SoundDrive: A Machine Learning Application for Hearing-Impaired Drivers

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Driving is a task that is heavily reliant on auditory signals for communication and crash avoidance. Around 430 million people around the world suffer from disabling hearing loss, preventing them from being able to identify important auditory signals. Most hearing-impaired drivers must, therefore, rely on visual cues to compensate for their hearing impairment. But under chaotic road conditions, harsh weather, or low light conditions, this approach may not be feasible, inspiring the development of SoundDrive. SoundDrive is a cost-efficient, easily accessible application that accurately and efficiently identifies important auditory signals and their movement relative to the user. To do this, the application utilizes two custom-trained convolutional neural networks (CNNs). The sound classification CNN was trained on over 4,500 audio files and identifies important auditory signals for driving. The movement identification CNN was trained on over 200 audio files and identifies distinct shifts in siren amplitude to identify whether a siren is approaching or moving away from the user. The output of these models is displayed in real-time using an easy-to-read graphical user interface, allowing the user to quickly identify the classification while staying focused on the road. The sound classification and movement classification models demonstrated an average accuracy of 94% and 84%, respectively, across all types of validation and testing, demonstrating the high accuracy of the application. SoundDrive can be realistically uploaded to the app store and become available worldwide, providing thousands of hearing-impaired drivers with a tool that can allow them to drive more safely and independently.

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