BLOOD PRESSURE PREDICTION SYSTEM BASED ARTIFICIAL INTELLIGENCE

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ABSTRACT

This paper is to implement the algorithm that estimates systolic and diastolic blood pressure through artificial intelligence learning by measuring optical blood flow signals. When the heart contracts, the blood that flows in through the pulmonary artery is supplied through the aorta to the peripheral blood vessels of organs and tissues that make up our body. Photo plethysmograph is obtained by measuring the amount of light absorbed according to the amount of blood supplied from the heart to ventricular contraction. It is a waveform that expresses the change in blood volume as a photoelectric signal and appears in proportion to the blood flow. PPG shows a close relationship with the activity of the heart. In proportion to the amount of oxygen in the blood, a photoelectric signal of red light according to the change in blood flow is detected. Based on the relationship between cardiac activity and PPG, blood pressure information can be obtained. The entire system consists of a PPG measurement module, signal processing, and artificial intelligence algorithm.

KEYWORDS

Blood Pressure, Artificial Intelligence, Photoplethysmograph, Prediction System, Continuous Monitoring

1. INTRODUCTION

In order to measure the PPG signal, it is measured through a sensor dedicated to photoplethysmography (Chandrasekhar, et al, 2020). Fluctuations in blood pressure are composed of the amount of blood flowing through the blood vessels and resistance components that impede the flow. The PPG signal shows similar changes in blood pressure, and shows periodic changes by repeating systole and diastole of blood vessels (Chandrasekhar, et al, 2020; Seung-Il Cho, et al., 2018). Figure 1 shows an example of PPG signal measurement.

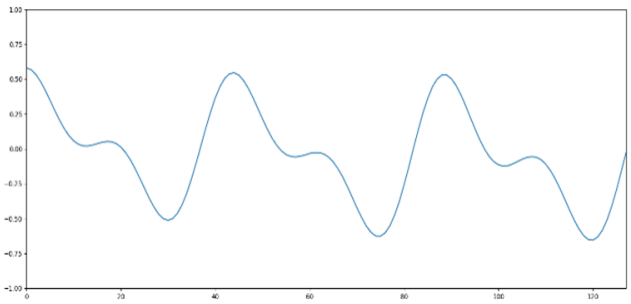

Figure. 1. PPG signal measurement example

The proposed method analyzes the correlation between PPG signals and blood pressure using deep learning artificial intelligence technology instead of statistical and mathematical methods, and predicts blood pressure by identifying meaningful patterns. In order to obtain a stable PPG signal, the signal from which breathing and motion artifacts are removed is used as an artificial intelligence learning and verification signal. In each frame, the average value within a certain level range was obtained, and frames showing rapid changes over a certain range were excluded from learning and recognition. This is because the statistical characteristics within the frame are not stable due to the DC component in the PPG.

2. ARTIFICIAL INTELLIGENCE MODELING

In this study, we develop an algorithm that estimates blood pressure using the PPG signal, which is closely related to the movement of the heart, and has systolic and diastolic blood pressure information, and weight and height signals. The anatomical structure of the heart and the contraction and relaxation activities of the heart appear in the PPG signal through blood flow and blood vessels. The PPG signal was directly used as an input variable in the artificial intelligence model, and weight and height, which are closely related to blood pressure, were added to the input variables. By configuring the system with the proposed method, the subject's height, weight, and PPG signals related to blood pressure were measured, and blood pressure was predicted in real time by learning using artificial intelligence. The artificial intelligence model consists of one input layer and one output layer, and three hidden layers.

3. CONCLUSION

The entire system allows you to check the most recently measured SpO2 average, the average diastolic and systolic blood pressure predicted by artificial intelligence, and the corresponding health status through the web. The accuracy of the proposed method is shown in Figure 2, and it showed 82% accuracy at convergence of 0.8254. It can be seen that the error rate of the data used for testing is slightly higher than that of the training data.

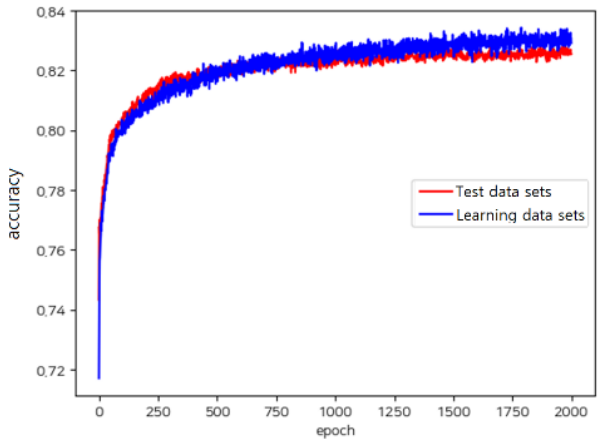

Figure 2. Accuracy comparison graph between test sets and learning sets

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