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IMPLEMENTATION OF TEMPLATE MATCHING ALGORITHM FOR HAND GESTURE RECOGNITION

POOJA S. KORDE*, SNEHA U. BOHRA

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Abstract

Humans can quickly identify body and sign language, thanks to a combination of eyesight and synaptic connections. Some challenges must be overcome before this talent can be replicated in computers, such as how to segregate items of interest in photographs and which image capture technology and classification approach are most suited, among others. Normal people do not comprehend deaf people's signs because they do not know what they signify. The solution presented here addresses this problem. This technology collects various hand gestures using a camera. Following that, the image is processed using a variety of approaches. Hand Gesture Recognition has been successfully substituted for Speech Recognition using the proposed system. Methodologies for recognizing gestures are typically classified into two categories: static and dynamic. The advantage of this strategy is the lower computing cost. Static gestures only need the analysis of a single picture at the input of the classifier. Image sequence processing and more complicated gesture detection algorithms are required for dynamic gestures. Finally, OpenCV, which will act as the system's Eye, capturing and processing Real-time Hand Gestures and predicting their outcomes, and finally, The Deep Learning Techniques which is known as Convolutional Neural Network that has been used to aid with Image Recognition by transforming photos into a matrix that the model can understand and making it Classifier ready. The concepts employed include Deep Learning, Convolutional Neural Networks, Tensor Flow, openCV and Python Modules. The hand motions are recorded by a camera and then analyzed.

Keywords: TensorFlow, Convolutional Neural Network, Machine Learning, Image Recognition, Sign Language

1. INTRODUCTION

People use a variety of sign languages all throughout the world. To represent diverse hand gestures in Indian Sign Language, both the hands are used. The idea is based on American Sign Language and emphasizes hand form and orientation. When utilizing ASL, only one hand is used. As a result, setting up the system is straightforward. ASL has its own growth path and is not dependent on any spoken language. In a nutshell, the method comprises taking images with a camera. Pre-processing procedures are then used to the image, which includes transforming the RGB-model image to a gray-scale image. Use a sophisticated edge detecting technique to trace the edges. When the pattern is recognised using a template-matching approach, the output is produced as text. This device eliminates the need for a translator to help reduce the communication gap between deaf and hearing persons. The goal of transforming motions to text is achieved. A variety of libraries are used by the system. Hearing loss affects around 4,94,93,50,000 people worldwide. The first step is to prepare the image for processing. The edge detection technique is used to find the edges in images. Finally, a template-matching algorithm is used to identify the sign and show the text. The meaning of a particular sign is easy to discern because the output is text. It is also easier to communicate with deaf persons as a result of this.

2. LITERATURE SURVEY

Various cultures have conducted substantial research on sign recognition. Hand gesture research may be classified into three groups, according to the article: The study of drawing movements, hand-based, and vision-based,.[7]. A hand motion detection and classification technique for international sign language was presented in [9], which used an artificial neural network as a sign language knowledge base. The algorithm correctly identified 79.8% of the 80 photographs it was given. However, for a higher recognition rate, the preprocessing and recognition steps must be enhanced. The Korean Manual Alphabet Identification System [2] detected skin-colored human hands with a 96.7 percent recognition rate by adopting a fuzzy min- max neural network algorithm. The four extremely basic yet effective approaches for implementing hand motion recognition were proposed: Subtraction, Gradient, PCA, and Rotation Invariant. The procedures utilized to find the relevant matches were successful. [4] offered a new method for recognizing hand

Department of Computer Science and Engineering, School of Engineering & Technology, G H Raisoni University, Amravati, Maharashtra, India.
*Corresponding author email- poojakorde23@gmail.com

gestures. A Convolutional Neural Network-based hand motion classification and identification framework was developed by Neethu et al. [3]. To eliminate hand portions from pictures, mask photographs were used, and then CNN was used to split fingers of images from the image. Finally, to categorize hand movements, the generated images are fed into a CNN model. Zhan and his associates. [8] To solve the black and white hand movements applies a CNN model. In addition, to enhance the CNN network's performance, Islam et al. used augmentation techniques and extended the hand gesture data sample. [19] Adithya and her associates, without using any segmentation approaches, create a CNN model for displaying hand gestures that are static.

Starner et al. [10] The first system, which saw the user from a desk mounted camera and achieved 92 percent word accuracy, and the second system, which saw the user fro+-*m a cap mounted camera and achieved 98 percent accuracy with constrained grammar, described two video-based systems for real-time identifying continuous American sign language (ASL) phrases. A 40-word lexicon was utilized in each exam. On a 262-sign vocabulary, HMM was utilized to detect solitary signs with 91.3 percent accuracy. They used camera footage of signatories using colored gloves to extract the traits. In [12], HMM has been used to detect continuous German sign language with only a specific color recording device as input. The effect of several sorts of features on recognition outcomes was studied. The accuracy of identifying sign language phrases with 97 signs is 91.7 percent.

Through the use of an algorithm called Speeded Up Robust Characteristics (SURF) and image analysis, a preliminary method for a sign language identification system with a set of recognized characteristics and hand motion extraction approaches was presented [15].

3. SIGN LANGUAGES

Table 1 Sign Languages

S.No	Country	Sign Language	Abbreviation
1	Republic of India	Indian Sign Language	ISL
2	Japan	Japanese Sign Language	JSL
3	United Kingdom	British Sign Language	BSL
4	United States of America	American Sign Language	ASL

Indian Sign Language

Professionals in India feel that special schools for deaf children are in low supply. Sign language is used as a medium of education in only a handful of schools. In these institutions, there is also a dearth of adequate and effective audiovisual assistance for oral teaching. As a result, the majority of deaf children have limited communication and language abilities, which has a negative influence on the deaf community's literacy. In reality, [5, 13, 16] Most deaf schools do not utilize ISL, and only around 5% of deaf children attend deaf schools. Only vocational programs and short-term courses are allowed to use ISL. The finger spelling method and a few additional signs in ISL were impacted by BSL, although the rest of the signs are unrelated to the European sign system.

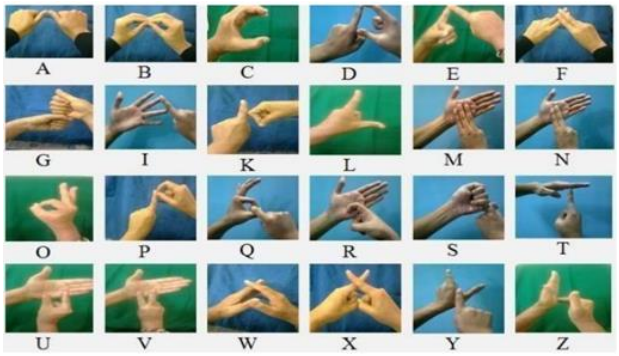

Figure 1 Indian Sign Language Symbols

Japanese Sign Language

Japanese Sign Language [6] is a collection of difficult visual-spatial languages spoken by Japan's deaf citizens. Although the Tokyo version has considerable predominance due to the fact that many Tokyo Deaf organizations sponsor TV broadcasts and events, and that there is no one JSL curriculum. Certain JSL signs and forms appear to have been acquired by Taiwanese and Korean sign languages as a result of Japan's colonial domination over these countries prior to World War II.

British Sign Language

BSL [3] has gone through a few stages. In the 16th century, a community program was held in sign language, according to British history. BSL appears to have had a much better point in history all through the 18th and 19th centuries. BSL is the cornerstone of almost all sign languages.

American Sign Language

The National Association for Deaf Children (NAD) supports the idea that learning sign language from birth is a human right for all individuals, and that deaf newborns and children should be educated ASL as soon as practicable. This methodology is also aligned with the World Federation of the Deaf and the United Nations' civil rights guidelines, which include acknowledgment of sign language.

4. DATA COLLECTION

The Indian sign needed to be taken care of for this study will be obtained from several deaf schools around India. As per Zeshan et al [17], the Ali Yavar Jung National Institute for Hearing Handicapped can provide standardized Indian sign movements in the form of photographs and videos.

5. IMAGE-PROCESSING

Photographic process of improving or obtaining data from a snapshot by executing processes to it. The basic principle of image recognition is "the study and alteration of a digital picture, particularly in order to ensure quality."

6. CONVOLUTION NEURAL NETWORK

As a normal multilayer neural network, a convolutional neural network (CNN) has one or more fully linked convolutional layers. The CNN architecture was created with the goal of effectively processing two-dimensional pictures.

CNN is employed to extract features in an automatic manner in our proposed model since the output is quite satisfying. CNN, on the other hand, comes with a number of dynamic parameters that make it simple to train the machine.

7. FEATURE EXTRACTION

Pattern recognition and machine learning issues need feature extraction as a pre-processing step. It's frequently broken down into two parts: feature development and feature selection.

8. TEMPLATE MATCHING ALGORITHM

The recognized pattern is compared to a stored template, which accounts for all conceivable posture (translation and rotation) and scale changes.

9. OPENCV

OpenCV is a free and open-source source library for computer vision, deep learning, and image recognition that is increasingly used during real-time applications. By studying video and photos, it may be able to recognize things, people, and even human calligraphy. Python can process the OpenCV array structure for evaluation when used in combination with the other libraries including NumPy.

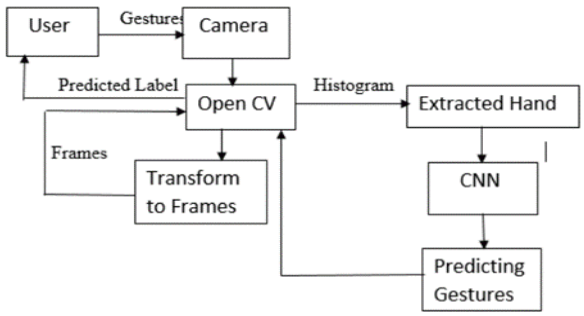

Figure 2 Data Flow Diagram for Hand Gesture

10. CONCLUSION AND SCOPE

Today's applications need a wide range of image kinds as data sources for interpretation and analysis. In order to complete various activities, certain qualities must be obtained. As a result, the final image has to go through an image process of optimization, which encompasses a range of techniques designed to improve a picture's visual presence. Image enhancement improves the human interpretation of information in photos while also giving superior input to other autonomous image processing techniques. To construct the photograph, the picture is then subjected to a variety of approaches for extracting characteristics. It will be easier for the computer to read. An efficient method for bringing together expert knowledge, identifying edges, and merging inaccurate data from various sources. The goal of a CNN is to categorize the data adequately. Using the integrated Web Camera, the built system was able to successfully capture Hand Gestures, analyse them, convert them to text, and display them on the Input frame. However, in low light and without a suitable backdrop, the system failed to give accurate and expected results.

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