Artificial Intelligence in Oncology

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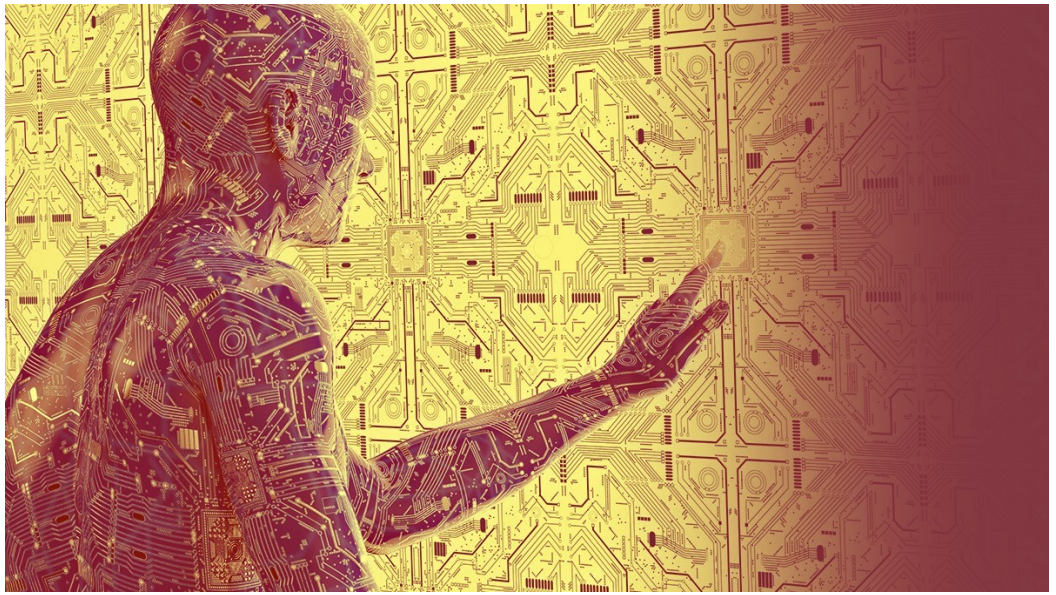

AI Recent Evolution

AI sees a fast adoption in many industries

In the last years it saw its first superhuman medical applications

Should we be worried?

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Era of *Augmented Intelligence* NOT AI Era

- AI is **enhancing** not **replacing** human intelligence
- It's being proven that physicians and AI **working together**
- **Outperform** AI or Physicians working alone

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AI Advantages for Physicians & Patients

AI gives physicians more **time for human interactions with their patients**

Patients will no longer **seem like a collection of clinical, lab data, and images**

AI could **enhance patients' image as human beings**

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Information Technology

Facilitated the rise of modern medicine

Has a profound impact on medical imaging and molecular biology

Both fields produce vast amounts of high-throughput data

Instead of finding answers to biomedical questions we just started to formulate more meaningful ones.

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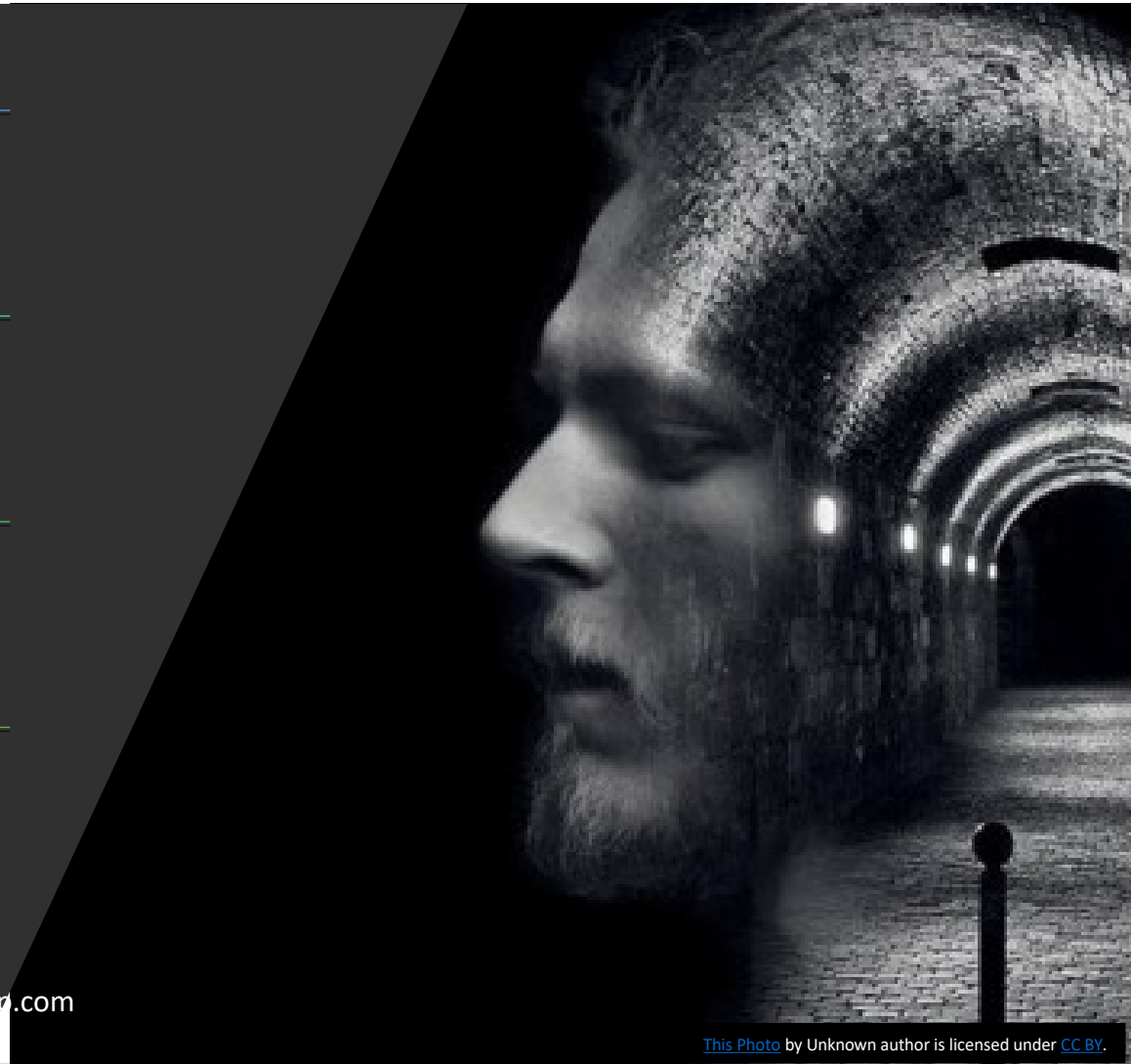
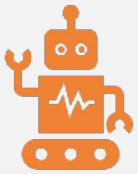


Modern Medicine faces Data Science problems



Data Science problems are properly **solved with AI**

NOT by a conventional hypothesis-driven approach

and the old fashion **statistical approach**

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Cancer facts

Globally, more than 8 million people die from cancer every year

But **early** detected cancers can be cured

Existing tests:
invasive (surgical procedures) or non-invasive but with low accuracy

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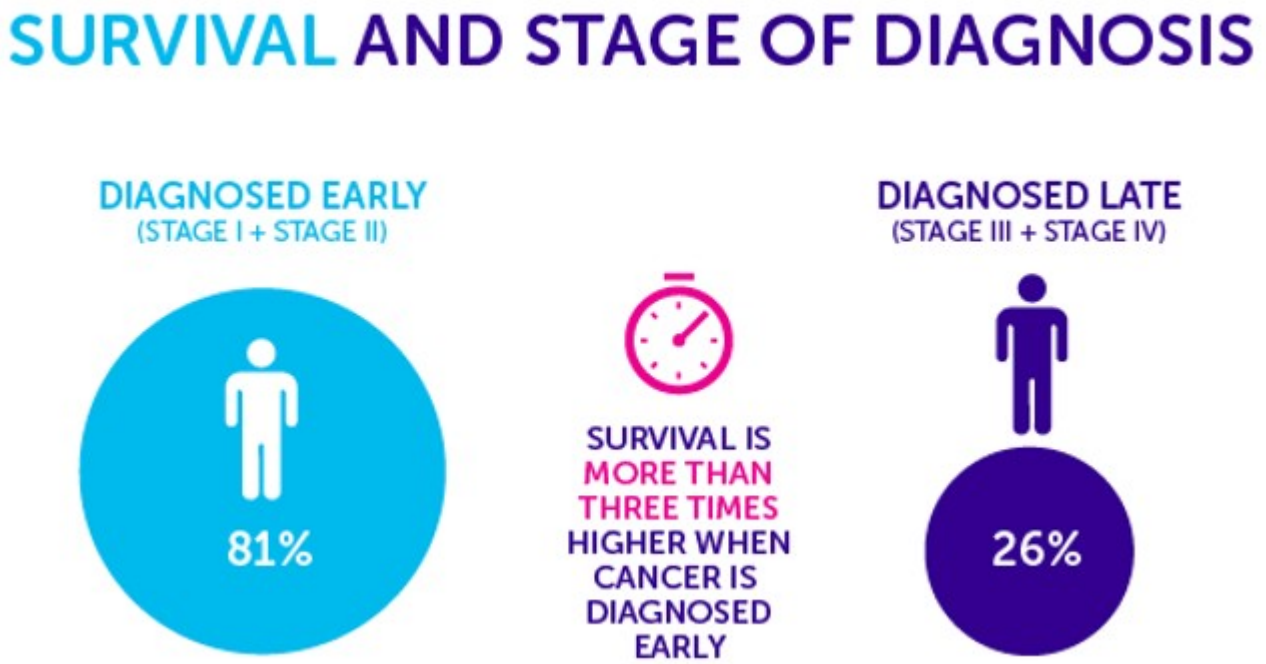
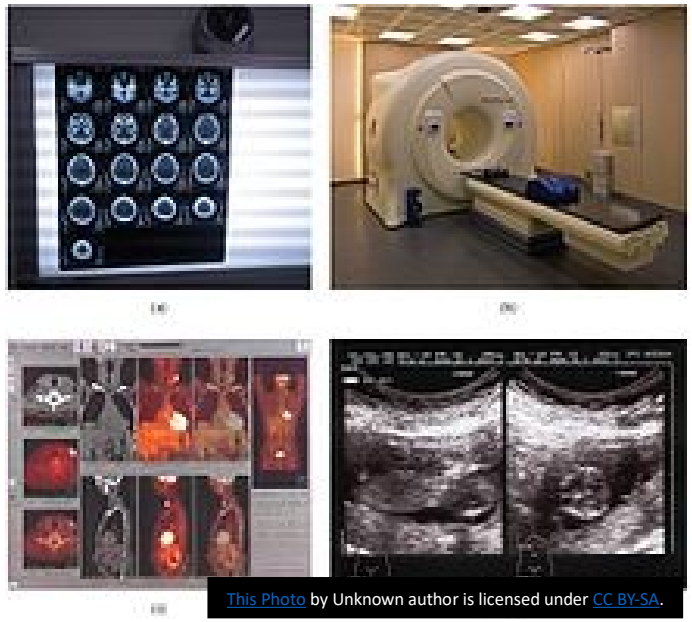
- Treatment efficiency
- Treatment costs



Molecular vs. Imaging alterations



- Imaging methods can be used for cancer early detection.
  - e.g. mammography in breast cancer
- AI can simultaneously analyze many medical images, and **YET..**
- Imaging can't detect a tumor before formation

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Molecular vs. Imaging alterations

Molecular alterations related to cancer development, precede the formation of a tumor

These methods work for a size undetectable by the imaging techniques

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No more pain: "Liquid biopsies"

For molecular cancer tests:

tissue biopsies could be replaced by "liquid biopsies," (e.g., a blood drop)

blood circulation is like a *liquid nervous system*

These *non-invasive* tests avoid related patients':

- Fear
- Pain
- Risks

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Collaboration not replacement !

The best strategy is to exploit the complementarities between Human and Artificial Intelligence

A common mistake is to use biomedical knowledge to select subsets of relevant molecular alterations from Big Data

Or to impose a model

Let the data speak to the AI (not to us!)

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AI predictive models could be very accurate (>95%)

By letting the data speak to the AI

Highly accurate predictive models can be developed

These models should satisfy the ART criteria

- Molecular tests for diagnosis
- Prognosis
- Response to treatment prediction

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The ART criteria

Highly **A**ccurate, with performance > 95%

Robust, having similar accuracy for different groups of patients

Transparent instead of "black-box."

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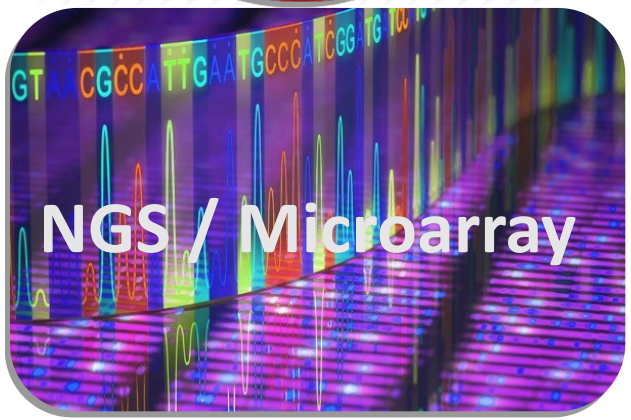
Our AI non-invasive multi-cancer diagnosis and early detection test

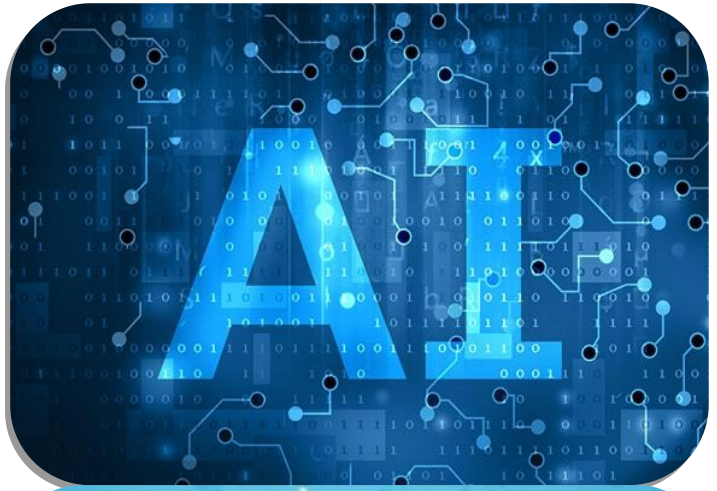
- Is the best existing test
- Working on 13 cancer types.
- Accuracy greater than 99%.
- Non-invasive, starts from a blood drop ("liquid biopsy").

Diagnosis for **13** cancer types

I. Data gathering

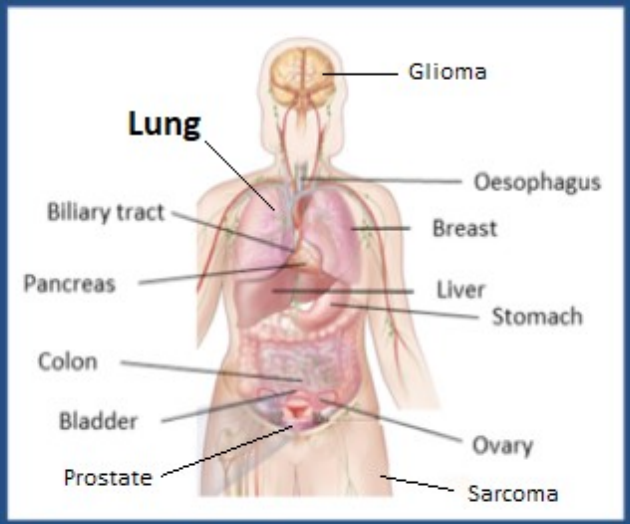


II. AI phase
(ML + DL)



OUTPUT

1. Cancer: YES or NO
2. Benign versus malignant
3. Cancer types:



4. Accuracy (>99%)
5. Personalized miRNA signature
6. Stratification

Solution: Our multi-cancer early-detection test

Accuracy > 99%!

Comparison with the competition

Our test:

- Has the highest accuracy (>99%)
- Works on more cancer types (13)
- Successfully discriminates between malign and benign tumors
- Was validated on a higher number of cases

Company	Cancer types	Median accuracy	Lowest accuracy	Number of cases
AIE	13	>99%	99%	>6000
CancerSEEK	8	~77%	33%	~1000
Delfi	7	~73%	57%	208

Ethical problems and Benefits

AI applications pose new and complex ethical problems.

Yet they can be solved with a clear and pragmatic approach.

Despite this, the benefits to the:

- Patients
- Physicians
- Healthcare systems

can be enormous!

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The real issue

Considering all the benefits,

It would be unethical not to use AI to revolutionize medicine.

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