

## HAND GESTURE RECOGNITION USING MACHINE LEARNING

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### ABSTRACT

In order to offer new possibilities to interact with machine and to design more natural and more intuitive interactions with computing machines, this research aims at the automatic interpretation of gestures based on computer vision. One such technique can be used for detecting and understanding various human gestures as it would make the human-machine communication effective.

This could make the conventional input devices like touchscreens, mouse pad, and keyboards redundant. In this project we will design a hand gesture recognition system which will perform defined task. Here we are using classroom as an application. Instead of classroom any other applications can be also used.

### INTRODUCTION

Machine learning (ML) is the study of computer algorithms that improve automatically through experience. It is seen as a subset of artificial intelligence Machine learning algorithms build a model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so.] Machine learning algorithms are used in a wide variety of applications, such as email filtering and computer vision,

With the development of interaction between human and machine, the interaction between computer and human is becoming more and more frequent. Among them, hand gestures are commonly used in this aspect. Since there are various hand gestures and enriched information contained in them, recognition of hand gesture has been greatly used in many fields, such as UAV, somatosensory game, sign language recognition and so on. In this regard, it is of great significance to study on hand gesture recognition.

Gesture recognition is the mathematical interpretation of a human motion by a computing device. Modern research of the control of computers changes from standard peripheral devices to remotely commanding computers through speech, emotions and body gestures. This application belongs to the domain of hand gesture recognition recognition. The aim is to recognize hand gestures while maintaining accuracy and speed of the system. The recognized gestures are to command the computer which will then perform defined task.

### LITERATURE REVIEW

#### 1. Hand Gesture Recognition using PCA based Deep CNN Reduced Features and SVM classifier

**Author: Jaya Prakash Sahoo, Samit Ari, Sarat Kumar Patra**

This system proposes novel techniques to develop a user independent hand gesture recognition system, considering the above challenges. The deep features are extracted from fully connected (FC) layers such as 'FC6 and 'FC7' of pre-trained Alex Net. A support vector machine (SVM) based classifier with linear kernel is used to classify gesture poses.

The highest recognition accuracy is evaluated using the deep feature extracted from 'FC6 and 'FC7' independently and combination of both the feature vector with SVM classifier. Second, feature dimension of deep features are reduced using principal component analysis (PCA) based dimension reduction technique for further improvement in gesture recognition accuracy. The extensive analysis is performed on 36 American Sign Language (ASL) benchmark static hand gesture dataset using both the CV test. The experimental result shows that, the proposed technique is superior as compared to state-of-the-art techniques.

## **2. Deep Learning for Hand Gesture Recognition on Skeletal Data**

**Author: Guillaume Devineau and Wang Xi and Fabien Moutarde1 and Jie Yang**

In this paper, there is a new 3D hand gesture recognition approach based on a deep learning model. A new Convolutional Neural Network (CNN) where sequences of hand-skeletal joints' positions are processed by parallel convolutions; then investigate the performance of this model on hand gesture sequence classification tasks. This only uses hand-skeletal data and no depth image. This model achieves a 91.28% classification accuracy for the 14 gesture classes case and an 84.35% classification accuracy for the 28 gesture classes case.

## **3. Human Action Recognition Using Deep Neural Networks**

**Author: Rashmi R. Koli**

This upper proposed system was introduced for deaf and dumb people for removing the connection gap between normal people. This system converts gestures in video into frames and then into meaningful text. Proposed work has gave special attention to the CNN training component using CNN algorithm. The concept includes designing a gadget and then provide recognizable output in text format.

## **4. Automated Hand Gesture Recognition using a Deep Convolutional Neural Network model**

**Author: Ishika Dhall, Shubham Vashisth, Garima Aggarwal**

The unique architecture of CNNs allows it to extract relevant information from the input images without any hand-tuning. Such powerful models we have quite a flexibility build technology that may ameliorate human life. A technique can be used for detecting and understanding various human gestures as it would make the human machine communication effective. This could make the conventional input devices like touchscreens, mouse pad, and keyboards redundant. Also, it is considered as a highly secure tech compared to other devices. In this system, hand gesture technology along with Convolutional Neural Networks has been discovered.

## **5. Deep Learning Based Approach For Sign Language Gesture Recognition With Efficient Hand Gesture Representation**

**Author: Muheer Al-hammade**

This proposed study gave a novel system for dynamic hand gesture recognition . A robust face detection algorithm and the body part ratios theory were utilized for gesture space estimation and normalization. Two 3DCNN instances were used separately for learning the fine grained features of hand shape. Software function was used here for the classification purpose. This proposed system is evaluated on a very challenging dataset which consist of 40 dynamic hand gestures performed by 40 subjects in an uncontrolled environment. The result in the system show that system outperforms state of art approaches , demonstrating its effectiveness.

## **6. Pattern Recognition of Human Arm Movement Using Deep Reinforcement Learning**

**Author: W. Seok , Y. Kim, C. Park**

Hand gesture recognition is one of the major research areas in the field of Human computer interaction (HCI). This system proposes a deep reinforcement learning algorithm to recognize the human arm movement patterns using an IoT sensor device. It allows users to control the IoT device and produce the desired arm movement patterns without creating any labels. In this system, the performance of convolutional neural network (CNN) with the DQN model is compared with that of long shortterm memory (LSTM) models with DQN. Results show that the CNN based DQN model was more stable compared to the LSTM based model.

## **7. Hand Shape And Hand Gesture Recognition**

**Author: Ryzard S. Choraoss.**

In the paper some approaches are presented for hand and hand gesture recognition. The features of hand were extracted from the hand shaped image. The hand gesture recognition was realized based on the gesture blob and texture parameters extracted with the blocks RT image and also invariant parameters. Here a

gesture recognition method is presented in which the hand is segmented using skin colour then features vector is extracted from segmented hand image and hand's gesture is recognized using geometrical and random transform RT features. The correct detection rate was 94 % which prove that the proposed approach was effective in recognizing hand gestures.

## **8. Research on the Hand Gesture Recognition Based on Deep Learning**

**Author: Jing-Hao Sun, Ting-Ting Ji, Shu-Bin Zhang**

Since hand gestures are able to express enriched information, the hand gesture recognition is widely used in robot control, intelligent furniture and other aspects. This system uses segmentation of hand gestures by establishing the skin color model and AdaBoost classifier based on haar according to the particularity of skin color for hand gestures, since hand gestures are able to express enriched information, the hand gesture recognition is widely used in robot control, intelligent furniture and other aspects. system uses segmentation of hand gestures by establishing the skin color model and AdaBoost classifier based on haa This according to the particularity of skin color for hand gestures, as well as the denaturation of hand gestures with one frame of video being cut for analysis. In this regard, the human hand is segmentd from the complicated background, the real-time hand gesture tracking is also realized by CamShift algorithm.

## **9. Deep Learning for Electromyographic Hand Gesture Signal Classification Using Transfer Learning**

**Author: Ulysse Côté-Allard, Cheikh Latyr Fall**

This paper proposes applying transfer learning on aggregated data from multiple users, while leveraging of deep learning algorithms to learn discriminant features from large datasets. Two datasets of 19 and 17 able-bodied participants was recorded for this work using the M yo Armband. Third Myo Armband dataset was taken from the Nina pro database and is comprised of 10 able-bodied participants.

Three different deep learning networks employing modalities as input are tested on second and third dataset. Offline accuracy of 98.31 % is achieved. This accuracy is for 7 gestures over 17 participants for CWT-based Conv Net and 68.98% for 18 gestures over 10 participants for the raw EMG base conv Net. This proposed work presented a new TL scheme that systematically and significantly enhances the performance of the tested conv Nets.

## **10. Hand Gesture Recognition Using Deep Learning**

**Author: Soeb Hussain, Rupal Saxena**

This research aims at an automatic interpretation of gestures based on computer vision. This system checked for size static and eight dynamic hand gestures. The proposed system was a vision based hand gesture recognition method using transfer learning. The method is made robust by avoiding the skin colour segmentation bob-detection, skin is cropping and centroid extraction from unidirectional dynamic gestures. Here for hand shape recognition a CNN based classifier is trained through process of transfer learning over a pretrained convolution neural net which is initially trained on large dataset. VGG16 is used here as the pretrained model. The result obtained here were compared with CNN architecture. Alex Net over all accuracy for the Alex Net was 76.96 % and recorded accuracy was 93.09 %. They tested in different background and different light condition.

## **CONCLUSION**

From the above reviews, it is necessary to design and develop a hand gesture recognition system with reduced dataset, high recognition accuracy and high speed process through the approach using machine learning.

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