**AMERICAN SIGN LANGUAGE GESTURE RECOGNITION SYSTEM USING DEEP LEARNING**

**A PROJECT REPORT**

***Submitted by***

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*Under the guidance of*

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(Assistant Professor, Department of Information Technology) ***in partial fulfillment for the award of the degree of***

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**BONAFIDE CERTIFICATE**

Certified that this Minor project report **AMERICAN SIGN LANGUAGE GESTURE RECOGNITION USING DEEP LEARNING** is the bonafide work of SHATAKSHI KISHAN, NIKITA KANDPAL, SUNNY LAKHANI and APRAJEY AKHOURI who carried out the project work under my supervision at SRM University , IT Department, Kattankulathur.

**SIGNATURE SIGNATURE**

**Ms. P.Nithyakani Dr.G.VADIVU ASSISTANT PROFESSOR HEAD OF THE DEPARTMENT**

**INFORMATION TECHNOLOGY INFORMATION TECHNOLOGY**

INTERNAL EXAMINER

# DECLARATION

We Shatakshi Kishan RA1611008010554, Nikita Kandpal RA1611008010698, Sunny Lakhani RA1611008010078 and Aprajey Akhouri RA1611008010533 studying in IV year B.Tech Information Technology program at, SRM University, Kattankulathur, Chennai, hereby declare that this project is an original work of mine and I have not verbatim copied / duplicated any material from sources like internet or from print media, excepting some vital company information / statistics and data that is provided by the company itself.

Signature of the Student Date:

Place:

# ACKNOWLEDGEMENT

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# ABSTRACT

Sign language is widely used by individuals with hearing impairment to communicate with each other conveniently using hand gestures. However, non-sign-language speakers find it very difficult to communicate with those with speech or hearing impairment since it interpreters are not readily available at all times. Many countries have their own sign language, such as American Sign Language (ASL) which is mainly used in the United States and the English-speaking part of Canada. The proposed system helps non-sign-language speakers in recognizing gestures used in American Sign Language.

In this project, we are using SURF (Speeded up Robust Feature) on different algorithms like SVM and Naive Bayes for ASL gesture recognition and comparing the efficiency of these models.

In this approach, firstly, the signs are captured using a webcam. First the input image is processed and skin masking is done. Then edge detection is used to detect the edge of the hand. After that SURF feature detection is used and then image is classified using SVM and Naive Bayes algorithm and the accuracy of both the algorithms is calculated.

We have then applied a deep learning model-CNN and used it to predict the input gesture and the accuracy.

# INTRODUCTION

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# 1.1 Overview

In a general overview, signed language is a technique used for communicative purposes by deaf people. It is a three-dimensional language that relies on visual gestures and moving hand signs that classify letters and words. Gesture recognition has been always a relatively fearful subject that is adherent to the individual on both academic and demonstrative levels

The use of sign language is not only limited to individuals with impaired hearing or speech to communicate with each other or non-sign-language speakers and it is often considered as a prominent medium of communication.In this project, we aim towards analyzing and recognizing various alphabets from a database of sign images. Database consists of various images with each image clicked in different light condition with different hand orientation. With such a divergent data set, we are able to train our system to good levels and thus obtain good results.

Gesture recognition is the mathematical interpretation of a human motion by a computing device.Gesture is a symbol of physical behavior or emotional expression. It includes body gesture and hand gesture. It falls into two categories: static gesture and dynamic gesture . For the former, the posture of the body or the gesture of the hand denotes a sign. For the latter, the movement of the body or the hand conveys some messages. Gesture can be used as a tool of communication between computer and human . It is greatly different from the traditional hardware based methods and can accomplish human-computer interaction through gesture recognition. Gesture recognition determines the user intent through the recognition of the gesture or movement of the body or body parts.

# 1.2 Learning Techniques

We have then applied a deep learning model-CNN and used it to predict the input gesture and the accuracy. First image segmentation is done.This is achieved via Skin Masking defining the threshold on RGB schema and then converting RGB colour space to grayscale image. Finally Canny Edge technique is employed to identify and detect the presence of sharp discontinuities in an image, thereby detecting the edges of the figure in focus.The Speeded Up Robust Feature (SURF) technique is used to extract descriptors from the segmented hand gesture images.The SURF descriptors extracted from each image are different in number with the same dimension (64). Bag of Features (BoF) is implemented to represent the features in histogram of visual vocabulary rather than the features as proposed.After obtaining the bof of features model, we are set to predict results for new raw images to test our model.

# 1.3 Data Flow

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Fig 1. Process-flow diagram

* + - Data Acquisition
    - Feature Extraction
    - Pre-processing
    - Classification

# 1.4 Python libraries and Algorithms

The various algorithms that we use are deployed in python programming language and they utilize a number of open source python libraries

1. Python 3.5 or above
2. Libraries

* Numpy (numerical python, core library for SC, integrates C/C++)
* Pandas (opensource library, data manipulation)
* Sklearn (opensource ML library, supervised and unsupervised learning algo)
* Scipy (opensource library, scientific and mathematical problems)
* Opencv (optimised library with MATLAB-like syntax, computer vision problem)
* Scikit (free ML library, features SVM, classification and regression)
* Keras (opensource neural network library, user-friendly, fast experimentation)
* TensorFlow (creates deep learning models by using wrapper libraries)

# LITERATURE SURVEY

# A comparison of machine learning algorithms applied to hand gesture recognition(2014).

# Author: Paulo Trigueiros ,Fernando Ribeiro, Luís Paulo Reis

# Objective: The primary goal of gesture recognition research is to create a system, which can identify specific human gestures and use them to convey information or for device control. This paper presents a comparative study of four classification algorithms for static hand gesture classification using two different hand features data sets.

# Results: The results obtained proved that the ANN had a good performance and that the feature selection and data preparation is an important phase in the all process, when using low resolution images like the ones obtained with the camera in the current work.

# Limitations: The major drawback of their research was the poor implementation of the algorithm which in turn resulted in less accuracy.

# Sign Language Recognition using Convolutional Neural Networks(2014).

# Author: Lionel Pigou, Sander Dieleman , Pieter-Jan Kindermans ,Benjamin Schrauwen

# Objective: The contribution considers a recognition system using the Microsoft Kinect, convolutional neural networks (CNNs) and GPU acceleration. Instead of constructing complex handcrafted features, CNNs were able to automate the process of feature construction.

# Results: The predictive model was able to generalize on users and surroundings not occurring during training with a cross-validation accuracy of 81.7%. The model achieved a mean Jaccard Index of 0.789.

# Limitations: An observation of 4.13% false positive rate, was caused by the noise movements. We note that the test result was lower than the validation result, because the validation set contained users and backgrounds in the training set.

# A mobile application of American sign language translation via image processing algorithms(2016).

# Author: Cheok Ming Jin, Zaid Omar, Mohamed Hisham Jaward

# Objective: In this paper, a novel framework comprising established image processing techniques was proposed to recognise images of several sign language gestures. More specifically, it was initially implemented using Canny edge detection and seeded region growing to segment the hand gesture from its background.

# Results: The proposed framework has been implemented on smartphone platforms, and experimental results show that it is able to recognize and translate 8 different American Sign Language gestures with an overall accuracy of 87.13%.

# Limitations: The limitation of this algorithm was that the main profile was very time consuming and complex.

# Hand Gesture Recognition Approach for ASL Language Using Hand Extraction Algorithm(2015).

# Author: Alhussain Akoum, Nour Al Mawla

# Objective: The core objective of this system was to produce a method which could identify humanoid gestures and use them to either deliver ones thoughts, or for device control.

# Results: Different steps were used to input, recognize and analyze the hand gestures, transforming them to written words. Each step is an independent algorithm that has its unique variables and conditions.

# Limitations: The limitation was that although the system produced accurate results but it was not capable of identifying the humanoid gestures instantly.

# Gesture Recognition: A Survey(2014)

# Author: Sushmita Mitra, Tinku Acharya

# Objective: A survey on gesture recognition with particular emphasis on hand gestures and facial expressions. Applications involving hidden Markov models, particle filtering and condensation, finite-state machines.

# Results: This was useful in recognizing a complex gesture consisting a sequence of smaller gestures. Soft computing tools pose another promising application to static hand gesture identification.

# Limitations: Similarity-based matching of the retrieved images was not distinguished uniquely.

# A Framework for Hand Gesture Recognition and Spotting Using Sub-gesture Modeling(2016)

# Author: Manavender R. Malgireddy, Jason J. Corso, Srirangaraj Setlur

# Objective: In this paper, we proposed a new sub-gesture modeling approach which represented each gesture as a sequence of fixed sub-gestures and it provided a robust modeling of the visual features.

# Results: Experimental results showed that the proposed method outperforms state-of-the-art Hidden Conditional Random Fields (HCRF) based methods and baseline gesture spotting techniques.

# Limitations: It provided lesser flexibility in modeling gestures as the observations provided smaller sequence of actions (sub-gestures) as compared to a larger sequence (gesture) in the previous methods.