Sepsis Prediction by Segmentation of Multivariate Time Series using Convolutional Neural Network

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We propose temporal segmentation of multivariate time-series data using convolutional neural network for early prediction of sepsis. The input to the model is the time-series of 36 variables (vital signs, laboratory values, age and gender) and the target is the binary segmentation map (where 0 and 1 indicate the non-sepsis and the sepsis time points respectively). The model uses only convolutional layers, batch normalization and activation layers and this ensures that temporal length of the input and the output is same. Also, this gives our model a distinct advantage of segmenting time-series of varying length without padding. This property of the network makes it ideal for real time setup where prospective data is unavailable, unlike the challenge data where we have the advantage of analyzing complete records. In our preliminary experiment, we work with the initially released dataset comprising of 5000 records (279 sepsis and 4721 non-sepsis). The training and validation set was split in the ratio of 3:1 with proportionate number of positive cases in both sets. The multivariate time-series is NaN filled, interpolated and normalized and used as input to the network while the output is sepsis probability at each time point. The network consists of 3 convolutional layers each with a kernel size of 3 and filter size of 72. The network has a total of 24,265 trainable parameters and the 'mean square error' is used as loss function while training. We obtain a normalized utility of 0.34 and 0.23 on training and validation set respectively.

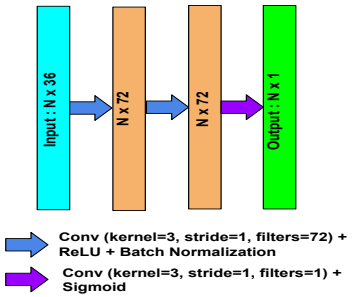

Figure 1. CNN for Sepsis Segmentation