**Machine Learning Approach to Study the Impact of Obesity on Autonomic Nervous System using Heart Rate Variability Features**

Obese people have high chances of cardiovascular disease (CVD), which is supposed to be due to the alteration in autonomic nervous system (ANS) activity. The changes in ANS activity can be identified using heart rate variability (HRV). HRV is a non-invasive tool to measure the ANS activity using linear and non-linear HRV features. The paper presents an aim to understand the effect of obesity on ANS using HRV parameters. Initially, sixteen control and sixteen obese subjects of both the gender between ages 20 to 50 were involved in the study after that synthetic minority oversampling technique (SMOTE) was used to increase the sample size of control and obese subjects from sixteen to fortyeight. The statistically significant difference between two groups was observed using the Independent t test. The statistical results of the study indicate the sympathovagal imbalance due to reduced parasympathetic activity. The statistical results were validated by incorporating the machine learning technique into the study. Machine Learning (ML) algorithm helps to identify the most important predictor that can clearly differentiate control and obese subjects. The statistical and ML algorithm result shows changes in the sympathovagal balance due to decreased parasympathetic activity.

**EXISTING SYSTEM:**

One of the leading disorder that enhance mortality in an obese person. The definition of obesity says an excessive fat accumulation in the body that resulted in chronic diseases like hypertension, CVD, myocardial infarction (MI), and diabetes. Many researchers have found a strong correlation between obesity and CVD [1]. The study has suggested that an imbalance of autonomic activity increases CVD chances in obesity. The ANS is a control mechanism of the body that generally maintains homeostasis in the body. ANS regulates the glands, blood vessels, and internal organs. The ANS is divided into two branches sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The SNS mobilizes the body systems to provide energy for the fight or flight response, whereas PNS conserve the energy by regulating the rest and digest response.

**DISADVANTAGES OF EXISTING SYSTEM:**

* the important predictor that can differentiate the control and obese group was not identified using a statistical test
* frequency domain, and non-linear HRV parameters are significantly reduced but do not give an important predictor.

**Algorithm**: svm,linear regression(lr).

**PROPOSED SYSTEM:**

This study was performed solely for research purposes at the institute level with the permission of Dean Research and Development of College of Engineering Pune following all ethical guidelines. The researcher and subjects have made a voluntary agreement. The study involves the electrocardiogram(ECG) acquisition of sixteen normotensive obese individuals and sixteen control subjects between 20 to 50 years of age of both genders who participated in the study. However, sixteen sample size of control and obese are not sufficient to analyse the statistical results. Thus we have synthetically increased the sample size of control and obese subjects using the Synthetic Minority Oversampling Technique(SMOTE)[4]. It is powerful and most widely used technique. It creates random set of samples to balance minority class. New synthetic data samples are generated between randomly chosen minority class sample and its nearest neighbors samples. The details about the implementation of SMOTE technique.

**]ADVANTAGES OF PROPOSED SYSTEM:**

* we observed accuracy of 93.10%, the sensitivity of 93.33%, the specificity of 92.86%, precision of 93.33%, F1 score of 0.93 with an AUC of 0.92.
* The ML algorithms are used to find the most important predictor that separates obese subjects from the control

**Algorithm**: ECG Recording and HRV Analysis Classification and Regression Tree(CART) and Gradient Boosting Decision Tree(GBDT).

**SYSTEM REQUIREMENTS:**

**HARDWARE REQUIREMENTS:**

* System : Intel Core i3.
* Hard Disk : 1TB.
* Monitor : 15’’ LED
* Input Devices : Keyboard, Mouse
* Ram : 8GB.

**SOFTWARE REQUIREMENTS:**

* Operating system : Windows 10.
* Coding Language : Python
* Tool : PyCharm, Visual Studio Code
* Database : SQLite

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