CUFF-LESS ARTERIAL BLOOD PRESSURE ESTIMATION USING MACHINE LEARNING TECHNIQUES

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DECLARATION

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ABSTRACT

High Blood pressure is considered as one of the main factors that affect human health. In addition, it leads to many other complications, risks and other cardiovascular diseases in the human body. Arterial Blood Pressure changes very frequently. Variability of Arterial Blood Pressure over a certain period is related to the cardiovascular risk. Therefore, continuous measurements of blood pressure is a significant input for diagnosis and treatments. There is an immense motivation towards building a cuff-less blood pressure monitoring system which can determine the Systolic Blood Pressure and Diastolic Blood Pressure with minimal settings. With the removal of cuff, the system could be used for continuous measuring. Photoplethysmography is one of the low-cost optical methods that could be used in measuring arterial blood pressure continuously and noninvasively. Features of several different categories can be extracted from PPG signals including width-based features, frequency domain features and features extracted from the second derivative of the signal (Accelerated PPG). Existing methods primarily use one category of features or another. A method to extract a combination of characteristics from multiple categories of PPG signal is proposed under this research. Furthermore, it is been evaluated using a benchmark dataset (MIMIC II) collected in a clinical setting as well as a dataset collected using a consumer-grade device in a nonclinical setting. From the results of the method that is tested, 53 features achieved Mean Absolute Errors of 4.8 mmHg & 2.5 mmHg for Systolic Blood Pressure value and Diastolic Blood Pressure value respectively while reaching grade A for both the estimates under the standard British Hypertension Society for the MIMIC II dataset. The same methodology applied to the second dataset showed good agreement (MAE 4.1, 1.7 mmHg for SBP and DBP respectively) with readings taken using a standard oscillometric device, which suggests the robustness of the approach.

Keywords : Arterial blood pressure, Photoplethysmography, Ocillometry

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LIST OF ABBREVIATIONS

Abbreviation	Description
ABP	Arterial blood pressure
BP	Blood pressure
MAP	Mean arterial blood pressure
PWV	Pulse Wave Velocity
SBP	Systolic blood pressure
PTT	Pulse transit Time
DBP	Diastolic blood pressure
PPG	Photoplethysmography
LED	Light emitting diode
ICU	Intensive care unit
APG	Accelerated PPG
SD	Standard deviation
MAE	Mean Absolute Error
BHS	British Hypertension
ECG	Electrocardiogram