Fondazione IRCCS Istituto Nazionale dei Tumori

Sistema Socio Sanitario Regione Lombardia

POLITECNICO MILANO 1863

I3LUNG

A project funded by the European Union

Apollo 11 STRENGTH IS UNITY

AI-ON-Lab

AI for precision oncology, from research to patient care

3 November 2025

Federica Corso

Bioengineer, Post-Doc Researcher

AI-ON-Lab

ESAC

COORDINATION

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Arianna RIgamonti, PhD student

Trustworthy AI


Sara Ferri, Research Fellow

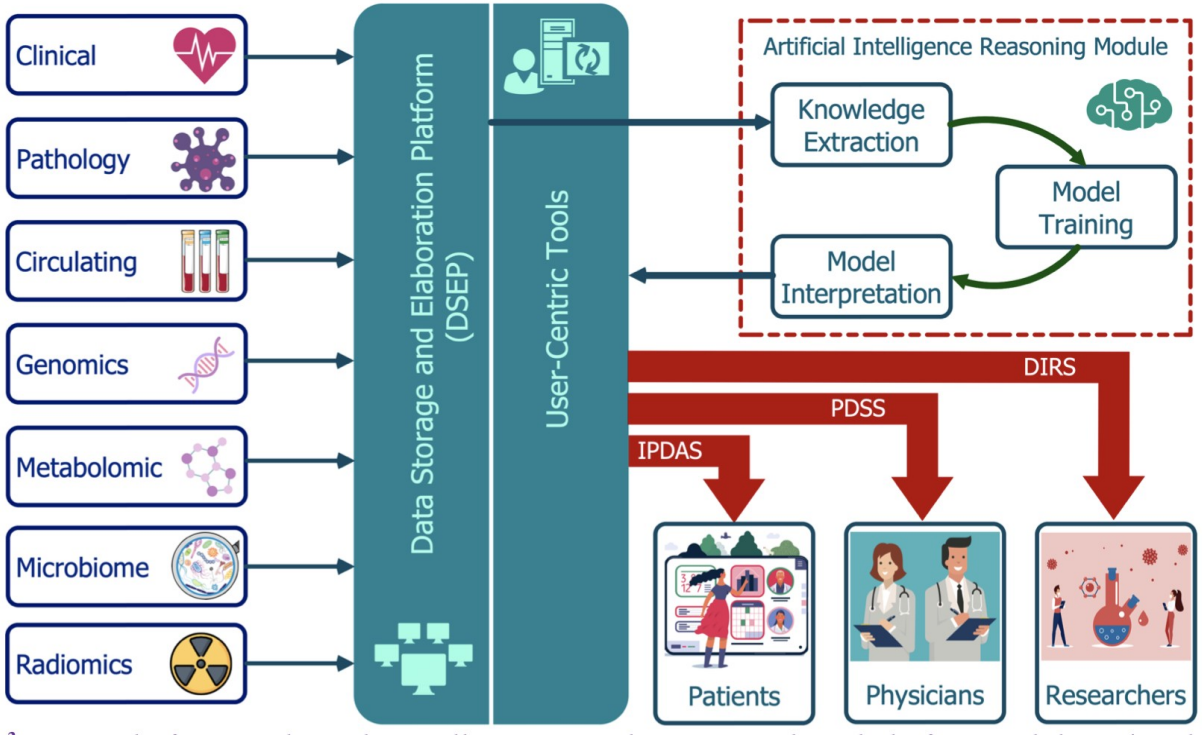
App and devices

Chiara Giangregorio, PhD student

Our Main Projects: I3LUNG and APOLLO11

Project 1: I3LUNG

A European and beyond project on AI, IO and NSCLC



10.000.000 € Grant

I³LUNG

A project funded by the European Union

Goal: Develop a Data storage and Elaboration Platform (DESP) by integrating **Real world** and **multiomics** data in NSCLC patients treated with immunotherapy with the aim to produce a clinical decision-making tool using AI approaches

https://i3lung.eu/

I3LUNG: PDSS R-tool

I3LUNG
A project funded by the European Union

Cohort collection

Study population

2252 patients, III-IV stage NSCLC ,
Immune checkpoint inhibitors
6 clinical cancer centers:
INT, GHD, SZMC, VHIO; UOC, MH

Collected baseline data

2252 clinical data
demographic;
treatment; lab;

1723 driver
(ALK/ROS/RET/EGFR);
STK11; KRAS; TP53

936 H&E slides

1705 CT scans

Cohort creation

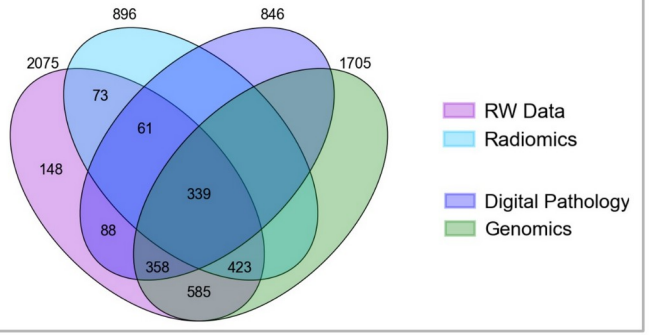
Cohort 1	Cohort 2	Cohort 3
Curative setting	First metastatic line	Later metastatic lines

used in analysis (n=2075)

Train set (85%, n=1550)

Test set (15%, n=274)

ex. val. set (UOC) (n=251)



Data preparation

Outcome calculation
Missing values queries x2
hypothesis driven feature selection x2
imputation
11 clinical features

Quality control
segmentation
post-processing
VOI
bounding box
pyradiomics extraction
FM f. extraction
128 radiomics features
4096 radiomics features

Quality control
tile extraction
normalization
FM f. extraction (GigaPath, UNI)
784 pathomics features

missing value query
wilde type data recovery
gene selection
driver pathway annotation
4 genomics features

AI-based analysis

clinical
radiomics
pathomics
genomics

LASSO +ML early fusion
(Logistic regression, Random Forest, XGBoost)

DL intermediate fusion (MIL with attention)

Survival
OS, PFS

Classification
bad
good

DCR: Non- responder vs Responder
OS<6m: poor survivors vs others
OS≥24m: others vs long survivors

Fairness evaluation

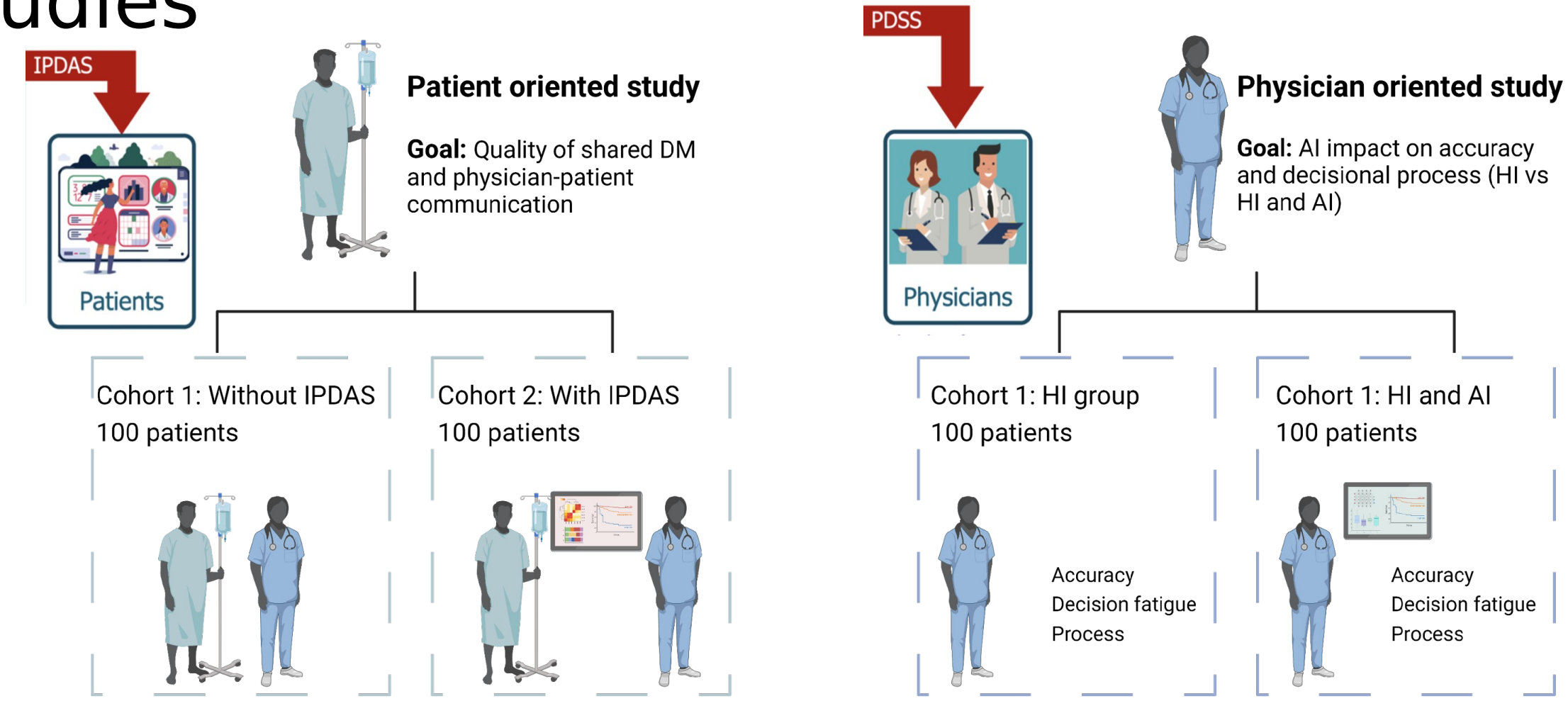
Explainability analysis

Validation against scores and biomarkers

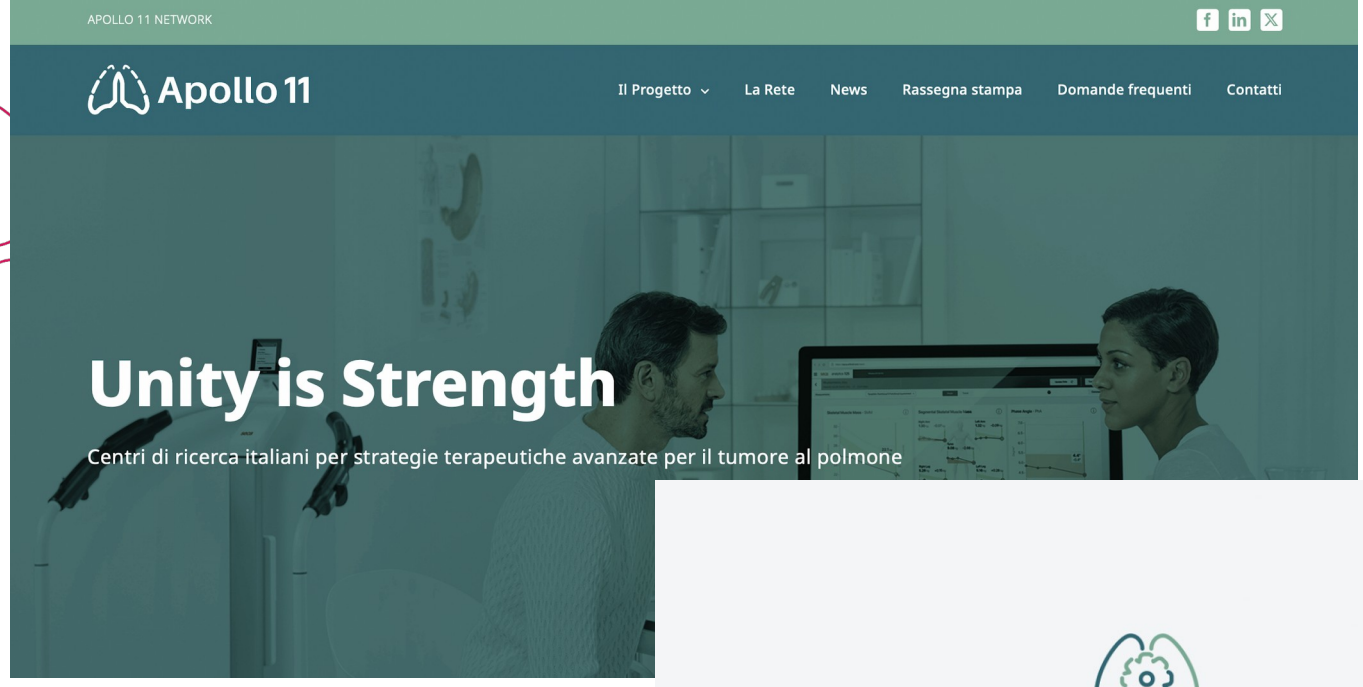
Clinical usability

Presented at **WCLC 2025**, oral presentation, Under

I3LUNG: psychological and usability studies



APOLLO 11



Apollo 11
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https://apollo11.network/

48 Centri di ricerca avanzata sul tumore al polmone

Creazione di una rete di centri italiani che si occupano di pazienti affetti da tumore del polmone NSCLC avanzati già trattati o candidati a ricevere una terapia a base di ICI

Real world data da tutti i centri attivi

Sviluppo di un database nazionale Real World per i pazienti affetti da tumore del polmone trattati con TERAPIE INNOVATIVE (ad es. immunoterapia, terapie target, anticorpi coniugati)

Biobanche

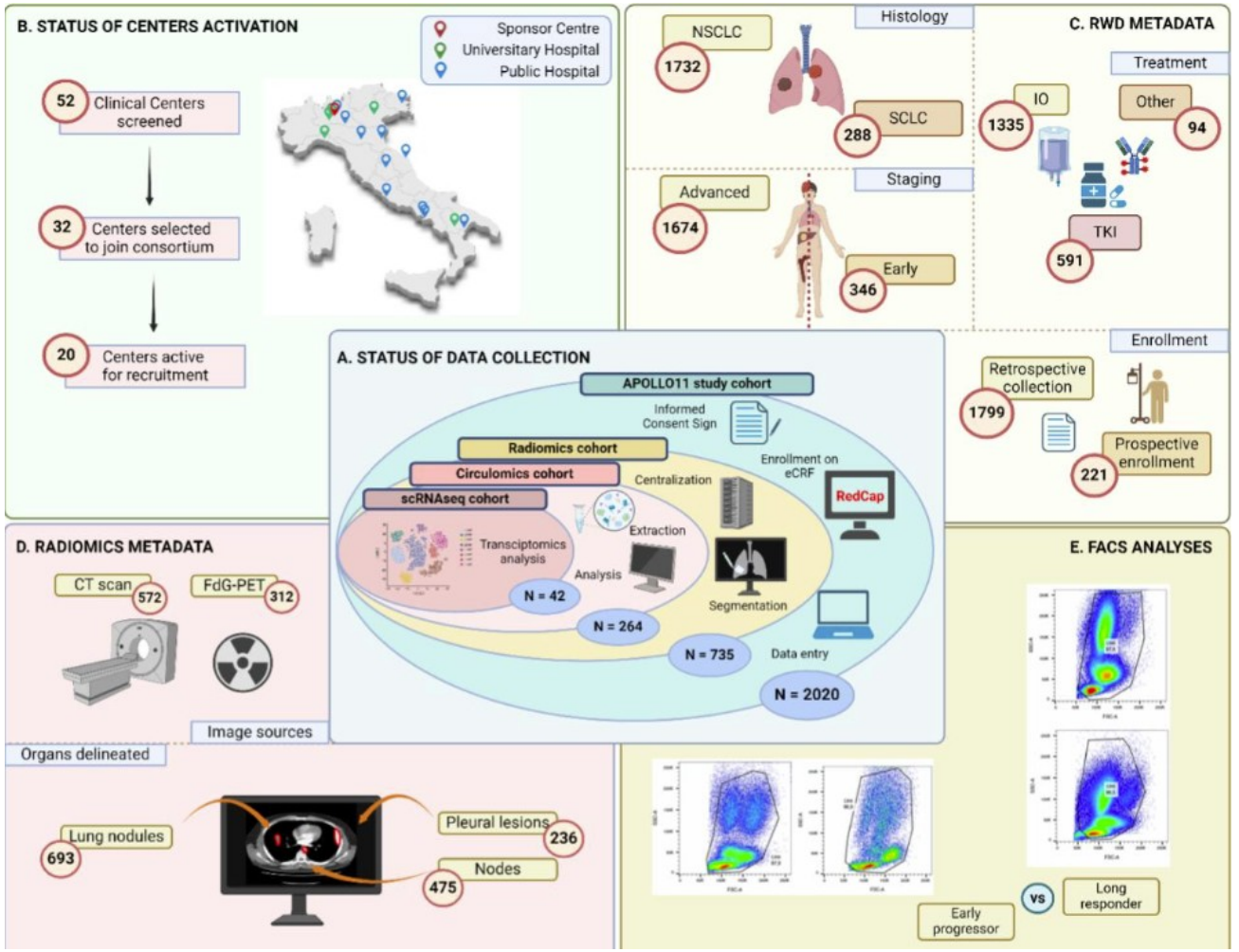
Sviluppo di una biobanca multilivello nazionale registrata con impostazione e armonizzazione delle procedure operative per la raccolta, la conservazione e la spedizione dei campioni biologici.

Intelligenza Artificiale

Creazione di un modello predittivo di intelligenza artificiale (AI) per migliorare la previsione della risposta, portando in ultima analisi a una migliore sopravvivenza e qualità di vita dei pazienti oncologici

Project 2: APOLLO11

Data driven vs hypothesis driven research



Clinican design & Database collection Under revision

APOLLO 11: Lung Cancer, innovative therapies and longitudinal monitoring with biomarker collection and AI analysis

Project 2: APOLLO11

IASLC 2025 World Conference on Lung Cancer
SEPTEMBER 6-9, 2025
BARCELONA, SPAIN

Cost-Effective Machine Learning for Predicting Survival in NSCLC Patients on Immunotherapy: Insights From the APOLLO11 Study

AI-ON-Lab

N. 3049

Vanja Miskovic[1], L. Mazzeo[1], C. Silvestri[1], A. Ferrarin[2], C. M. Licciardello[2], C. T.a Saracino[3], E. Mingo[3], M. Fiorenti[3], R. Romano'[1], A. Servetto[4], C. Della Corte[5], M. S. Cona[6], N. La Verde[6], C. Bareggi[7], M. Brighenti[8], F. Biello[9], A. Tartarone[10], I. Antonuzzo[11], L. Provenzano[1], A. Spagnoleti[1], B. Guirges[2], M. Ganzinelli[1], M. Meazza Prina[1], P. Ambrosini[1], A. Vingiani[1], T. Beninato[1], R. Serino[1], C. Cavalli[1], E. Zito[1],R. di Mauro[1], A. D. Dumitrascu[1], G. Corrao[1], G.di Liberti[1], M. Occhipinti[1], . Brambilla[1], C. Agosta[1], C. Proto[1], M. C. Garassino[12], A. Panzardi[13], C. Catania[13], L. Esposito[3], N. Salmistraro[14], S. Siena[14], E. G. Pizzutilo[14], D. Signorelli[12], F. Trovò[2], F.M. De Braud[1], A. L. G. Pedrocchi[2], G. Lo Russo[1], A. Prelaj[1]
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IASLC

INTRODUCTION

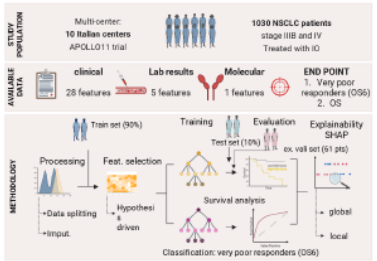
- Identifying NSCLC patients with **very poor outcomes** (OS < 6 months) after immunotherapy (IO) is a key clinical challenge.
- These patients might benefit more from clinical trials or supportive care rather than standard IO.
- Machine Learning (ML) models using routine clinical and laboratory data show promise in predicting outcomes and supporting decision-making.[1,2]

- **Main question:** Can ML models, trained on real-world and cost-effective data, reliably identify very poor responders to immunotherapy?

METHODS

Patients data collected through **APOLLO11 project.**

1130 NSCLC patients from 10 Italian centers.

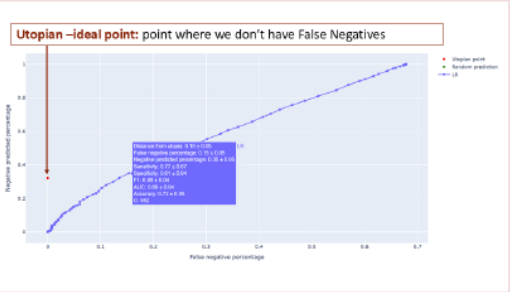


Study overview: classification analysis using routine clinical and lab data with a goal to identify very poor outcome (OS < 6 months) and Survival analysis (OS)

RESULTS

		Train set (90%)	Test set (10%)	Ex. Validation (61 pts)
Age		65 (27-92)	63 (29-85)	52 (47-54)
Sex (%)	F	36	39	26
	M	64	61	74
Histology (%)	Squamous	18	21	0
	Non-squamous	82	79	100
Line (%)	First	73	74	88
	Further	27	26	12
ECOG PS (%)	0	35	38	14
	1	50	53	64
	2,3	15	9	22
PDL1 category (%)	≤ 1	27	32	29
	1-49	45	42	26
	≥50	28	26	45

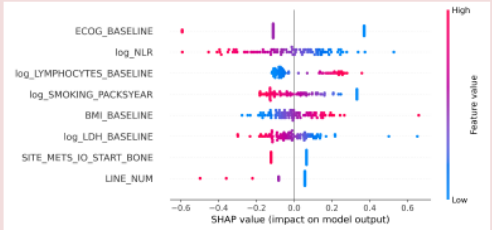
Key patients characteristics: Diverse real-world dataset reflecting clinical heterogeneity!



Cost search - logistic regression CV:
The key objective: minimize false negatives -
everyone who would benefit from ICI will receive it.
Model selection - the closest to the utopian point.

Model	Test set	N. pts	AUC	Sensitivity	Specificity
PDL1	PDL1 subset	80	0.65	0.51	0.78
EPSILON	EPSIOLON subset	28	0.37	0.41	0.33
	Full test	**95**	**0.72**	**0.76**	**0.69**
Logistic regression	PDL1 subset	80	0.76	0.91	0.61
	EPSILON subset	28	0.73	0.95	0.50

Results on the independent test set: ML models were trained on train set. Testing was done on: independent test and subset test set with PDL1 and EPSILON information.
The same model reach **AUC 0.8** on ex. valiadtion.



Global SHAP - the overall importance of each feature in the LR model
color - feature value.

	C-index CV	C-index test	C-index ex.validation
Cox-ML model	0.67	0.72	0.64

Results on the survival analysis - COX-ML

Main takeaways:
- Cost tuning can help in optimizing predictions of logistic regression.
- Selected model achieved AUC 0.72 on a test set and 0.80 on ex. validation set - good generalizability.
- Key variables for very poor prognosis:
  - High ECOG Performance status
  - High NLR
  - low lymphocytes

CONCLUSION

- Clinical and laboratory data have strong value for predicting very poor outcomes in NSCLC patients treated with IO.
- Our results are **consistent with recent findings** (SCORPIO[1] and LORIS[2]).
- This approach is **scalable, cost-efficient, and applicable** in real-world settings, as it relies only on routinely collected data.
- Explainable AI confirmed **known prognostic factors** (e.g., ECOG PS, NLR) as key model features.
- Early identification of very poor responders may help guide patients toward alternative strategies such as clinical trials or supportive care, improving personalization of treatment.

Take-home message

Simple ML models using routine clinical and lab data can identify NSCLC patients with very poor outcomes to immunotherapy.
This could enable earlier, more personalized treatment strategies.

1 Yoo, SK., Nat. Med. 2025
2 Chang, TG, Nat Cancer 2024.

Real world data from 10 centers!

Ongoing projects and Italian Collaborations

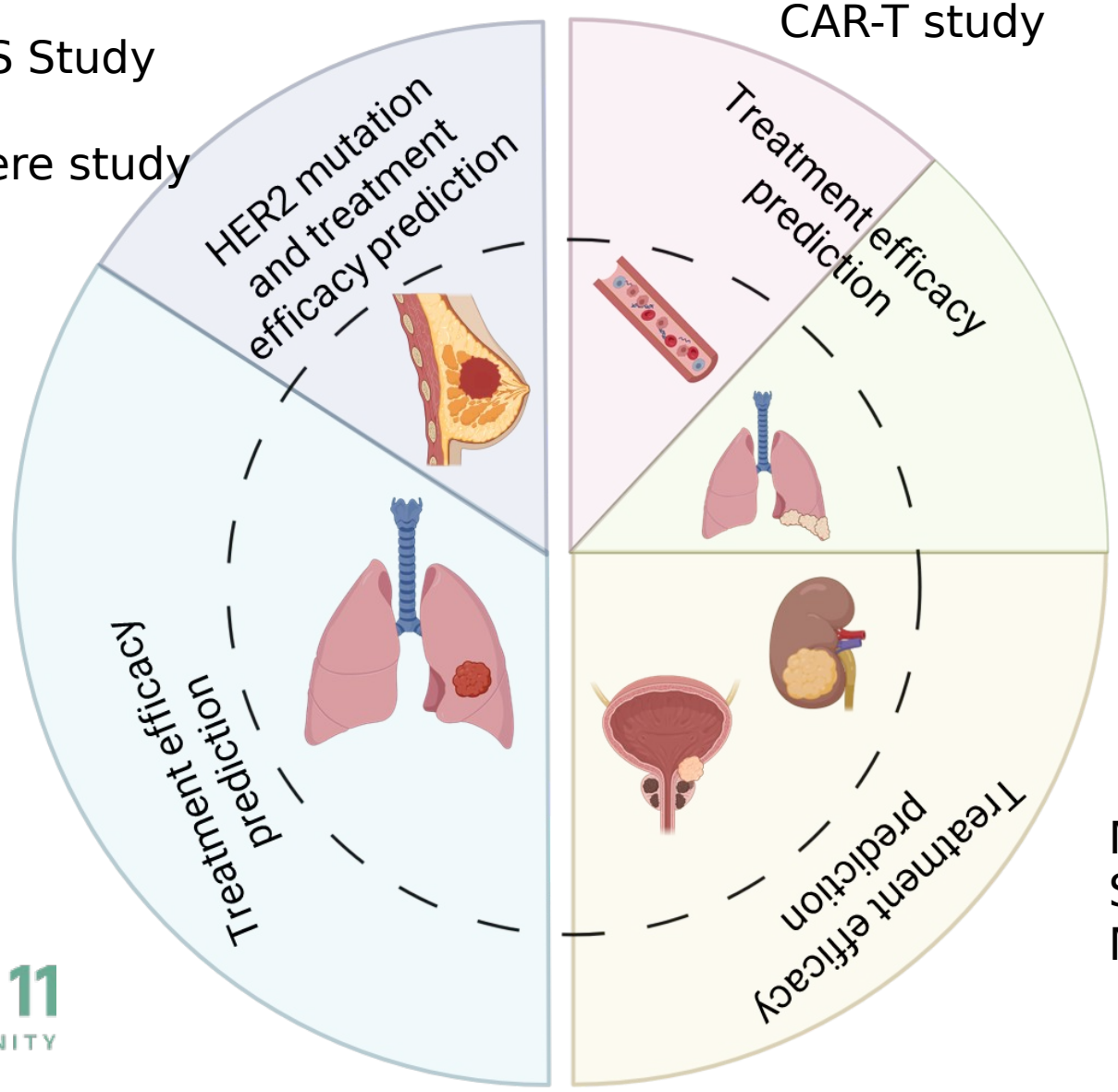
PALMARES Study

Radiosphere study

CAR-T study

Mesothelioma project

MeeTURO
SamurAI
Malva



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Main partnership

Sorab Shah – Data science department - multimodal fusion

Tech. Univ. Dresden – Jakob N. Kather, Clinical AI Lab

Alexander T. Pearson - H&N computational methods
Marina Garassino – Lung oncologist
Matteo Sacco – Data Scientist
Sam Armato – Radiologist

Raquel Perez-Lopez - Radiomics Unit

Dean Ho,
Head of Dept. of Biomedical Engineering

Jana Lipkova – Researcher (expert in Multimodal fusion)

ESMO – Working Group on Digital Health and RWD

Helena Linardou – lung oncolo

Opportunities

Theses in Artificial Intelligence
A.A. 24-25

AI-tools

Olha Sidelnikova: Application of TabPFN for Predictive Modeling Using Real-World Data in Lung Cancer Patients

Valentina Bitetto: Implementation and Evaluation of an Intermediate Multimodal Fusion [illegible]ng Cancer Patient Data

Digital Pathology

Eric Lombardo: Optimization and Evaluation of Foundation Models for Feature Extraction from PDL-1 slides

Radiomics

Giorgia Aprile: Application of nnUNet for Automatic Segmentation of Thoracic Cancer Lesions in [illegible]nts

LLMs

Valentina Bruzzi: LLM-On-Hub: A User-Friendly Platform for Cancer Medication Extraction and Model Comparison with Large Language Models

Francesca Chite: LLM-On-Hub: A User-Friendly Platform for Cancer Timeline Extraction and Treatment Response Inference with Large Language Models

Explainability approaches for AI-based immunotherapy predictive models for NSCLC using CT scans

Radiomics

A.A. 25-26

Co-supervisors:
Margherita Faval
Vanja Miskovic
Dr. Arsela Prela

Aim: AI-based models has shown promising results in deriving novel data-driven biomarkers from medical imaging, offering a promising approach to enhance treatment stratification. One primary barrier of integration into clinical practice is the lack of interpretability of these models, which undermines clinician trust. **The aim of this thesis is to evaluate existing methods for explaining AI-based models to enhance the interpretability of models within the context of radiological images (CT scans).**

Models already implemented:

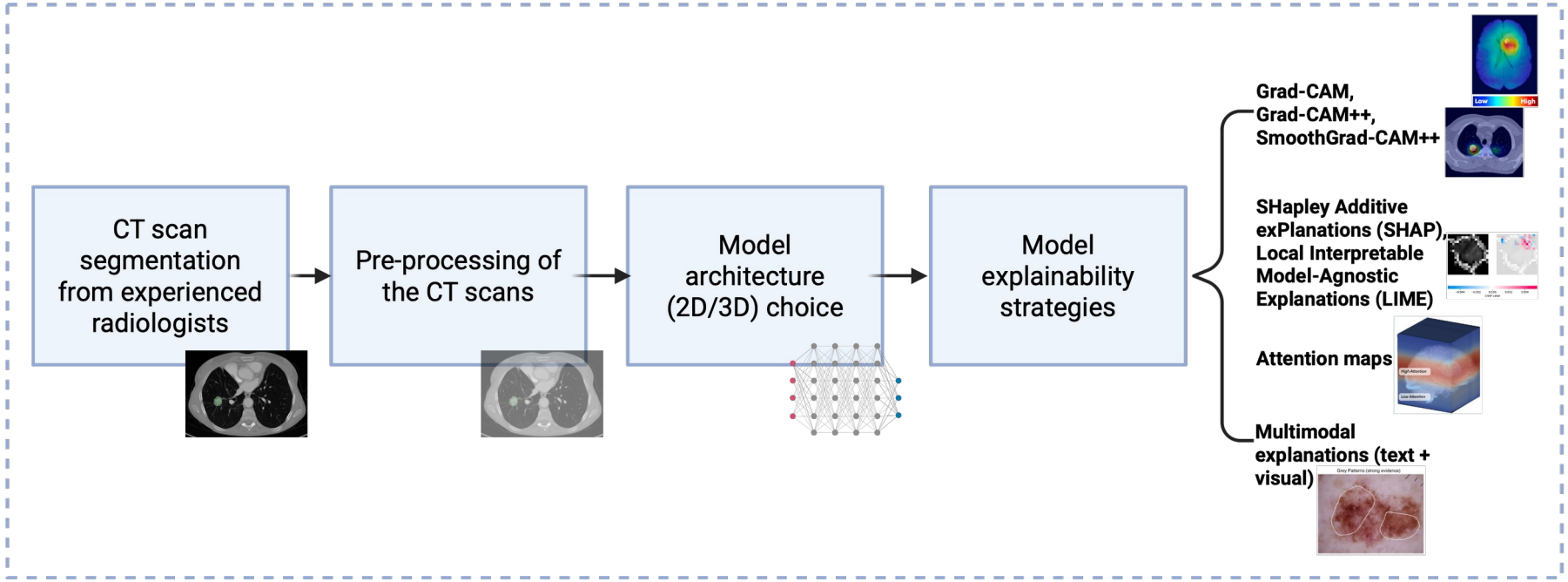
- 2D ResNet50 pre-trained on public radiological images
- 3D ResNet50 pre-trained on medical images

Project phases:

- Literature review on current explainability methodologies for radiological images
- Implementation of explainability approaches (e.g., saliency maps, Grad-CAM, LIME, SHAP) on AI models

Requirements:

- Good knowledge of Python
- Good knowledge of Machine and/or Deep Learning



Explainability approaches for Large Language Models in Electronic Health Records of cancer patients

LLMs

A.A. 25-26

Co-supervisors:
Federica Corso
Dr. Laura Mazzeo
Dr. Arsela Prela

Aim: Large language models (LLMs) have achieved impressive progress in healthcare, they can answer patients' queries predict patient trajectories using electronic health records, and write incredibly coherent medical documents. LLMs, like other AI models, must satisfy explainability constraints for stakeholders like clinicians and patients. **The aim of this thesis is to evaluate existing methods for explaining LLMs to enhance the interpretability of models within the context of electronic health records of cancer patients.**

Models already implemented:

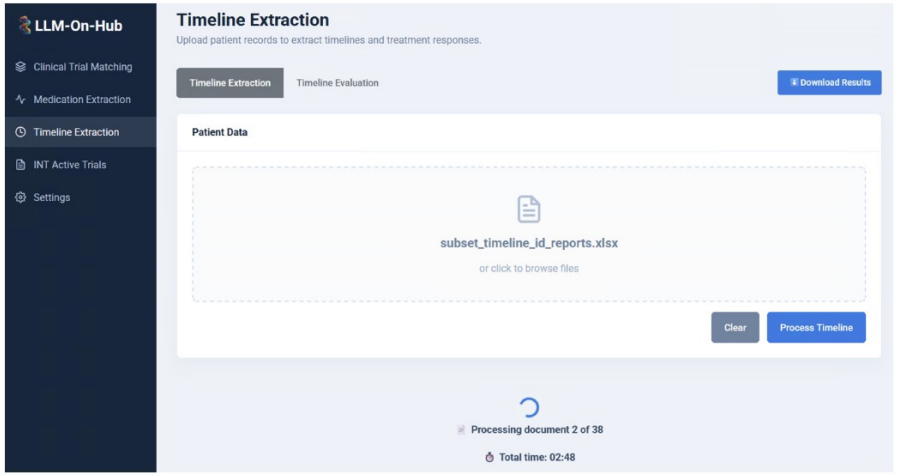
- Open-source LLMs already available in our web-platform

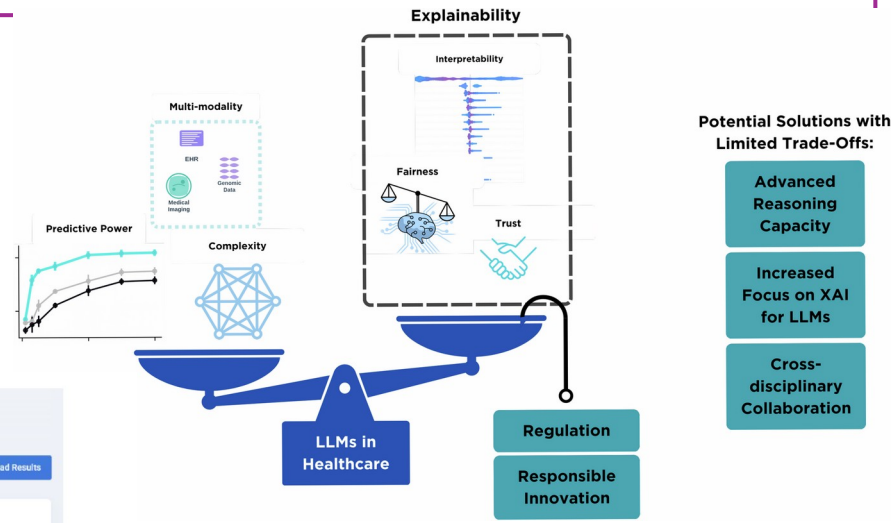
Project phases:

- Literature review on current explainability methodologies for LLMs
- Implementation of explainability approaches with existing libraries
- Usability studies for evaluation

Requirements:

- Good knowledge of Python
- Good knowledge of Machine and/or Deep Learning





Mesinovic, M., Watkinson, P. & Zhu, T. Explainability in the age of large language models for healthcare. *Commun Eng* **4**, 128 (2025).

Opportunities beyond thesis

- Opportunity of **payed intership** after graduation (6 months minimum – potentially renewable).
- Work preferebly in presence, remote work is allowed only in accordance with the group leader.

Let’s keep in touch!

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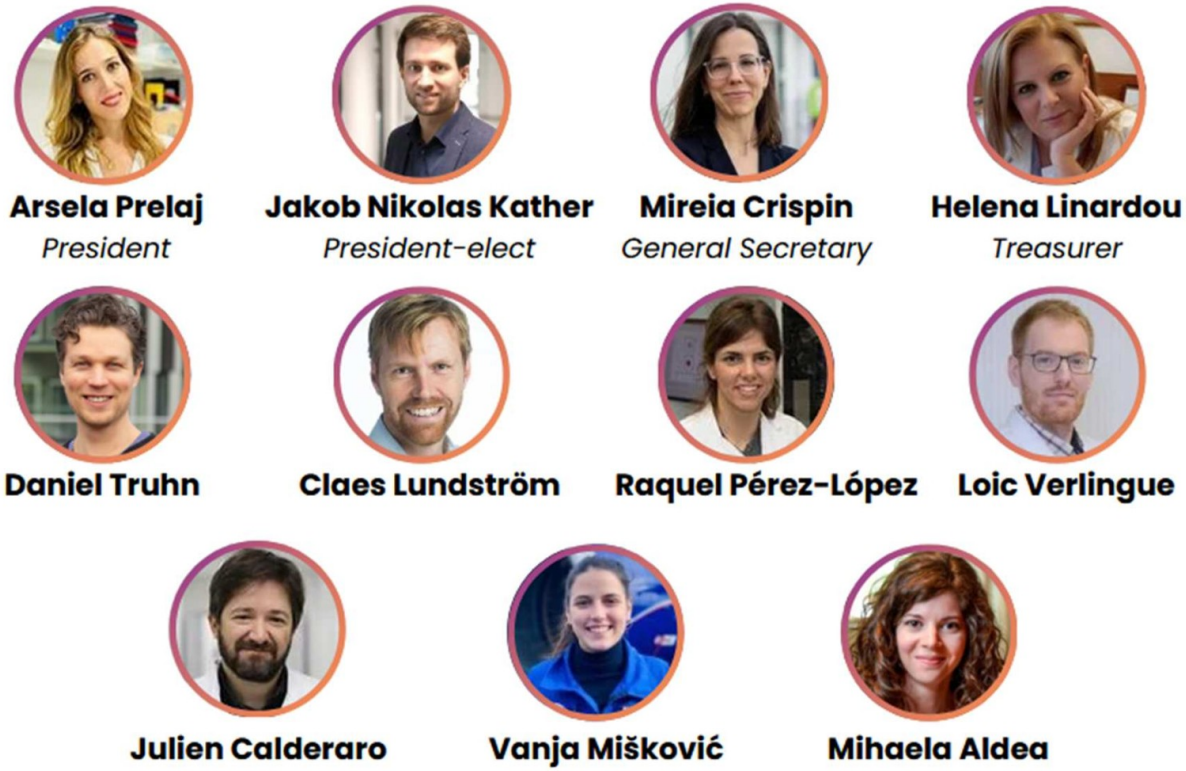
European Interdisciplinary Society of Artificial Intelligence in Cancer research.
Founded in 19th Dec 2024



Be a catalyst for collaboration

Truly effective AI integration hinges on the combined expertise of a variety of research figures: medical oncologists, imaging specialists (nuclear) radiologists, pathologists, physicists, bioinformaticians and AI engineers.
SPEAK THE SAME LANGUAGE

Build a multidisciplinary network

ESAC aims to bridge strategic alliances with key European initiatives and scientific organizations to amplify AI's impact in research, diagnostic and oncology.
DELIVER AI CARE across Cancer Societies

Comprehensive educational programs

Recognizing the need for specific expertise, ESAC provides training opportunities, from webinars and interdisciplinary conferences.
SUMMER SCHOOL IN CANCER RESEARCH
MASTER: AI IN CANCER RESEARCH

WEBSITE: https://esac-network.eu. CONTACT US by e-mail: *contact@esac-network.eu*

European Interdisciplinary Society of Artificial Intelligence in Cancer research. Founded in 19th Dec 2024

1st ANNUAL MEETING

MAY 7–8, 2026

@ POLITECNICO DI MILANO (TRIFOGLIO)

REGISTRATIONS OPENING SOON

Announcing ESAC's first Annual Meeting

Oct 28, 2025 | Events

We are proud to confirm the dates of the Society's first Annual Meeting, co-organized by the Fondazione IRCCS Istituto Nazionale dei Tumori di Milano (www.istitutotumori.mi.it) which will take place on May 7th and 8th in Milan, in the beautiful...

Save the Date: 2nd AI for Cancer Research Summer School

by Admin | Oct 28, 2025 | Events | 0 comments

3–8 September 2026 | Corfu, Greece

Following the success of its inaugural edition, the **AI for Cancer Research Summer School** returns in Corfu in 2026. This second edition will once again bring together a diverse community of researchers, clinicians, data scientists, and industry professionals to explore the rapidly evolving applications of artificial intelligence in cancer research and care. The week-long event will combine lectures, practical workshops, case discussions, and mentoring sessions, offering participants a comprehensive view of both the theoretical foundations and real-world challenges of AI in oncology.

WEBSITE: https://esac-network.eu. CONTACT US by e-mail: *contact@esac-network.eu*

Thanks for your attention!