

# Exploring texture analysis in oncological positron-emission-tomography

Project Management and Software Development  
for Medical Applications

## General Info

Project Title: Exploring texture analysis in oncological PET imaging

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## Project Abstract

In recent years, texture analysis gained a lot of attention in medical imaging. However, it appears that every modality (CT, MRI, PET) and every tumor entity revealed different candidates. Thus, this project aims to set up a test bed to let a medical user perform rapid tests.

## Background and Motivation

In contrast to the increasing availability of multimodal data (e.g. PET/CT and PET/MRI) as well as serial examinations of patients in various techniques, flexible visualization and evaluation applications are lacking in the clinical environment. As the omnipotent solution appears to be an illusion, we focused in the past on modular, compact application addressing particular questions. Now, as texture analysis indices are of growing interest for tumor characterization in PET imaging, such a tool would be very useful for this question.

Texture analysis parameters with respect to tumor aggressiveness could show advantages over more established parameters such as the SUV (standard uptake value) where only the metabolic activity of the tumor is assessed. PET tracers such as 18F-FDG or 68-Ga-PSMA currently play a major role in

cancer patient staging, management, and monitoring. Standardized uptake values (SUVs) are often reported to support diagnosis, assist prognosis, and serve as baseline values to later assess tumor response to therapy. The measurement of texture analysis indices from tumor images has also been recently proposed in order to predict tumor response to therapy. It is well known that tumors often show biologic heterogeneity and are constituted of areas with necrosis, fibrosis, and actively growing regions. Such biologic characteristics are relevant as they influence the specific therapy. Fortunately, we have access to large amounts of clinical data in the context of generic tumor imaging with FDG and prostate cancer imaging with PSMA with “ground truth” data gathered from invasive biopsies and/or sequential imaging using state-of-the-art hybrid imaging systems. However, the data exists only in a rather unstructured archive. Thus, efficient data import strategies play an important role.

## Student's Tasks Description

The sequential steps of this project are described below.

- Develop an understanding of the existing needs and available tools (ref. 1-2)
- Implement an easy to use region/volume of interest and texture analysis tool based on the existing literature (ref. 3-4)
- Provide documentation and initial user training

During this project, the student will gather a good understanding in PET imaging in general and nuclear cardiac imaging in particular to appreciate



the potential advantages and consequence of this imaging concepts. The student has the opportunity not only the work with the data but also experience the clinical workflow how these images are acquired and reconstructed.

### Technical Prerequisites

The implementation of the tool can be done with Matlab, Python or any similar environment. Computers running Windows or MacOSX will be provided. A private system can be used as well as the data is anonymized.

### References

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