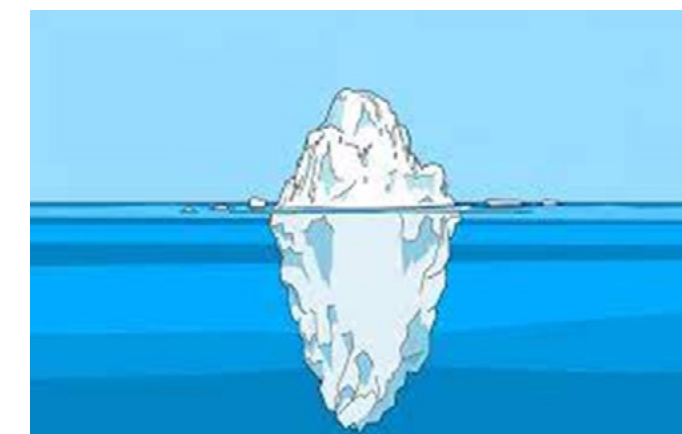


Dr Silvia Franceschi, Research Director
Aviano Cancer Institute (CRO), IRCCS

AI in Health Care: Which Intelligence and for what?



Artificial Intelligence (AI)



Disclaimer: no conflict of interest and not a computer scientist

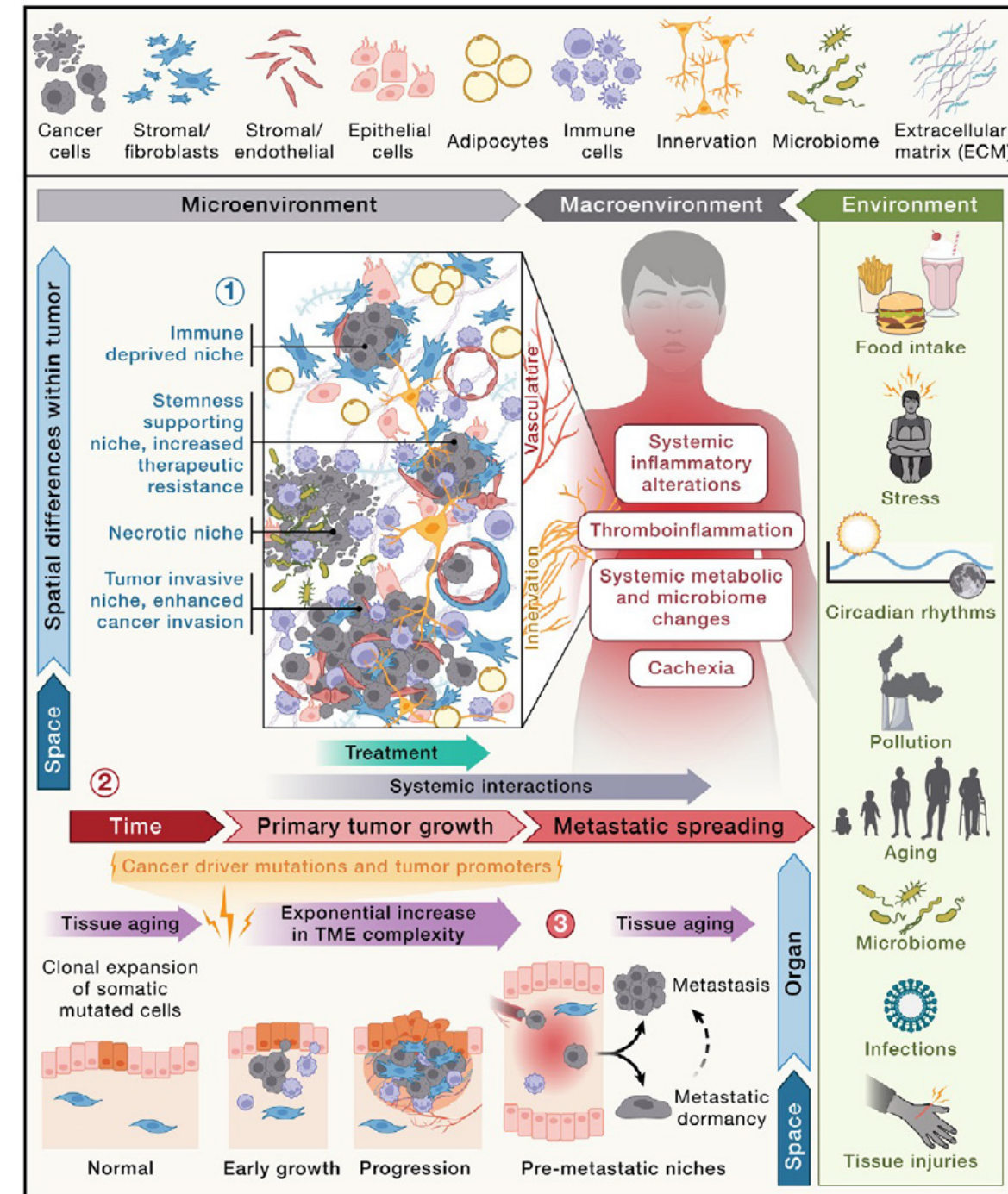
Examples of **Research** that matters for *patients* and/or *doctors*

- Access to the favourable impact of precision medicine ←
- Prompt reaction to adverse reactions to drugs/vaccines, e.g., recent examples of vaccines ←
- Overdiagnosis/overtreatment **NEGLECTED, SHOULD MATTER TO ALL**
- Long-term improvements in Cancer Survival/ Cure Fraction ←
- Use and compare health data all over Europe ←

DILEMMA: **Real-world Data vs Randomized Clinical Trials**



The (UN?) SUSTAINABLE COMPLEXITY of modern ONCOLOGY

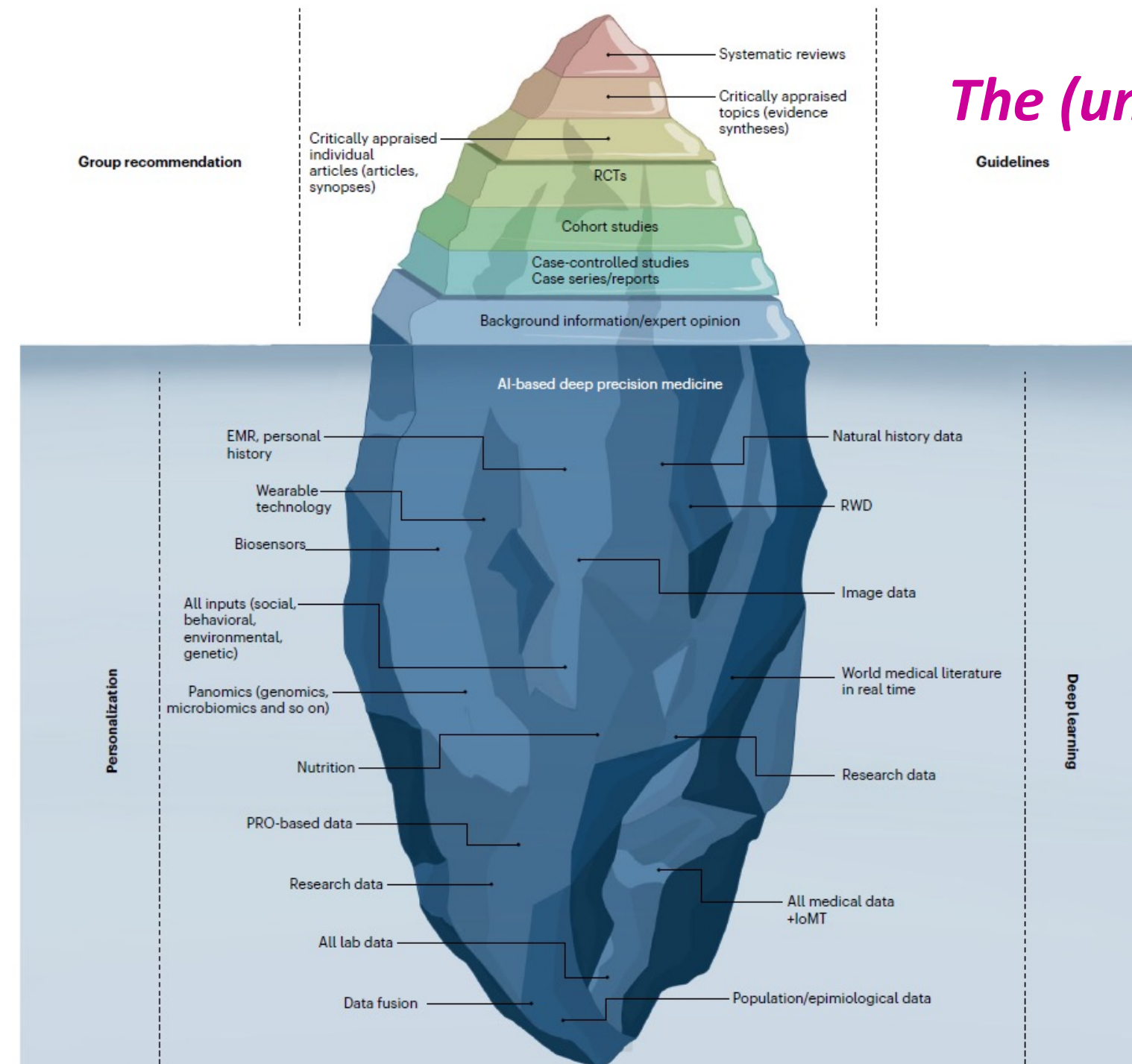


Non solo sede e cellule tumorali

- Representation of the complex tumor ecosystem,
- Interactions between diverse components of the tumor **micro- and macro-environments** are depicted,
- Influences of the **host**, as well as **external factors**, on tumor growth and metastatic dissemination.

FROM: *Embracing cancer complexity: Hallmarks of systemic disease*, Swanton et al, Cell, 2024

AI REQUIRED



The (un)sustainable depth of data

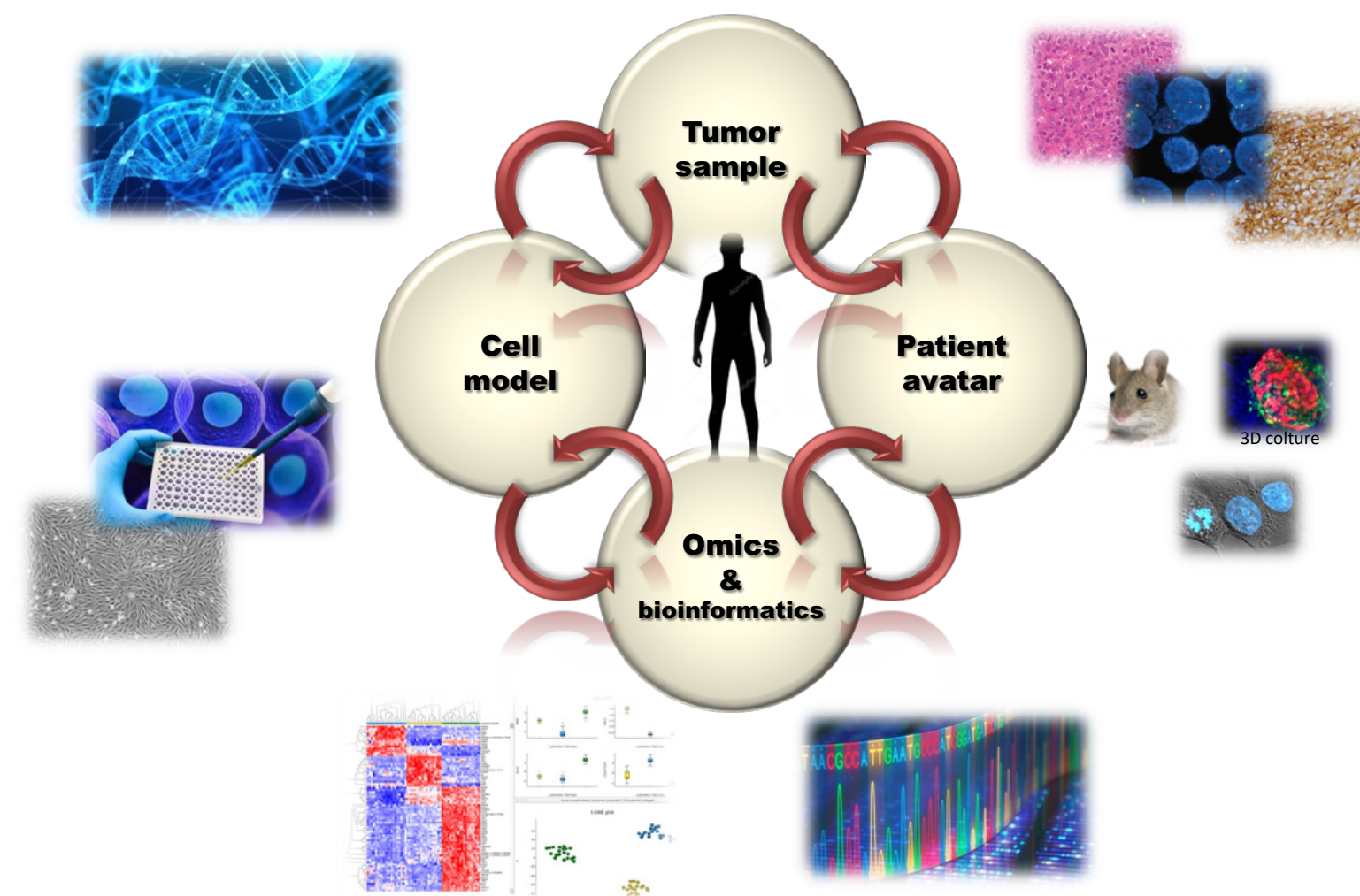
A synthesis all data is needed for next-generation, deep evidence-based medicine.

The challenge is extracting:

- **natural history** data,
- genomics and all **omics** analyses,
- published **clinical trials**,
- **real-world data** (RWD),
- data from the **Internet** of MedicalThings (IoMT), and
- patient-reported **outcomes** (PRO)

From NEXT-GENERATION EVIDENCE, Subbiah, Nature Med, 2023

All Research is Translational at Aviano Cancer Centre



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Share Platforms, Registries and Databases!

Technological Platforms

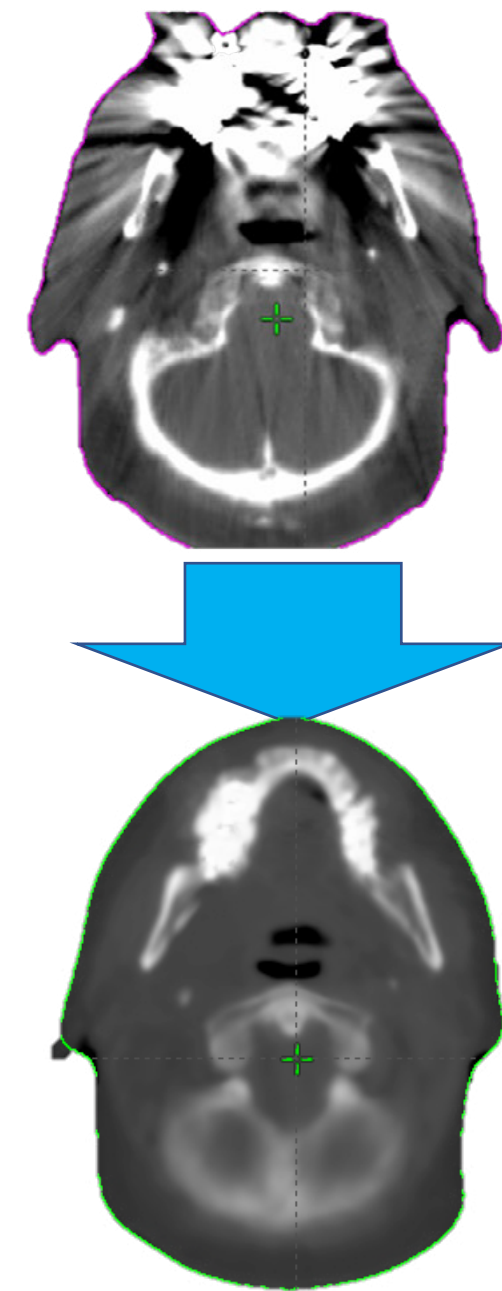
- Multi-spectral cytofluorimetry/cell sorting;
- Conventional and Next-generation sequencing (+ Nanostring);
- In-vitro ed in-vivo Imaging (+ mini-PET);
- Animal house;
- Piattaforma informatica per la ricerca e l'assistenza.

Registries and Banks

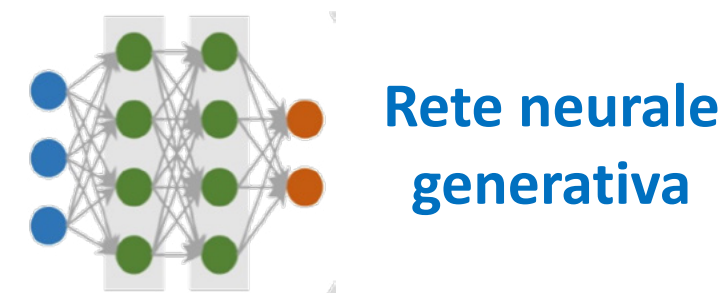
- CRO-Biobank: about **155,000 frozen samples**
- **Population-based Cancer Registry of Friuli Venezia Giulia** (since 1998);
- Diagnostic **Imaging** registry;
- Regional Center for Genetic Syndromes of the digestive tract;
- Stem-Cell Bank and Onco-Haematological Biobank;
- Clinical Trial Office and Technology Transfer Office



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TC tradizionale,
con **artefatti** da impianti
dentali



**Rete neurale
generativa**

Megavolt CT Sintetica, libera da
artefatti, **generata da AI addestrata** a
riconoscere le caratteristiche
principali.

**Advanced experience
in IMAGING
(M. Avanzo et al)**

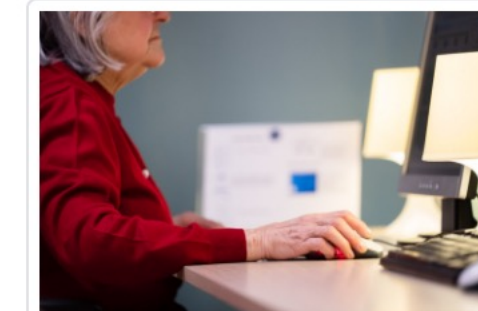
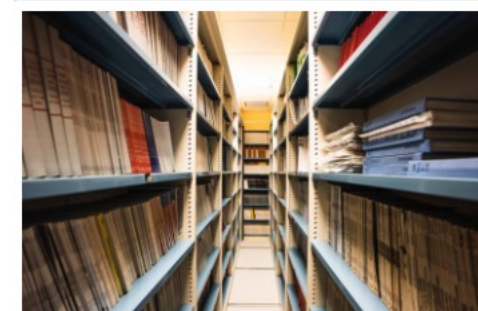
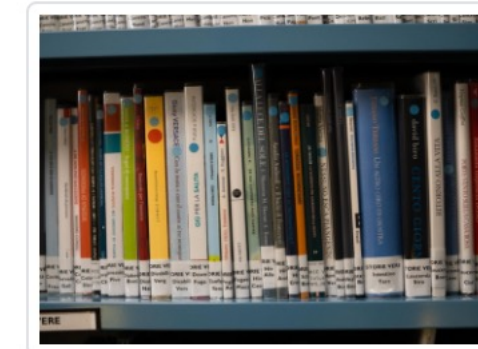


UNIVERSITÀ DEGLI STUDI DI UDINE
DIPARTIMENTO DI SCIENZE
MATEMATICHE, INFORMATICHE E FISICHE



BUT ALSO «Patient Education & Empowerment» to strengthen exchanges between patients and health providers is essential

See also **CROinforma booklets and new AI platform**



Thanks to Dr M Mazzocut, C Cipolat and all the Library staff for their help

glossary

- Tailoring of treatment to patients dates back at least to the time of **Hippocrates**, BUT NOW **new diagnostic and informatics** approaches that provide an understanding of the molecular basis of disease, particularly genomics.
- These tools allow to **stratify patients**.
- Personalized medicine and precision medicine are used interchangeably **BUT:**

PRECISION MEDICINE BETTER REFLECTS the current SCIENTIFIC APPROACH while THE WORD “personalization” has been abused by corporate advertisements

Indeed, a balance between REAL-WORLD DATA AND Randomized CLINICAL TRIALS must be kept

HISTORY of AI: the obsession of winning the human brain

- 1950'-1970': connectivism, more and more computers linked together;
- 1980S: Internet goes global
- 1980'-1990': big improvements and spread of the PC use at work and at home;
- 2000': Corporate-based AI on gigantic amount of data collected by Facebook, Google and Amazon thanks to unprecedented PROFITS;

1996-1997

Deep Blue vs. Kasparov



Deep Blue
IBM chess computer

Garry Kasparov
World Chess Champion

There is so **much intelligence on this planet** other than ours

- Human intelligence is not unique and there appear to be many different kinds of intelligence with their own strengths, competencies and suitabilities in different environments, e.g., **models for soft mini-robots in health care**
- **Cows, sheep, dogs** and other animals have been shown to **predict earthquakes** in advance of tremors which register on seismographs;
- **Squids and octopuses**, we have learned, spread their neurons out through their bodies in ways that **allow their limbs, and perhaps other faculties, to act independently** of a centrally controlling mind;
- **Spiders store information in their webs**, using them as a kind of extended cognition: a mind outside the body entirely;

James Bridle, Ways of Being: Animals, Plants, Machines: The Search for a Planetary Intelligence, Farrar, Straus & Giroux, 2022, ISBN 9780374601119

Miniature robots have a wide range of applications also in health care ,e.g., medical tools for imaging and performing micro-surgery.

BIG CHALLENGE: shrinking conventional electromagnetic actuators, which transform **electrical energy into mechanical energy** and movement Wang et al, Nature Custom Media, 2022.



▲ The compact, yet powerful, limb muscles of insects including grasshoppers (left), have inspired the work of researchers such as Hongqiang Wang (right), pictured here with a sheet of electrostatic actuators.

Conclusions

YES, AI can be non-inferior OR better than humans in:

Classification of images and clusters
Mass screening and telemedicine
Simulation of epidemics
Prediction of outcomes and efficacy of new drugs and vaccines

NO, AI cannot at the moment substitute doctor in patients care:

Human supervision is required for important decisions

Challenge: **COMMERCIAL APPLICATIONS (Facebook, Amazon, Google)** should not stop **RESEARCH AND INVESTEMENTS IN SOCIALLY IMPORTANT use of AI**

Thanks and arrivederci in Aviano

Delitti in materia di violazione del diritto d'autore (Art. 25-novies, D.Lgs. n. 231/2001) [articolo aggiunto dalla L. n. 99/2009]

- Messa a disposizione del pubblico, in un sistema di reti telematiche, mediante connessioni di qualsiasi genere, di un'opera dell'ingegno protetta, o di parte di essa (art. 171, legge n.633/1941 comma 1 lett. a) bis)
- Reati di cui al punto precedente commessi su opere altrui non destinate alla pubblicazione qualora ne risulti offeso l'onore o la reputazione (art. 171, legge n.633/1941 comma 3)
- Abusiva duplicazione, per trarne profitto, di programmi per elaboratore; importazione, distribuzione, vendita o detenzione a scopo commerciale o imprenditoriale o concessione in locazione di programmi contenuti in supporti non contrassegnati dalla SIAE; predisposizione di mezzi per rimuovere o eludere i dispositivi di protezione di programmi per elaboratori (art. 171-bis legge n.633/1941 comma 1)
- Riproduzione, trasferimento su altro supporto, distribuzione, comunicazione, presentazione o dimostrazione in pubblico, del contenuto di una banca dati; estrazione o reimpiego della banca dati; distribuzione, vendita o concessione in locazione di banche di dati (art. 171-bis legge n.633/1941 comma 2)
- Abusiva duplicazione, riproduzione, trasmissione o diffusione in pubblico con qualsiasi procedimento, in tutto o in parte, di opere dell'ingegno destinate al circuito televisivo, cinematografico, della vendita o del noleggio di dischi, nastri o supporti analoghi o ogni altro supporto contenente fonogrammi o videogrammi di opere musicali, cinematografiche o audiovisive assimilate o sequenze di immagini in movimento; opere letterarie, drammatiche, scientifiche o didattiche, musicali o drammatico musicali, multimediali, anche se inserite in opere collettive o composite o banche dati; riproduzione, duplicazione, trasmissione o diffusione abusiva, vendita o commercio, cessione a qualsiasi titolo o importazione abusiva di oltre cinquanta copie o esemplari di opere tutelate dal diritto d'autore e da diritti connessi; immissione in un sistema di reti telematiche, mediante connessioni di qualsiasi genere, di un'opera dell'ingegno protetta dal diritto d'autore, o parte di essa (art. 171-ter legge n.633/1941)
- Mancata comunicazione alla SIAE dei dati di identificazione dei supporti non soggetti al contrassegno o falsa dichiarazione (art. 171-septies legge n.633/1941)
- Fraudolenta produzione, vendita, importazione, promozione, installazione, modifica, utilizzo per uso pubblico e privato di apparati o parti di apparati atti alla decodificazione di trasmissioni audiovisive ad accesso condizionato effettuate via etere, via satellite, via cavo, in forma sia analogica sia digitale (art. 171-octies legge n.633/1941).

[Torna all'inizio](#)