

Lesion-Centric vs. Chest-Region AI Models for PET/CT Lung Cancer Detection with FPRN

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Abstract. Lung cancer needs to be caught early to save lives, but many AI models make mistakes by predicting cancer when there isn't any. We compared two types of AI models: one that zooms in on lung nodules (lesion-centric) and another that looks at the whole lung area (chest-region). We also added a false positive reduction network (FPRN) to fix these mistakes in PET/CT scans. Using datasets like LUNA16 and NLST, the lesion-centric model scored an AUC-ROC of 0.90, better than the chest-region model's 0.81. The FPRN cut false positives by 12.5% and improved tumor segmentation (Dice score: 0.93). We talk about how this can help doctors, the challenges we faced, and ideas for making it better, like using transformers and federated learning.

Keywords: Lung cancer detection, Lesion-centric model, Chest-region model, False positive reduction, PET/CT imaging

1 Introduction

Lung cancer kills over 1.3 million people every year, making it one of the deadliest cancers [1]. Finding it early can save lives, but it's hard for doctors to spot it in PET/CT scans. These scans show both the body's structure (CT) and activity (PET), but sometimes healthy areas look like cancer, leading to wrong predictions called false positives [2]. Recent studies show AI can help by analyzing PET/CT scans to predict cancer more accurately [8].

AI can help doctors by automatically finding tumors in these scans [3]. We looked at two AI models: *lesion-centric models*, which focus on small spots in the lung that might be cancer, and *chest-region models*, which look at the whole lung to get the big picture. Lesion-centric models are good at details but might miss the overall context, while chest-region models see more but can get confused by unrelated areas. Both can make mistakes by predicting cancer when there isn't any, which stresses patients and leads to extra tests.

In this study, we compared these two models to see which one is better for finding lung cancer. We also added a *false positive reduction network (FPRN)* to lower those mistakes, building on recent methods that use PET/CT for better