DIPARTIMENTO DI INGEGNERIA
CORSO DI DOTTORATO IN INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE -
PHD COURSE IN INDUSTRIAL AND INFORMATION ENGINEERING -
34TH CYCLE

Title of the research activity:	**Shape and textural analysis of three-dimensional imaging data through machine learning for biomedical and industrial applications.**
State of the Art:	Three-dimensional imaging techniques such as Computed Tomography (CT), Magnetic Resonance (MRI) and Positron Emission Tomography (PET) have become widespread in recent years. As a consequence, quantitative analysis of 3D-data generated by such devices is of much interest in a number of biomedical and industrial applications. Artificial intelligence techniques applied to imaging data from CT, MRI, PET have for instance shown the potential to improve the diagnostic process of a number of disorders (Buvat *et al*., 2015; Sala *et al*., 2017; Sollini *et al*.; 2017). Similar methods have been applied to quality control of a number of goods including mechanical parts, fruit, vegetables, etc. (Fuchs *et al*., 2011).
Short description and objectives of the research activity:	The overall objective of this research is to investigate suitable machine learning, shape and texture analysis methods to extract meaningful prognostic biomarkers from three-dimensional medical imaging data. Specific aims are: 1) to differentiate malignant vs. benign lesions, 2) to discriminate between primary vs. metastatic lesions and 3) to predict the overall survival, disease-free survival and/or response to treatment.
Bibliography:	- Buvat, I., Orlhac, F., Soussan, M. Tumor texture analysis in PET: Where do we stand? (2015) Journal of Nuclear Medicine, 56 (11), pp. 1642-1644. - Fuchs, T., Keßling, P., Firsching, M., Nachtrab, F., Scholz, G. Industrial applications of dual X-ray energy computed tomography (2X-CT), (2012) RILEM Bookseries, 6, pp. 97-103. - Sala, E., Mema, E., Himoto, Y., Veeraraghavan, H., Brenton, J.D., Snyder, A., Weigelt, B., Vargas, H.A. Unravelling tumour heterogeneity using next-generation imaging: radiomics, radiogenomics, and habitat imaging (2017) Clinical Radiology, 72 (1), pp. 3-10. - Sollini, M., Cozzi, L., Antunovic, L., Chiti, A., Kirienko, M. PET Radiomics in NSCLC: State of the art and a proposal for harmonization of methodology (2017) Scientific Reports, 7 (1), art. no. 358.
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