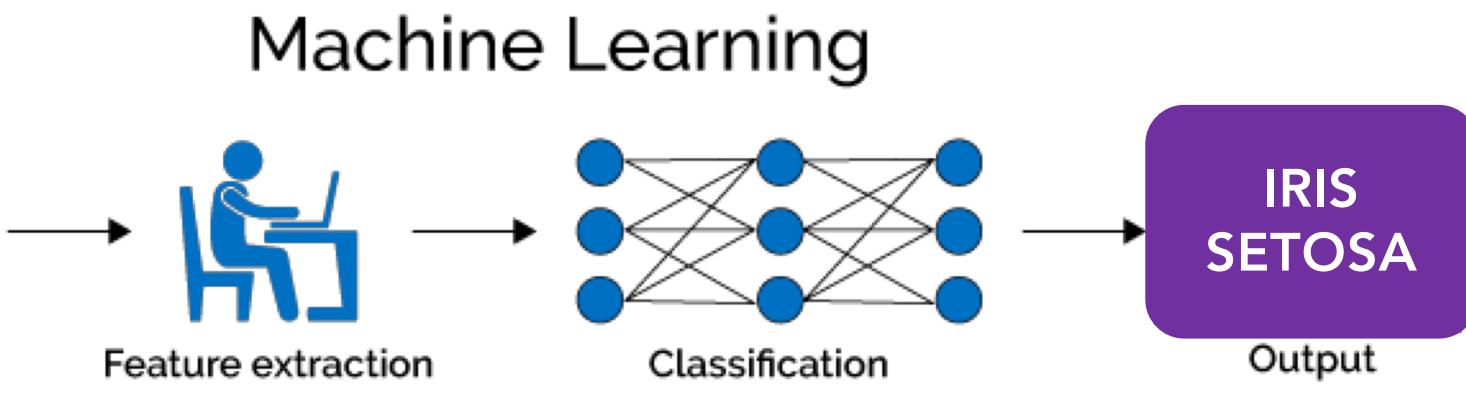
[https://upload.wikimedia.org/wikipedia/commons/4/4f/Iris\\_versicolor\\_5.jpg](https://upload.wikimedia.org/wikipedia/commons/4/4f/Iris_versicolor_5.jpg)



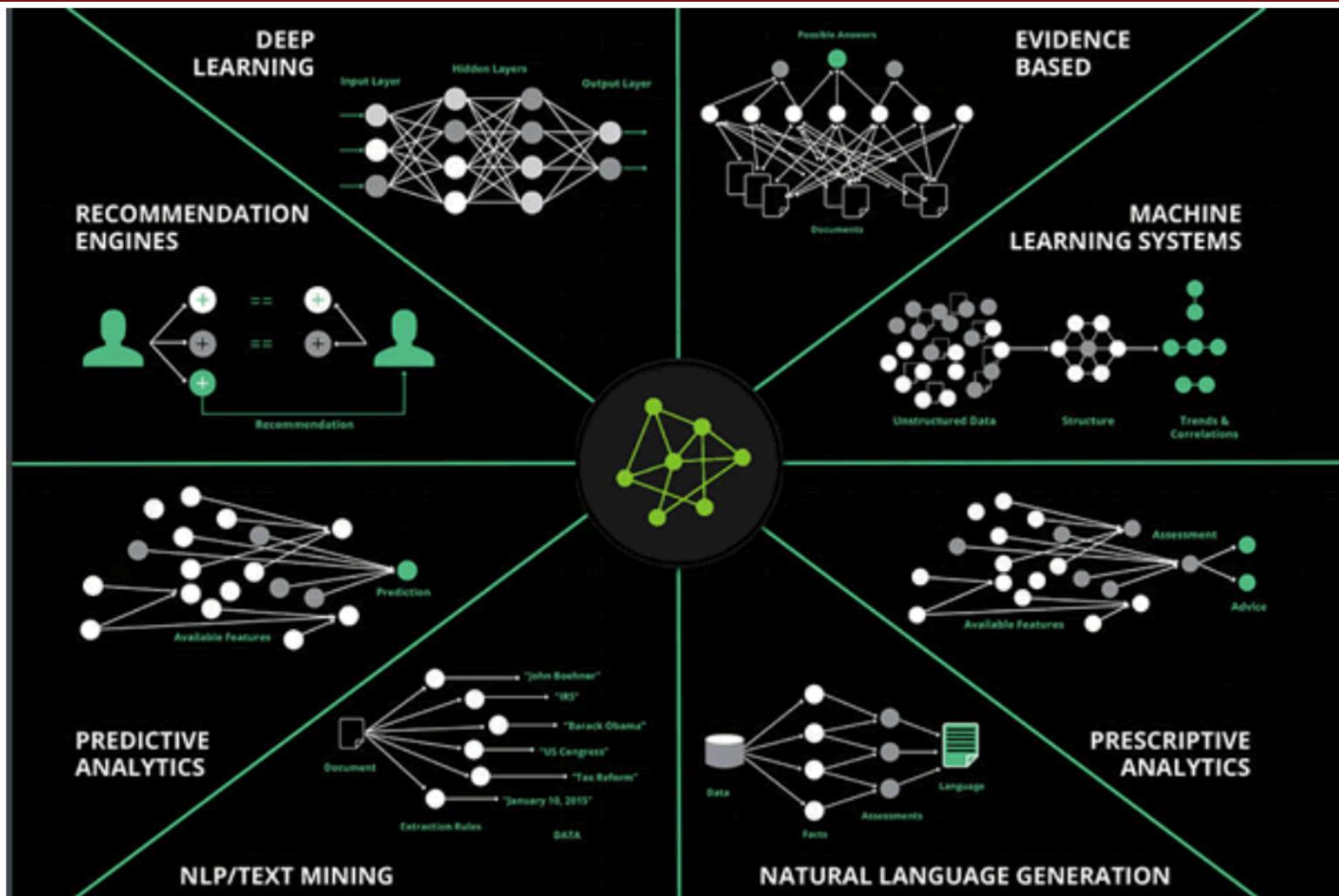
IRIS SETOSA



# Deep learning vs machine learning



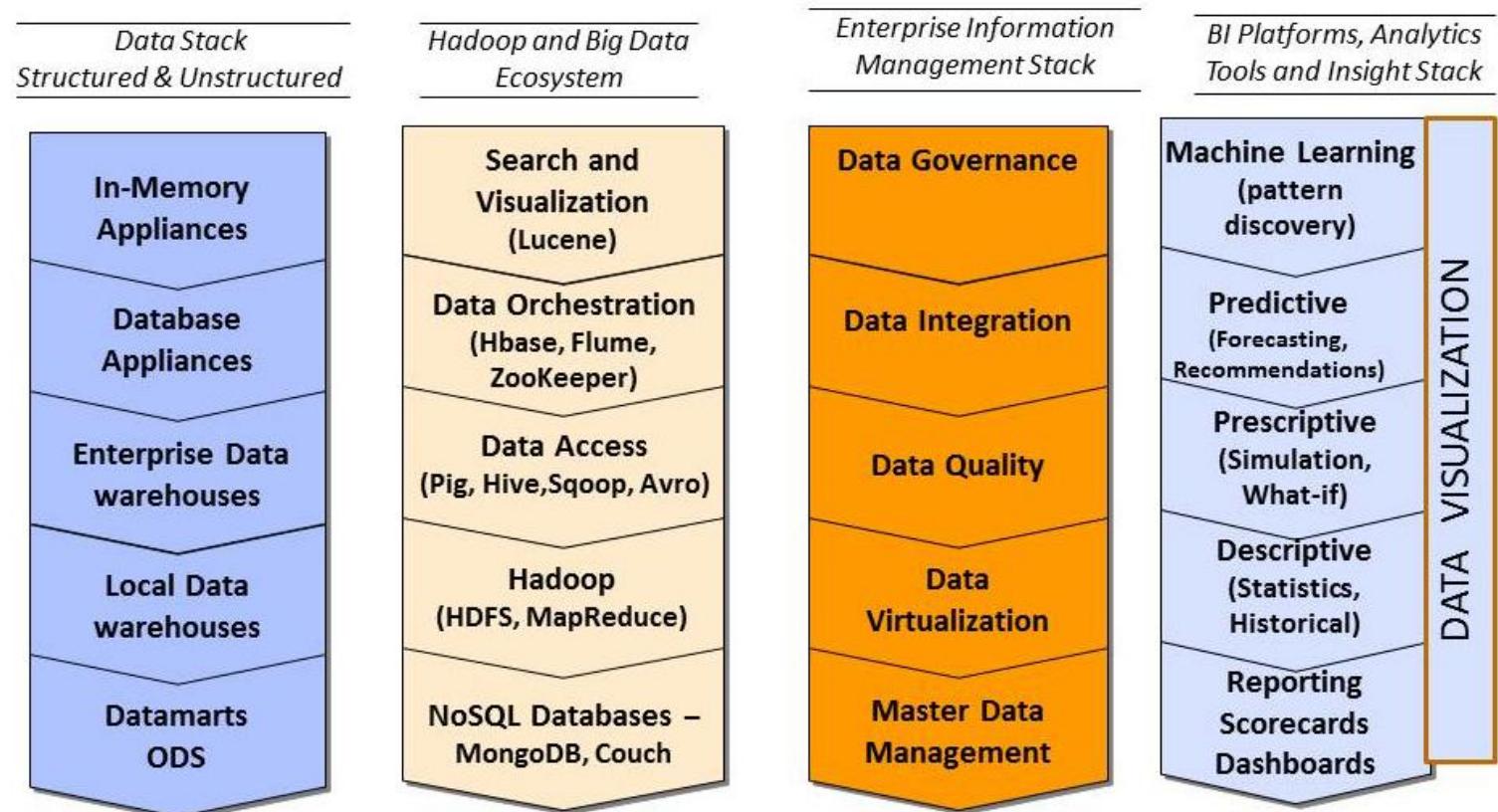
# Artificial intelligence



# Big data in healthcare: hardware infrastructures



Big Data require a technological infrastructure that goes beyond the classical stand-alone system: nodes, distributed processing, high performance computing

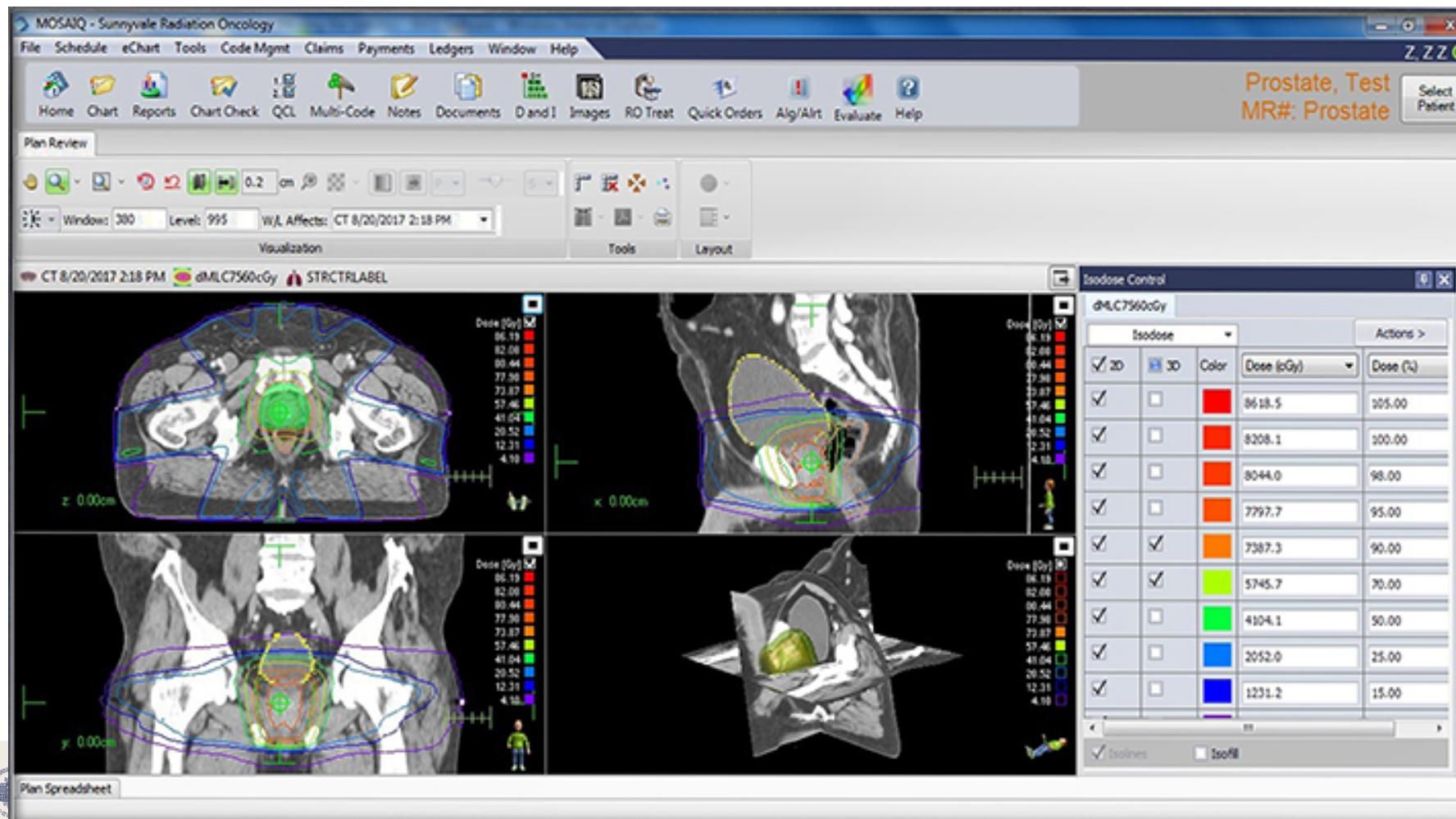


# Health innovation

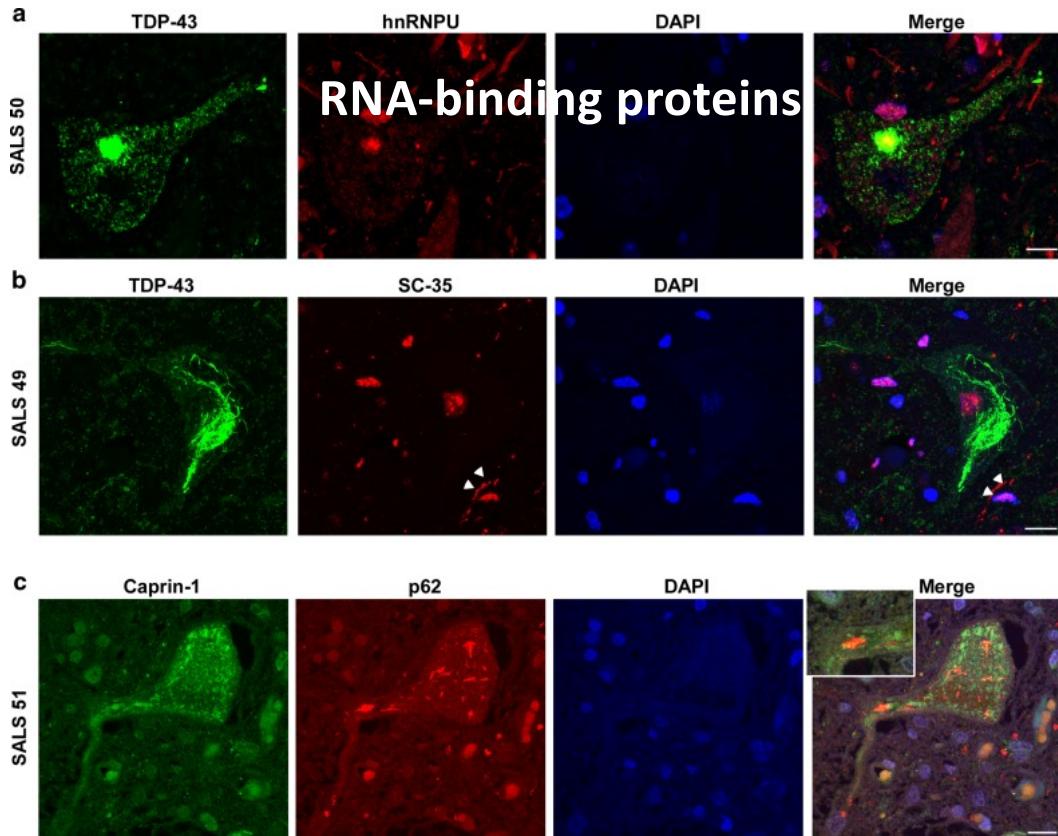
## 106 STARTUPS TRANSFORMING HEALTHCARE WITH AI



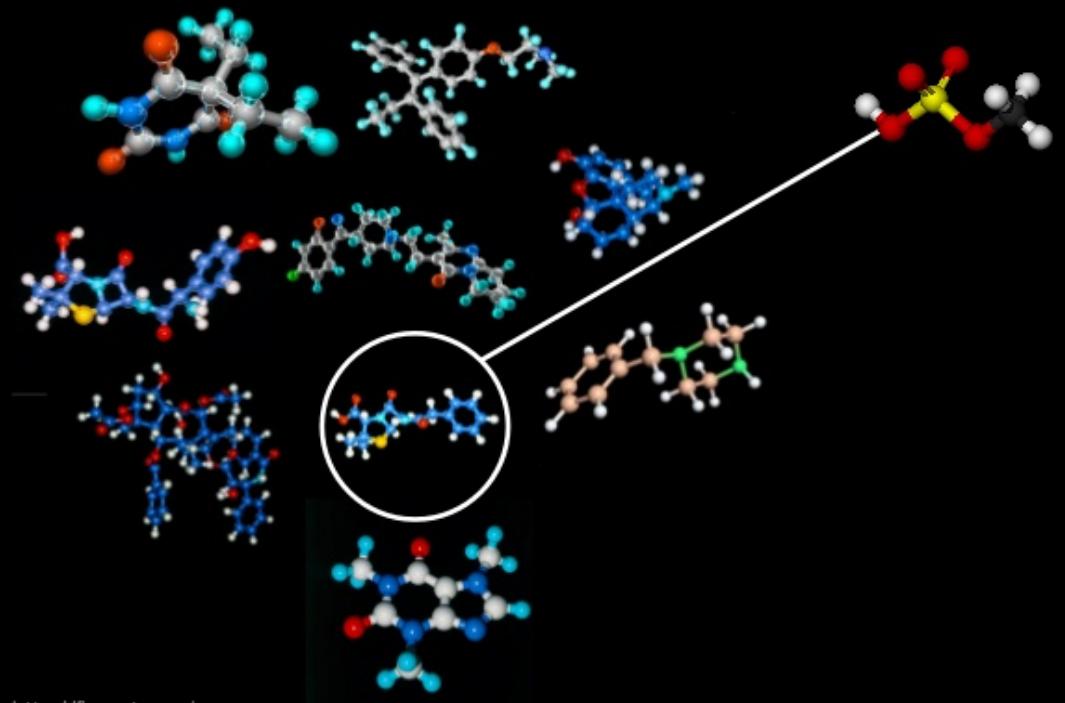
# Sistemi di supporto alla decisione



# Genomica e farmaci



## Drug discovery



# Cybersecurity



*“Threats will be dealt with in hours, not days or weeks”*  
**M. Taddeo, L. Foridi**  
*Nature 2018*

## Ambiente e sostenibilità

### Google uses AI to cut data centre energy use by 15%

Technology firm hailed success of machine-learning trial and said efficiencies will be applied to all its centres by end of year



AI-powered devices are helping consumers battle climate change



## AI a supporto della clinica

### STUDY: NEW PEDIATRIC AI OUTPERFORMS JUNIOR DOCTORS

Training a doctor takes years of grueling work in universities and hospitals. Building a doctor may be as easy as teaching an AI how to read.

How Big Data Helps To Tackle The No 1 Cause Of Accidental Death In the U.S.

Big Data In Healthcare: Paris Hospitals Predict Admission Rates Using Machine Learning



### AL HOSPITAL TACKLES PATIENT SAFETY WITH NEW AI

By identifying at-risk patients and informing care, Alabama's Southeast Health Medical Center is making the case for the potential impact of AI on reducing hospital-acquired infections like sepsis.



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## Caveat



**Stephen Hawking**



*"Humans, who are limited by slow biological evolution, couldn't compete, and would be superseded."*

*"The development of full artificial intelligence could spell the end of the human race."*

**Elon Musk**

*'What harm can a deep intelligence in the network do?'  
Well, it can start a war by doing fake news and spoofing  
email accounts and doing fake press releases and by  
manipulating information*



# Privacy

SIFY.COM



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# Cosa deleghiamo alla AI?

COMPAS



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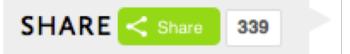
Cosa deleghiamo alla AI?

## FDA permits marketing of AI software that autonomously detects diabetic retinopathy

By **Dave Muoio** | April 12, 2018

## Viz.ai's stroke-detecting CDS app receives FDA nod

By **Dave Muoio** | February 14, 2018



[www.mobilehealthnews.com](http://www.mobilehealthnews.com)

## Regole

### Clinical and Patient Decision Support Software

### Draft Guidance for Industry and Food and Drug Administration Staff

Considera come punto cruciale il coinvolgimento dell'umano nella decisione

### Voluntary Industry Guidelines for the Design of Medium Risk Clinical Decision Support Software to Assure the Central Role of Healthcare Professionals in Clinical Decision-Making

Developed by the CDS Coalition



# Responsabilità condivisa



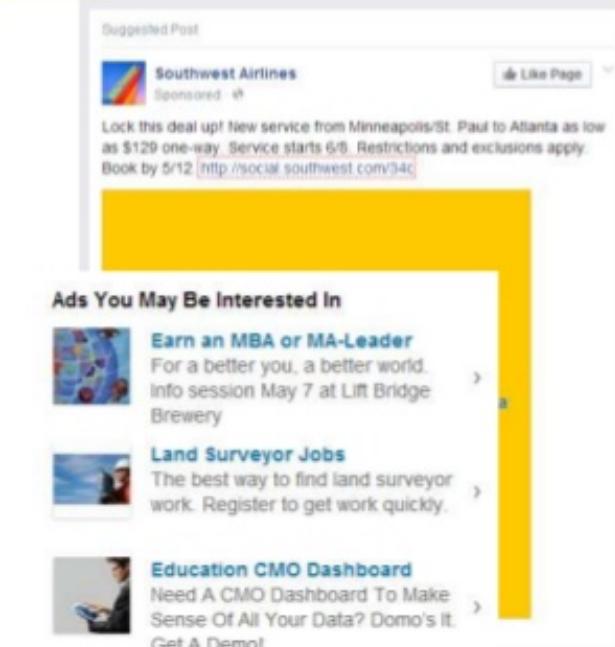
**Self-driving cars**



**Autonomous lethal weapons  
(LAW)**

# Autodeterminazione

## Targeted Social Advertising Examples



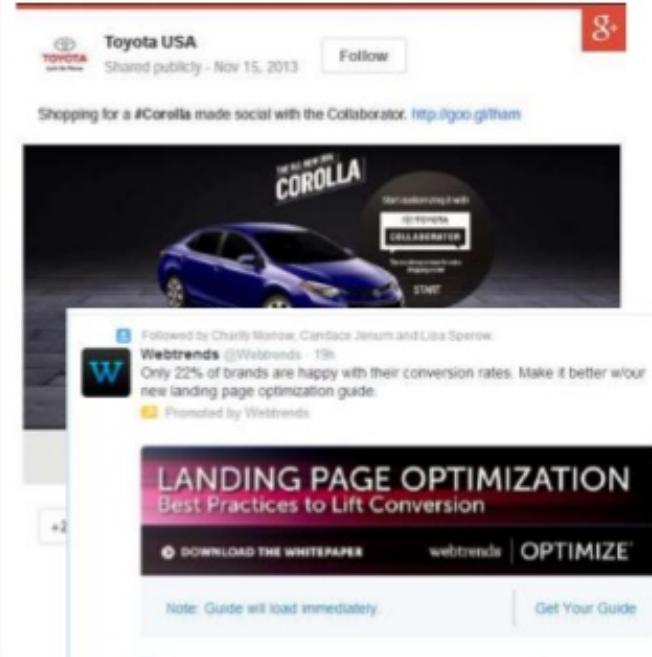
Suggested Post

**Southwest Airlines** Sponsored Like Page

Lock this deal up! New service from Minneapolis/St. Paul to Atlanta as low as \$129 one-way. Service starts 6/8. Restrictions and exclusions apply. Book by 5/12. <http://social.southwest.com/34c>

Ads You May Be Interested In

- Earn an MBA or MA-Leader**  
For a better you, a better world. Info session May 7 at Lift Bridge Brewery
- Land Surveyor Jobs**  
The best way to find land surveyor work. Register to get work quickly.
- Education CMO Dashboard**  
Need A CMO Dashboard To Make Sense Of All Your Data? Domo's It. Get A Demo!



Toyota USA Shared publicly - Nov 15, 2013 Follow

g+

Shopping for a #Corolla made social with the Collaborator. <http://goo.gl/tham>



The all-new COROLLA

Followed by Charity Monroe, Candace Jerum and Lisa Sperow. Webtrends (@Webtrends) 19h Only 22% of brands are happy with their conversion rates. Make it better w/our new landing page optimization guide. Promoted by Webtrends

**LANDING PAGE OPTIMIZATION**  
Best Practices to Lift Conversion

DOWNLOAD THE WHITEPAPER webtrends | OPTIMIZE

Note: Guide will load immediately. Get Your Guide

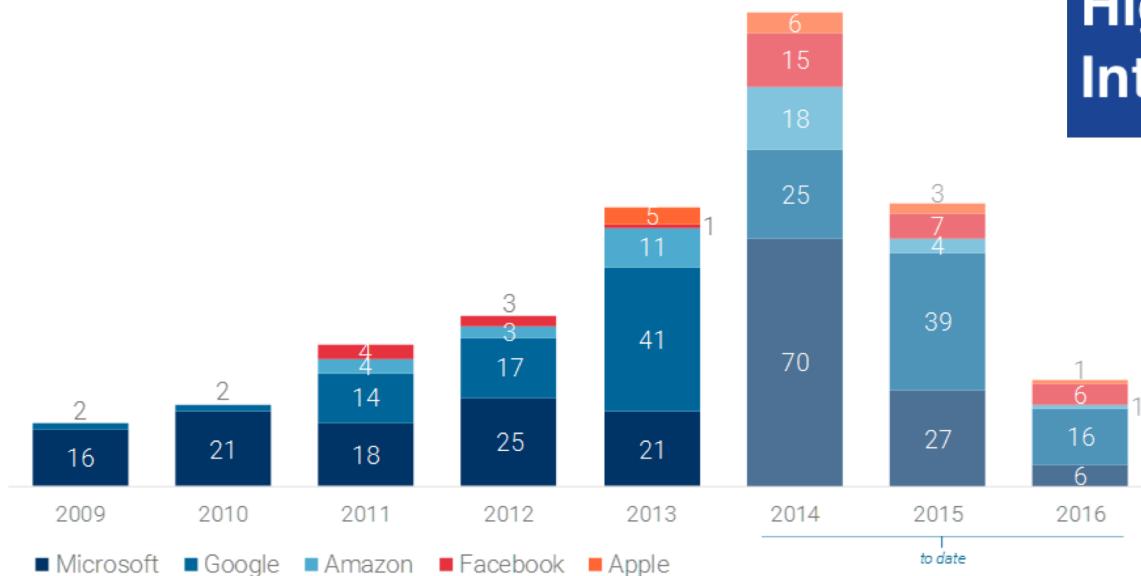


# Le nuove élite



## ARTIFICIAL INTELLIGENCE PATENT APPLICATION ACTIVITY

By date of application, 2009 - 2016 YTD (12/12/16)



CB INSIGHTS

## High-Level Expert Group on Artificial Intelligence

52 membri:  
17 accademici  
4 società civile  
**31 grande industria**



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## Come affrontare le tematiche di etica

The image shows the DARPA logo, which is a blue globe with the letters "DARPA" in white. To the right of the logo, the text "DEFENSE ADVANCED RESEARCH PROJECTS AGENCY" is written in blue capital letters. Below the logo, there is a horizontal line. Underneath the line, the text "Defense Advanced Research Projects Agency > Program Information" is in blue. At the bottom, the words "Explainable Artificial Intelligence (XAI)" are displayed in a large, bold, black font.

DEFENSE ADVANCED  
RESEARCH PROJECTS AGENCY

Defense Advanced Research Projects Agency > Program Information

Explainable Artificial  
Intelligence (XAI)

# The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems



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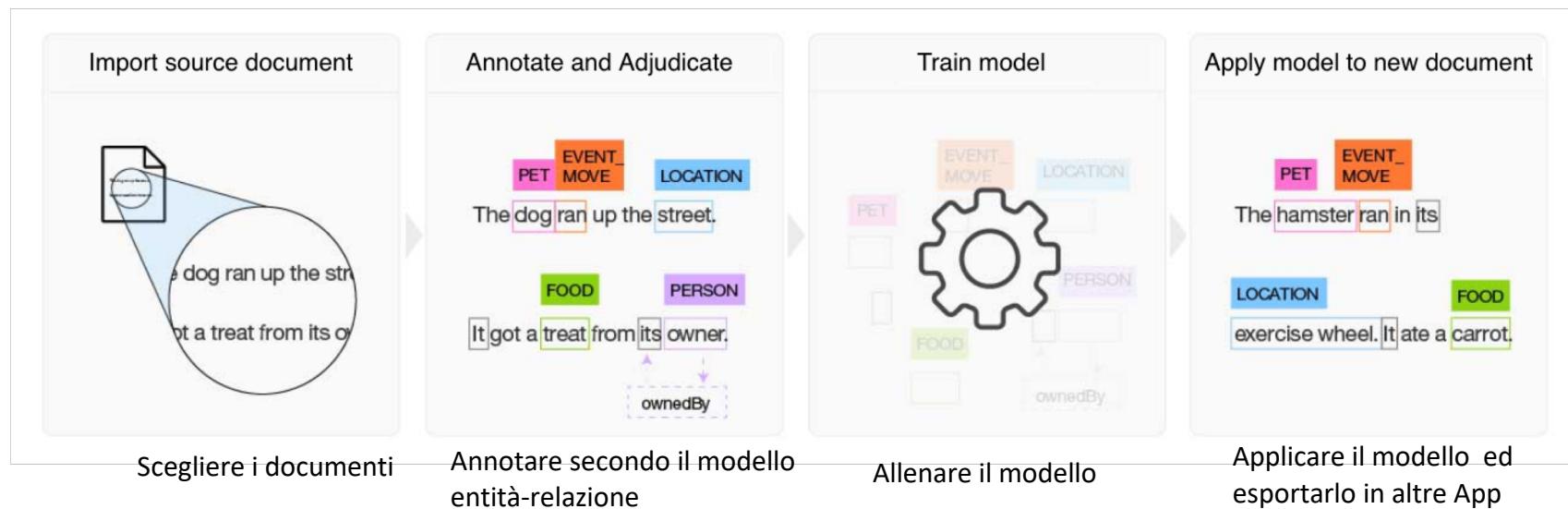
## IBM Watson

- IBM Watson è una piattaforma cloud che include diversi servizi (database, integrazioni di diversi linguaggi di programmazione, statistiche...)
- può apprendere automaticamente nuove nozioni (machine learning), reperire informazioni all'interno di un database in maniera immediata e naturale e rappresentare la conoscenza



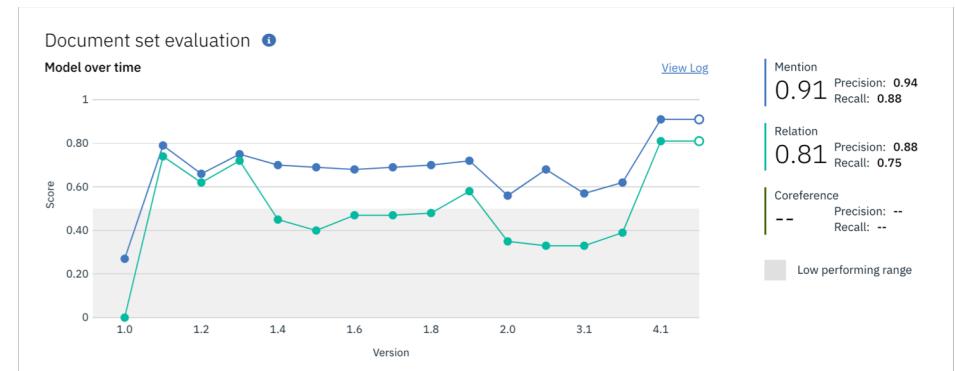
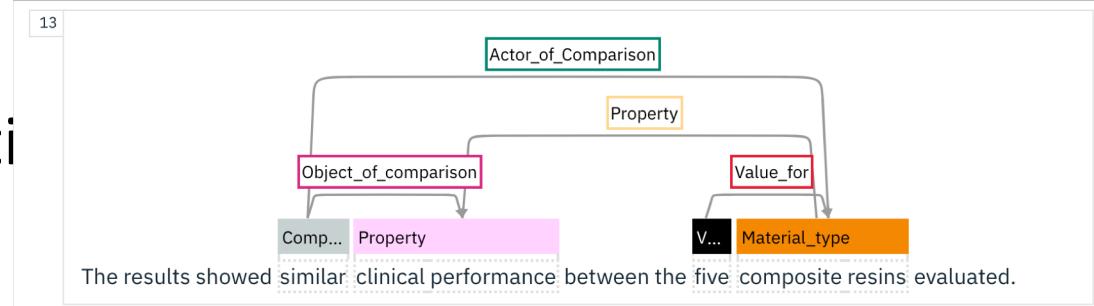
# Watson knowledge studio

consente di creare un modello di machine learning in grado di rilevare automaticamente e comprendere le sfumature linguistiche oppure estrarre concetti sotto forma di entità-relazione



# Watson knowledge studio

1. Caricare i documenti
2. Annotare alcuni set di documenti
3. Applicare il modello a set non annotati
4. Allenare il modello e valutare le performance
5. Esportare il modello

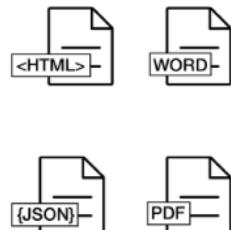


# Watson Discovery

- Consente la creazione guidata di applicazioni per l'esplorazione cognitiva di documenti non strutturati, portando alla luce informazioni in essi contenute.
- Utilizza query in linguaggio naturale o un modello Knowledge Studio.
- Si può connettere a database esterni o alimentare tramite upload di documenti.

## | Data

Private data



## | Ingestion

Documents are automatically converted and enriched by leveraging Watson APIs to add Natural Language Processing metadata to your content, making it easier to explore and discover insights

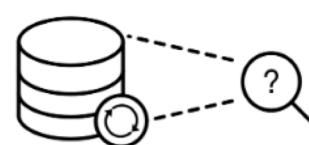
## | Storage

Data is indexed into a collection as part of your environment in the cloud



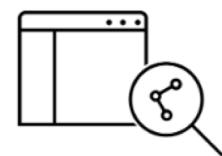
## | Query

Understand data faster, create better hypothesis and deliver better outcomes



## | Output

Actionable insights into your app



# Watson Discovery

I documenti vengono caricati e  
Discovery identifica automaticamente  
Entità e Relazioni

Overview Errors and warnings (0)

165 documents

⚠ 0 documents failed [View details](#)

neconf [Edit](#) | [Switch](#)

Added 1 enrichment to your data

Entity Extraction

Material\_type (144) | Restauration\_Type (135) | Charater (127) | Comparator (121) | Value (107)

Entity Extraction

Extracts people, companies, organizations, cities, geographic features, and more from this field. You can also create and add custom entity models with Watson Knowledge Studio.

[Learn more](#) ✓ Added!

Custom Model ID ⓘ a9262638-8298-46fd-9dce-6... [Edit](#) [Delete](#)

Relation Extraction

Recognizes when two entities are related and identifies the type of relation. You can also create and add custom relation models with Watson Knowledge Studio.

[Learn more](#) ✓ Added!

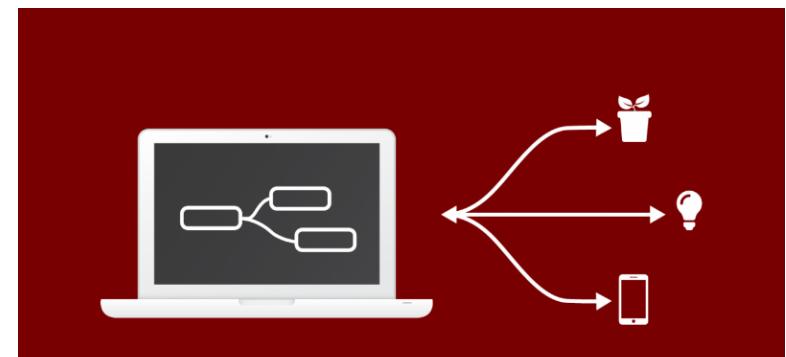
Custom Model ID ⓘ a9262638-8298-46fd-9dce-6... [Edit](#) [Delete](#)

Per ricercare Entità e Relazioni desiderati  
deve essere inserito il link al Modello  
Knowledge Studio



## Node Red

- Node-red è uno strumento basato sul flusso.
- Editor intuitivo per la creazione di flussi e interfaccia, anche con hardware.
- Si basa sull'utilizzo di nodi funzionali, l'uscita è l'ingrasso del successivo.
- Esistono svariate librerie di Nodi già implementati.



**Node-RED**

# IBM Academy program



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<https://units.onthehub.com>

Ricerca del prodotto

Faculty/Staff

Microsoft IBM

Cloud Watson IoT Data & Analytics Security Blockchain IBM Z Power Systems Commerce Quantum More Resources

Cloud Access Software

In addition to the valuable resource below, check out [Watson Academy](#).

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