NeuroNet: Enabling the Early Detection and Severity Ranking of Time-Sensitive 911 Stroke Cases via a Novel Audio and Text-Based Analysis of 911 Calls

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Stroke, the 2nd leading cause of death(>7M) and 3rd leading cause of disability (94M) worldwide, is a time-critical emergency. Rapid, accurate stroke detection and severity assessment during 911 calls is critical for effective triage and early treatment to prevent death and disability. Yet, current emergency-response systems achieve only 37% detection accuracy due to regional training disparities, constrained budgets, and technological limitations, while high turnover, understaffing, and rising call volumes further reduce response efficiency. Thus, my project NeuroNet presents the first computational framework to detect and estimate the severity of stroke at the initial 911 call, using deep learning, NLP, and novel mel-spectrogram analysis of live call audio. NeuroNet's audio classifier, trained on 911 call recordings, achieved 95.74% accuracy in stroke detection, with an AUC of 0.90 for both stroke and nonstroke classes. NeuroNet stroke prediction is 4 times faster than transcription-only-based framework attempts that have been deemed impractical due to background noise interference. Then, the NLP neural regression component, trained on MIMIC-III/IV database NIH Stroke Scale (NIHSS)-annotated clinical narratives, analyzes call-log transcripts produced from noise-filtered audio of suspected stroke cases to predict NIHSS severity scores. Ultimately, NeuroNet offers emergency-call operators around the world the first mel-spectrogram-based digital biomarker candidate with supporting severity scores to enable rapid, accurate triage and earlier clinical intervention, surpassing the accuracy of all other stroke classification methods, serving as a scalable, affordable, and comprehensive solution that can help prevent millions of deaths and long-term disability from stroke.

Awards Won: