Identification of Devnagari Signs for word formation Based on Fingertips and Palm

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Abstract –

In this paper, A finger point and palm based database is used for assigning signed language symbol to text identification and a word is created after classification of symbol. The creation of a voltage signal that is uninterrupted takes place as a direct consequence of the process of detecting the data. After the information has been acquired, it is then converted into a digital format so that digital images may be created. In this stage of the process, sampling and quantization are used in order to complete the task at hand. If you follow these instructions, you will be able to create a digital image in the form of a two-dimensional array of integers as the end product. In a subsequent part of this investigation, we are going to propose a method for the efficient identification and classification of signed language symbols to text that is based upon RGB photo datasets. This method will use finger points to represent the symbols. This algorithm will be used to recognize and categorize the symbols used in signed languages. The palm-sized photographs are captured for the aim of preprocessing in order to meet the conditions for the creation of a convolution neural network-based approach. These photos are of varied sizes, backdrops, and orientations. This method makes use of AlexNet for the preprocessing requirements, which include enhancing 47 symbols of the Devanagari script based on the reference rulebook that was developed specifically for our needs and which is emphasized in this paper. The symbol is added in such a way to make word which are based upon RGB images with cluttered, non-cluttered, noisy, scattered light etc. environment. We have processed and trained 20000 plus images where we achieved the desired signs from the real time video with an efficiency of 95 %. The algorithm which is implemented on MATLAB as well as PYTHON platform with the help of machine learning solution libraries is used because of its faster training of models.

Keywords: *PYTHON,* convolution, Devanagri, Image processing, classification,rulebook.

Introduction –

Signed languages are developed for human wellbeing. They are not only have their own texture, representation but also have its own grammar etc. that a language requires. Although amendments with any language at any abstract level cannot consider body language a type of nonverbal communication which is the thumb rule of any form of communication.

Introduction to Gesture Recognition Models

A gesture is an instinctive and vivid style of behaving that conveys a range of information that is both rich and significant. In recent years, experts from both the United States and other countries have focused their attention on the technology of gesture recognition. The study of gesture recognition can be approached from a variety of perspectives, the most prominent of which are pattern recognition, signal processing, computer vision, and human-computer interaction. Some common approaches to the study of gesture recognition include gesture recognition based on deep learning, gesture recognition based on Hidden Markov model (HMM) [2], gesture recognition based on geometric features, and gesture recognition based on computer vision [3].

Application of Gesture Recognition Models

The human-computer interaction technology, which is widely utilized at the present time with the mouse, keyboard, or touch screen as the interactive means, is widely believed to become the bottleneck for the further effective utilization of information flow as the use of computers and the internet becomes more widespread in people's day-to-day lives. The process of employing different computer-related technologies to construct a simulation of a real-world environment and experience in the hopes of achieving an immersive sense is referred to as "virtual reality," or "VR" for short. The phrase "virtual reality" refers to this approach. Anything that does not exist in the actual physical space but does exist in the "virtual" or "cyberspace" of the image that was made by the computer is referred to as "virtual."

Use of Fingerprints and Palm for identification of Gestures

The accuracy of visual gesture tracking situations, as well as their ability to operate well in real time, are both impacted by a wide number of factors that are present in the real world. The occlusion of the target, gesture distortion, motion speed, gesture size, light intensity, and gesture scale are some of these parameters. It is a kind of multisource information fusion of interactive 3D dynamic visual and physical behavior of the system simulation that can use sensing helmet, data glove, and other specialized equipment and allow the user to enter a virtual space, real-time perception, and operation of various variables. In other words, it is a simulation of the system that combines the visual and physical behavior of the system.

Proposed Algorithm Methodology –

To start with we need to define the symbols that are to be utilized for creating the master dictionary. For this our work is novel in a way where Recognition of a signed symbol to its Devanagari script text representative is based on three step algorithm that involves majorly creating a dataset of images which are to be preprocessed, followed by feature extraction and finally classification of test images based on the training sets. We selected the basis of 34 signs as per now which can be changed according to the need of language where the finger tips of the finger is detected , where thumb is being utilized as the reference index/pointer so as to provide detection of each symbol individually. So when one uses a thumb to point a specific location on a specific finger the number of tips are restricted to 16 that is 4 points on each finger. From the point of view of creating database which is the first step one needs to first specify the points and the methods utilized for symbol detection that is the prima face rules for which the machine learning algorithm is to be developed. For the rules/ boundary development one needs to understand the overview of the devnagri symbols to be detected.

Proposed Devanagari Script –

The Nagari script comprises of the 47 primary characters including 14 vowels and 33 consonants which is the first level detection of our developed algorithm and thus the fingertips detection is assigned to the particular text/ Unicode of the devnagri script from the dataset. These symbols as shown in figure 1 below are to be detected with the help of sign language based moments that are the requirements of our fingertips/points rule dataset creation as shown in figure 2 below.

अ आ इ ई उ ऊ
ए ऐ ओ औ अं अः

क ख ग घ ङ च छ ज झ ञ
ट ठ ड ढ ण त थ द ध न
प फ ब भ म य र ल व
श ष स ह क्ष त्र ज्ञ

Fig 1. Vowels and Constants in Nagari Script [1].

Database Creation –
The database is created total X × Y × 47 image collection set. All the images are captured with the help of cellphone camera with multiple persons or environment consideration. Starting from sample folders like 5, 10, 15, 20, 25,30,35,40,45,50,55,60,150, and 200 the database is gathered. The Devanagari script, composed of 47 primary & secondary characters including 14 vowels and 33 consonants. So, there will be [11]. The data set will be captured in standard and cluttered backgrounds as well. Besides, for each gesture, the subject poses with variations in hand orientation, scale, articulation, and so forth. For capturing images standard cameras will be used of appropriate resolution. Every Folder consist of 34 more folders of different signs which is preprocessed later and every separate sign folder consists of images with cluttered and non cluttered environment.

Data Base Preprocessing –
Proposed Pre-processing includes cleaning, Instance selection, normalization, transformation at the first instance which can be extended as per the tuning parameters required to over come the setbacks the algorithm the images are to be resized at 227 x 227 x 3. The resizing of image is very useful in terms of the pixels classification and its features. So as per the requirements of Alexnet that we have utilized for feature extraction the images are to be resized to 227x227.

Feature Extraction –
The classifier selection in neural network which is the very first important step is where the database images is feeded properly respective of algorithm requirement. From this the output is feeded with all the features. The classifiers will then predict the class to which the test image belongs. The selection of CNN is based upon the performance of the approach which is based on the following parameters:

- Classification Accuracy
- Precision and Recall
- Confusion Matrix etc.

From the point of view of CNN algorithm for feature extraction step a researcher has multiple options like that of Alexnet,densenet,Google net etc. For our research backbone of feature extraction we have chosen Alexnet because of its simplicity and numerous advantages . According to the need of Alexnet we have defied layer number 23 as the fully connected layer and layer number 25 as the classification layer. From the point of view of feature based database creation we have kept the training feature parameters as SGDM as trainer having maximum epocs as 200 and batch size of 128 of for 256x256 image resized images. The MATLAB is doing the rest of the function in which the file of database is saved in mat file. This net file is continuously upgradable as per the user algorithm requirements in the near future. At this level our database creation algorithm is complete and the required features of the database are stored in the classification layer so that the algorithm is trained and tested with the help of images under test.

Classification / Algorithm Testing –

The test images features are extracted and the extracted features are compared with the features present in the classification layer of Alexnet. The classified image features are then converted to the desired Nagari symbol as shown in the figure 8 below from the created rulebook. Now considering a prototype, in order to detect a sequence of symbols a slider is used with the help of GUI . Proposed work includes 5 sequence of symbols at a delay of 2 sec. After every delay the snapshot of the image is saved and tested with the trained network images.

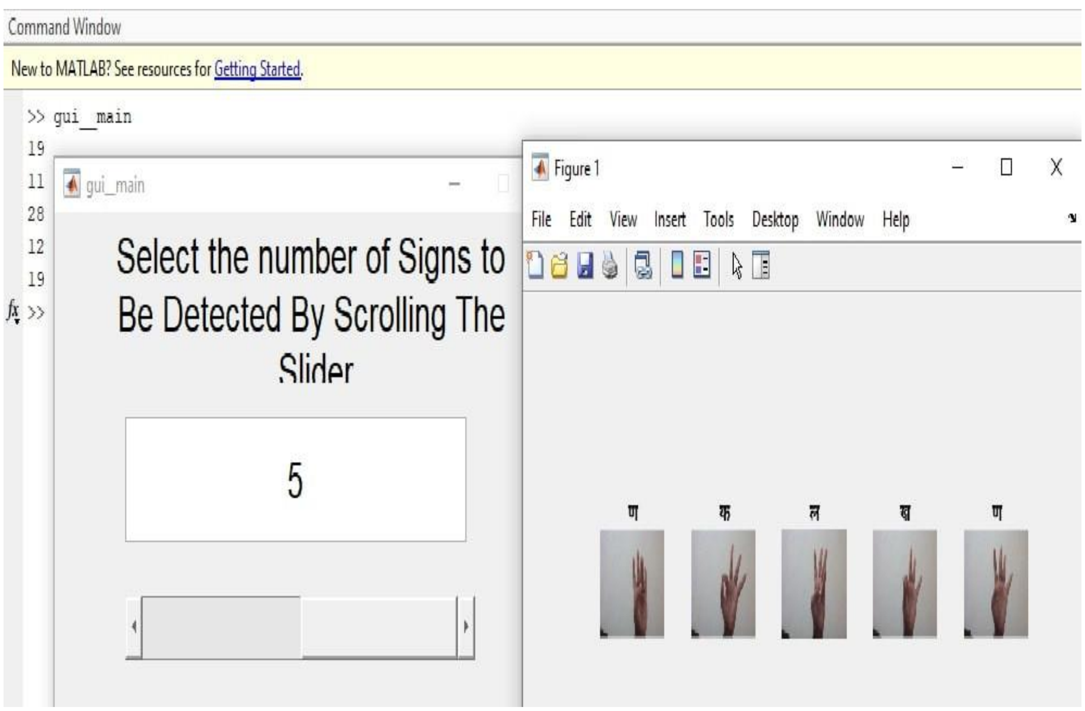


Fig 2.Test Input Image Capture from Input Video Source.

The symbols recognition in text as given below:

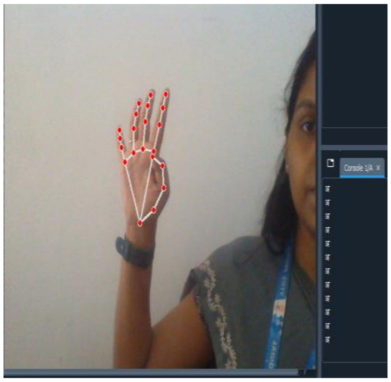
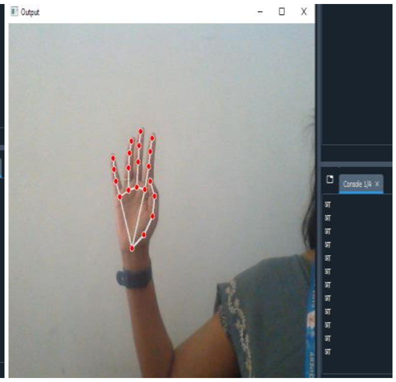


Fig 3



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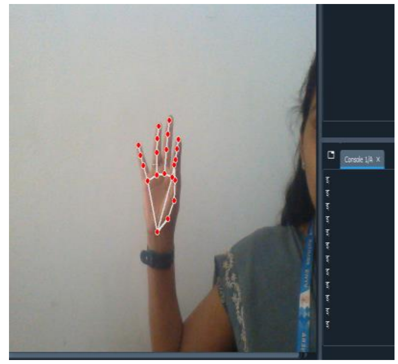

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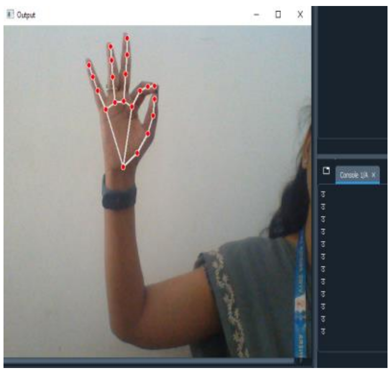

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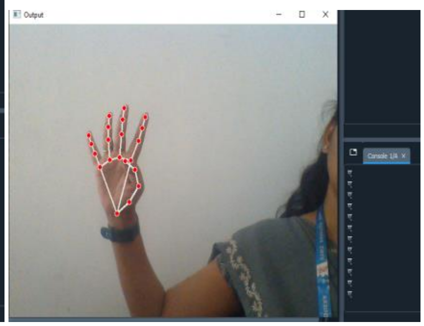

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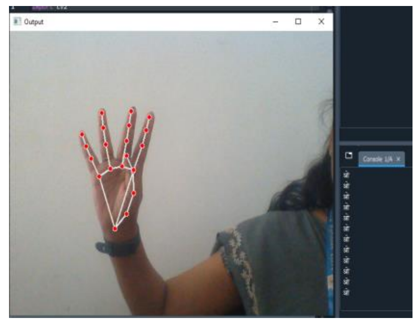

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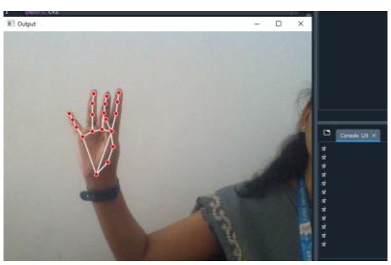

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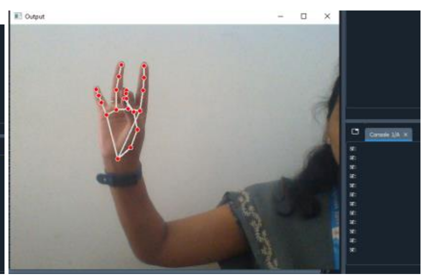

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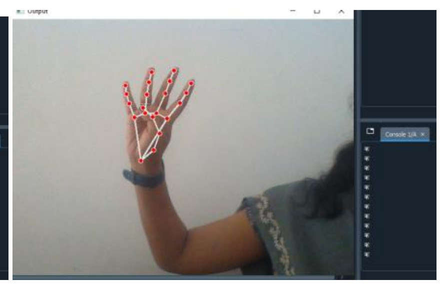

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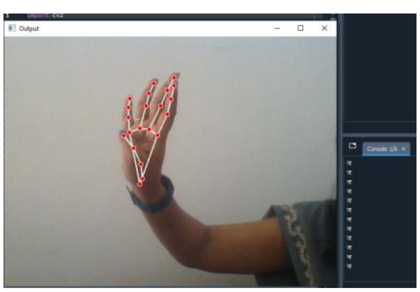

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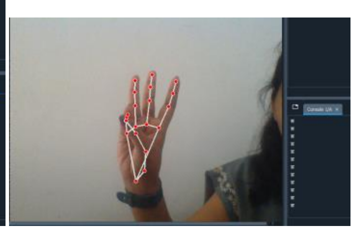

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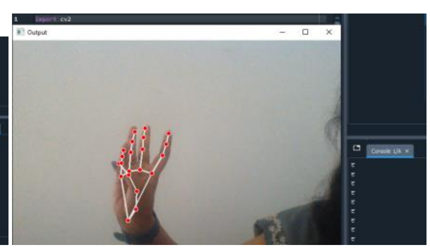

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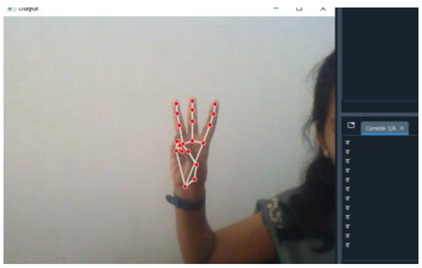

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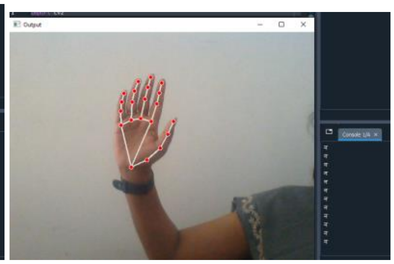

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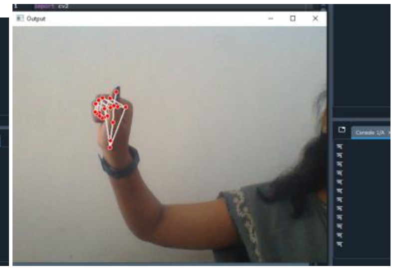

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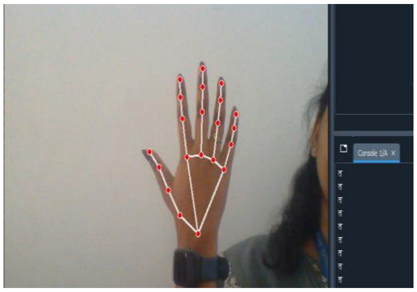

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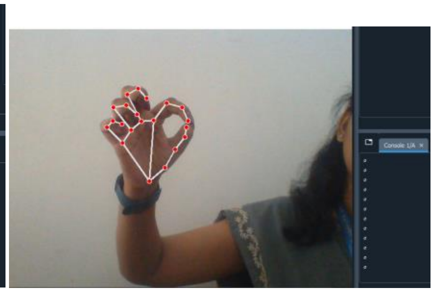

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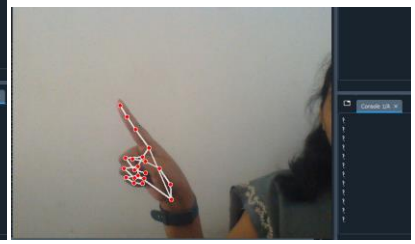

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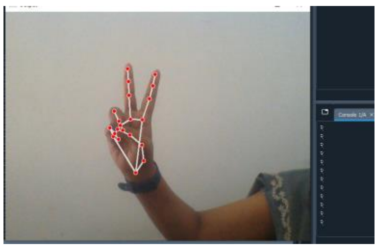

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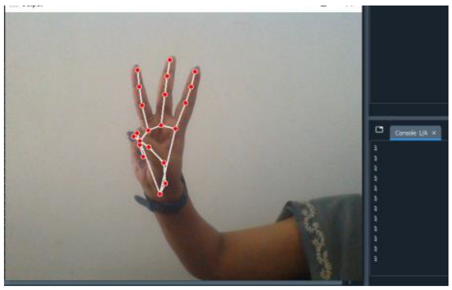

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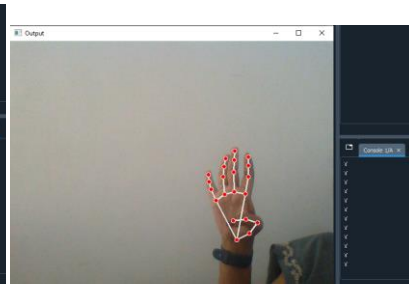

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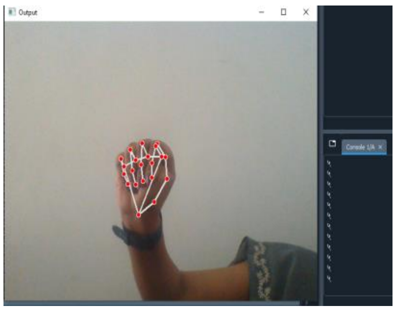

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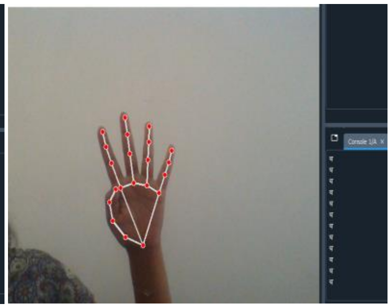

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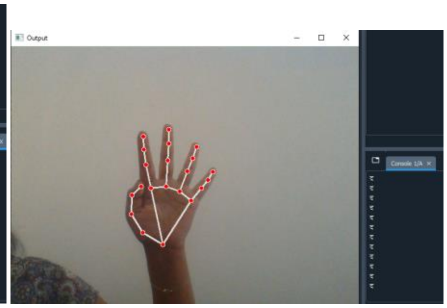

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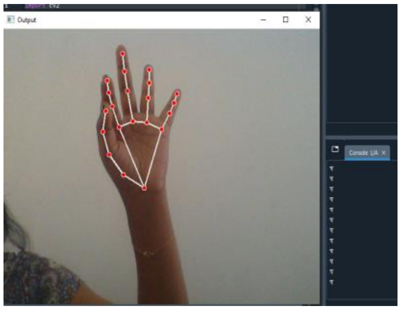

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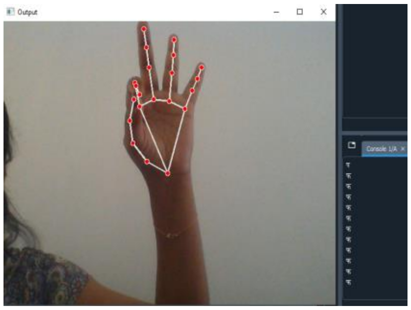

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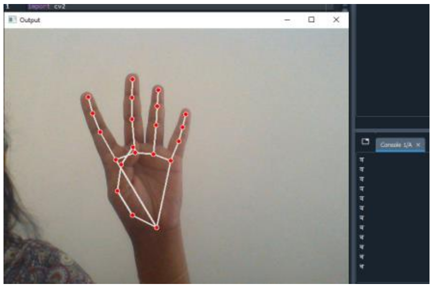

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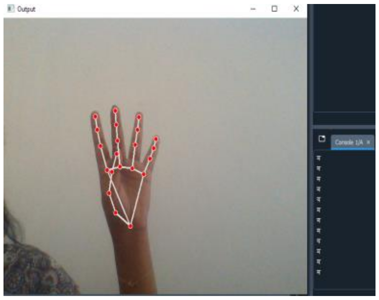

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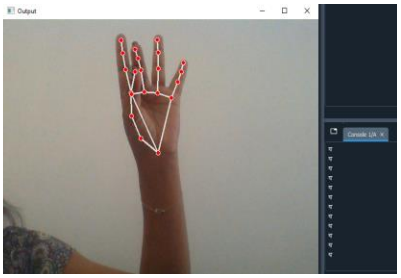

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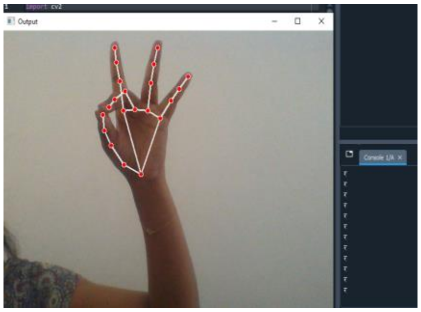

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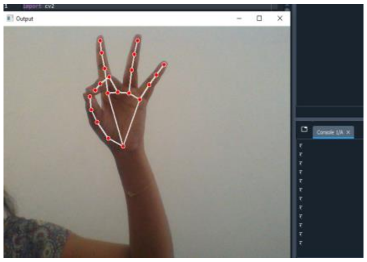

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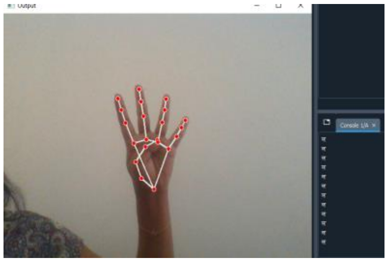

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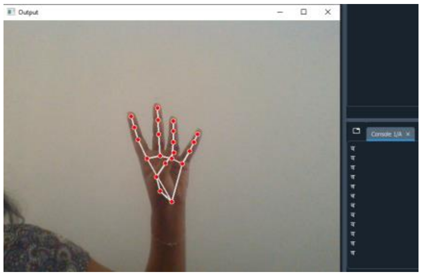

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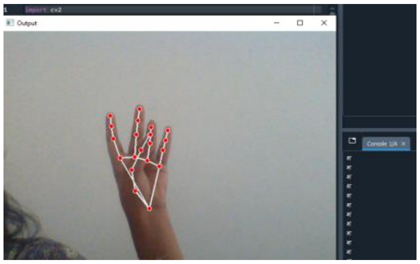
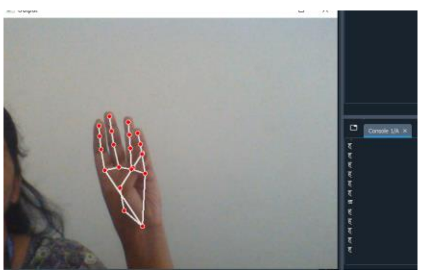


Fig 36

Fig 37

Fig 38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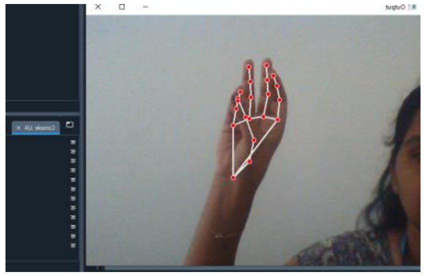
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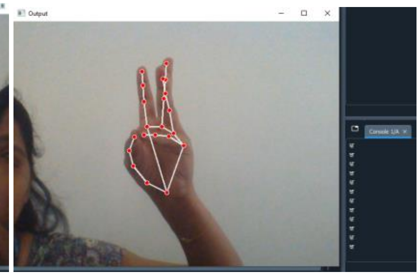
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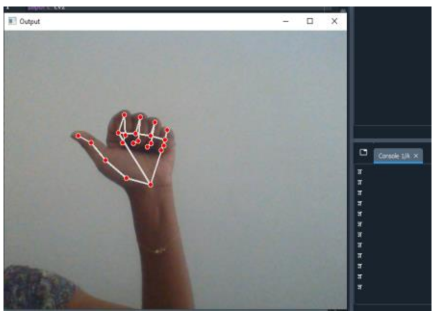
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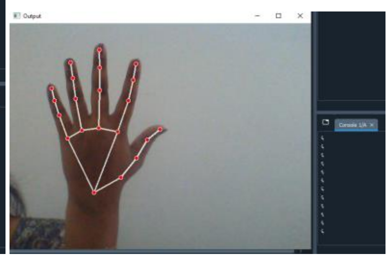
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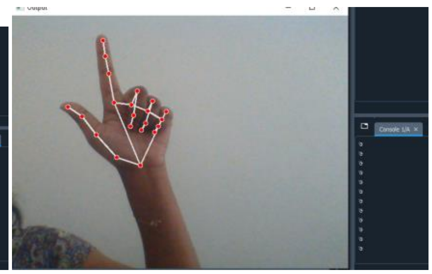
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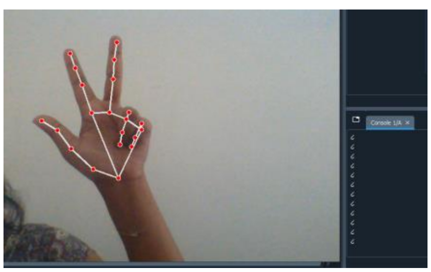
Fig 45

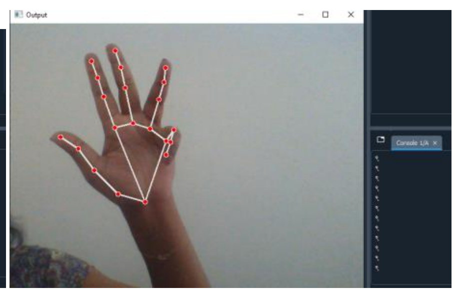
Fig 46

Command Window

178	18850	20:07:14	100.00%	0.0006	0.0010
179	18900	20:10:22	100.00%	0.0006	0.0010
179	18950	20:13:34	100.00%	0.0021	0.0010
180	19000	20:16:51	100.00%	0.0005	0.0010
180	19050	20:20:02	100.00%	0.0012	0.0010
181	19100	20:23:13	100.00%	0.0013	0.0010
181	19150	20:26:24	100.00%	0.0005	0.0010
182	19200	20:29:37	100.00%	0.0011	0.0010
182	19250	20:32:53	100.00%	0.0014	0.0010
183	19300	20:36:05	100.00%	0.0006	0.0010
183	19350	20:39:15	100.00%	0.0021	0.0010
184	19400	20:42:24	100.00%	0.0027	0.0010
184	19450	20:45:37	100.00%	0.0008	0.0010
184	19500	20:48:48	100.00%	0.0011	0.0010
185	19550	20:51:57	100.00%	0.0017	0.0010
185	19600	20:55:08	100.00%	0.0006	0.0010
186	19650	20:58:21	100.00%	0.0007	0.0010
186	19700	21:01:33	100.00%	0.0007	0.0010
187	19750	21:04:43	100.00%	0.0004	0.0010
187	19800	21:07:52	100.00%	0.0004	0.0010
188	19850	21:11:02	100.00%	0.0012	0.0010
188	19900	21:14:14	100.00%	0.0006	0.0010
189	19950	21:17:28	100.00%	0.0005	0.0010
189	20000	21:20:40	100.00%	0.0022	0.0010
190	20050	21:23:50	100.00%	0.0009	0.0010
190	20100	21:27:01	100.00%	0.0007	0.0010
191	20150	21:30:15	100.00%	0.0007	0.0010
191	20200	21:33:22	100.00%	0.0006	0.0010
192	20250	21:36:34	100.00%	0.0007	0.0010

Fig 47. Training Efficiency

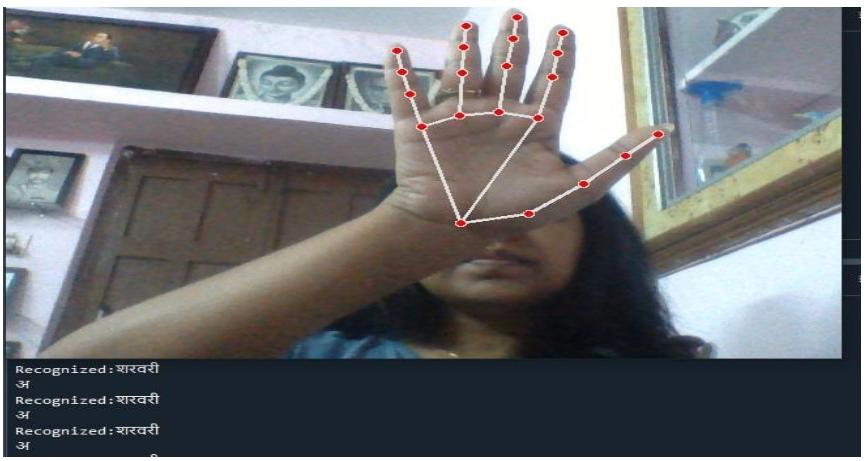

Fig.48 Word formation

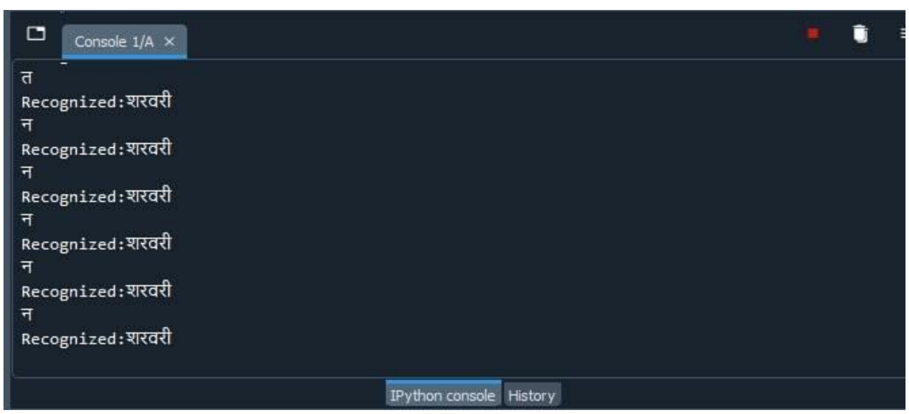

Fig. 49 **शरवरी word formation**

Result and Discussion –

Our proposed research work indicates successful word formation based on finger tips and palm where the symbol to text classification is successfully carried out. The convolution model is used widely as the need arises for the symbol identification or in future if we need to detect more number of sequence signs. But the time constraint can affect the accuracy level while extending the margins of the work. Our findings have an opportunity to so many interested researchers in their like-wise experiments where a slider is used for many more number of signs detection. The future of machine learning towards the betterment of human society; when we talk about signed languages to be considered as universal natural language of communication in this modern world. Thus we achieved 100 % testing efficiency as shown in fig.8 and fig. 9 and fig.10 tells us about the word formation and 90% testing efficiency for video processing whereas 95% efficiency on stable database images .

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