

# A Real-Time Hand Sign Language Recognition System for Threatening Situations Using Deep Learning

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**Abstract**—Hand sign language has been done as physical movements in natural languages that humans have used since ancient times, along with letters, words, and spoken language. This paper presents a real-time method to identify threatening signs by criminals during interrogation, which increases their criminal rank and helps to reach conclusions. The proposed method is to install a camera of appropriate quality in front of the offender, record hand gestures in a specific area of the hand, apply some image processing techniques, such as contrast enhancement techniques, to the image to facilitate recognition as input, and then classify the images using a convolutional neural network (CNN) for a specific problem with high specifications for that topic by and using AlexNet. The accuracy of the presented method is more than 94.2% in real-time testing.

**Keywords**—Hand Gesture, Deep Learning, CNN, CE Techniques, Real-time

## I. INTRODUCTION

Real-time hand sign language recognition using deep learning is an active area of research that aims to develop systems that can recognize hand gestures and translate them into text or speech in real-time. This can be useful in a variety of applications, including threat detection in public spaces, assistive technology for the deaf and hard of hearing, and human-computer interaction. These systems typically use deep neural networks to process images of hand gestures and make predictions about what they represent. In the last ten years, several techniques for hand gesture recognition have been suggested in different ways, and different results have been obtained [1, 2]. There are various architectures that can be used for the deep learning model, such as CNN, RNN, LSTM, etc. The model is trained on a large dataset of hand gestures and then fine-tuned to the specific gestures that are relevant to the application. The system also needs to be robust to variations in lighting, background, and hand pose [3]. If the investigators try to recognize sign language in body language communication, they must learn and train themselves. This is why their team can successfully identify the criminal or

dangerous person and recognize the intent to commit a crime during the conversation [4].

There is no globally accepted sign language. Every country has its own sign language, but the signs of threatening language are the same in most countries [5]. While rarely enforced by prosecutors, the laws allow verbal threats using hand gestures to be considered violent, which proves that sin does not have to be purely physical. Fear and threats often have much worse effects on people. These threatening gestures can be used as evidence against criminals. Sign language is a language in which individuals can communicate with each other without saying a single word. For this reason, we believe that this paper will benefit this area by exposing criminals more easily [6]. Currently, machine learning algorithms are widely used to recognize and convert conversations into text, identify targets in an image, match news topics, detect rare diseases such as breast cancer, and many other areas [7]. Deep learning is a method for learning representations that allows computational models composed of multiple layers of processing to learn data representations at multiple levels of concept [8]. This method significantly increases efficiency in conversation recognition, visual object recognition, object detection, and so on. One of the deep learning methods often used in various fields for image recognition is deep convolutional neural networks [9-12]. Any study done to recognize hand gestures begins with identifying a method of CNN techniques, then capturing gestures will come to be processed in real-time. The captured gestures will be collected through a USB camera connected to a computer, and then the images will be subjected to some image processing techniques to remove the noise and filtering to improve the image. The last step is comparing them with pre-stored and trained gestures to verify the sign of the gestures [13].