# Generalizable PPG Signal Quality Assessment Using Correlation-Derived Morphological Features

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**Aims:** Photoplethysmographic (PPG) signal quality assessment (SQA) remains a major challenge in wearable monitoring because motion artifacts, low perfusion, and poor sensor coupling can severely distort waveform morphology. In previous works, we showed that feature-optimized machine learning can accurately classify PPG signal quality. Here, we extend that research by evaluating whether a compact set of correlation-based morphological descriptors can support robust binary PPG signal quality classification across heterogeneous datasets, with improved interpretability and stronger evidence of generalization.

**Methods:** PPG signals were segmented into fixed-length windows and analyzed using an adaptive peak-and-valley detection framework. For each segment, beat-centered windows were extracted and compared using sliding Pearson correlation to quantify waveform self-consistency. The resulting correlation profiles were then compared to form a matrix, from which low-dimensional descriptors were extracted, capturing the consistency and variability of PPG morphology. The model was developed on a subset of the MIMIC-III-Ext-PPG dataset (1,962 segments from 100 subjects) and evaluated on three external wearable datasets from the Segade benchmark collection: PPG-DaLiA, WESAD, and TROIKA, comprising 21,921 segments from 42 subjects in total.

**Results:** The proposed framework achieved consistent classification performance across datasets. Using nested subject-wise cross-validation on MIMIC-III-Ext-PPG, the model reached an accuracy of 87.0%. When evaluated on the external datasets, accuracies of 88.3%, 89.8%, and 82.9% were obtained for PPG-DaLiA, WESAD, and TROIKA, respectively. Although performance decreased in free-living wearable recordings, as expected, the method remained stable across heterogeneous acquisition conditions and noise profiles. **Conclusions:** The proposed method provides a lightweight and interpretable solution for binary PPG signal quality assessment, relying on a low-dimensional representation of morphological self-consistency. Its robustness across clinical and wearable datasets supports its applicability as a practical quality-control stage in real-world PPG monitoring.