Newsletter

Winter 2023

ProCAncer-I

In this issue

ProCAncer-I has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 952159

European Commission

ProCAncer-I project after three years of implementation

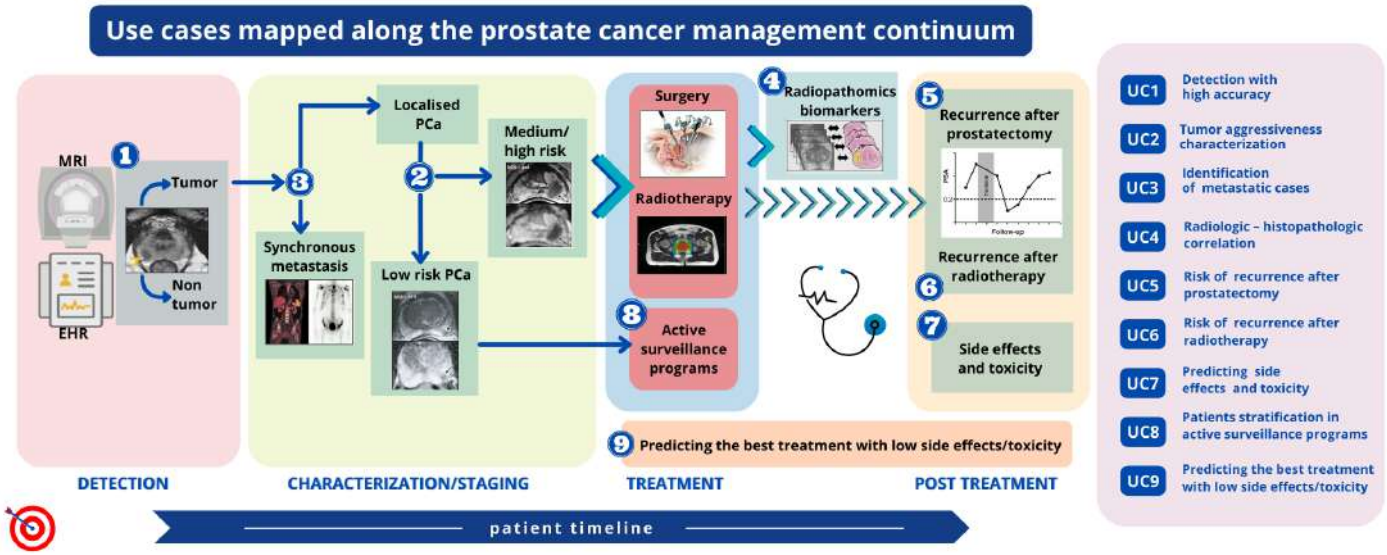
Editorial by Prof. Manolis Tsiknakis , Coordinator of the ProCAncer - I Project

ProCAncer-I's vision is to deliver a platform featuring a unique collection of PCa mpMRI images worldwide, in terms of data quantity, quality and diversity; to focus on delivering novel AI-based clinical tools for advancing characterization of PCa lesions, assessment of the metastatic potential, and early detection of disease recurrence; to design and seamlessly integrate an open source framework for the development, sharing and deployment of AI models and tools; to contribute in the increase of the trust in PCa AI tools by introducing AI model interpretability functionality and delivering a complete technological, organizational, and legislative framework for model evaluation; and to develop a concrete plan to sustain and exploit project result.

ProCAncer-I has developed nine concrete and clinically relevant use cases that span the care continuum of PCa. These are used as demonstrator use cases for validating the added value and usability of the platform. The ProCAncer-I project has achieved significant milestones from the clinical viewpoint, including the definition of detailed study protocols for retrospective and prospective studies and is registered on clinicaltrial.gov. The project also established robust procedures and technologies for data anonymization, developed the ProCAncer-I platform as a secure cloud-based infrastructure supporting AI model development, and delivered locally installed eCRF (electronic Case Report Form) and data upload tools to clinical partners, enhancing data control capabilities.

A significant focus of our work has been on defining ontologies and catalog mechanisms. The MOLGENIS platform functions as the primary metadata catalogue, aligned with the DCAT-AP specification. Moreover, the project uses the OMOP-CDM, along with its extensions introduced within ProCAncer-I, as a common data model for storing clinical and imaging-related metadata. Collaboration with the OHDSI Medical Imaging Working Group persisted, focusing on integrating annotation, segmentation, and curation data as radiomics features, leading to the creation of two extensions to the OMOP-CDM (MI-CDM and R-CDM).

Substantial efforts have been dedicated to enhancing the platform with various image pre-processing and curation tools including Bias Field Correction, Image Enhancement (RACLAHE histogram equalization, Deep Learning Noise Reduction, Radiomics Normalization (based on ComBat method) and Radiomic Feature Stability. Also, a significant result of our work has been the development of master models, as foundational models used for different tasks and methodologies. Efforts were directed mainly towards creating classification master models based on radiomics and deep learning (DL), alongside segmentation master models for whole prostate gland, prostate zone, and lesion segmentation. Certain partners concentrated on a consistent feature extraction and machine-learning pipeline using automatic whole prostate gland segmentations to evaluate predictive performance across various use cases (UC2, UC3, UC5, UC6, UC7b, and UC8). They conducted analyses like fairness, learning curve, and feature importance to understand diverse model requirements and feature impacts on performance. Other partners focused on analyzing performance using manually annotated lesion or whole prostate gland segmentation masks, offering a comparison between different model requirements, whereas others assessed



Figur 1: Use Cases mapped along the prostate cancer management continuum in the ProCAncer-I Project

radiomics features on UC7a, employing predicted whole prostate gland segmentations.

Regarding the development of Deep-Learning based Master Model we have:

• Studied the impact of different factors on classification performance in UC2, including model types, clinical features, crop sizes, and data amounts.

• Studied the impact of image cropping techniques in UC2 and UC5 classification, alongside learning curve analysis.

• Compared unsupervised and supervised approaches in UC1, providing a learning curve analysis.

• Compared 2D and 3D data performances in prostate and lesion segmentation models.

• Examined architecture impacts on lesion segmentation models using mpMRI data.

• Enhanced existing prostate segmentation model's robustness.

• Designed a deep learning-based lesion segmentation model and strategies to address over-fitting and

• Investigated self-supervised learning (SSL) models' performance in 3D classification using 2D orphan data stored in DICOM format, comparing their performance with models trained in previous chapters.

Ongoing experiments with deep learning models highlight benefits and dependencies on data quantity, case complexity, and image quality variations, offering adaptable AI strategies for better models addressing clinical questions. The project is collaborating with AI4HI network projects and notably, it contributed to defining "FUTURE-AI" principles, essential for AI model development in medical imaging and generated significant scientific output, publishing AI-based model reports.

Clinical Challenge: Can artificial intelligence based mpMRI with clinical data predict prostate cancer recurrence after prostatectomy?

By Prof. Kai Vilanova. Chief MRI Department. Institute of Biomedical Research of Girona (IDIBGI)

Radical prostatectomy (RP) is a first-line treatment for organ-confined or locally advanced prostate cancer (PCa). Biochemical recurrence after surgery is defined as two consecutive PSA values ≥0.2 ng/ml after radical prostatectomy.

Post-RP biochemical recurrence (BCR), affecting 50% of the patients, is a strong surrogate marker for indicating subsequent distant metastasis. BCR predominantly develops in patients with high-risk features, such as high initial prostate-specific antigen (PSA) levels, adverse RP pathology, including extracapsular extension (ECE) and seminal vesicle invasion (SVI), positive surgical margins (PSM), and surgical Gleason score (GS) ≥8.

Early identification of patients with PCa at a higher risk for developing post-RP BCR is important for intensive monitoring or providing adjuvant therapies at the proper time for effectively managing systemic micro-metastasis and ultimately securing long-term survival advantages mpMRI could be helpful to better stratify the disease-risk and support the physician in counseling the patient regarding treatment. MpMRI combined with advanced post-processing techniques seems to be an effective non-invasive method to identify the set of features characterizing increased risk for symptomatic and probably fatal prostate cancer.

Use Case (UC) 5 of the ProCAncer-I project, aims to predict the risk of disease recurrence after prostatectomy. Validated models are going to be used to evaluate

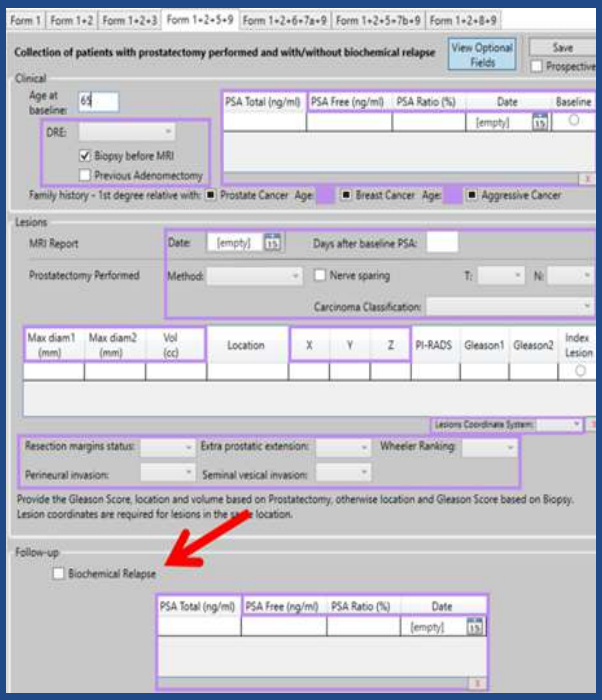


Figure 2: eCRF form for UC 5 collects clinical, MRI data and the PSA follow-up to consider biochemical recurrence/relapse

the risk of disease recurrence.,using pre and post-treatment mpMRI imaging studies both in vendor-specific and vendor-neutral models. In this task we are focusing on post-surgery findings as well as positive surgical margins. In addition, a nomogram comprising of a radiomic score and clinical variables that are known to be good predictors of disease recurrence (Gleason Score, status of resection margins, extracapsular extension) will be externally validated.

Data is collected from patients who have undergone prostatectomy. The Case Report Form (eCRF) from UC 5 has three information sections: Clinical, Lesions, and Follow-up. In the section "Follow-up" (Figure: arrow) the user should provide the following information: Biochemical Relapse: true (checked) or false (not checked).

AI trustworthiness in prostate cancer: where we stand

By Sara Colantonio, Researcher at ISTI-CNR

Artificial intelligence (AI) is set to drive groundbreaking medical solutions and services that could transform the diagnosis and treatment in clinical practise, with image-based diagnostics at the forefront of these advancements.

ProCAncer-I is a brilliant example of how AI can enhance the entire imaging-based diagnostic and therapeutic continuum in oncology. The project is developing AI models designed to aid essential clinical tasks related to prostate cancer. By utilising the extensive imaging and clinical data available, the AI models will enable radiologists and oncologists to detect and distinguish indolent from aggressive cases, make early predictions of recurrence, and detect metastases, towards a more precise and personalised patients' care.

As stated by M.D. Villanova, one of the project radiologists, "***The possibility of having an intelligent prostate software means a great saving in analysis time, but also the most important is to improve the diagnostic accuracy to better detect cancer […]. These technological tools that the ProCAncer-I project is developing, give us, healthcare personnel, the opportunity to free up part of our working day, dedicated to healthcare visits, and use it to continue with research to improve the health of our patients***".

In this direction, the largest collection of prostate cancer magnetic resonance images of its kind has been assembled to facilitate the development of highly effective and efficient AI models. At the same time, the partners involved fully recognise the importance of releasing AI models that can ensure reliability and clinical value, gain stakeholders' trust and acceptance, and guarantee the complete safety of patients. This is the only way to obtain regulatory clearance and acceptance within the clinical community. Therefore, the project is focusing on creating a methodological framework and tools that endorse the trustworthiness and robustness of the AI models in development and undergoing testing.

Actually, despite the undeniable potential of AI, real-world adoption and deployment of AI-powered applications in clinical practice remains limited. Adoption barriers include perceived challenges to human autonomy, accountability and liability issues, potential biases and risks as well as excessive requirements in terms of effort and cognitive load and dissatisfaction with user interfaces. Overall, a general lack of trust is reported, which also seems to be linked to a lack of knowledge about the assumptions, limitations and capabilities of AI-based tools. From the perspective of citizens, a recent survey of more than 900 respondents in the United States showed that most had a positive view of AI's ability to improve healthcare by making it much better (10.9%) or somewhat better (44.5%). However, the survey also revealed predictable concerns about potential misdiagnoses, privacy breaches, a reduction in time spent with clinicians and increased costs, with racial and ethnic minority groups expressing greater concern. The survey also found that most respondents would be very uncomfortable (31%) or somewhat uncomfortable (40.5%) with receiving a diagnosis from an AI algorithm that was 90% accurate but unable to explain its rationale. It is worth noting that trust is a complex, multidimensional construct that touches on technological, but also psycho-sociological, philosophical and ethical issues. A large body of literature has been devoted to defining and modelling trust in human interactions. Many of the attempts to ensure trust in AI have focused on the kind of characteristics AI applications should have, in order to be considered

trustworthy. ProCAncer-I moves in this direction.

In collaboration with the AI4HI cluster, (Artificial Intelligence for Health Imaging), ProCAncer-I has contributed to define the so-called "FUTURE-AI guidelines: Guiding Principles and Consensus Recommendations for Trustworthy Artificial Intelligence in Medical Imaging", which aim to provide guidance and concrete recommendations for developing future trustworthy AI solutions in medical imaging. The guidelines consist of six core principles: (i) Fairness, which refers to creating equitable systems that do not promote discrimination and that perform well even on underrepresented sub-groups of the population. Alternatively, systems should at least make stakeholders aware of any limitations in this area; (ii) Universality, which mandates the use of standard and verifiable approaches that can be easily deployed in settings with limited resources; (iii) Traceability, which demands for transparent and traceable systems, with comprehensive tracking of details during both the development and usage phases; (iv) Usability, which requires that AI systems integrate seamlessly and effectively into clinical processes; (v) Robustness, which mandates for systems capable of generalizing and managing adverse situations; and (vi) Explainability, which requires that AI systems provide end users with all the necessary elements to make safe and appropriate use of the system's outputs and predictions.

ProCAncer-I's AI approach aligns with the six FUTURE-AI principles, providing tailored solutions across multiple work packages. In terms of fairness, the GDPR-compliant data infrastructure securely stores fully anonymised data from various clinical centres. This implies that the available demographic data is restricted to patients' age. Consequently, the fairness analyses are being conducted as sub-cohort analyses, by primarily considering the tumour severity classes and the data acquisition vendors and protocols. Their purpose is to determine whether there are any variations in performances across the different options. As far as universality is concerned, the multi-tier approach, based on the delivery of Master, Vendor-specific and Vendor-neutral models, aims to guarantee AI models' reliability across a range of diagnostic resources. This approach is also relevant to ensure robustness of the models. Traceability is ensured through two approaches. Firstly, each AI model is equipped with its designated Model Passport, housed within a dedicated model registry. The passport presents all the necessary details in a uniform format, utilizing a metadata structure. The information includes the scope of the models, actors and developers involved, development tools, technical choices made, versions, performance metrics and deployment information. Furthermore, the Passport provides details on the data employed in the model's training, incorporating data provenance and localization. Secondly, methods are being developed to track the performance of AI models over time after deployment in order to detect any data and concept drift. The Passport also encompasses pertinent information regarding this matter. The foundation of usability was established by determining nine use-cases that meet the requirements of clinical partners. A further elicitation exercise has been carried out to ascertain clinicians' preferences regarding interaction and integration modalities. Various questions were posed to gain insights into the key features that a high-quality AI system should possess to effectively persuade and gain the trust of clinical stakeholders. Questions covered a large range of topics from preferred performance metrics, sensitivity and sensitivity balance, to reading modalities and types of explanations offered by the AI system. This last point is also related to the principle of explainability. In fact, one of the still open challenges in explaining the results of an AI system is how to assess the quality of an explanation for different user groups, as there is still no common agreed understanding of what 'explainability' means from the end-user's point of view. In this respect, a field study has been organised to gather their requirements and feedback to test their understanding and satisfaction with different types of explanations. Finally, in terms of robustness, we are also working to provide the outputs of the AI models with a confidence or certainty value that can be used by clinical end users to make a safe and confident use of them. The importance of such a certainty/uncertainty score has emerged as one of the key requirements from the elicitation exercise.

Thanks to feedback from clinical partners, an improved version is being circulated to members of the European Society of Oncology Imaging (ESOI) to gather a more comprehensive view of what an AI system should exhibit to be trusted by clinical end-users. The ProCAncer-I consortium endeavours to contribute to finding the most appropriate means to ensure that radiologists can benefit from the best that AI has to offer.

What is the experience of a young researcher in participating in a European project with great impact on healthcare like ProCAncer-I?

Interview with Dr. Giacomo Aringhieri, Radiology Research Fellow, Academic Radiology, Department of Translational Research, University of Pisa

What are the main opportunities for a young researcher?

Participating in a research project at the European level like ProCAncer-I is surely a great opportunity for young researchers like me. It is intrinsic and of innovative value to be working for a recognized project by the EU as worthy of funding. Being part of such an innovative project, it is important because it allows you to collaborate with several experts in different fields with diverse background, from engineers to clinicians, merging their expertise to a common goal: a better care for prostate cancer patients. This leads to better understanding how your work can affect others work, and vice versa, and this lets you get a wider comprehension of the problem considering different points of view, not limited to the radiologic one.

Moreover, the contact with patients' organizations provides a deeper awareness about the patients' needs, aside from the mere clinical aspects.

Finally, from a practical view, working in the ProCAncer-I European multidisciplinary team of experts, as a young researcher gave me the chance to learn or improve skills and abilities such as project management, collaboration, and communication, which are transferable across different fields.

What difficulties did you encounter?

Personally, especially in the first period of the project, the main challenge was to understand the complicated formal aspects of such a big project. Along the way, with the kind support of all collaborators, the work has become increasingly better and smoother. To be honest, in the first period, it was not easy to balance local academic and clinical work with the global project workflow, probably due to my little experience in that kind of European projects. It took a considerable amount of time to optimize the effort of UNIPI group in order to be efficient as required.

From a practical point of view, one of the main difficulties has been reconciling local and EU regulations; the main obstacle that was overpassed was about the different ethical and privacy regulation across the different countries participating in the project. Particularly, the Italian regulation is one of the most stringent in the EU and we had to encounter several complicated steps to obtain the Ethical Committee approval. Actually, In my opinion, this step is one of the most controversial in every Italian participation in European projects.

How do you think participating in ProCAncer-I might impact your future professional career?

In the future, I think that many of things I have learned from participating in the project, will be of use in better managing the next research projects, both European and local ones. It will be fundamental to exploit all I have acquired during this project, such as responsibilities and deadlines shared with the collaborators: it is clear now how the work of a single work group, for example, affects all the other participants and how the global project management has a crucial role in the conceptual development and practical execution of the project. I also understood that coordinating projects can be very difficult, as there are many very heterogeneous teams each busy with a lot of bureaucratic work, and that can sometimes lead to paralysis. For this, I have to thank the project management team for the hard and great work done so far.

During this experience, I had the chance to work with high-quality researchers in a prestigious consortium. I think that my involvement in a European-level project like ProCAncer-I will improve both my academic position and my professional one. Additionally, the project has helped me to acquire a more international and European prospective for my personal research, thanks to the several contacts with experts from within and outside the EU. I believe international experience is very valuable and being able to learn from experts in the context of a European Project is truly invaluable.

Presentation of partners

Candiolo Cancer Institute, FPO – IRCCS

The Candiolo Cancer Institute mission is to give significant contribution to fight cancer, by understanding the basics and providing state-of-the-art diagnostic and therapeutic services. The Institute works in synergy with the University of Torino Medical School and the interface between molecular biology and medicine is at its core. The interaction between experimental and clinical expertise allows constant transfer of innovative care models into the clinic. The Image and Data Processing (IDP)-Lab, embedded in the Imaging Unit of the Candiolo Cancer Institute, has been actively pursuing research on prostate MRI and computer aided detection (CAD) systems since the last decade, using artificial intelligence (AI) driven technologies. The Laboratory is directed by Prof. Regge, who is a pioneer in the field of in-vivo imaging biomarkers and is internationally recognized for his contributions to CT colonography and prostate MRI. The research team at the Candiolo Cancer Institute is composed by a multidisciplinary, multi-investigator group, involving researchers from different fields: medical imaging, biomedical engineer, computer science, radiology, urology and pathology. The team has interdisciplinary competences ranging from biology and experimental work to biostatistics and data analysis.
The Candiolo Cancer Institute has participated to set the legal and ethical framework of retrospective and prospective data collections (WP2), is actively involved in the dissemination and communication activities (WP3), in developing the master (WP5), vendor specific and vendor neutral (WP6) models. Since the IDP-Lab has a large experience in developing and validating AI models for the detection and characterization of prostate cancer to predict the risk of cancer progression, the group is task leader in the development and validation of models for characterization of cancer according to its biological aggressiveness (WP7).
The Candiolo Cancer Institute's contribution to the ProCAncer-I project includes the uploading of 1,500 MRI examinations, including 250 cases with high quality imaging annotations, of biopsy and pathology data after surgery. In addition, Candiolo Cancer Institute is coordinating all the clinical activities of the other 12 data providers of the ProCAncer-I project.
https://aipocratech.com/

CNR – National Research Council of Italy (CNR-ISTI and CNR-IFAC)

The National Research Council (CNR) is the main public research organisation in Italy with the aim of carrying out, promoting, disseminating, transferring and improving research activities in the main fields of knowledge. The CNR consists of around 100 different research institutes, ranging from human and social sciences to engineering.
In ProCAncer-I, the two CNR units involved belong respectively to:
1. "Alessandro Faedo" Institute of Information Science and Technologies (ISTI), Pisa
2. "Nello Carrara" Institute of Applied Physics (IFAC), Sesto Fiorentino (Florence).

ISTI-CNR is committed to producing scientific excellence and to playing an active role in technology transfer. The field of competence covers informa-

tion, science, related technologies and a wide range of applications. The ISTI-CNR unit is led by the "Signals & Images" Lab (https://si.isti.cnr.it/), a research group working in the elds of computer vision, signal acquisition and processing, image understanding, arti cial intelligence, knowledge representation and modelling, intelligent vision systems and multimedia data understanding.

In IFAC-CNR, the main research lines pertain to the general fields of optoelectronics, spectroscopy, and ICT, including the investigation of novel applications in several branches of interdisciplinary sciences, such as photonic devices and data analysis techniques for healthcare and well-being, mainly carried out by the BioPhotonics and Nanomedicine lab (https://bpnlab.ifac.cnr.it/artificial-intelligence-for-health/). IFAC-CNR's expertise also includes complementary aspects related to healthcare, such as privacy, ethical/legal issues and clinical policy. Both units are involved in different projects aiming to build imaging biobanks (the first for Tuscany region) and platforms, to boost 4P precision medicine in oncology by advancing translational research based on quantitative imaging and multi-omics analyses, towards a better understanding of cancer biology, cancer care, and, more generally, cancer risk.

The expertise of ISTI-CNR and IFAC-CNR in radiomics and deep learning is fundamental both for the devel opment of AI validated models for the clinical scenarios envisaged in ProCAncer-I, and for ensuring that such AI tools and models comply with the FUTURE AI philosophy towards Fair, Universal, Traceable, Usable, Robust and Explainable AI.

In this respect, CNR is currently involved in the activities of WP4 (image repositories, sharing mechanisms, annotation, curation and standardisation methodologies), WP5 (development of master models), WP6 (development of vendor-specific and vendor-neutral AI models) and WP7 (clinical evaluation of AI models), and is leading Task 6.5: "Explainable, interpretable, ethical and trustworthy AI framework".

In the latter task, CNR's activities are mainly dedicated to improving the trustworthiness of the solutions to be delivered in terms of (i) fairness and privacy, (ii) security and robustness, (iii) explicability and interpretability, and (iv) reproducibility and verifiability. Such an investigation will be carried out both by analysing the state-of-the-art literature and by fostering close collaboration between developers (e.g. computer scientists and engineers) and domain experts/end users (e.g. clinicians) in order to agree on the specifications of the ProCAncer-I solution and to clearly define a set of performance metrics to assess the value/efficiency of the AI framework in terms of trustworthiness.

Finally, with regard to the system transparency of the AI models, the CNR-ISTI is working on the definition and development of the traceability framework of the AI-based solutions and models, based on novel concept of the AI-Passport, jointly designed with FORTH, and on the definition of specific performance metrics and evaluation criteria to be used for monitoring the performance of the models after deployment.

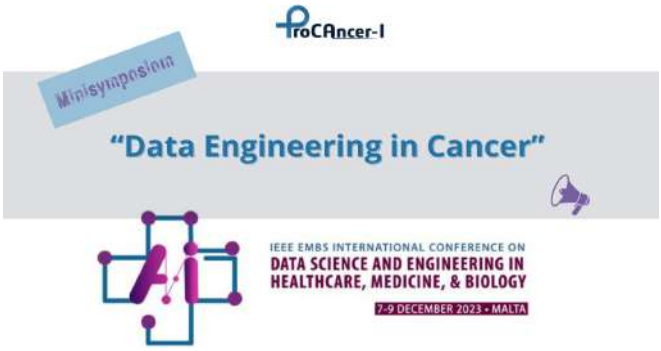
NEWS

Second Dissemination Event of the ProCAncer-I Project in Lisbon

ProCAncer-I organised the 2nd Dissemination Event on June 30th within the title "AI and Machine Learning in Cancer Imaging 3.0 – Enhancing Healthcare through AI". The event took place on 30th June & 1st July 2023 in Lisbon, Portugal, organised jointly by the Champalimaud Foundation and the International Cancer Imaging Society. The ProCAncer-I event was entitled "The best practices on machine learning for multicentric approaches" and various discussion on AI development and data curation issues took place.

ProCAncer-I at the IEEE Engineering in Medicine & Biology Society (EMBS) in Malta

The ProCAncer-I Consortium organised a mini symposium under the scope Data Engineering in Cancer, chaired by prof. Dimitris Fotiadis. The mini symposium took place during the IEEE EMBS International Conference on Data Science and Engineering in Healthcare, Medicine & Biology, in Malta (Hilton Malta Hotel) on December 7, 2023 – December 9, 2023, on the second day.



ProCAncer-I Project at the RSNA 2023

"RSNA 2023: Leading Through Change" brought together an international community of medical imaging professionals and industry partners and helped to stay up to date with the latest radiology advancements. Our partners, ADVANTIS Medical Imaging and Biotronics 3D Limited (B3D) attended, presenting the Advantis Platform, the FDA-cleared solution for brain and prostate MRIs and OpenRad's Imaging Platform.

AI & Cancer: Unleashing Opportunities, Overcoming Challenges

AI and Cancer: Unleashing Opportunities, Overcoming Challenges Clustering is an event powered by INCISIVE, EUCAIM and the AI4HI cluster, that took place on 7/11/2023 in Madrid. In this vibrant session organised by Incisive , EUCAIM and the AI4HI cluster explored how AI powered by health data sharing can transform cancer challenges into remarkable opportunities. The ProCAncer-I project was represented by Prof. Kostas Marias, the technical Manager of the project.

ProCAncer-I at the IEEE EMBC 2023 in Sydney

EMBC 2023 is the 45th Annual International Conference of the IEEE Engineering in Medicine and Biology Society. The conference was held in Sydney, Australia from 24th to 27th July 2023. The ProCAncer -I participated in a Mini-Symposium jointly with the FutureAI Initiative and the EUCAIM. The theme of the symposium was: The European Cancer Imaging Initiative – Status, Challenges and Opportunities

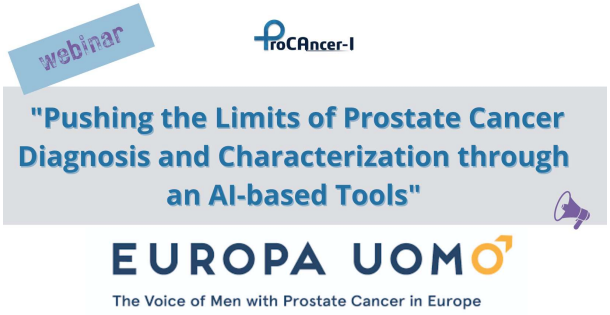
UPCOMING EVENTS

ProCAncer-I at the European Congress of Radiology 2023

A special AI4HI Session at the European Congress of Radiology 2024 in Vienna (February 28-March 3, 2024) will take place themed: Artifical Interligence (AI) for health imaging: pioneering cancer image repositories for diagnosis and analysis. Dr. Nickolas Papanikolaou, from Champalimaud Foundation representing ProCAncer-I will give a talk on "AI models of prostate cancer diagnosis". The University of Pisa and the Candiolo Cancer Institute will also showcase the project and members from both teams will be available to provide comprehensive information about our work and its implications.

Europa Uomo webinar with the ProCAncer-I Project

On January 25th, 2024 at 5.00PM CET, a webinar is organised by Europa Uomo, in collaboration with the ProCAncer-I project. The webinar is entitled "Pushing the Limits of Prostate Cancer Diagnosis and Characterization through an AI-based Tools" and speakers will be Cosimo Pieri, Prof. Manolis Tsiknakis, Prof. Daniele Regge and Dr. Nickolas Papanickolaou, discussing theProCAncer –I platform and prostate cancer management.



Third Dissemination Event of the ProCAncer-I Project in Athens

The 3rd Dissemination Event will take place during the International Symposium on Biomedical Imaging (ISBI) 2024 as a Special Session, in Athens 27-30/5/2024. The first part will discuss issues on validation and trustworthiness of AI-based models. The second part will be a tutorial on "AI Platform integrating imaging data and models, supporting precision care through prostate cancer's continuum based on the ProCAncer-I". The tutorial, will be showcasing all the experience gained in the last 3 years based on the collaborative work of ProCAncer-I project, and will include research-based educational material in the field of medical imaging applications of AI,

PUBLICATIONS

1] Pachetti, E.; Colantonio, S. 3D-Vision-Transformer Stacking Ensemble for Assessing Prostate Cancer Aggressiveness from T2w Images. Bioengineering 2023, 10, 1015. https://doi.org/10.3390/bioengineering10091015

2] Aikaterini Dovrou, Katerina Nikiforaki, Dimitris Zaridis, Georgios C. Manikis, Eugenia Mylona, Nikolaos Tachos, Manolis Tsiknakis, Dimitrios I. Fotiadis, Kostas Marias ,2023."A segmentation-based method improving the performance of N4 bias field correction on T2weighted MR imaging data of the prostate". Magnetic Resonance Imaging 101, 1-12 (2023),10.1016/j.mri.2023.03.012

3] Dimitrios I. Zaridis, Eugenia Mylona, Nikolaos Tachos, Vasileios C. Pezoulas, Grigorios Grigoriadis, Nikos Tsiknakis, Kostas Marias, Manolis Tsiknakis & Dimitrios I. Fotiadis ,2023."Region-adaptive magnetic resonance image enhancement for improving CNN-based segmentation of the prostate and prostatic zones". Scientific Reports 13 (1), 714 (2023), https://doi.org/10.1038/s41598-023-27671-8

4] Andrea Berti, Rossana Buongiorno, Gianluca Carloni, Claudia Caudai, Giulio Del Corso, Danila Germanese, Eva Pachetti, Maria Antonietta Pascali and Sara Colantonio, 2023." Exploring the potentials and challenges of Artificial Intelligence in supporting clinical diagnostics and remote assistance for the health and well-being of individuals",Ital-IA 2023: 3rd National Conference on Artificial Intelligence, organized by CINI, May 29–31, 2023

more publications

Subscribe *to our* **Newsletter** *and* **follow us** *on* **Social Media!**

Check our **Website**:
https://www.procancer-i.eu/

Follow us on **Twitter**:
*https://twitter.com/***ProCAncer_I**

Like us on **Facebook**:
*https://www.facebook.com/***ProCAncer.I**

Follow us on **LinkedIn**:
*https://www.linkedin.com/company/***procancer-i-project**

Subscribe to **YouTube**:
https://www.youtube.com/@ProCAncer-I


FORTH
INSTITUTE OF COMPUTER SCIENCE

Champalimaud
Foundation

HACETTEPE
ÜNİVERSİTESİ

IdIBGi

ISTITUTO DI CANDIOLO - IRCCS

Università di Pisa

Radboudumc

INSTITUT PAOLI-CALMETTES
unicancer Marseille

NACIONALINIS VĖŽIO INSTITUTAS
NCI

Instituto de Investigación
Sanitaria La Fe

Consiglio Nazionale
delle Ricerche

The ROYAL MARSDEN
NHS Foundation Trust

JCC
DIAGNOSTIC IMAGING

ΑΓΙΟΣ ΣΑΒΒΑΣ

quibim

universität
wien
Department of Innovation
and Digitalisation in Law

ADVANTIS
MEDICAL IMAGING

Biotronics 3D

MASSACHUSETTS
GENERAL HOSPITAL
MGH

quirónsalud
La salud persona a persona