

 <p>UniSR Università Vita-Salute San Raffaele</p>	<p>APPLICATION TO ACT AS SUPERVISOR AND RESEARCH PROJECT PROPOSAL</p>	<p>MO 20-5 ed. 01 del 21/02/2025 PO 20 Page 4 of 9</p>
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PROJECT

Supervisor: Prof. Giulia Veronesi

Title: Artificial Intelligence for heALTH and prevention of smoking-related diseases (ARIA)

Curriculum: Molecular medicine – Clinical and experimental medicine

Link to the personal page of the University or relevant hospital site website: <https://www.unisr.it/docenti/v/veronesi-giulia>

Description of the Project (max 3,000 characters including spaces)

Background/gap of knowledge

Lung cancer (LC) is the leading cause of cancer-related death worldwide, primarily due to its aggressive nature and frequent late-stage diagnosis [1]. Early detection is essential to improve prognosis [2], and low-dose computed tomography (LDCT) has shown a significant reduction in LC-specific mortality [3]. However, large-scale implementation remains limited by high false-positive rates, overdiagnosis, costs, and limited healthcare infrastructure. Importantly, the target population for LDCT screening—individuals over 50 with a significant smoking history—also carries a high burden of comorbidities, including cardiovascular disease (CVD) and chronic obstructive pulmonary disease (COPD) [4]. Coronary Artery Calcification (CAC), measurable via LDCT, is a strong predictor of CVD risk [5], yet often underutilized. Integrated strategies that simultaneously address early cancer detection and preventive care for smoking-related diseases are still lacking in routine clinical practice. Addressing this gap represents a key opportunity to transform the effectiveness of screening programs.

Rationale and hypothesis

Artificial intelligence (AI), especially convolutional neural networks (CNNs), has shown remarkable promise in automating and enhancing medical image interpretation [6]. We hypothesize that an explainable AI model can improve the diagnostic accuracy and consistency of LDCT screening for pulmonary nodules, while also enabling integration of multi-source data—including imaging, clinical history, and lifestyle factors—for comprehensive risk profiling of LC and CVD.

Objectives and specific aims



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The primary objective is to develop and validate an AI algorithm capable of detecting and characterizing pulmonary nodules on LDCT scans, benchmarked against expert radiologists using AUC metrics. Secondary aims include CAC-based CVD risk stratification, structured smoking cessation support, biobanking of blood and tissue samples for molecular analyses, and longitudinal assessment of patient-reported outcomes and quality of life.

Expected outcomes

The project will deliver a robust AI tool (target AUC ≥ 0.80) to improve diagnostic precision and reduce false positives in LC screening. CAC analysis and prevention counseling will promote personalized cardiovascular care. A dedicated biobank will support future biomarker discovery. Overall, the study aims to create a scalable, AI-powered, preventive screening model to improve outcomes in high-risk, multi-morbid populations.

Skills that the student should acquire (max. 600 characters including spaces):

The student will acquire advanced interdisciplinary skills at the intersection of thoracic oncology, artificial intelligence, and preventive medicine. The student will gain hands-on experience in clinical research design, patient recruitment, biobanking, and longitudinal data collection, while also developing proficiency in the validation of machine learning models, analysis of medical imaging, and integration of clinical and molecular datasets. Emphasis will be placed on critical thinking, scientific writing, and translational impact.

References (max. 15)

1. Siegel, R.L.; Miller, K.D.; Wagle, N.S.; Jemal, A. Cancer Statistics, 2023. *CA Cancer J Clin* 2023, 73, 17–48, doi:10.3322/CAAC.21763.
2. Goldstraw, P.; Chansky, K.; Crowley, J.; Rami-Porta, R.; Asamura, H.; Eberhardt, W.E.E.; Nicholson, A.G.; Groome, P.; Mitchell, A.; Bolejack, V.; et al. The IASLC Lung Cancer Staging Project: Proposals for Revision of the TNM Stage Groupings in the Forthcoming (Eighth) Edition of the TNM Classification for Lung Cancer. *Journal of Thoracic Oncology* 2016, 11, 39–51, doi:10.1016/j.jtho.2015.09.009.
3. Cancer Screening – SAPEA Available online: <https://sapea.info/topic/cancer-screening/> (accessed on 29 March 2023).
4. Hecht, H.S. Coronary Artery Calcium Scanning: Past, Present, and Future. *JACC Cardiovasc Imaging* 2015, 8, 579–596, doi:10.1016/J.JCMG.2015.02.006.



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5. Rasmussen, T.; Kober, L.; Abdulla, J.; Pedersen, J.H.; Wille, M.M.W.; Dirksen, A.; Kofoed, K.F. Coronary Artery Calcification Detected in Lung Cancer Screening Predicts Cardiovascular Death. *Scand Cardiovasc J* 2015, 49, 159–167, doi:10.3109/14017431.2015.1039572.
6. Rabbani, M.; Kanevsky, J.; Kafi, K.; Chandelier, F.; Giles, F.J. Role of Artificial Intelligence in the Care of Patients with Nonsmall Cell Lung Cancer. *Eur J Clin Invest* 2018, 48, doi:10.1111/EJC.12901.