

## Digital Art using Machine Learning Algorithm

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**ABSTRACT:** Gesture Recognition is a technology which is used to identify human gestures with the help of mathematical algorithms. Gesture recognition recognizes the hand, tracks the hand movements & also provides information about hand position orientation and movements of the fingers. The colour markers are placed at the tip of the user fingers. This helps the webcam to identify the movement of hand and the gesture recognition. The drawing application allows the user to draw on any surface by tracking the fingertip movements of the user's index finger. The pictures that are drawn by the user can be stored and replaced on any other surface. The user can also shuffle through various pictures and drawing by using the hand gesture movements. Present days, technology far advanced to do things. Digital revolution is one of the major trends in the industry. Art drawing is one of the toughest job once but now it become easy. Here we proposed digital art drawing in the air through hand gestures and using a camera capturing the digital art. We are giving different hand gestures to draw an art. Here each finger covered with different colours and the gesture captured by camera and displays the digital art using raspberry pi.

**KEYWORDS:** gesture recognition, hand gesture, camera capturing, digital art, raspberry pi.

### I. INTRODUCTION

Digital art refers to forms of expression and transmission of art form with digital form. Relying on modern science and technology is the distinctive characteristics of the digital manifestation. Traditional art refers to the art form which is created before the digital art. From the recipient to analyze, it can simply be divided into visual art, audio art, audio-visual art and audio-visual imaginary art, which includes literature, painting, sculpture, architecture, music, dance, drama and other works of art. Digital art and traditional art are interrelated and interdependent. Social development is not a people's will, but the needs of human life are the main driving force anyway. The same situation happens in art. In the present circumstances, digital art and traditional art are inclusive of the symbiotic state, so we need to systematically understand the

basic knowledge of the form between digital art and traditional art.

Traditional art developed under social conditions of the division in the body and the brain, in which the advantages of the elite art is much larger than the public art, these advantages are protected by the social hierarchy, but then they have been more advanced with the strengthen of the copyright system. The creators of traditional art are mostly artists who engaged in the research of art and design, they have a solid theoretical foundation and a keen insight of the new trend of art, and constantly adjust their own artistic ideas to adapt to new forms of art, they are creative power driven. In the digital network, anonymous login is a certain degree of concealment. There is no hierarchy to exert its influence. It is difficult to control the movement of art works and the copyright maintenance. The creators of digital art are an integrated group of genius, they have a certain degree of understanding of art, digital technology and other professions. They can apply the digital art to mastery, their creative energy is far more proactive than traditional artists. Of particular importance is: the digital network in the world as a major creative space for the vast majority of creators in creative concepts are no longer the same as the traditional artists, who are concerning all about to achieve the economic income through the traditional copyright, mainly reflected their values and self-realization is linked to a sense of achievement. In this sense, the advent of digital art and the non-vocational trend of the creators have expanded the digital popularity and the artistic teams.

### II. PROBLEM STATEMENT

- To develop a system where user can use his hand gesture to write alphabets and number in air i.e. air-writing with the help of machine learning algorithm.
- To achieve this, we will be using Raspberry-pi advance version to get quick output.

### III. LITERATURE REVIEW

The already existing systems consist of digital pen having in built inertial sensor. It writes

on paper but the inbuilt system will transmits this regular writing into digital one. Also there are some wearable devices consist of different sensors like accelerometer by using which user can write digitally.

*In, Hand Gesture Recognition And Device Control:* In this paper, Hand gesture based electronic device control is gaining more importance nowadays. Most of electronic devices focus on the hand gesture recognition algorithm and the corresponding user interface. This paper presents hand gesture recognition based Device control by using microcontroller. Gesture recognition is interpretation of human motion by computing device. An automatic gesture segmentation algorithm is developed to identify individual gestures in a sequence and The device is control by microcontroller. The purpose of project is to design & develop a hand gesture based Device control which can be easily controlled by the help of gesture recognition system[1].

*In, HAND GESTURE RECOGNITION: A LITERATURE REVIEW:* This paper proposes Hand gesture recognition system received great attention in the recent few years because of its manifoldness applications and the ability to interact with machine efficiently through human computer interaction. In this paper a survey of recent hand gesture recognition systems is presented. Key issues of hand gesture recognition system are presented with challenges of gesture system. Review methods of recent postures and gestures recognition system presented as well. Summary of research results of hand gesture methods, databases, and comparison between main gesture recognition phases are also given. Advantages and drawbacks of the discussed systems are explained finally[2].

*In, Handwritten Text Recognition using Machine Learning Techniques in Application of NLP:* This paper proposes Handwriting Detection is a technique or ability of a Computer to receive and interpret intelligible handwritten input from source such as paper documents, touch screen, photo graphs etc. Handwritten Text recognition is one of area pattern recognition. The purpose of pattern recognition is to categorizing or classification data or object of one of the classes or categories. Handwriting recognition is defined as the task of transforming a language represented in its spatial form of graphical marks into its symbolic representation. Each script has a set of icons, which are known as characters or letters, which have certain basic shapes. The goal of handwriting is to identify input characters or image correctly then analyzed to many automated process systems. This system will be applied to detect the writings of

different format. The development of handwriting is more sophisticated, which is found various kinds of handwritten character such as digit, numeral, cursive script, symbols, and scripts including English and other languages. The automatic recognition of handwritten text can be extremely useful in many applications where it is necessary to process large volumes of handwritten data, such as recognition of addresses and postcodes on envelopes, interpretation of amounts on bank checks, document analysis, and verification of signatures. Therefore, computer is needed to be able to read document or data for ease of document processing[3].

*In, Handwritten Text Recognition: With Deep Learning and Android:* This research paper offers a new solution to traditional handwriting recognition techniques using concepts of Deep learning and computer vision. An extension of MNIST digits dataset called the Emnist dataset has been used. It contains 62 classes with 0-9 digits and A-Z characters in both uppercase and lowercase. An application for Android, to detect handwritten text and convert it into digital form using Convolutional Neural Networks, abbreviated as CNN, for text classification and detection, has been created. Prior to that we pre-processed the dataset and applied various filters over it. We designed an android application using Android Studio and linked our handwriting text recognition program using tensorflow libraries. The layout of the application has been kept simple for demonstration purpose. It uses a protobuf file and tensorflow interface to use the trained keras graph to predict alphanumeric characters drawn using a finger[4].

*In, Survey On Air Writing Recognition:* Human Computer Interaction (HCI) enhances communication with the computer and reduces the barrier between the human expressions and the understanding of computers. The applications include gesture recognition, sign languages, finger painting, virtual mouse and keyboards, etc. Color tracking and detection are other interactions provided by the vision-based HCI systems. The system presents an effective way of communication for deaf or dumb peoples are helps user to convey many messages with little efforts. In this paper we reviewed several algorithms and techniques used for finger tip detection and tracking[5].

*In, Inertial Pen Based Alphabet Recognition using KNN Classifier:* In today's electronics world human machine interface is important part. Pen with inbuilt inertial sensors devices capture human handwriting or drawing motions in real-time and use the sensor data for recognition. An inertial sensor based Inertial pen

consist of an inertial sensor MPU 9150 (accelerometer gyroscope and magnetometer), microcontroller, and a wireless transmission module, for sensing and collecting movement data for writing alphabet. The sensor data is received and processed for alphabets, recognition. The recognition algorithm composes of the steps of sensor data acquisition, signal pre-processing, feature generation, feature selection, and classification. KNN Classifiers for classification among 26 capital alphabets classes is built. The project aims at to validate the effectiveness of the inertial pen based motion data acquisition and recognition of class of test sample from among 26 classes. The recognition accuracy achieved is 82%. The recognition accuracy of 93 % is achieved for recognition of four gestures[6].

*In, An Inertial Pen With Dynamic Time Warping Recognizer for Handwriting and Gesture Recognition:*

This paper presents an inertial-sensor-based digital pen (inertial pen) and its associated dynamic time warping (DTW)-based recognition algorithm for handwriting and gesture recognition. Users hold the inertial pen to write numerals or English lowercase letters and make hand gestures with their preferred handheld style and speed. The inertial signals generated by hand motions are wirelessly transmitted to a computer for online recognition. The proposed DTW-based recognition algorithm includes the procedures of inertial signal acquisition, signal preprocessing, motion detection, template selection, and recognition. We integrate signals collected from an accelerometer, a gyroscope, and a magnetometer into a quaternion-based complementary filter for reducing the integral errors caused by the signal drift or intrinsic noise of the gyroscope, which might reduce the accuracy of the orientation estimation. Furthermore, we have developed a minimal intra-class to maximal inter-class based template selection method (min-max template selection method) for a DTW recognizer to obtain a superior class separation for improved recognition. Experimental results have successfully validated the effectiveness of the DTW-based recognition algorithm for online handwriting and gesture recognition using the inertial pen[7].

*In, Analysis of the Interaction between Digital Art and Traditional Art:* During this paper, the great art form is accomplished from constant accumulations in life, it needs generalization and refining rather than pure imagination. We only have to absorb and integrate the advantages of various art forms in order to create more outstanding works of art that facilitate the audience to accept and recognize. Therefore, digital

art and traditional art will obtain better development if they integrate and learn from each other. Especially as the form of new digital art, it should be open-minded to the traditional art of learning, so as to continuously strengthening their creative energy[8].

*In, Analysis about application of learning system into Interactive digital art implementation:* The rapid growth of science and technology influences to Digital Arts. Digital art is no more unfamiliar genre in art field. We can see many kinds of digital arts in our surroundings. High technology makes digital art more brilliant and various. Interactivity is very important factor in digital art. Some interactive digital art works are look like a game. Many digital artists make their art works like game using reactions of spectators. For examples; touching, sound, moving and so on. Many kinds of interactive control elements are used in interactive arts. Some interactive artworks are called game art, because they have strong disposition of games. Usually, we define game art when 'goal' and 'match' concept is used in interactive art. Interactive art and game are very similar genre. One of important things are spectators and they are immersed to the interactive artwork when the artwork has dispositions of games. Most digital artists design their artwork using their own philosophical thinking. However, we tried to apply the learning system that is related to the game to interactive artworks. In the artistic point of view, we analyzed 'Insight Learning', 'Reinforcement Learning', 'Neural Network', and 'Fuzzy' in some digital interactive artworks. These learning systems are atypical learning system in game fields[9].

*A Review Of Classification Algorithms Used For Gesture Recognition Using Accelerometer (2018):* Gesture recognition has the potent and capacity to be a natural means of interaction with PCs and can also prove to be a powerful tool in the domain of communication between the humans and the computers. A disparate range of algorithms are available in the areas of data mining, machine learning, gesture and pattern recognition for solving the same kind of problem. But there is a little guidance for suggesting which algorithm to use which gives best results for the problem at hand. Classification plays a vital role in many information administration and retrieval tasks. Document classification, also known as document categorisation, is the process of assigning a class to one or more predefined category labels. Classification is often posed as a supervised learning problem in which a set of labeled data is used to train a classifier which can be applied to label future examples [1]. Gesture classification includes

different parts such as data processing, feature extraction, feature vector construction and final classification. Thus improvement in each part should lead to better results in document classification. In this paper, we apply machine learning methods for gesture recognition using classification techniques and algorithms available. The aim is to train our classifier by support vector machine (SVM) and K-nearest neighbour (KNN) algorithms. We aim to propose a framework for an accelerometer based gesture recognition of 26 letters of the english alphabet, all established and collected by means of a sensor placed on the palm of a person used as a device. Using machine learning the results achieved are recognitions made by 50 gestures, using the support vector machine classification methods with a performance of 0.94 accuracy. In Experiments, although both algorithms show acceptable results for gesture recognition, the performance of SVM is better in comparison to KNN[10].

#### IV. PROPOSED SYSTEM

The project consists of different parts which work individually and is integrated as a whole in order to make single complete system. As a result of this, the proposed system is divided into two different modules namely as a software module and a hardware module.

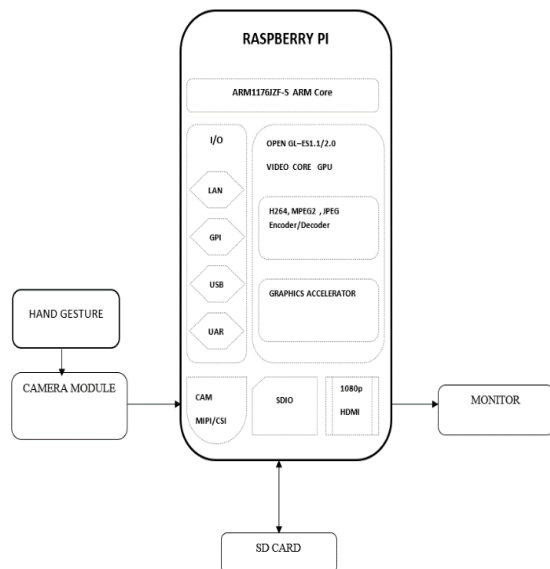


Fig-1: System Block diagram

The system consists of ARM11 Raspberry Pi device, camera and Projector. There are colour markers placed at the tip of users fingers. Marking the user's fingers with red, yellow, green and blue coloured tape helps the camera to recognize the

hand gestures. Captured gesture image is transferred to the ARM11 Raspberry Pi device for further processing. Projector receives the information from the ARM11 Raspberry Pi device & projects on to any particular surface or screen.

Gesture recognition is used to identify human hand gesture with the help of mathematical algorithm. The color markers are placed at tip of the user fingers which are detected by the webcam by tracking the fingertip movements of the user's finger. Also there are different options provided like stop, pause and start. So the gesture recognition enables the human computer interaction in smooth way.

In [5], Air writing is different from traditional handwriting. The characters or words recognize the basis of 6 degrees of freedom hand motion data. Written motion is observed with location and orientation in the global frame, and the acceleration and angular speed in the device-reordered coordinates. The air-recording recording process takes a long time. To make the recording process possible, the limited words in the stroke orders and upper-case letters makes limitations on the possibility of air-writing data acquisition without losing too much of them. From this motion data, get basic features for observations of HMM, and combination of complete optical, clean incentive, and complete 6- DOF features. Though the handwriting is in full-planar shape, the motion information beyond the spatial orbital is a diagnostic description. Air-writing without a pen-up / pen-down information is one-stroke. Writing style and motor control are typically different from Pen-based texts. They are divided air-writing into two levels , movement characters and movement motions as mentioned in [5].

#### V. SOFTWARE AND HARDWARE

##### Software:

- Raspbian Jessie OS
- Python language

##### Hardware:

- Raspberry pi
- SD card
- Camera
- Monitor

##### ADVANTAGES

- Can be replicated with precision
- Almost limitless possibilities
- Tools of dreams to create with
- Easy to use and more accurate

## VI. CONCLUSION

In this paper, we presented a new framework for the recognition of mid-air finger writing using web-cam video as input. We proposed a new writing hand gesture detection algorithm for the initialization of air-writing. The proposed air-writing recognition framework can find applications in virtual classroom and drawing applications with the help of Raspberry pi and web camera. A key application may be in smart home automation for gesture-controlled smart home devices.

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