SIGN LANGUAGE RECOGNITION USING CONVOLUTIONAL NEURAL NETWORK

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Abstract

Sign language recognition is an important task for facilitating communication between hearing-impaired and non-hearing-impairedindividuals. In recent years, deep learning techniques such as convolutional neural networks (CNNs) have shown promising results in this field. In this paper, we propose a CNN-based approach for sign language recognition. Our approach involves preprocessing the sign language images, segmenting them into individual signs, and feeding them to a CNN for classification. We train the CNN on a large dataset of sign language images and evaluate its performance on a separate test set. Our results demonstrate that the proposed approach achieves high accuracy in recognizing sign language gestures, outperforming several state-of-the-art methods. The proposed method has the potential to be integrated into real-world applications for improving communication with the hearing-impaired systems.Sign Language Recognition (SLR) targets on interpreting the sign language into text or speech, so as to facilitate the communication between deaf-mute people and ordinary people. This task has broad social impact, but is still very challenging due to the complexity and large variations in hand actions. Existing methods for SLR use hand-crafted features to describe sign language motion and build classification models based on those features. However, it is difficult to design reliable features to adapt to the large variations of hand gestures.

Keywords: CNN classifier,Sign language Recognition,Image Processing, Edge Detection,Hand Gesture Recognition.

1. Introduction

Sign language recognition is the process of detecting and interpreting sign language gestures performed by a person, with the goal of translating them into natural language or other forms of output. Convolutional neural networks (CNNs) have emerged as a powerful tool for image recognition tasks, including sign language recognition.

CNNs are a type of deep learning algorithm that can automatically learn to recognize patterns in images. They are particularly well-suited to detecting spatial patterns in images, which makes them well-suited for recognizing the intricate and

complex hand gestures that are used in sign language.In sign language recognition, a CNN is typically trained on a large dataset of sign language images and videos. The network learns to recognize the key features of each sign language gesture, such as the shape of the hands, the position of the fingers, and the movement of the hands.

Once the CNN has been trained, it can be used to recognize sign language gestures in real-time. This has important applications in fields such as communication, accessibility, and education, enabling deaf and hard-of-hearing individuals to interact with others and access information more easily.

As well stipulated by Nelson Mandela[1], Talk to a man in a language he understands, that goes to his head. Talk to him in his own language, that goes to his heart, language is undoubtedly essential to human interaction and has existed since human civilisation began. It is a medium humans use to communicate to express themselves and understand notions of the real world. Without it, no books, no cell phones and definitely not any word I am writing would have any meaning. It is so deeply embedded in our everyday routine that we often take it for granted and dont realise its importance. Sadly, in the fast changing society we live in, people with hearing impairment are usually forgotten and left out. They have to struggle to bring up their ideas, voice out their opinions and express themselves to people who are different to them. Sign language, although being a medium of commu- nication to deaf people, still have no meaning when conveyed to a non-sign language user. Hence, broadening the communication gap.To prevent this from happening, we are putting forward a sign language recognition system. It will be an ultimate tool for people with hearing disability to communicate their thoughts as well as a very good interpretation for non sign language user to understand what the latter is saying. Many countries have their own standard and interpretation of sign gestures. For instance, an alphabet in Korean sign language will not mean the same thing as in Indian sign language. While this highlights diversity, it also pinpoints the complexity of sign languages. Deep learning must be well versed with the gestures so that we can get a decent accuracy. In our proposed system, American Sign Language is used to create our datasets. Figure 1 shows the American Sign Language (ASL) alphabets.

Identification of sign gesture is performed with either of the two methods. First is a glove based method whereby the signer wears a pair of data gloves during the capture of hand movements.Second is a vision based method, further classified into static and dynamic recognition. Static deals with the 2dimensional representation of gestures while dynamic is a real time live cap- ture of the gestures.And despite having an accuracy of over 90%, wearing of gloves are uncomfortable and cannot be utilised in rainy weather. They are not easily carried around since their use require computer as well. In this case, we have decided to go with the static recognition of hand gestures because it increases accuracy as compared to when including dynamic hand gestures like for the alphabets J and Z. We are proposing this research so we can improve on accuracy using Convolution Neural Network(CNN).

2. System Implementation

Preprocessing:

Understanding aspect ratios:An aspect ratio is a proportional relationship between an image's width and height. Essentially, it describes an image's shape.Aspect ratios are written as a formula of width to height, like this: For example, a square image has an aspect ratio of 1:1, since the height and width are the same. The image could be 500px × 500px, or 1500px × 1500px, and the aspect ratio would still be 1:1.As another example, a portrait-style image might have a ratio of 2:3. With this aspect ratio, the height is 1.5 times longer than the width. So the image could be 500px

× 750px, 1500px × 2250px, etc.

Cropping to an aspect ratio

Aside from using built in site style options , you may want to manually crop an image to a certain aspect ratio. For example, if you use product images that have same aspect ratio, they'll all crop the same way on your site. 7

Option 1 - Crop to a pre-set shape

Use the built-in Image Editor to crop images to a specific shape. After opening the editor, use the crop tool to choose from preset aspect ratios.

Option 2 - Custom dimensions

To crop images to a custom aspect ratio not offered by our built-in Image Editor, use a third-party editor. Since images don't need to have the samedimensions to have the same aspect ratio, it's better to crop them to a specific ratio than to try to matchtheir exact dimensions.

For best results, crop the shorter side based on the longerside.

➢ Image scaling:

In compuer graphics and digital imaging , image scaling refers to the resizing of a digitalimage. In video technology, the magnification of digital

material is known as upscaling or resolution enhancement .

- When scaling a vector graphic image, the graphic primitives that make upthe image can be scaled using geometric transformations, with no loss of image quality. When scaling a raster graphics image, a new image with a higher or lower number of pixels must be generated. In the case of decreasing the pixel number (scaling down) this usually results in avisible quality loss. From the standpoint of digital signal processing, the scaling of raster graphics is a two-dimensional example of sample-rate conversion, the conversion of a discrete signal from a sampling rate (in this case the local sampling rate)to another.

HISTOGRAMCALCULATION:

Histograms are collected *counts* of data organized into a set of predefined *bins*

When we say *data* we are not restricting it to be intensity value. The data collected canbe whatever feature you find useful to describe your image.

Let's see an example. Imagine that a Matrix contains information of an image (i.e. intensity in the range 0−255):

What happens if we want to *count* this data in an organized way? Since we know that the *range* of

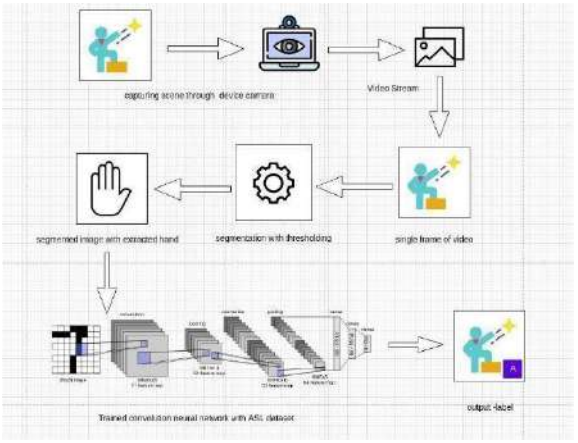
information value for this case is 256 values, we can segment our range insubparts(called **bins**) like:

[0,255]=[0,15] [16,31]..... [240,255]range=bin1 bin2.....

BackPropogation:

Back-propagation is the essence of neural net training. It is the method of fine-tuning the weights of a neural net based on the error rate obtained in the previous epoch (i.e., iteration). Proper tuning of the weights allows you to reduce error rates and to make the model reliable by increasing its generalization.Backpropagation is a short form for "backward propagation of errors." It is a standard method of training artificial neural networks. This method helps to calculate the gradient of a loss function with respects to all the weights in the network.

gradient itself like SGD with momentum. Adam is an adaptive learning rate method, which means,



it computes individual learning rates for different parameters. Its name is derived from adaptive moment estimation, and the reason it's called that is because Adam uses System Architecture.

estimations of first and second momentsof gradient to adapt the learning rate for each weight of the neural network. Now, whatis moment ? N-th moment of a random variable is defined as the expected value of that variable to the power of n. More formally

LossFunction(categorical cross entrophy):
Categorical crossentropy is a loss function that is used for single label categorization. This is when only onecategory is applicable.

METHOD OF IMPLEMENTATION :

Once the user uploads the currency notes, all the pre-processing and feature extraction along with the comparision of pre-defined features will be done. Finally, the result of all algorithms is displayed to the user. The extracted image of each feature and the various important data collected for each feature is displayed properly in a GUI window. Further, the status (Pass/ Fail) of each feature is displayed along with the details.

A Survey of Hand Gesture Recognition Methods in Sign LanguageRecognition

Sign Language Recognition (SLR) system, which is required to recognize sign languages, has been widely studied for years.The studies are based on various input sensors, gesture segmentation, extraction of features and classifcation methods.This paper aims to analyze and compare the methods employed in the SLR systems,

classi cations methods that have been used, and suggests the most promising method for future research. Due to recent advancement in classifcationmethods, many of the recent proposed works mainly contribute on the classifcation methods, such as hybrid method and Deep Learning. This paper focuses on the classifcation methodsused in prior Sign Language Recognition system. Based on our review, HMM- based approaches have been explored extensively in prior research, including its modifcations.

This study is based on various input sensors, gesture segmentation, extraction of features and classification methods. This paper aims to analyze and compare the methods employed in the SLR systems, classifications methods that have been used, and suggests the most reliable method for future research. Due to recent advancement in classification methods, many of the recently proposed works mainly contribute to the classification methods, such as hybrid method and Deep Learning. Research, including its modifications.Hybrid CNN-HMM and fully Deep Learning approaches have shown promising results and offer opportunities for further exploration.

Conclusion

Nowadays, applications need several kinds of images as sources of informationfor elucidation and analysis. Several features are to be extracted so as to perform various applications. When an image is transformed from one form to another such as digitizing, scanning, and communicating, storing, etc. degradation occurs. Therefore,the output image has to undertake a process called image enhancement, whichcontains of a group of methods that seek to develop the visual presence of an image. Image enhancement is fundamentally enlightening the interpretability or awareness of information in images for human listeners and providing better input for other automatic image processing systems. Image then undergoes feature extraction usingvarious methods to make the image more readable by the computer.Sign language recognition system is a powerful tool to preparae an expert knowledge, edge detect and the combination of inaccurate information from different sources.the intend of convolution neural network is to get the appropriate classification

Future work

The proposed sign language recognition system used to recognize sign language letters can be further extended to recognize gestures facial expressions. Instead of displaying letter labels it will be more appropriate to display sentences as more appropriate translation of language.This also increases readability.The scope of different sign languages can be increased. More training data can be added to detect the letter with more accuracy. This project can further be extended to convert the signs to speech.

BIBILOGRAPHY

[1] Prof. Renuka Nagpure, Shreya Sheety,Trupti Ghotkar, "Sign gestures and textual idea ", IJIRCCE ,Vol-4,2019.

[2] Vibhuti Vashishtha and Md. Sadim “connvolutional neural network Using Image Processing To Improve the Reliability with PCA Method”. International Journal of Engineering Science & Research Technology. ISSN: 2277-9655 Vol-1 Issue: 1,2020.

[3] Aruna D H, Manpreet Bagga, Dr.Baljit Singh “A Survey on Indian Currency Note Denomination Recognition System”. International Journal of Advance Research in Science and Engineering, IJARSE, Vol. No.4, Special Issue (01), 2015.

[4] http://www.rbi.org.in/currency/

[5] Rubeena Mirza,Vinti Nanda,“Paper Currency verification System based on

Characteristic Extraction using Image Processing”, IJEAT, Vol.1, Issue 03, pp.68-71, February 2019.

[6] R. C. Gonzalez and R. E. Woods, Digital Image Processing, 2nd ed., Prentice HallIndia, ISBN-81-203-2758-6, 2006.M. Young, The Technical Writer’s Handbook. Mill Valley, CA: University Science, 2021.

[7] Ms.Rumi Ghosh, Mr Rakesh Khare, “A Study on Diverse Recognition Techniques for Indian Currency Note” ,IJESRT, Vol.2, Issue 6, June 2018.R. Nicole, “Title of paper with only first word capitalized,” J. Name Stand. Abbrev., in press. [8] Amol A. Shirsath S. D. Bharkad, “Survey of sign gestures Using CNN Image Processing*”*, IJCER, Vol.3, Issue 7, pp 36-40, July 2016.

[9] M.Deborah and Soniya Prathap “Detection of SIGN GESTURES using Image Processing”. IJISET-International Journal of Innovative Science, Engineering & Technology, Vol. 1, Issue 10, 2018.