Area of interest:

Predicting expressive facial motor deficits in movement disorders and depression using deep learning

Research Question:

Topic: Can we use online pictures and videos to detect early symptoms of facial motor disorders in patients?

Literature review:

Paper 1

Title: An Early Prediction of Parkinson's Disease Using Facial Emotional Recognition (Ansuri, et al., 2021)

Summary:

In this research, Convolutional Neural Network (CNN) architecture with 16-layered visual geometry group (Vgg16) was compared to CNN with Alex Net. It was proved that Vgg16 was 10% more accurate than Alex Net in detecting the reduction in facial emotional expression in patients with Parkinson's Disease (PD). Vgg16 achieved accuracy of 96.5%, sensitivity of 93%, specificity of 96%, F1 score of 97.7%, and area under the curve of 95.3%, while Alex Net had accuracy of 83.2%, sensitivity of 84.1%, specificity of 82%, F1 score of 86%, and area under the curve of 85.2%. The reduction in facial emotional expression is a manifestation of PD that

develops at the first stage of PD. CNN Vgg16 architecture can be used as a non-invasive and reliable method for early PD detection.

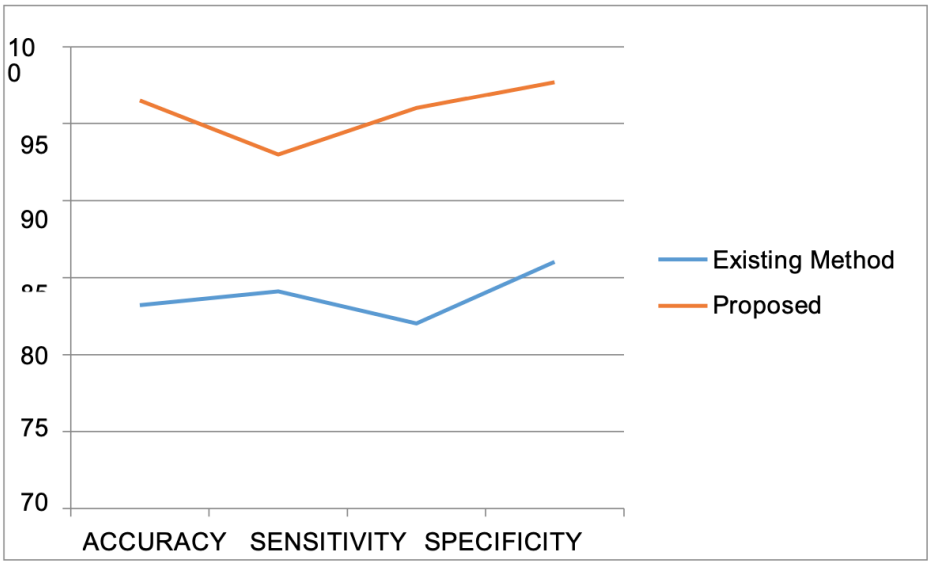

Fig 7: Comparison of the result

Paper 2 (Astrid)

Title: Facial Expression Processing Is Not Affected by Parkinson's Disease, but by Age-Related Factors (Derya et al., 2019).

Summary:

Derya and more (2019) have found that age-related factors might also affect the evaluation of facial expressions. The study shows that the younger group assesses negative facial expressions as more natural, persuasive, sincere, and empathic. In contrast, older participants tend to perceive negative expressions as more positive, but also as less natural, persuasive, and empathic. However, Derya and more (2019) also point out that the results of this study might be impacted

by a possible own-age bias, which is an optimized response to stimuli derived from peers of the same age.

Paper 3:

https://www.pnas.org/doi/10.1073/pnas.1807862115

Title: Distinct facial expressions represent pain and pleasure across cultures (Chen et al. 2018)

This paper aims to investigate whether extreme positive and negative emotional states have a communication purpose in facial expressions.For modeling the dynamic facial expressions of pain and orgasm in 40 observers from each of the two cultures, a complementary strategy of machine learning, information-theoretic analysis, and human perceptual judgement tasks was applied (Western, East Asian).The findings acquired raise doubts about their non-diagnostic nature and instead imply that they can be used for communication. They show that the mental representations of facial expressions of pain and orgasm are distinct.

Paper 4:

Title: A survey on computer-assisted Parkinson's Disease diagnosis (Pereira et al., 2019)

The analysis revealed that most works employ signal-based data, which is frequently collected via sensors. Additionally, researchers have seen a rise in the number of projects using e-health monitoring and virtual reality to improve the quality of life for PD patients. Although there are

many various methods used in the literature, practically all of them rely on a machine learning process to help with the automated PD diagnosis. This survey's major objective is to examine computer-assisted diagnosis and its potential utility in addressing the issue of PD detection.

Reference:

Ansuri, U., Dhatchayani G., Princely Angelinal Y., Kamalraj S. (2021). An Early Prediction of Parkinson's Disease Using Facial Emotional Recognition. *Journal of Physics: Conference Series,* 1937.

Chen, C., Crivelli, C., Garrod, O. G., Schyns, P. G., Fernández-Dols, J.-M., & Jack, R. E. (2018). Distinct facial expressions represent pain and pleasure across cultures. *Proceedings of the National Academy of Sciences*, *115*(43). https://doi.org/10.1073/pnas.1807862115

Derya, D., Kang, J., Kwon, D. Y., & Wallraven, C. (2019). Facial Expression Processing Is Not Affected by Parkinson's Disease, but by Age-Related Factors. *Frontiers in psychology*, *10*, 2458. https://doi.org/10.3389/fpsyg.2019.02458

Pereira, C. R., Pereira, D. R., Weber, S. A. T., Hook, C., de Albuquerque, V. H. C., & Papa, J. P. (2019). A survey on computer-assisted Parkinson's Disease diagnosis. *Artificial Intelligence in Medicine*, *95*, 48–63.