CO3519 Assignment – Facial Emotion Recognition and Classification using Machine Learning

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## ***Introduction***

Theory of Mind Artificial Intelligence (AI) encompasses the enablement of AI systems to understand human emotions. A Theory of Mind AI would have the capability to interpret human needs, emotions and behaviours and respond appropriately.

Whether current AI technologies such as Large Language Models (LLMs) have achieved Theory of Mind is contested, however a potentially powerful application of current AI is for Facial Expression Recognition (FER).

The detection of emotions is typically based on the analysis of facial landmark positions such as nose, eyebrows, mouth etc. and changes to those positions can be analysed. These can then be classified to various emotions (European Data Protection Supervisor, 2021).

FER is deemed to be important since much communication is non-verbal, with some studies suggesting up to 60-80%. FER has numerous applications from areas such as education, neuroscience and psychology, to autopilot and more (Huang et al., 2023).

This paper will explore the implementation of a Machine Leaning (ML) algorithm to recognise and classify basic facial emotions, demonstrating the power of AI in this area.

## ***State Of The Literature***

RECONGITION – LBP vs HOG

Local Binary Patterns (LBP) are a method of feature extraction which can be applied to facial expression recognition. Faces are processed to extract texture patterns by thresholding a 3x3 neighbourhood of each pixel with the centre pixel value and considering the result as a binary number. A histogram is then formed from these labels that can represent the unique textures of a face. The histogram can then be used to train a machine learning model recognize various faces within the images. (Ghorbani, Targhi and Dehshibi, 2015)

Histogram of Oriented Gradients (HOG) is another method of feature extraction that works with histograms, however the process for feature extraction is slightly different. Occurrences are counted of edge orientations in a localized image neighbourhood. These neighbourhoods represent facial contours and textures that can be used to distinguish emotions. **MORE TO BE ADDED**

https://ieeexplore.ieee.org/document/7381860

Support Vector Machines (SVM)

Decision Trees/Random Forest

**Much literature uses deep learning, however traditional machine learning is still sufficient for this scope.**

**Be clear on the specific use case for this**

**ENSURE FACIAL RECOGNITION 2D ONLY**

## ***Datasets***

## ***Model Evaluation***

## ***Demonstration***

## ***Conclusion***

## ***References***

European Data Protection Supervisor (2021). *Facial Emotion Recognition*. [online] Available at: <https://www.edps.europa.eu/system/files/2021-05/21-05-26_techdispatch-facial-emotion-recognition_ref_en.pdf>.

Ghorbani, M., Targhi, A.T. and Dehshibi, M.M. (2015). HOG and LBP: Towards a robust face recognition system. *2015 Tenth International Conference on Digital Information Management (ICDIM)*. doi:https://doi.org/10.1109/icdim.2015.7381860.

Huang, Z.-Y., Chiang, C.-C., Chen, J.-H., Chen, Y.-C., Chung, H.-L., Cai, Y.-P. and Hsu, H.-C. (2023). A study on computer vision for facial emotion recognition. *Nature : Scientific Reports*, 13(1). doi:https://doi.org/10.1038/s41598-023-35446-4.