NEXT_AIM: breve descrizione ed obiettivi

[2022-2024]

https://www.pi.infn.it/aim/

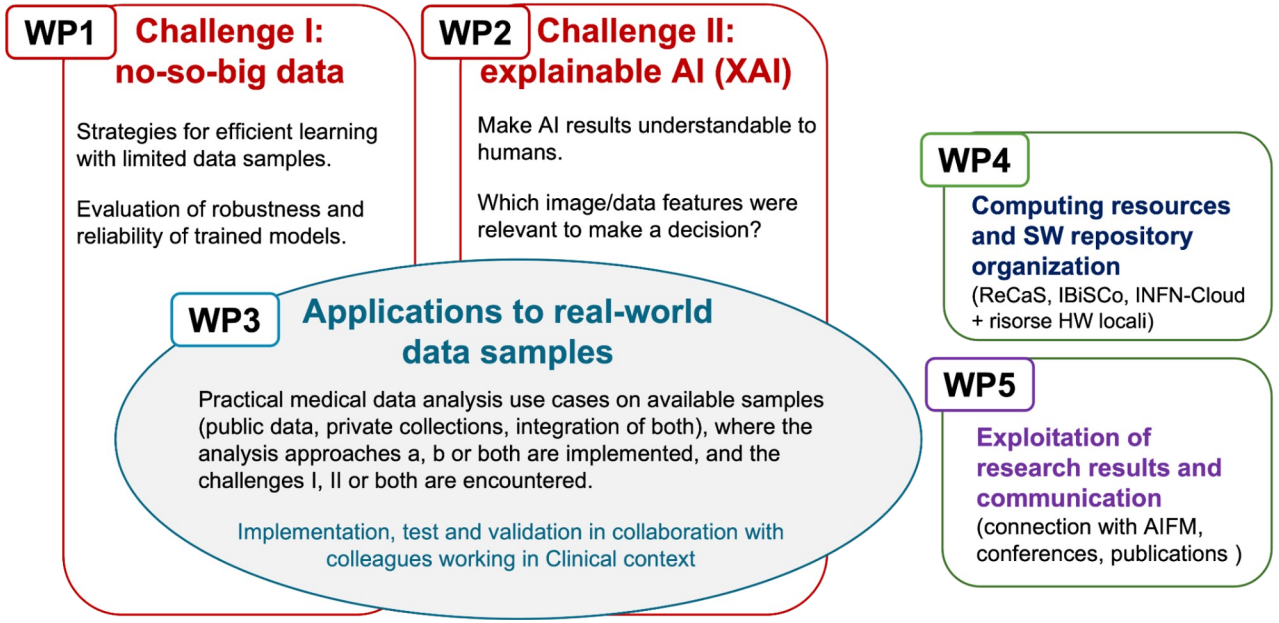
Artificial Intelligence in Medicine (AIM): *next steps*
focus on *n*o-so-big data and *ex*plainable *t*echniques

next_AIM
Resp. Nazionale: A. Retico
Resp. Locali:
- Bari (S. Tangaro)
- Bologna (D. Remondini)
- Cagliari (P. Oliva)
- Catania (M. Marrale)
- Ferrara (G. Paternò)
- Firenze (C. Talamonti)
- Genova (A. Chincarini)
- Lab. Naz. Sud (G. Russo)
- Milano (C. Lenardi)
- Napoli (G. Mettivier)
- Pavia (A. Lascialfari)
- Pisa (M.E. Fantacci)

\+ **Padova (Alberto Zucchetta) from 2023**

next **AIM** goal: *to take steps towards developing robust and explainable AI algorithms and validating them on realistic use cases in the medical field*

A large variety of AI-based algorithms have already been developed to analyse medical images and data.
Their potential to improve clinical workflows has not yet been fully exploited due to:
- the lack of model robustness or generalizability
- the lack of transparency



NEXT_AIM: stato di avanzamento e obiettivi 2023

WP3: Real-world study cases

WP conveners: P. Oliva (CA), A. Lascialfari (PV), M. Marrale (CT)

			FE				NA	PI			Radiomics in Digital Breast Tomosynthesis (DBT)
	BO		FE				NA				Super-Resolution in DBT
	BO	CT									Radiomics in prostate cancer
	BO	CT									Radiomics and DL in tcMRgFUS
	BO				GE	LNS					Nuclear NeuroImaging Quantification and Radiomics
BA		CA CT						PI		PD	Connectivity in functional MRI
		CA CT	FE	FI	GE	MI		PI	PV		Radiomics and Deep Learning analysis of CT/RX and patient data in COVID-19
								PI	PV		Radiomics and ML-segmentation on Facio-Scapulo-Humeral dystrophy (FSHD) and lung tumor
BA									PV		ML on Imaging data of 10B uptake tracks and dose monitoring by Compton cameras
				FI				PI			Artificial intelligence for monitoring RT response in soft-tissue sarcomas
			FE						PV	PD	Machine Learning techniques for cardiological applications
				FI				PI		PD	Application of NLP techniques to clinical notes towards the automated reading of instrumental data

MILESTONES

2022		
31 Dec	M1.1	Identification of methodological pitfalls in case of small datasets
31 Dec	M2.1	Identification of explainability requirements for medical applications
31 Dec	M3.1	Identification of data samples for practical use cases and fist tests
30 Jun	M4.1a	Identification of available resources and usage instructions
31 Dec	M4.1b	SW package release instructions
31 Dec	M5.1	Workshop organization: "
2023		
31 Dec	M1.2	Definition of robust pipelines for efficient model training on small datasets
31 Dec	M2.2	Customization of explainability pipelines to AI models for medical imaging
31 Dec	M3.2	Implementation of robust pipelines and explainability algorithms in at least three different use cases
31 Dec	M4.2	Integration of at least 1 application
31 Dec	M5.2	Workshop organization: "
2024		
30 Jun	M2.3	Definition of optimal explainability methodology for medical problems
31 Dec	M3.3	Result evaluation for the practical use case and reporting
31 Dec	M4.3	Integration of all analysis pipelines trained for the use cases of WP3 in the **next**AIM SW package repository
31 Dec	M5.3	Submission of at least 1 scientific publication per use case

WS AI@INFN, Bologna 2-3 Maggio 2022
https://agenda.infn.it/event/29907/

Workshop "AI methods and applications in Medical Physics"

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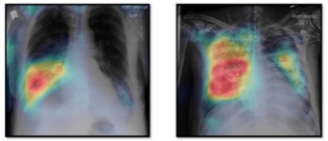
Workshop "The right to explanation"

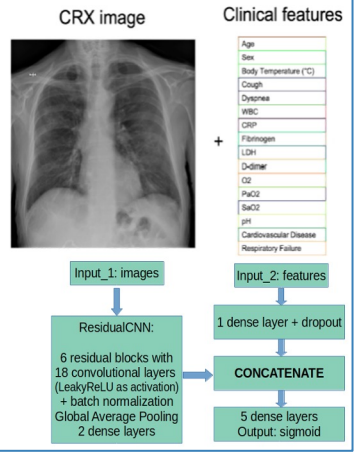
covidcxr - Hackathon

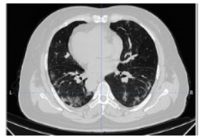
Artificial Intelligence for Covid-19 prognosis: aiming at accuracy and explainability



https://ai4covid-hackathon.it/
Challenge on chest X-ray and clinical data of patients with covid-19 pneumonia

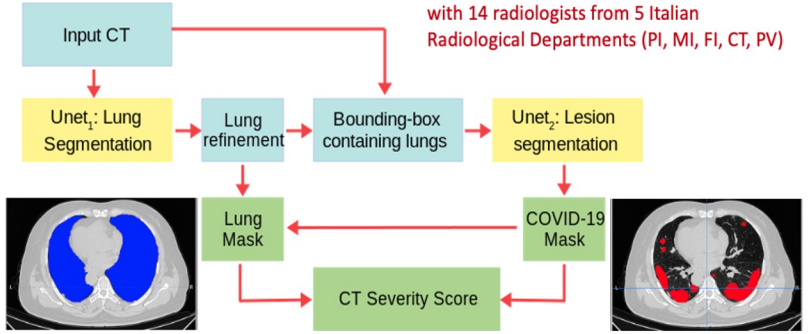
The **AIM-WG** team achieved the **4th place** with 74% accuracy in predicting patient prognosis

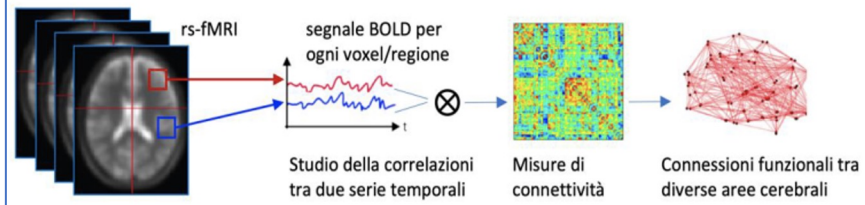




The *LungQuant* system

A multicenter study on 120 CT scan is in progress to validate the *LungQuant* quantification performance in collaboration with 14 radiologists from 5 Italian Radiological Departments (PI, MI, FI, CT, PV)





ABIDE
Autism Brain Imaging Data Exchange

Case-control discrimination with Deep Learning models vs traditional ones (RF)

Harmon. pipeline	AB I + II		AB I eye = open	
	DNN	RF	DNN	RF
Harmon_k-fold	71±1	66+2	73± 1	70± 3
Harmon_upstream	74±2	72+1	76±2	71± 2
No_harmon	73±3	65+1	72±1	68± 3

Sinergia delle tematiche con FAIR-AIM (Regione Toscana)

NEXT_AIM: personale @ INFN PI, richieste

Fantacci Maria Evelina	UNIPI	70%
Retico Alessandra	INFN	80%
Lizzi Francesca	INFN assegnista	90%
Scapicchio Camilla	UNIPI dottoranda	100%
Cipriano Emilio	UNIPI dottorando	100%
Biagi Laura	Stella Maris	10%
Bosco Paolo	Stella Maris	20%
Tosetti Michela	Stella Maris	10%
Arezzini Silvia	INFN	10%
Giampa Alberto	INFN	10%
Marzoni Enrico	INFN	5%
Laruina Francesco	SNS	50%

5,55 FTE

Missioni	6 kE	Partecipazione workshop, sessioni di lavoro con altri gruppi
Consumo	2 kE	Metabolismo relativo a calcolo e storage
Pubblicazioni	1.5 kE (SJ)	Open access publication fee
Inventario	~	See next slide

NEXT_AIM: richieste sui servizi, licenze e calcolo

Servizi in Sezione

Collaborazione con il personale del centro di Calcolo di Pisa

Licenze

Nessuna richiesta di licenze SW

Calcolo

Richieste di HW da integrare nelle risorse INFN nazionali:
2 x A100 Nvidia GPU (80 GB) → ~ 30 kE
oppure
2 x H100 Nvidia GPU (80 GB) → ~ 60 kE

\+ Storage → 3 kE