RadioWrite: Rapid Radiology Imaging Evaluation and Assessment Using Deep Learning and Natural Language Processing Methods

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Radiology is the field of medicine concerned with the interpretation of imaging of the human body for disease diagnosis. Most major forms of medical imaging scans occur within one hour or less, but interpretation of these scans can take upwards of 3 days. Thus, the diagnostic process for many diseases is extended, leading to prolonged periods of inflammation, buildup of complications, and increased severity of disease. Turnaround times are further delayed due to repeated verification steps from human intervention. RadioWrite proposes a generalizable deep learning and natural language processing approach to diagnose various diseases from radiology scans based on past radiographic studies as well as localization of conditions for suggested targeted therapy within the human body for implementation in clinical settings. Using chest x-rays as a case study, various multilingual public deidentified datasets of radiographic studies were used for extracting pulmonary and cardiac conditions determined through previous literature from radiology reports based on negation rules and UMLS terminology. Extraction was validated on a human-labeled subset of data. Extracted medical concepts were subsequently correlated to chest x-ray images. Images and diseases from multiple datasets were used to train/test multiple machine learning models to be compared on evaluation metrics including accuracy and F1 Score. Weights from the models were transformed to produce class activation maps for localization of diseases. Top-performing models were isolated and a QR-code-based mobile application was developed for rapid diagnosis and localization of radiographic imaging for use by physicians and radiologists in a clinical setting.

Awards Won: