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Whole-body FDG PET uptake decision support system for the identification of Metastatic Melanoma metastases

Analysis of Positron Emission Tomography (PET) with 18F-Fluorodeoxyglucose (FDG) medical images has proven to be an effective and efficient way for the diagnosis and therapy monitoring of patients with Metastatic Melanoma. The diagnosis and the assessment of Metastatic Melanoma requires the identification and quantification of tumor lesions. However, manual labeling of tumor lesions from 3D whole-body PET images is a labor intensive and time-consuming process that requires expert's knowledge. Manual and semi-automatic methods for the extraction of regions with high FDG uptake from PET leads to a large number of false positives which correspond to normal uptake. In this study, a clinical support system utilizing 3D radiomics analysis and Artificial Intelligence techniques is proposed in order to reduce the burden of tumor identification among the large number of suspicious regions of uptake from FDG-PET. Radiomics features extracted from FDG-PET undergo a selection step in which the most important for the identification of tumors are selected. The features with the most predictive power are then imported into a classification scheme based on Neural Networks that is capable of distinguishing normal uptake from metastases. This system can provide clinicians with a fast and accurate tool for the true tumorous regions identification from PET reducing both the required time and errors. The proposed framework supports the potential utilization of radiomics and machine learning in the quantification of Metastatic Melanoma from whole-body FDG PET achieving high performance with 76% sensitivity, 95% specificity, 70% F1-score and 92% AUC in the identification of tumors.

Keywords:
Metastatic Melanoma, Tumor identification system, Machine Learning, Artificial Intelligence, Classification.

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