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inform

Interpretability of Deep Neural Networks for Radiomics

Inserm

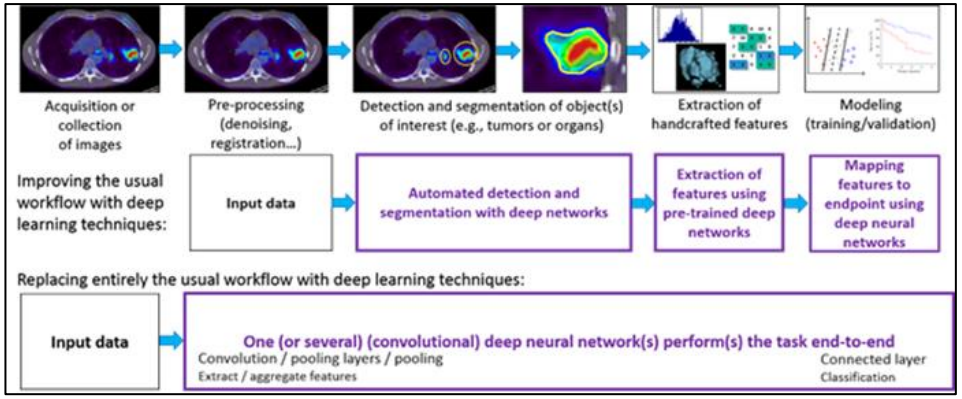
UNIVERSITY OF WARSAW

BIOEMTECH

Objectives

DNN-based models and algorithms have seen limited adaptation and development within the radiomics approach, which aims at improving diagnosis or prognosis through extraction of engineered image features (intensity, shape, textures) sometimes combined with other clinical expert-derived features. The ***INFORM*** consortium proposes to investigate explainable artificial intelligence (XAI) with a dual aim of:

- building high performance DNN-based classifiers and
- developing novel interpretability techniques for radiomics.



Hypothesis

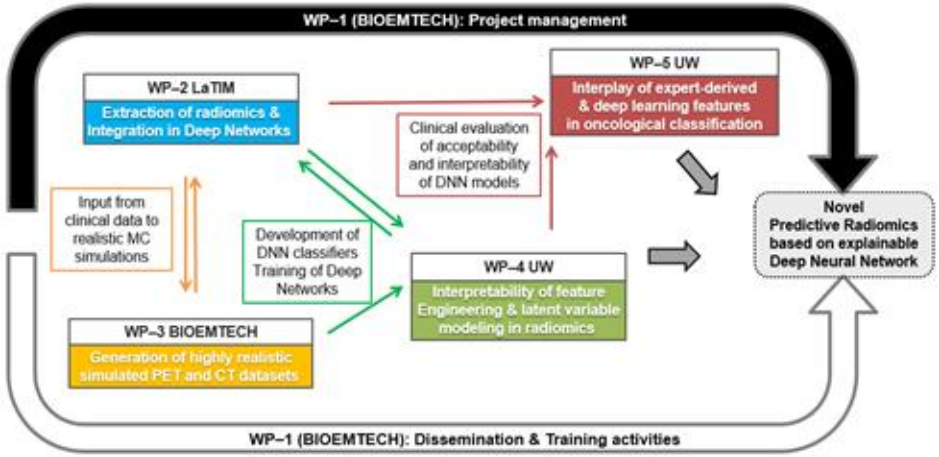
Deep neural networks (DNNs) have achieved outstanding performance and broad implementation in tasks such as classification, denoising, segmentation and image synthesis, including in medical imaging. However, DNN-based models and algorithms have seen limited adaptation and development within the **radiomics** approach.

We hypothesize that, despite the potential of DNNs to improve oncological classification performances in radiomics, a **lack of interpretability** of such models prevents their broad utilization, performance, and generalizability.

Methodology & Workflow

INFORM aims to address state-of-the-art challenges with:

- **Monte Carlo simulation** combined with generative adversarial networks (**GAN**) will be used for producing highly realistic simulated images to facilitate training DNNs.
- Innovative developments of **saliency maps** and related approaches tackle the interpretability of DNN-based modeling.
- Proposing to build explainable AI models that incorporate both **conventional radiomic and DNN-based features**.
- Preliminary evaluation with **clinical** collaborators on predicting outcome of patients with lung, cervical and rectal cancer.



Outcome

- ✓ The proposed DNN models will leverage the **robustness and trustworthiness** of expert-derived features that medical practitioners are familiar with, while providing **quantitative and visual feedback**.
- ✓ Our methodology will enhance the **adaptation of DNN-based models** in **medical imaging and clinical routine.**