Artificial Intelligence
A tool in modern and future oncology

The challenge of AI for OECI members

Dr. Giovanni Apolone

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Synopsis

- AI in our lives
- AI in the OECI Scientific Conference
- AI methods
- AI in Oncology
- A few reflections
- The very problem
- A proposal for OECI members

AI in our lives

- Artificial intelligence techniques are already in our life
- We often use them unconsciously
- A few examples
    - Social media (Tweeter, Facebook…)
    - Digital Assistants (Siri,…)
    - Self-Driving And Parking Vehicles (Tesla, …)
    - Email communications (Email filters …)
    - Web searching (Google, …)
    - Product recommendations (Amazon,…)
    - On line translations

IA in the Valencia Oncology days

OECI2022 ONCOLOGY DAYS

Scientific Conference

June 16th
Hotel Primus
Room: Opera

ARTIFICIAL INTELLIGENCE:
a tool in modern and future oncology

09.00 **Opening and welcome of the authorities**
Antonio Llombart Bosch

Opening lecture
Comprehensive cancer centers in Europe: OECI and European alignment
Thierry Philip (30')

10.00 *SESSION I*
AI in diagnostic procedures
Chairs: *Rui Henrique* and *Giorgio Stanta*

- **Artificial intelligence and computational pathology**
  Håvard Danielsen
- **Artificial intelligence application in cancer diagnostics**
  Regina Beets
- **Radiomics in Oncology: A Practical Guide**
  Angel Alberich Bayarri

Panel discussion (15')

11.00 Coffee Break

11.30 *SESSION II*
AI in clinical outcome prediction
Chairs: *Marco Pierotti* and *Iwona Lugowska*

- **AI and tumor molecular profiling**
  José Antonio López-Guerrero
- **May AI replace classic statistical approaches to predict clinical outcomes?**
  Jan Poleszczuk
- **Deep learning NMR and outcomes prediction**
  Leonor Cerdá-Alberich
- **AI in computational biology: tackling the difficulty of integrating complex datastreams from different diagnostic**
  Florian Markowetz (video recording)

Panel discussion (15')

13.00 Lunch

SCIENTIFIC CONFERENCE

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14.00 **Key Lecture: BIG DATA & AI**
Alfonso Valencia (30')

14.30 *SESSION III*
AI Future Directions
Chairs: *Giovanni Apolone* and *Ignacio Galve*

- **A new vision for collaborative RWD studies**
  Gennaro Ciliberto
- **AI and Big Data in Cancer Outcome Research**
  Xosé Fernandez
- **Big Data: may pharma companies and academy be allied?**
  Woolmore Ashley
- **Large-scale predictive model development and validation using data standardised to the OMOP Common Data Model**
  Peter Rijnbeek

Panel discussion (15')

15.45 Coffee Break

16.15 *SESSION IV*
Applications of AI in Oncology
Chairs: *Antonio Llombart Cussac* and *Maja Čemažar*

- **Experiences of AI in cancer surgery**
  Ibrahim Edhemovic
- **AI in Radiation Oncology**
  József Lövey
- **AI in drug development**
  Andreas Bender
- **Drug repurposing in oncology**
  Ciro Mercurio

Panel discussion (15')

17.30 **Key Lecture: The challenge of AI for OECI Members**
Giovanni Apolone (30')

18.00 **Closing remarks**

SCIENTIFIC CONFERENCE

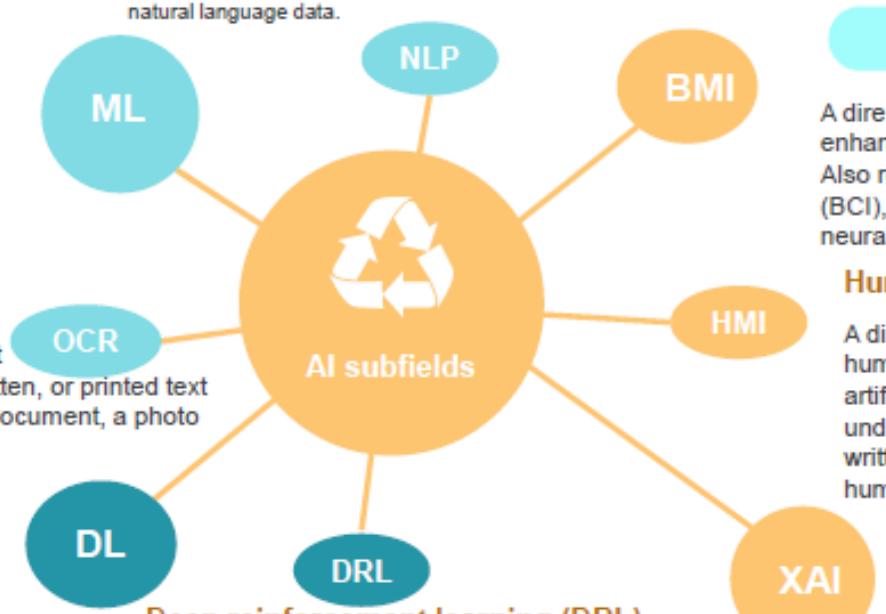
Artificial Intelligence methods

Natural language processing (NLP):

A subfield of AI concerned with the interactions between computers and human (natural) languages, in particular how to program computers to process and analyze large amounts of natural language data.

Machine learning (ML):

The scientific study of algorithms that build a mathematical model of sample data to make predictions or decisions without being explicitly programmed to perform the task. ML is often considered to be a branch of AI



Brain–machine interface (BMI)

A direct communication pathway between an enhanced or wired brain and an external device. Also referred to as a brain–computer interface (BCI), a mind–machine interface (MMI), or a direct neural interface (DNI).

Optical character recognition (OCR)

pattern recognition, and computational vision aimed at the electronic conversion of images of typed, handwritten, or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo, or from subtitle text

Human–machine interface (HMI)

A direct communication pathway between a human and a device. For example, an artificial system capable of automatically understanding and responding to spoken or written human language constitutes a human–machine Interface.

Deep learning (DL):

A class of ML methods based on artificial neural networks, inspired by information processing and distributed communication nodes in biological systems, that use multiple layers to progressively extract higher level features from raw input.

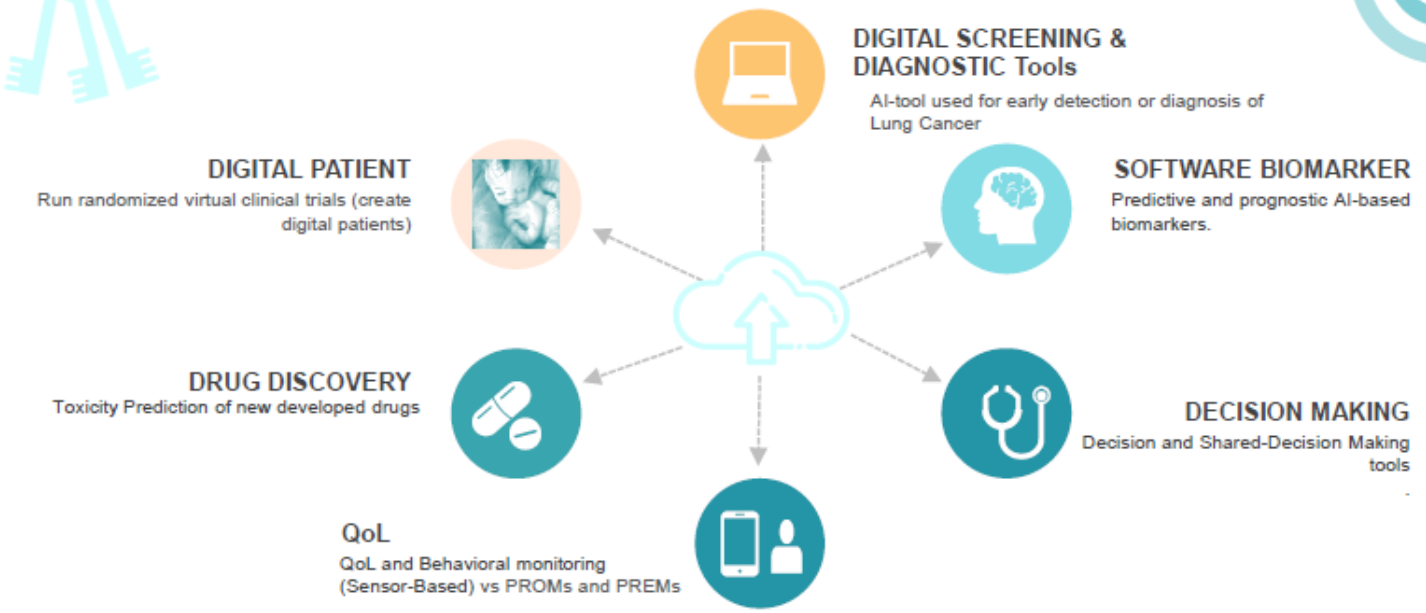
Deep reinforcement learning (DRL)

Is an area of ML that is concerned with building software agents that can take actions in an environment so as to maximize some notion of cumulative reward. DRL combines DL and RL principles to create efficient algorithms to achieve this task.

Explainable AI

Is one that produces details or reasons to make its functioning clear or easy to understand for physicians

AI applications in Oncology



Kann et al. Cancer Cell 39, July 12, 2021

AI emerging areas in Oncology

RADIOMICS

Radiomics features extract quantitative, and ideally reproducible, information from diagnostic images, including complex patterns that are difficult to recognize or quantify by the human eye.[1]

DIGITAL PATHOLOGY

AI techniques applied to the digitised specimen can utilise various features to perform segmentation and classification tasks.

GENOMICS/MULTIOMICS

Genomics is an interdisciplinary field of biology focusing on the structure, function, evolution, mapping, and editing of genomes.

COMBINED MULTIMODAL FEATURES

Integration of multimodal features and the use of AI to analyze their connection and try to predict clinical outcomes and bring biological insights.

A few reflections (1)

- Artificial Intelligence makes our lives more efficient every day
- But is it the same in the field of Medicine and Health Care?

A few reflections (2)

- First of all, we have to make a distinction between research and clinical practice
  - Research: many examples of use
  - Clinical practice: caution … may be as decisional support … room for RW Research (added value!)

FDA Medical Device Approval

Table 1. FDA approvals to date for deep-learning applications in clinical oncology

	Name	Data type	Task	FDA summary	Year
Thoracic/liver					
1	Arterys Oncology DL	CT, MRI	segmentation of lung nodules and liver lesions, automated reporting	https://www.accessdata.fda.gov/cdrh_docs/pdf17/K173542.pdf	2017
2	Siemens AI-Rad Companion (Pulmonary)	CT	segmentation of lesions of the lung, liver, and lymph nodes	https://www.accessdata.fda.gov/cdrh_docs/pdf18/K183271.pdf	2019
3	Riverain ClearRead CT	CT	detection of pulmonary nodules in asymptomatic population	https://www.accessdata.fda.gov/cdrh_docs/pdf16/k161201.pdf	2016
4	Siemens syngo.CT Lung CAD	CT	detection of solid pulmonary nodules, alerts to overlooked regions	https://www.accessdata.fda.gov/cdrh_docs/pdf19/K193216.pdf	2020
5	GE Hepatic VCAR	CT	liver lesion segmentation and measurement	https://www.accessdata.fda.gov/cdrh_docs/pdf19/K193281.pdf	2020
6	Coreline AView LCS	CT	characterization of nodule type, location, measurements, and Lung-RADS category	https://www.accessdata.fda.gov/cdrh_docs/pdf20/K201710.pdf	2020
7	MeVis Veolity	CT	detection of solid pulmonary nodules, alerts to overlooked regions	https://www.accessdata.fda.gov/cdrh_docs/pdf20/K201501.pdf	2021
8	Philips Lung Nodule Assessment and Comparison Option (LNA)	CT	characterization of nodule type, location, and measurements	https://www.accessdata.fda.gov/cdrh_docs/pdf16/K162484.pdf	2017
9	NinesMeasure	CT	characterization of nodule type, location, and measurements	https://www.accessdata.fda.gov/cdrh_docs/pdf20/K202990.pdf	2021
Breast					

Ethics and Human Research Protection

Independent Review Board

Single IRB

For nearly a decade, CTTI has championed the adoption of single IRBs (sIRBs) for multicenter clinical trials in an effort to streamline and optimize study execution.

Informed Consent

Informed Consent

The informed consent process can often be burdensome and lacks giving prospective trial participants the information they need to aid in their decision to participate..

Safety and Data Monitoring

Safety Reporting

Improve the quality and efficiency of safety reporting, reduce irrelevant reports, and increase adherence to FDA requirements for clinical trials conducted under an investigational new drug application (IND).

Data Monitoring Committees

Enhance your partnership and communication with DMCs, better understand the role of the DMC, and learn about best practices for DMC conduct, composition, and training.

https://ctti-clinicaltrials.org/wp-content/uploads/2021/06/CTTI_IND_Safety_Recs.pdf

Practical barriers for AI in clinical practice

Complexity of the model → training error minimization → Data overfitting, poor generalization → Training Datasets >100.000

Complexity of the pathology (which features are important?)

Costs and time to produce the medical data

Datasets in research are not generally shared
GDPR

The very problems

- Creation of large (big) data set with good quality
  - About quality: garbage in /garbage out
  - Possibility to use and share it
    - GDPR

Additional constraints for AI use in clinical practice

ETHICS

AI act proposal

In April 2021, the **European Commission** proposed a **Regulation** on Artificial Intelligence, known as the **AI Act** (currently in legislative process, maybe adopted Q1 2023, applied Q1 2025)

The Goal of the AI Act

The proposal lays out a legislative framework for dealing with AI in the future - with the goal of driving innovation and mitigating risks.

How do you take ethical implications of AI use cases into account?

#1 Our Priority

We need efforts on data collection and sharing thus generating new data storage platform, also:

1. Simplify ethical and legal framework
2. Novel Trials Design
3. Cybersecurity
4. New endpoints and monitoring

#2 Our Priority

We also need to understand how to integrate different platform to:

1. Maximise use
2. Avoid double work
3. Focus on more specific
4. Collecting different kind of data
5. Reuse existing data

A proposal for OECI Members

Creation of a new Working Group with two main objectives

1. Share experiences
3. Design a collaborative (pilot) exercise

Next step: a survey in interested Institutions to:

1. assess AI “maturity” in each interested Institutions
2. Identify main questions/needs

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Aknowlegements

I have to thank dr. Arsela Prelaj (INT, Milano)
for helping me in the preparation of the presentation

Dr Prelaj is the leader of a Horizon Europe AI Project
in lung cancer patients