

Postgraduate student: **George Tzanoukos**

Thesis Title:

A detectably study of Solitary Pulmonary Nodule in PET/CT images using simulation methods

Abstract:

The purpose of this thesis is the development of a method for the modeling of Solitary Pulmonary Nodule (SPN) in Computed Tomography (CT) and Positron Emission Tomography (PET) images.

The modeling of SPN was implemented by Monte Carlo simulation methods taking into consideration its morphological characteristics, internal features and Standardized Uptake Value (SUV) activity distribution. With this method, realistic images of various types of simulated SPNs were generated and embedded into raw data acquired from 5 different patients into CT and PET slices. The raw data were acquired using a clinical PET/CT scanner of the Nuclear Medicine Department of BRFAA, and for image reconstruction the software STIR was used. For the final validation of the model, an observer study from three independent medical experts was performed.

A total of 80 simulated SPNs were produced and in this quantity, the percentage of benignity and malignancy was 80% and 20% respectively. Furthermore, 20 real cases with SPN were selected, 14 of them were benign and 6 malignant. Among the 120 cases, 25 of them were repeated in order to check the consistency of the observers. The reviewers were asked to localize the SPN, then to characterize the lesion as simulated or real and finally to classify it as probably benign or probably malignant.

According to the results, more than 50% of the simulated lesions could not be differentiated from the real ones lesions and were designated as real. Regarding the classification of the nodules to probably benign or probably malignant, we noticed that the simulated class was consistent with the observers' classification. Finally, it's worth to be noted that, in 28 cases, all of the three observers designated the simulated lesion as real.

Examining Committee

Dr. George Spyrou, Staff Research Scientist (Professor Level), BRFAA – Advisor

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