

# HAND SIGN RECOGNITION FOR DAILY INFORMATION ACQUISITION BASED ON NONLINEAR DIMENSIONAL REDUCTION

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**ABSTRACT:** Hand gestures are the way of communication between speech impaired people and normal persons. It provides human-machine interaction, Gestures are the inputs in hand sign recognition as we use input devices such as keyboard and mouse in computer system. The aim of this paper is to provide interface that connect digital world to physical world. Keyboard and mouse are the input devices used to get information about news, weather, business news etc. Hand gestures are the medium of communication through expressions, through sign language. In every state of India there are different languages used, so sign language is also different but having same grammar. Distributed locally linear embedding (DLLE) is a learning algorithm which is used for the dimensionality reduction. This algorithm is used to specify the intrinsic structure of data.

**KEYWORDS:** Hand gesture, distributed locally linear embedding (DLLE), hand detection, hand sign recognition, information acquisition, human-computer interaction (HCI), and Indian Sign Language.

## I. INTRODUCTION

Gestures are the expressions and used to communicate with speech impaired persons, in other ways. In aircrafts for the safety of passengers, hosts and hostess uses gestures when aircraft takes off. Gestures provide communication between human as well as machines also. It consists of man-machine interface or human-computer interface (HCI). HCI is the way of communication in which gestures are taken as input, as we use keyboard or mouse in computer system.

Now-a-days in our daily life we use newspaper, news and internet. Internet is only one source of information that can be accessed everywhere. Information about weather, news is the most common aspect to access internet. Internet is the most efficient source that connects digital world to physical world. Hand gesture recognition having applications such as robot controlling and sign language used [1].

*Manuscript received Feb, 2016.*

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Hand sign recognition is used to control a robot. As we provide counts or numbers to a robot, count 'one' means 'move forward' and count 'five' means 'stop'. Count 'two', 'three', and 'four' means 'move left', 'move right', and 'move backward'. The working of robot depends on its functioning. User can program their robot as they want.

Second application of hand sign recognition is sign language. In every country different sign languages are used. Every sign language has its own grammar and gestures. Static and dynamic gestures are used in hand sign recognition. Sign language consists of gestures which is easiest way of Communication between speeches impaired people and normal persons.

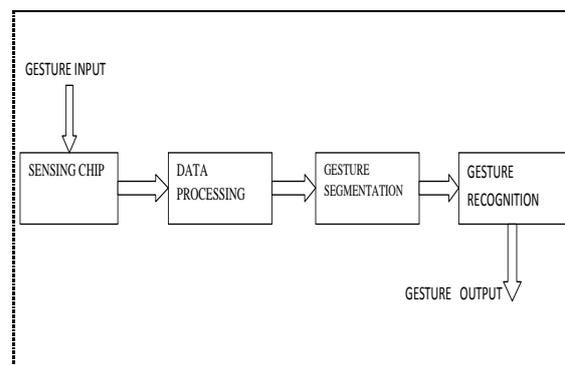


Fig. 1: system overview.

In hand sign recognition gesture input is applied to sensing chip. Sensing chip leads to data processing in system. After data processing there is gesture segmentation which leads to recognized gestures and provides output to the system. Hand sign recognition uses gestures as input through cameras. The gestures are recorded in camera and image processing is done by sending them into system. After image processing it interact with internet. This process of image processing provides human-computer interface that does not require input devices such as mouse, keyboard. System takes gestures as input device and provides accurate output after data processing.

## II. GESTURES

Gestures are of two types: static and dynamic gestures. Static gestures are observed over a period of time such as sign to stop. Dynamic gestures are not constant; it changes over a period of time such as motion of hand for goodbye.

### III. INDIAN SIGN LANGUAGE

Sign language is a medium of communication with the movements of hands. It uses static and dynamic gestures. Sign language uses single handed and double handed movements. Sign language is used in all over world. Every country had its own sign language and grammar. Every state of India has different languages such as Gujrati in Gujrat, Marathi in Maharashtra etc. Sign languages used in India are different to each other but grammar is same for all. Sign language is very helpful to provide communication between disabled persons and normal people.

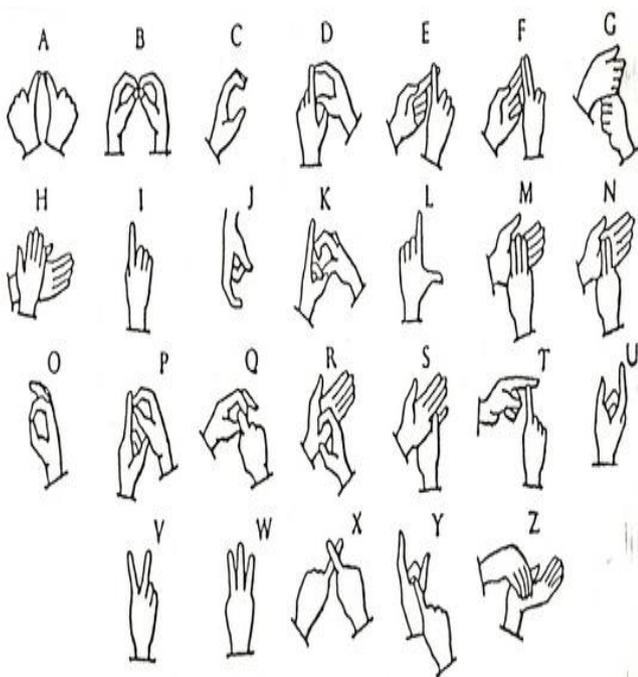


Fig2. Indian Sign Language.

Indian sign language includes both single handed and double handed expressions. Gestures are an expression that provides communication between disabled persons and normal people.

Gestures are also used by the pilots in aircrafts while flight takes off. These gestures are difficult to understand for disabled person or aged people. Speech and gestures are the expressions that commonly used by the human beings. Sign language is very helpful for the disabled people.

### IV. DLLE

DLLE stands for distributed locally linear embedding. DLLE algorithm is used for the non-linear dimensionality reduction [3]. Data that requires two or three dimensions to represent are difficult to interpret. If manifold process is of low dimensional space then the data acquired having low dimensional space. Linear embedded system consists of data has higher dimensional space that is specified by simplification process.

#### A. ADVANTAGES

Advantages of dimensionality reduction are:

1. It reduces the time and storage space required.
2. It improves the performance of machine in learning model.
3. It becomes easier to visualize the data and it reduces very low dimensions such as 2D and 3D.

#### a.) EMBEDDING COORDINATES COMPUTING

Computations of embedding coordinates are:

$$\begin{aligned} \Delta(Y) &= \sum_i^N \|Y_i - \sum_{j \in S_i(x)}^{s_i(x)} W_{ij} y_j\|^2 \\ &= \sum_i^N \|Y_i - W_i\|^2 \\ &= \text{Tr}(Y(I - W_i)(Y(I - W_i))^T) \\ &= \text{Tr}(YMY^T) \end{aligned}$$

In these equations  $W_{ij}$  are the reconstruction weights.

$Y_i, Y_j$  are the coordinates of point  $x_i$  and its neighbour  $x_j$  in the embedded space.

The algorithms used in Distributed locally linear embedding are such as self organizing maps (SOM) [2]. Self organizing maps are the algorithms used to reduce non-linear dimensions.

Self organizing maps are discovered by Teuvo Kohonen in 1980s. So it is also called Kohonen's map or network. It consists of different nodes and binary quantization or linear vector quantization. Self organizing maps includes coloured format of images in image processing. Colours used are Red, Green and Blue for image processing.

#### b.) INFORMATION ACQUISITION

When data is requested, then data is collected from internet by using process of information acquisition. For accessing the information URL is defined by the user. Different URL's are used for the different hand gestures in the system. Once URL is selected for first time then information is acquired from the internet. This is the process of information acquisition for the data collection [4].

#### c.) HAND DETECTION

Hand detection process image is taken by the camera. Video stream is taken as input in the system. Many approaches are used for the hand detection. In hand detection skin colour is also detected. The simple way for hand detection is to capture image and find for skin colour region in an image. But skin colour detection is very difficult because it detects background colours and other body parts from image. Skin colour detection is completed by the skin colour detection algorithms such as sobel, prewitt algorithms [5].

### V. ALGORITHMS

Algorithms used in hand detection are 3D model based, skeletal based model, and Appearance based model.

**3D Model based:** volumetric or skeletal models are used in 3D based model, or combination of both approaches can be used. Volumetric models are heavily used in computer vision purposes and in computer animation industry. It forms complicated 3D surfaces such as NURBS and polygon meshes.

**Skeletal based model:** it uses simplified version of joint angles parameters along with segment lengths. It uses variety of parameters. This process or model is called as skeletal model.

**Appearance based model:** Appearance based model directly takes its input from images or videos. In this model parameters are directly derived from the database to system.

The advantages of skeletal model are:

- Algorithms are faster because only key parameters are analysed.
- Pattern matching against a template database is used.

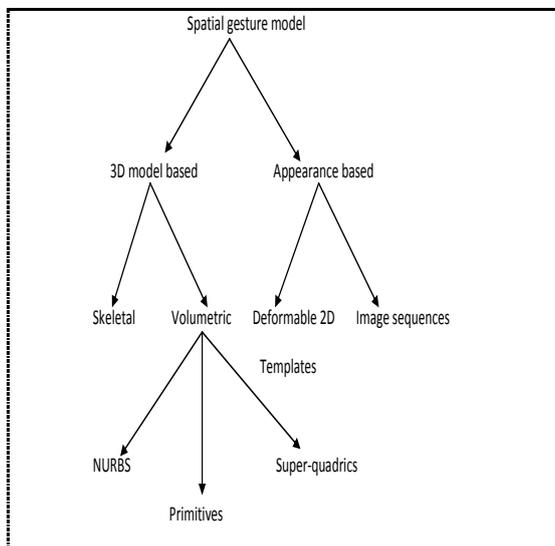


Fig 3. Classification of algorithms.

## VI. HAND SIGN RECOGNITION

Hand sign recognition allows human beings to communicate with machines and interact naturally without using mechanical devices. It provides man machine interface by using gestures. Gestures are static and dynamic.

Sign language uses manual communication or body language to convey meanings. Sign language uses orientation and movement of hands, facial expressions etc. Sign language is also used by the pilots while flight take off. It provides communication between normal persons and disabled persons.

Sign languages were used earlier in western societies in 17<sup>th</sup> century as a visual language that provides communication. Sign language uses signs of hands, hand orientation and movement[6].

Sign language provides communication to disabled people. Sign language is different in every country and had its own grammar. In India every state had its own sign language but its grammar is same. Hand sign recognition consists of two applications that it is used to control a robot, depends on its

functioning. The other one is that it uses sign language and gestures to provide communication

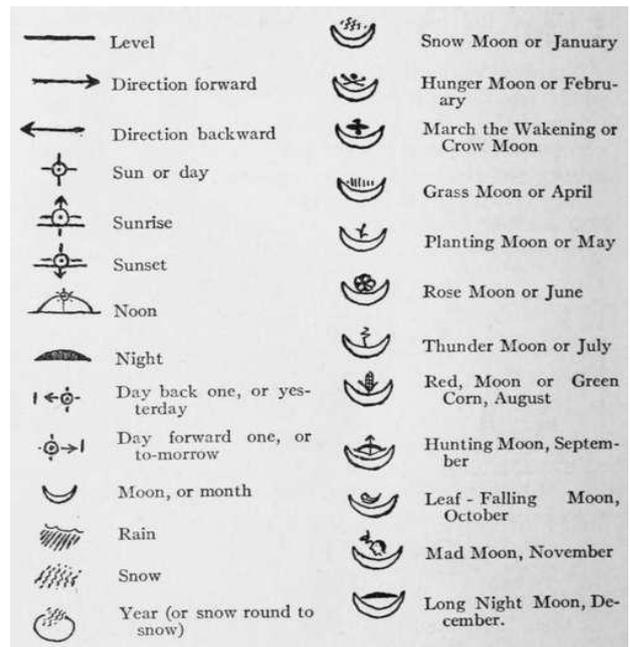


Fig 4: Earlier sign language.

These are the signs or sign language used earlier over a years ago. It consists of method of communication such as sunset, sunrise, rain, snow etc. This is the sign language in earlier times.

Hand sign recognition proves efficient communication techniques for disabled persons. These are used in controlled robotic arms and sign language.

The term gestures and postures are similar in meaning but these are not same. Postures consists of static movement which means holding the hand with specific pose such as signal to stop called posture. Gesture consists of dynamic movement of hand such as waving hand means goodbye.

## VII. CONCLUSION

In this paper we had implemented that we can use hand gesture recognition in system that interfaces daily information acquisition. We can implement this system in public as well as in home environment. Static and dynamic gestures are used in the system. These are more accurate and fast system. It gives non linear dimensionality reduction by using distributed locally linear embedding. This algorithm is used for the dimensions reduction such as 2D or 3D. This is the appropriate hand gesture system.

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## BIOGRAPHY



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