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Paper Title: Machine Learning-Enhanced Acoustic Reflectometry for Early Detection of Middle Ear Infections

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Abstract

Middle ear infections are a prevalent health issue affecting individuals across all age groups. Timely and accurate detection is crucial for effective treatment and preventing complications. This study introduces an innovative smartphone-based machine learning system for detecting middle ear infections. The system combines an acoustic analysis module, using acoustic reflectometry theory, with a custom smartphone application. By connecting an earphone device to the smartphone, chirping noises are emitted and received in the ear, and the embedded microphone captures and analyzes the reflected sound waves using a machine learning algorithm. The system accurately categorizes the results into "no water," "monitor," and "water," identifying middle ear fluid, an important indicator of infection. Early detection of fluid buildup can lead to timely intervention, potentially preventing infections. Extensive testing was conducted on various subjects to validate the system's accuracy against a commercial device. The research represents a significant advancement, providing a non-invasive, accessible, and cost-effective solution for detecting middle ear infections in both home and clinical settings, promoting self-monitoring of ear health and reducing associated complications
