

Explainable DeiT Model for Lung Cancer Classification from CT Images

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ABSTRACT

Lung cancer is the most frequently diagnosed cancer worldwide and remains the leading cause of cancer-related deaths, accounting for millions of fatalities each year. Advances in imaging technologies, particularly Computed Tomography (CT), have facilitated the early identification of lung abnormalities. However, the interpretation of these images remains challenging, often requiring expert radiological assessment and being susceptible to inter-observer variability. In this study, we proposed an explainable Data-Efficient Image Transformers (DeiT) model for the automatic classification of lung cancer from CT images. The model is capable of categorizing images into three distinct classes: Non-Small Cell Lung Cancer (NSCLC), Small Cell Lung Cancer (SCLC), and Normal. To enhance the interpretability of the model's predictions, we integrated the Gradient-weighted Class Activation Mapping (Grad-CAM) algorithm, which provides visual explanations by highlighting the regions of CT scans that contribute most to the classification decisions. The model was trained and evaluated on a dataset of 900 CT images, achieving 94.44% accuracy on the test set. The Grad-CAM visualizations revealed that the model consistently focused on clinically relevant regions, aligning with expert annotations and demonstrating the model's potential for aiding radiologists in diagnostic processes.

Keywords: diagnosis, deep learning, explainable AI, Grad-CAM, transformers