AIM-AI: An AI-Based Natural Language Processing Approach To Reducing Fatal Risks of Medical Imaging in Patients Through Automated Imaging Order Selection

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Medical imaging holds profound value in disease diagnosis for millions worldwide. However, studies show that physician imaging orders may frequently be inappropriate (26% of cases) for the corresponding patient evaluation. Measures are necessary to mitigate patient risks in the subsequent re-imaging necessitated by physician error, including radiation exposure, additional sedation (pediatrics), and delayed treatment. To address these dangers, AIM-AI presents an unprecedented platform for automated medical imaging order selection using natural language processing and machine learning (ML). The algorithm was trained with anonymized imaging records and associated provider-input symptoms for 40,667 patients from Texas Children's Hospital, obtained after institutional review board approval. First, the data was preprocessed using tokenization and lemmatization to extract keywords. Second, an entity-embedding ML model converted the symptoms to high-dimensional numerical vectors suitable for model comprehension, which we used to balance the dataset through k-nearest-neighbor-based synthetic sampling. Third, a Support Vector Classifier (ML model) was trained and hyper-parameter tuned using the embedded symptoms to predict modality (CT/MRI), contrast (with/without), and anatomical region (head, neck, etc.) for an imaging order with 93.2% accuracy on 4,704 test cases. Finally, a web application was developed to package the model, which analyzes user-input symptoms and outputs the predicted order. The implementation of this application would save the lives of millions of patients facing potentially fatal risks associated with medical imaging by reducing costs, expediting treatment, and maximizing patient health. In this way, AIM-AI paves the path to a revolutionized medical field.

Awards Won:
Third Award of $1,000