Facial AU-aid hypomimia diagnosis based on GNN

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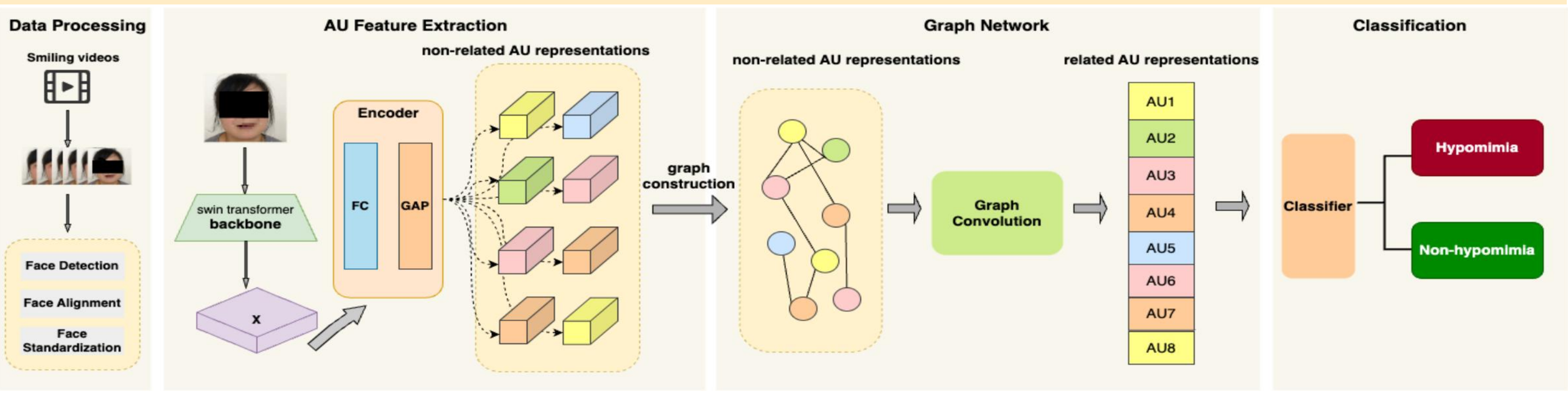
Introduction

Parkinson's disease is a common neurological disease, the prevalence of Parkinson's disease in the population over 65 years old is about 1.7%. Facial hypomimia is one of the manifestations of motor symptoms, the patient's facial expression ability is impaired, and the delay of facial movement leads to the reduction of facial movement. The MDS Unified-Parkinson Disease Rating Scale(MDS-UPDRS) is an authoritative scale used to assess PD in the clinic. With the development of facial recognition, Action Unit(AU), a technique to represent and quantify facial status, has been widely used and can effectively reflect facial movement. In this paper we propose a video-based hypomimia recognition framework that utilizes AU that combing facial area information and uses GNN to measure the relation between facial AU areas. Our method can extract comprehensive AU information and outperform traditional machine learning methods in the experiment.

Method



We applied a AU intensity prediction method[2] in our method. As detailed below, Figure depicts the pipeline of the proposed method. First, Smiling videos are converted into aligned frames after dataprocessing. Next, 8 AU representations are extracted by Swin Transformer[1] . After graph construction and convolution, we can get related AU representations. At last, classifier determines hypomimia by related AU representations.

Experiment

Table 1: Results on validation and test sets.

Model	Accuracy	PPV	TPR	F1 score
RF	0.845	0.848	0.827	0.837
SVM	0.887	0.88	0.887	0.883
Our method	**0.917**	**0.928**	**0.906**	**0.917**

Our method outperformed the traditional machine learning classifiers in terms of accuracy, PPV, TPR, and F1 score, indicating that the graph representation of facial expressions can better capture the relationship between facial areas and improve the diagnosis of hypomimia with PD.

Conclusion

In this work, we propose a deep learning method to encode facial action unit information to recognize hypomimia with PD based on GNN. We demonstrate that using GNN to extract AUs can better represent facial features and their relationships, leading to improve accuracy of hypomimia identification. Through short videos, it can help ordinary users to get more convenient diagnosis. For future work, integrating the characteristics of the disease into the graph construction can increase the medical interpretability of the model, and increase the reliability of Parkinson's disease recognition.

References

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