Work Programme

The use of artificial intelligence (AI) has dominated the field of medical image analysis, including digital pathology and radiomics, to responde at principal unmet clinical needs. Specifically, digital pathology has emerged with the digitization of patient tissue samples and in particular with the use of digital whole slide images (WSIs). A successful application of deep learning to WSIs has the potential to provide new insights on various pathologies. The request of AI models to identify digital imaging signatures, that combined with clinical variables and radiomic signature, are able to give accurate predictions for the different clinical task in different oncological pathology, such as breast, melanoma, lung, and head and neck cancer. The research program mainly covers the following research lines:

- response to treatment
- prediction of recurrence or progression disease
- prediction lymph node status

Team composition

Taem Leader: Dott.ssa Raffaella Massafra

Team Leader Junior:

Team members:

Dott.ssa Annarita Fanizzi, senior researcher
Dott. Vittorio Didonna, medical physicist
Dott. Pasquale Tamborra, medical physicist
Dott. Maria Colomba Comes, researcher
Dott.ssa Samantha Bove, researcher
Dott.ssa Nicole Petruzzellis, data manager
Dott. Alessio De Bartolo, administrative
Dott.ssa Domenica Bavaro, researcher
Dott.ssa Erika Di Benedetto, data manager
Dott.ssa Rahel Signorile, researcher
Dott.ssa Martina Milella, researcher
Dott. Federico Fadda, researcher

Team networks:

Alleanza Contro Cancro (ACC)
Associazione Italiana di Fisica Medica (AIFM)
Istituto Nazionale di Fisica Nucleare (INFN)
Dipartimento Interateneo di Fisica, Università degli Studi di Bari
Dipartimento di Diagnostica per Immagini, Ospedale Universitario di Siena, Azienda Ospedaliera Universitaria Senese, Siena,
Università degli Studi della Campania Luigi Vanvitelli, Dipartimento Medicina di Precisione, Napoli,
Radiodiagnostica ad indirizzo senologico, Policlinico Bari
Radiologia e Senologia presso P.O. San Paolo, Bari,
Radiology and Biomedical Imaging Department, University of California, San Francisco.

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- *Health Big Data*, funded by the Ministry of Health, involving the IRCCS Networks and the Politecnico di Milano, aimed at creating a technological platform that allows the collection, sharing and analysis of clinical and scientific data of patients.
- *Progetto di Rete 2018*, funded by the Ministry of Health in the context of Finalized Research 2018, co-financed by the Puglia Region, it involves in addition to the Istituto Superiore di Santità and 7 other national health institutes, aimed at experimenting with the integrated use of the HTA methodology with machine learning techniques for the development of automated systems to support doctors' decisions in defining personalized treatment paths.
- *Alleanza Contro Cancro (ACC)*, WG Radiomics
- *Ricerca Corrente 2016-2018, 2018-2021, 2022-2024*

Key pubblication:

- Bove, S., Comes, M. C., Lorusso, V., Cristofaro, C., Didonna, V., Gatta, G., ... & Massafra, R. (2022). An ultrasound-based radiomic approach to predict the nodal status in clinically negative breast cancer patients. *Scientific Reports*, 12(1), 1-10.
- Massafra, R., Comes, M. C., Bove, S., Didonna, V., Gatta, G., Giotta, F., ... & Paradiso, A. V. (2022). Robustness Evaluation of a Deep Learning Model on Sagittal and Axial Breast DCE-MRIs to Predict Pathological Complete Response to Neoadjuvant Chemotherapy. *Journal of personalized medicine*, 12(6), 953
- Massafra, R., Catino, A., Perrotti, P. M. S., Pizzutilo, P., Fanizzi, A., Montrone, M., & Galetta, D. (2022). Informative Power Evaluation of Clinical Parameters to Predict Initial Therapeutic Response in Patients with Advanced Pleural Mesothelioma: A Machine Learning Approach. *Journal of Clinical Medicine*, 11(6), 1659
- Comes, M. C., Fanizzi, A., Bove, S., Didonna, V., Diotaiuti, S., La Forgia, D., ... & Massafra, R. (2021). Early prediction of neoadjuvant chemotherapy response by exploiting a transfer learning approach on breast DCE-MRIs. *Scientific Reports*, 11(1), 1-12.
- Comes, M. C., La Forgia, D., Didonna, V., Fanizzi, A., Giotta, F., Latorre, A., ... & Massafra, R. (2021). Early prediction of breast cancer recurrence for patients treated with neoadjuvant chemotherapy: a transfer learning approach on DCE-MRIs. *Cancers*, 13(10), 2298.
- Massafra, R., Bove, S., Fanizzi, A., Lorusso, V., Biafora, A., Comes, M. C., Didonna, V., ... & La Forgia, D. (2021). Radiomic feature reduction approach to predict breast cancer by contrast-enhanced spectral mammography images. *Diagnostics*, 11(4), 684.
- Massafra, R., Latorre, A., Fanizzi, A., Bellotti, R., Didonna, V., Giotta, F., ... & Lorusso, V. (2021). A clinical decision support system for predicting invasive

breast cancer recurrence: preliminary results. *Frontiers in Oncology*, 11, 576007.

- Massafra, R., Bove, S., La Forgia, D., Comes, M. C., Didonna, V., Gatta, G., ... & Lorusso, V. (2022). An Invasive Disease Event-Free Survival Analysis to Investigate Ki67 Role with Respect to Breast Cancer Patients' Age: A Retrospective Cohort Study. *Cancers*, 14(9), 2215.
- Fanizzi, A., Pomarico, D., Paradiso, A., Bove, S., Diotaiuti, S., Didonna, V., ... & Massafra, R. (2021). Predicting of sentinel lymph node status in breast cancer patients with clinically negative nodes: A validation study. *Cancers*, 13(2), 352.
- Fanizzi, A., Basile, T., Losurdo, L., Bellotti, R., Bottigli, U., Dentamaro, R., ... & La Forgia, D. (2020). A machine learning approach on multiscale texture analysis for breast microcalcification diagnosis. *BMC bioinformatics*, 21(2), 1-11.