P14 - Real-time Biosignal Processing and Feature Extraction from Photoplethysmography Signals for Cardiovascular Disease Monitoring

14. Medicinteknisk utbildning / Biomedical engineering education

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Abstract text*: Photoplethysmography (PPG) signals offer a non-invasive and cost-effective means for monitoring cardiovascular health. However, extracting clinically relevant information from these signals in real-time poses significant challenges. This paper presents a novel biosignal processing unit that utilizes the PPGFeat MATLAB toolbox to perform real-time signal processing and feature extraction from PPG signals, enabling continuous cardiovascular disease (CVD) monitoring and analysis. We propose a system that interfaces with PPG sensors to acquire raw signals in real-time. The PPGFeat toolbox provides an interactive user interface, it identifies high-quality signals based on their signal quality indices (SQIs) and performs segmentationThe segmented PPG signals are then preprocessed by PPGFeat to remove noise and artifacts, smooth the waveforms, and correct baseline drift using a Chebyshev type II 4th order, 20 dB filter with a frequency range of 0.4–8 Hz. After preprocessing, a novel algorithm within PPGFeat is employed to accurately extract key fiducial points from the filtered PPG signals and their first and second derivatives. These include systolic peaks, diastolic peaks, onsets, and dicrotic notches, as well as inflection points, maxima, and minima on the derivative waveforms. Utilizing these extracted points, PPGFeat computes a comprehensive set of features, including pulse transit time, augmentation index, stiffness index, various magnitudes, and time intervals. These features characterize the PPG signal's morphology, timing intervals, and other relevant characteristics. These features are continuously streamed as output, providing a real-time stream of biomarkers and indicators for CVD analysis and monitoring. The resulting biomarkers and features can be fed into machine learning models or rule-based systems for real-time CVD identification, risk stratification, and monitoring applications. By utilizing PPGFeat's robust algorithms and proven accuracy, the proposed biosignal processing unit enables efficient real-time extraction of clinically relevant information from PPG signals, paving the way for improved cardiovascular health monitoring and personalized healthcare solutions.