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Long Short-Term Memory (LSTM) Neural Networks for Cuffless Blood Pressure Monitoring with Imaging Photoplethysmography

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Introduction. The search for non-invasive continuous blood pressure monitoring has become a cornerstone of medical diagnosis due to the growing prevalence of hypertension worldwide[1]. Traditional cuff-based methods, although reliable, are unsuitable for continuous monitoring and can cause discomfort[2]. Recent advances in imaging photoplethysmography (iPPG) offer a promising alternative to unobtrusively measure changes in blood volume in the microvascular tissue bed. However, the complex nature of the PPG signal and its sensitivity to various physiological and environmental factors require sophisticated analytical methods to accurately assess blood pressure[3]. We explore the integration of long-term short-term memory (LSTM) neural networks with PPG signals to solve this problem, drawing on both domestic and international experience in this field.

The main part. The proposed solution uses the exceptional ability of LSTM to process sequential data, which makes it particularly suitable for time series analysis inherent in PPG signals. Using LSTM networks, we can effectively capture the temporal dependencies and subtle nuances within the PPG data, which are indicative of systolic and diastolic blood pressure fluctuations. Our approach eliminates the need for extensive feature development typically required by traditional machine learning algorithms, offering a more optimized and potentially more reliable method for estimating blood pressure. The adaptability of the latest model to different physiological profiles suggests its applicability to different demographic groups of patients, providing personalized monitoring. The results indicate that with additional improvements the LSTM can offer a reliable, cuffless BP monitoring solution, paving the way for real-time, patient-friendly cardiovascular health tracking.

Conclusions. This research demonstrates the practical applicability of LSTM neural networks in processing iPPG signals for continuous blood pressure monitoring. The proposed method holds potential for integration into wearable health devices, offering continuous monitoring capabilities without the constraints of traditional cuff-based systems.

List of sources used:

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