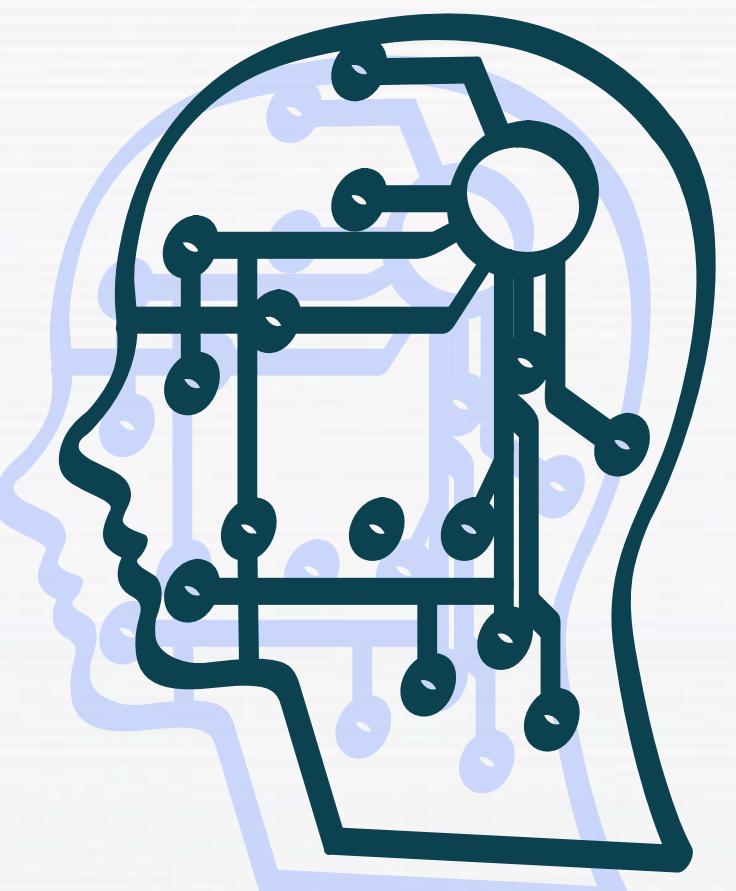


EEG-based Emotion Classification using Deep Belief Networks

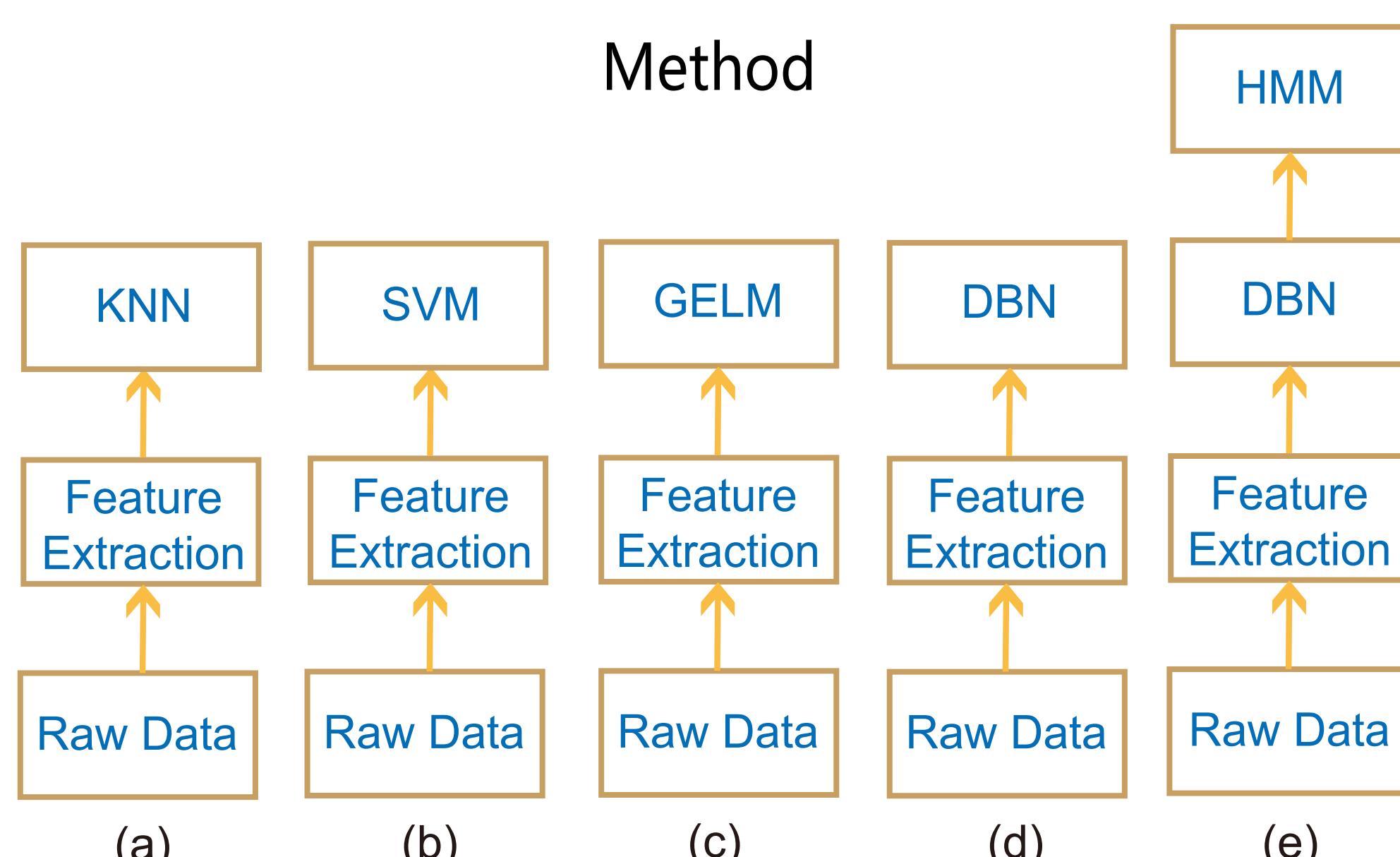
Wei-Long Zheng, Jia-Yi Zhu, Yong Peng, and Bao-Liang Lu

IEEE International Conference on Multimedia & Expo (ICME), 2014



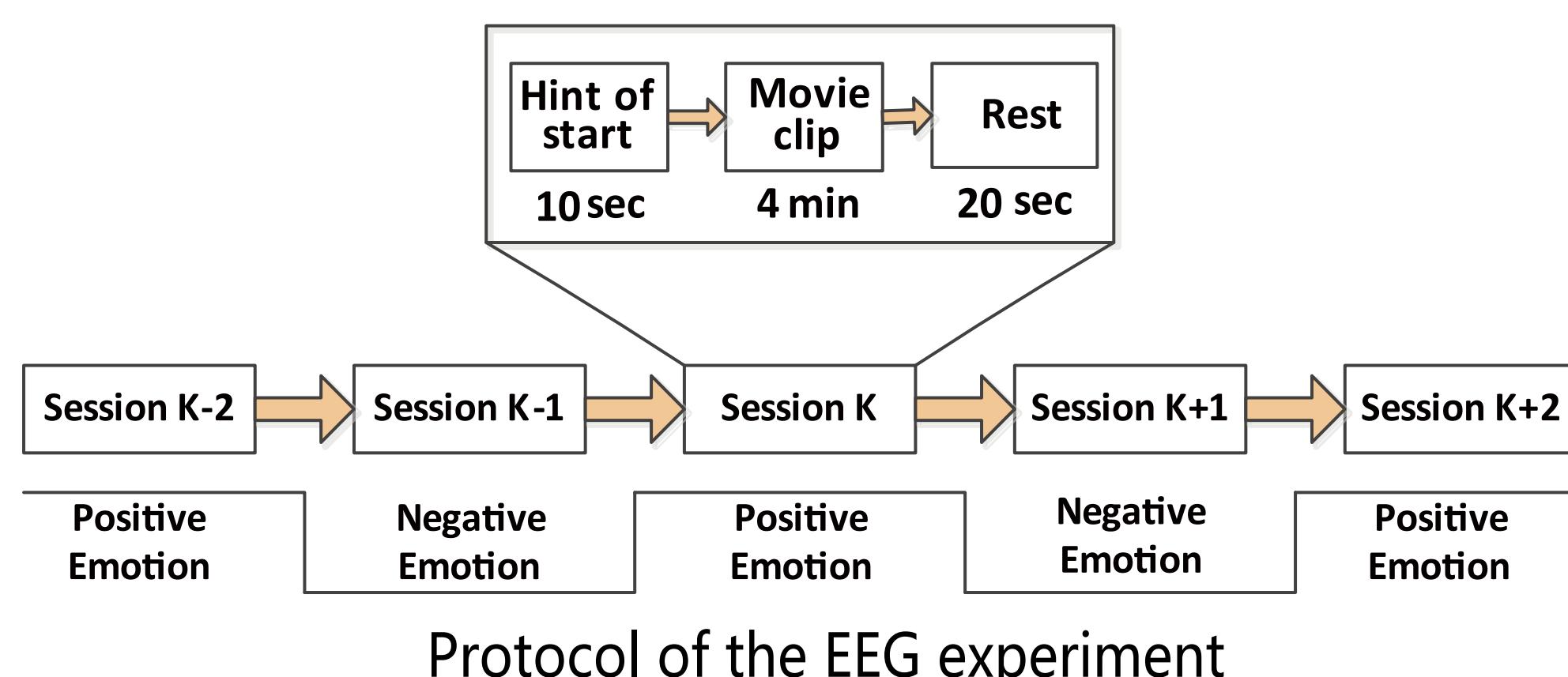
Introduction

Among the approaches to emotion recognition, methods based on electroencephalogram (EEG) signals are more reliable because of its high accuracy and objective evaluation compared to other external appearance such as facial expression and gesture. However due to the low signal to noise ratio (SNR), it is often very hard to analyze EEG signals ‘by hand’ even for neurophysiologists. Recent developing deep learning in machine learning community allows automated feature extraction and feature selection and eliminates the limitation of hand-crafted feature.



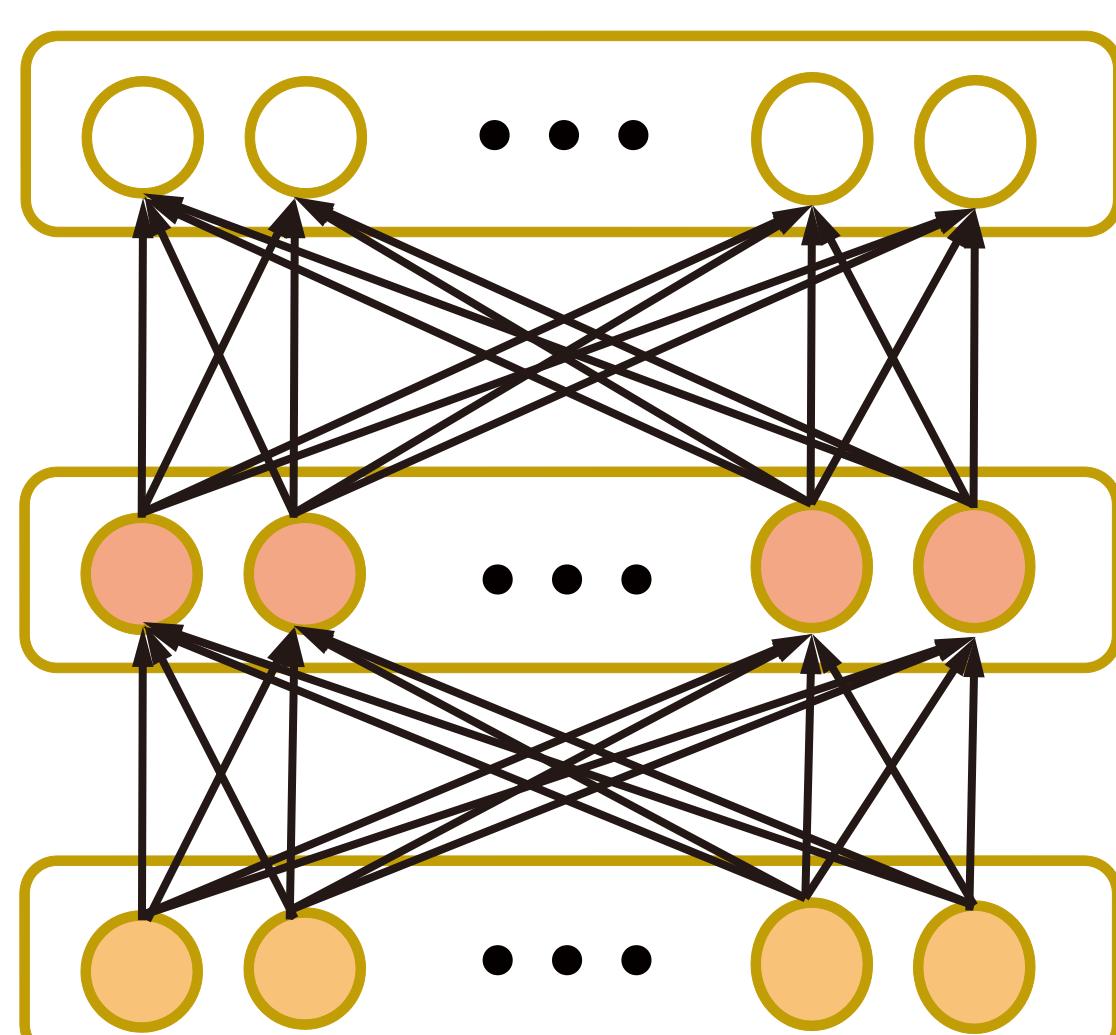
Overview of the five setups for EEG-based emotion classification used in this work

Deep Belief Networks (DBN) is a probabilistic generative model with deep architecture, which characterizes the input data distribution using hidden variables. A DBN is constructed by stacking a predefined number of restricted Boltzmann machines (RBMs) on top of each other where the output from a lower-level RBM is the input to a higher-level RBM.



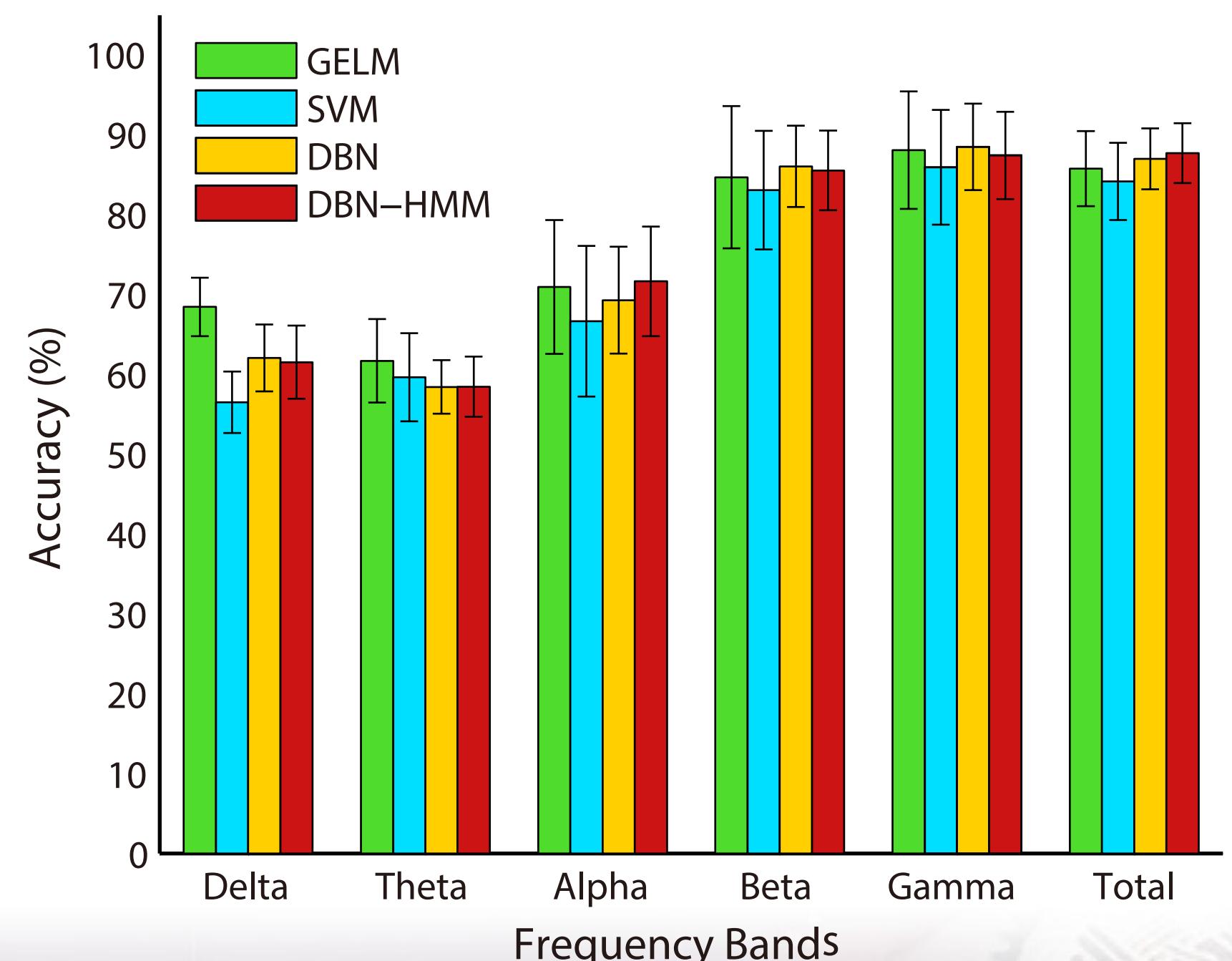
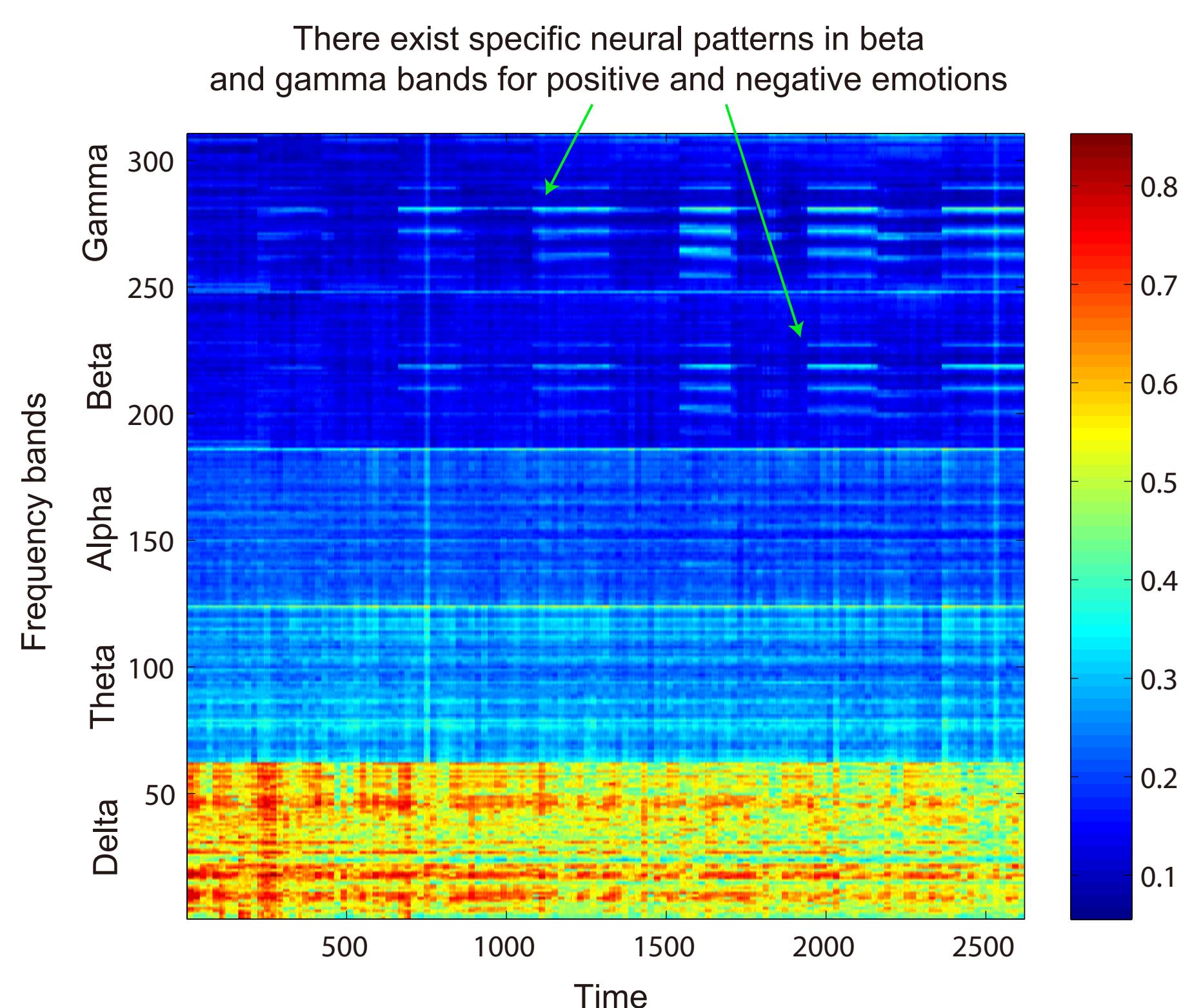
Conclusion

In this paper, we introduce recent advanced deep learning models to EEG-based emotion classification. The main contributions of this paper are as follows: First, we find that neural signatures associated with positive and negative emotions in beta and



The graphical depiction of DBN

gamma frequency bands do exist. Second, we show that differential entropy (DE) features extracted from EEG data possess accurate and stable information for emotion classification. Finally, the paper compares the results between deep models and shallow models like KNN, SVM and GELM. Moreover, DBN-HMM performs well when compared with the state-of-the-art classification methods.



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