

Master AI Graduation Project 1

- **Title of the Project: Sentiment analysis through image processing using artificial intelligence**
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- **Background and motivation**

Facial emotion analysis has been and still is one of the sciences of psychology, sociology and neuroscience through which customer and patient behavior and even gaming experiences are studied. Artificial intelligence has been introduced to help speed up the analysis and classification of emotions better in these different areas such as customer reactions in the job market, in emotional care to determine the patient's condition, in improving gaming experiences to get better results.

- **Problem statement**

Despite the progress of AI science specialized in analyzing facial emotions, there are many limitations that hinder responses and reliability, including Facial contrast , The presence of diverse data , Real-time processing limitations and Ethical concerns

- **Research objectives**

Enhance and enable classifications for analyzing facial expressions through the skills acquired from the Master's program to develop my own skills and gain sufficient knowledge for the field of work.

Literature Review

Paper 1 :Efficient Facial Emotion Recognition Using An Optimized Deep:

Facial expressions are a fundamental component of nonverbal communication and formed the basis of early studies in emotion recognition, as Ekman and Friesen (1978) argued. Mehrabian (2017) pointed out that current methods struggle to cope with varying environmental conditions, including lighting and posture, making them less effective in practical applications. Advances in deep learning, particularly convolutional neural networks (CNNs), have improved the performance of facial expressions, as Sajjad et al. (2023) noted. These challenges include high computational costs and the need for large-scale training data (Hi et al. 2021). This study aims to address these issues by integrating optimization techniques inspired by feature selection and quantum mechanics to improve model efficiency.

Paper 2:EmoCNN Unleashing human emotions with customized CNN using different optimizers:

According to Smith et al. (2019), traditional machine learning methods such as KNN and SVM achieved emotion recognition accuracy of up to 84%. However, Gautam (2020) demonstrated that deep learning models, especially CNNs, significantly outperform traditional techniques based on spatial features. EmoCNN (2024) demonstrated that using the Adam optimizer improved classification accuracy to 89%. However, others, such as Johnson (2023), point out that real-time emotion detection remains a challenging task due to computational limitations. This study aims to enhance the efficiency of CNN architectures by leveraging transfer learning to improve generalization.

Paper 3: Emotion categorization from facial expressions A review of datasets

Shihon et al. (2025) highlight that deep learning, such as CNN, achieves high accuracy in recognizing facial emotions, but is sensitive to subtle changes in the image, and this sensitivity reduces its reliability.

Zhang et al. (2023) argue that datasets such as AffecNet and RAF-DB improve generalization, but exhibit some biases that affect real-world performance.

Hong et al. (2024) point out that models such as ResNet-50 and VGG-16 focus on the pixel-level features rather than the actual emotional context, making them vulnerable to adversarial attacks.

To address these challenges, this study explores a hybrid approach of combining deep learning with facial action coding (FACO) systems to improve robustness and accuracy in real-world applications.

Paper 4: Sentiment Analysis from Images using VGG19 based Transfer Learning Approach

According to Mina et al. (2022), using transfer learning with the VGG-19 model significantly improved image sentiment analysis, achieving up to 99% accuracy on the CK+ dataset. Hua et al. (2019) argue that real-time sentiment detection remains a challenging challenge due to computational and dataset limitations, especially when using models like ResNet101. This study aims to address and find solutions to this problem by improving and developing the VGG-19 architecture and tuning hyperparameters to improve classification performance and reduce model complexity.

Paper 5: Sentiment analysis on images using different transfer learning

According to Hua et al. (2019), deep learning models used for CNNs have significantly improved the accuracy of facial expression recognition, providing stability. However, Bogda et al. (2022) argue that traditional feature extraction techniques, such as Gabor filters with genetic algorithms, can further improve classification performance, achieving accuracies exceeding 90% on the CK+ dataset. Falah et al. (2021) showed that fine-tuning deep learning models such as Alexnet-DCNN can achieve high recognition accuracy exceeding 92% on CK+. Hong et al. (2019) assert that dataset-dependent variation significantly impacts performance, as some models trained on a regular dataset tend to outperform on a more diverse dataset. This study aims to address these challenges by conducting a comparative analysis of transfer learning (TL) models across multiple datasets, optimizing their hyperparameters, and disaggregating their effectiveness on real-time emotion classification tasks.

Related Work

Several studies have found that sentiment analysis during image processing using artificial intelligence (AI) in (Meena et al 2022- Askari et al 2024) relies on Gabor filters, binary patterns (LBP), and histograms of directed gradients (HOGs) as traditional methods in deep learning and transfer learning, along with classic classification methods such as support vector machines (SVMs). While these methods offer robustness in low-data scenarios, they struggle to handle real-world variations. Convolutional neural networks (CNNs) have become dominant due to their ability to automatically learn high-level features. Recent studies have presented hybrid models that combine deep learning with classification accuracy enhancement techniques. Our study is based on facial sentiment analysis using AI, focusing on key facial regions, which improve interpretability. I am attempting to refine models that achieve an accuracy increase of up to 15%.

References

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