

# Facial Expression Recognition using Histogram of Oriented Gradients with SVM-RFE Selected Features

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**Abstract.** This study is an attempt towards improving the accuracy and execution time of a facial expression recognition (FER) system. The algorithmic pipeline consists of a face detector block, followed by a facial alignment and registration, feature extraction, feature selection, and classification blocks. The proposed method utilizes histograms of oriented gradients (HOG) descriptor to extract features from expressive facial images. Support vector machine recursive feature elimination (SVM-RFE), a powerful feature selection algorithm is applied to select the most discriminant features from high-dimensional feature space. Finally, the selected features were fed to a support vector machine (SVM) classifier to determine the underlying emotions from expressive facial images. Performance of the proposed approach is validated on three publicly available FER databases namely CK+, JAFFE, and RFD using different performance metrics like recognition accuracy, precision, recall, and F1-Score. The experimental results demonstrated the effectiveness of the proposed approach in terms of both recognition accuracy and execution time.

**Keywords:** Facial expression recognition (FER), Histogram of oriented gradients (HOG), Feature selection, Support vector machine (SVM) classifier.

## 1 Introduction

Psychological study has revealed facial expression as one of the most powerful ways through which humans communicate their emotions, cognitive states, intentions, and opinions to each other [1]. It is a well-known fact that facial expression contain non-verbal communication cues, which helps to identify the intended meaning of the spoken words in face-to-face communication. Therefore, there is a huge demand of an efficient and robust facial expression recognition (FER) system for a real-world human computer interaction (HCI) system. An automated FER technology equipped with robots can talk to children and take care of elderly people. This technology can also be used in hospitals to monitor patients, which will in turn save precious time and money. Additionally, FER technology can be applied in a car to identify the fatigue level of the drives which will avoid accidents and save lives.

Recognition of facial expression of a person either using a static image or sequence of images coming from a video stream is a well-studied problem since last decades.

