RespiraScan: Using Breathing Patterns as a Biomarker to Diagnose Restrictive Lung Disorders

Kochhar, Jayveer (School: Dhirubhai Ambani International School)

Respiratory issues like Interstitial Lung Diseases (ILDs), Occupational and Environmental Lung Diseases are difficult to identify because their symptoms closely resemble other musculoskeletal and pulmonary disorders. The older methods of diagnosis mainly spirometry, x-ray, and CT scans are costly, expose patients to radiation, and have limited availability in countryside regions. A portable, non-invasive, and novel device called RespiraScan is presented in this study. The device analyzes chest movement and evaluates with machine learning to identify restrictive lung disease. The device utilizes Inertial Measurement Unit (IMU) sensors that capture chest expansion in three dimensions. The data is then Kalman filtered to reduce noise and sensor drift, processed, and classified through Long Short Term Memory (LSTM) networks to detect diseases. Along with this, an additional audio input is taken and processed using hamming windowing functions and fast fourier transforms and serves as an additional input for the model. It is shown that the model achieves 90% disease classification accuracy after preprocessing and filtering. This indicates the system's ability to provide reliable real-time respiratory assessment. The study highlights the potential of machine learning-driven diagnostic tools in enhancing early detection and management of respiratory disorders.

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