

BLOOD PRESSURE PREDICTION FROM PHOTOPLETHYSMOGRAM SIGNAL USING ARTIFICIAL INTELLIGENCE

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ABSTRACT

Blood pressure measurement in current medical practice relies on manual methods with the most widely used modality being sphygmomanometers. Utilizing the principle of Photoplethysmography, it is possible to provide an accurate reading of one's blood pressure through light signals and photodetector devices. This research paper introduces a new Artificial Intelligence driven approach to predict Blood pressure levels and classify them according to the updated ACC criteria as Normal, Elevated, Stage I, and II Hypertension from the given PPG signal values using Machine Learning Models. This research paper aims to accurately read the Systolic and Diastolic Blood Pressure using Artificial Intelligence, place them into the correct value bins and further prove that the blood pressure values differ based on different skin tones in different light wavelengths such as red, infrared, and green. Machine Learning models such as the Support Vector Machine have shown an accuracy of 70.58% for Systolic Blood Pressure and Decision Tree with an accuracy of 74.4% for Diastolic Blood Pressure classification. This research study has future applications and extensions to predict blood pressure levels for patients with different skin tones under different light radiations and PPG signal readings. Neural Network models will be developed to compare the blood predictions from this work.

Keywords: Artificial Intelligence, Machine Learning, Blood Pressure, Hypertension, Photoplethysmography (PPG) Signal, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Time Series data.

INTRODUCTION

According to the World Health Organization (WHO), cardiovascular disease is the main chronic disease that causes around 32% of deaths worldwide [1] with hypertension being the highest medical risk factor as it currently affects 1.28 billion people [2]. According to the updated ACC guidelines in 2017 [24], Blood pressure categories are now classified as normal (<120/80 mm Hg), elevated (120-129/<80 mm Hg), stage 1 (130-139/80-89 mm Hg), stage 2 (>140/90 mm Hg) and finally, Hypertensive crisis (>180/>120 mm Hg). This new classification eliminates the class of pre-hypertensives. The aim to diagnose high blood pressure early, effectively, and easily would prevent many further deteriorating health complications.

Photoplethysmography (PPG), in recent years has emerged as a clinical staple and is often a part of daily practice. It was first described by Alrick Hertzman in 1937 [6], who used a combination of two ancient Greek words 'platysmas' which means increase, and 'graph' meaning write [7]. It is a low-cost, non-invasive technology that uses optical sensing mechanisms to evaluate data regarding cardiovascular