Using Deep Learning and Natural Language Processing to Detect and Optimize 911 Stroke Cases

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Stroke, the fifth leading cause of death and a major cause of disability in the US, is a time-critical emergency handled by EMS agencies—20% of which manage 80% of service calls (Krohmer & Elkins, 2020). Rising numbers of incoming 911 calls and outdated Computer-Aided Dispatch (CAD) systems further hinder response efficiency. This study aims to reduce stroke-related mortality and rehabilitation costs from 911 CAD delays by enabling faster, more accurate stroke predictions using deep learning techniques and mel-spectrogram analysis to analyze human speech during 911 calls. This study designed and developed the Python mel-spectrogram-based audio machine learning model using TensorFlow and YAMNet transfer learning and achieved 53% accuracy in categorizing calls into fire, police, stroke, or non-stroke departments, surpassing current human operator stroke prediction accuracy in the US (37%), with limited training data. Aside from the audio classifier, an NLP program records and provides 911 call reports for first responders, prompting relevant questions to the operator based on transcribed keywords. Ongoing efforts of this study aim to enhance stroke recognition accuracy in EMS calls using additional stroke-related EMS call datasets received from a leading medical school. Integrating this system into current 911 CAD could help operators and dispatchers. The developed system reduces response times through offering quick and accurate recognition of stroke cases, saving countless lives and patient care costs.

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