Pengembangan Sistem Pengukuran Detak Jantung Menggunakan Teknik Remote Photoplethysmography dan Pengolahan Sinyal Berbasis Video Wajah = Development of a Heart Rate Measurement System Using Remote Photoplethysmography Techniques and Signal Processing Based on Facial Video

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Abstrak

Penerapan teknik remote Photoplethysmography (rPPG) dalam proses underwriting asuransi menawarkan pendekatan inovatif untuk penilaian risiko kesehatan calon nasabah. rPPG adalah metode non-invasif yang memungkinkan pengukuran parameter fisiologis, seperti detak jantung. Metode ini memanfaatkan kemampuan kamera video pada perangkat seluler untuk merekam perubahan warna kulit yang terkait dengan variasi volume pembuluh darah selama siklus detak jantung secara real-time. Pada tahap pengolahan sinyal, algoritma Plame Orthogonal to Skin digunakan untuk menganalisis sinyal rPPG dari rekaman video, memastikan akurasi dan konsistensi hasil pengukuran detak jantung. Penelitian ini mengeksplorasi berbagai parameter eksperimen seperti durasi video yang digunakan, jarak antara kamera dengan subjek saat merekam video, serta proses partisi video menjadi 5 bagian untuk kemudian detak jantung ditentukan oleh partisi mana yang berpengaruh. Hasil terbaik diperoleh ketika jarak yang digunakan antara subjek dengan kamera adalah 30 cm, durasi video yang digunakan adalah 30 detik dan perhitungan detak jantung berdasarkan rata-rata perhitungan 3 partisi dari 5 partisi yang dihilangkan nilai tertinggi dan terendah dengan Mean Absolute Error (MAE) sebesar 5,765 bpm, Root Mean Squared Error (RMSE) sebesar 8 bpm, dan Mean Absolute Percentage Error (MAPE) sebesar 8%. Hasil penelitian diharapkan dapat memberikan kontribusi pada pengembangan metode underwriting yang lebih akurat dan efisien dalam industri asuransi.
.....The application of remote Photoplethysmography (rPPG) technique in the insurance underwriting process offers an innovative approach for assessing the health risks of prospective policyholders. rPPG is a non-invasive method that allows for the measurement of physiological parameters such as heart rate. This method leverages the capability of video cameras on mobile devices to record skin color changes associated with variations in blood vessel volume during the cardiac cycle in real-time. During the signal processing stage, the Plane Orthogonal to Skin algorithm is used to analyze the rPPG signal from the video recordings, ensuring the accuracy and consistency of heart rate measurements. This study explores various experimental parameters, such as the duration of the video used, the distance between the camera and the subject during recording, and the process of partitioning the video into five segments to determine which segments influence the heart rate measurement. The best results were obtained when the distance between the subject and the camera was 30 cm, the video duration was 30 seconds, and the heart rate calculation was based on the average of three partitions out of five, excluding the highest and lowest values, yielding a Mean Absolute Error (MAE) of 5.765 bpm, a Root Mean Squared Error (RMSE) of 8 bpm, and a Mean Absolute Percentage Error (MAPE) of 8%. The results of this research are expected to contribute to the development of more accurate and efficient underwriting methods in the insurance industry.