Monitoring Patient Deterioration Using Unsupervised Kernel-based Online Anomaly Detection

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Abstract

This paper proposes a novel approach for automated patient monitoring and emergency signaling, utilizing an unsupervised adaptation of the Kernel-based Online Anomaly Detection (KOAD) algorithm. To eliminate the need for supervision, we employ agglomerative hierarchical clustering to set threshold values. A modular patient deterioration monitoring system is implemented, which can be easily integrated with conventional biomedical sensors in hospitals. We evaluate our system on a data set comprising both real patient data and synthetic data. The system achieved a low false alarm rate and successfully detected a high percentage of critical events in real-time. The proposed algorithm demonstrated high performance across various metrics, including high accuracy, recall, precision, specificity, and favorable areas under the receiver operating characteristic and recall–precision curves. The results demonstrate a significant improvement over conventional methods, particularly in terms of efficiency, accuracy, and scalability. By building user trust, the system reduces alarm fatigue.

Keywords
Clinical decision support system, kernel method, anomaly detection, unsupervised learning, agglomerative hierarchical clustering.