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ICU Outcome Prediction Using Real-Time Signals with Wavelet Transform-Based CNN

RESEARCH BACKGROUND

ICU (intensive care unit)

- **Intensive monitoring**
- Life support of airway, breathing, circulatio
- **Resuscitation services**
- **ICU outcome predictions**
- alleviate the economic and healthcare burdens by critical care needs [1].
- **Electronic-ICU**[2]
- captures the status of patients' vital functions using bedside monitors
- the great number and diversity of dispersion of the vital sign data makes it difficult to detect its dynamic patterns.

RESEARCH QUESTION

- How can we design a new ICU mortality prediction model that uses real-time information, requires no expertise from intensivists, and is more accurate?
- How can we effectively extract accurate and interpretable features from ICU bedside monitoring data that is readily accessible?

LIMITATION OF EXISTING WORK

Existing Models	Limitation
Severity Scoring Systems	The models are based on traditional regress presuming the linear relationship between predictors and the response variable.
Machine Learning with handcraft features	The features extracted from the time series signs are elementary. Only simple statistics of vital signs are inclu these classification models. The model accuracy is relatively low.
Deep Learning	The structure lacks specific adjustments ac to the research question.

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PROPOSED MODEL We design a wavelet transform-based convolutional neural network (WTCNN) with a specific structure dealing with time-series data to address the research problem as shown in Figure 1. Padding=(0,1) DWT/C Heartrate Respiration Sao2

Figure 1. Structure of WTCNN

DATA DESCRIPTION

The data is the top 5 most frequent admission diagnoses from eICU **Collaborative Research Database, as summarized in the table below.**

Disease	HF	CVA	MI	SP	SR
#patient	4,840	5,284	5,919	6,823	4,284
Expire rate	5.42%	4.98%	3.16%	12.18%	6.38%
Length of stay rate for different classification	>3 days: 32.40% >5 days: 15.81% >7 days: 9.18% >10 days: 4.28%	>3 days: 23.35% >5 days: 11.28% >7 days: 6.75% >10 days: 3.91%	>3 days: 15.72% >5 days: 6.62% >7 days: 3.45% >10 days: 1.649%	>3 days: 41.56% >5 days: 24.88% >7 days: 16.38% >10 days: 9.38%	>3 days: 30.36% >5 days: 13.85% >7 days: 7.28% >10 days: 3.36%







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