**OBSTRUCTIVE SLEEP APNEA DETECTION USING AUDIO SIGNAL**

**Objective:**

The primary aim of this study is to develop a straightforward method to detect Obstructive Sleep Apnea (OSA) by analyzing snoring sounds. By leveraging machine learning and signal processing techniques, we aim to identify OSA events based on patterns in the extracted features.

Our specific goals are as follows:

1. **Feature Extraction**:

* Extracting Mel Frequency Cepstral Coefficients (MFCC), delta MFCC, Zero Crossing Rate (ZCR), and statistical features (mean, variance) from snoring signals recorded during polysomnography (PSG) sessions.

1. **Feature Analysis**:

* Analyzing the extracted features to understand their distribution and significance in distinguishing between normal breathing and OSA events.

1. **OSA Event Detection**:

* Develop and train machine learning models using the extracted features to automatically detect OSA events in snoring signals.

**Introduction:**

Obstructive Sleep Apnea (OSA) is a common sleep disorder where breathing repeatedly stops and starts during sleep due to blocked airways. Diagnosing OSA usually requires an overnight sleep study in a lab, which is basically the laboratory-based polysomnography testing.

**Procedure:**

**Data Collection**

* **PSG Dataset**: Snoring sounds are taken from a polysomnography (PSG) dataset. Each sound clip is 60 seconds long and represents different sleep stages and conditions.

**Feature Extraction**

* **MFCC and Delta MFCC**: These features capture important characteristics of the snoring sounds.
* **Zero Crossing Rate (ZCR)**: This feature measures how often the sound signal changes from positive to negative, indicating sudden changes in airflow.
* **Statistical Features**: Mean and variance provide additional information about the overall sound signal.

**Analysis and Detection**

* **Feature Analysis**: Comparing the features for normal breathing and OSA events to find distinguishing patterns.
* **Machine Learning Models**: Train different machine learning models using Supervised Learning Algorithms (like Neural Networks) to classify sound segments as either normal breathing or OSA events.

**Evaluation**

* **Performance Metrics**: Evaluate the models using accuracy, precision.

**Visualization**

* **Signal and Feature Visualization**: Creating graphs of the snoring sounds, MFCC, delta MFCC, and ZCR to visually compare normal breathing and OSA events.

**Conclusion**

* Presenting the models performance and analysis and Summarizing the main results and their importance for detecting OSA.