Continues Integration Pipeline Implementation for Tech11Software

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Overview

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INTRODUCTION

Hand gesture and hand posture differ in their respective interpretation.

HCI(Human Computer Interaction) using Gesture and Sign language recognition (SLR), aimed at creating a virtual reality, 3D gaming environment, helping the deaf-and-mute people etc., extensively exploit the use of hand gestures.

INTRODUCTION contd..

Gesture Recognition for Computer Games

Figure : Controlling Games with Gestures

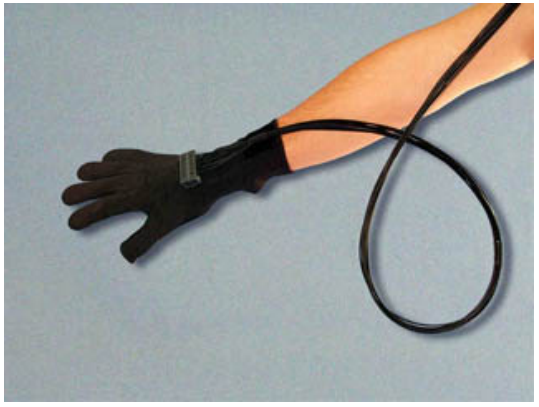
INTRODUCTION contd..

The Nintendo Wii is a big success because its motion-sensitive paddle lets users innovatively control objects on the screen with hand gestures.

Companies, such as GestureTek (www.gesturetek.com) and Oblong Indus- tries (www.oblong.net), are currently developing the necessary hardware and software to track hands and recognize hand gestures.

INTRODUCTION contd..

- Two types of Hand detection mechanism.
  - Glove based



  - Vision based
    - Color based
    - Hand based

INTRODUCTION contd..

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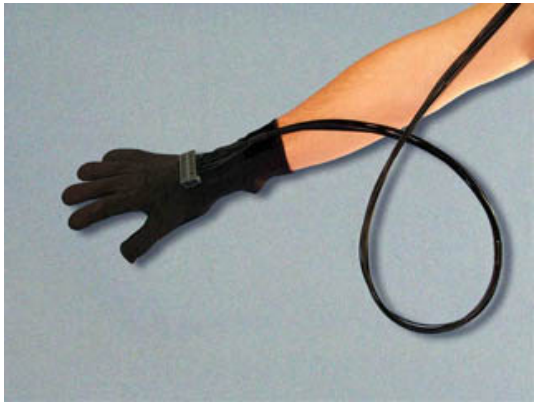

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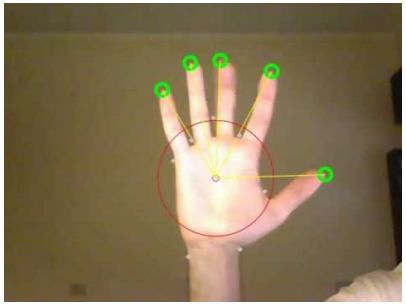
INTRODUCTION contd..

- Color based

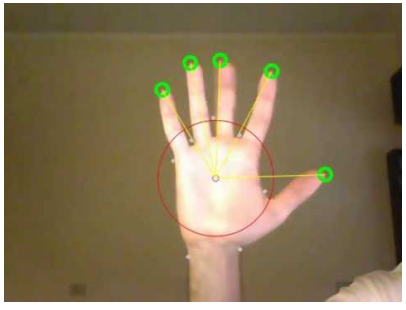
- Hand based



INTRODUCTION contd..

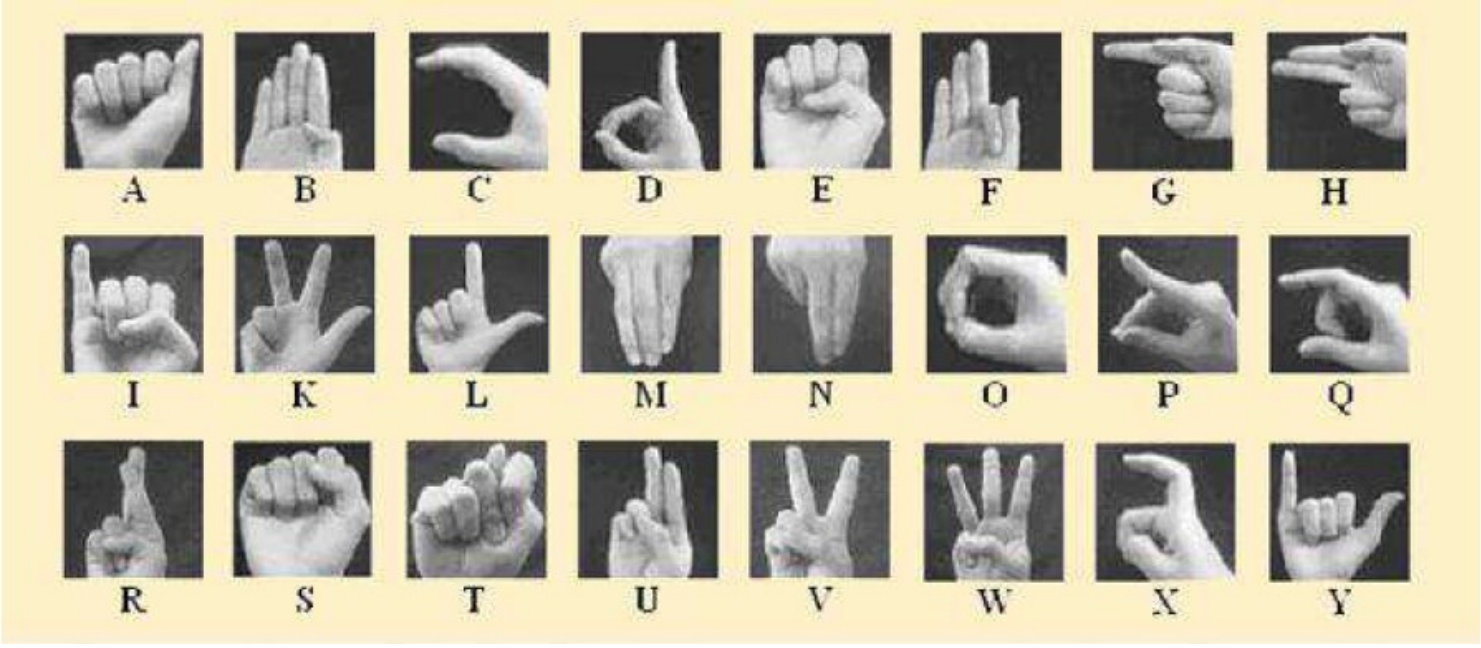
- Color based

- Hand based



INTRODUCTION contd..

- Hand Gestures for the English Alphabet



PROPOSED SYSTEM

- Any hand gesture recognition system requires some basic stages. These stages are
  - Gesture module and image acquisition
  - Hand segmentation
  - Tracking
  - Feature extraction
  - Classification

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Gesture module and Image acquisition

- The video frames of the user is captured with the low-cost web-cam.

Gesture module and Image acquisition

- The video frames is captured by a necessary Computer vision library[2].
- Here the system processes have been captured at a resolution of 720x480 at 40 frames. per second (fps).

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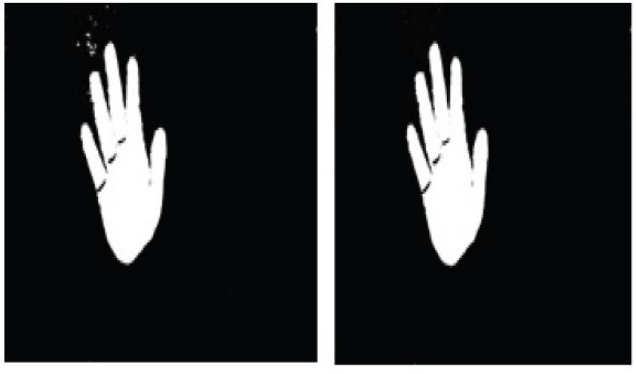
Hand Segmentation

- Proper hand segmentation from other body parts and background is very crucial for the overall efficacy and the effectiveness of any vision based hand gesture recognition.
- Skin colour based segmentation is used.

Hand Segmentation

- Here the Hand must separated from the rest of the body parts and from the surrounding.
- For proper segmentation, the user must worn a full sleeve black dress to separate hand from other body parts.



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Hand Tracking

- technique which constantly monitors the consecutive positions/locations of the region of interest (ROI) (hand in this case).
- To find the gesture trajectory - use Centroid
  - Centroid is found out by moment calculation.
- From moment the centroid (CoG) is found.

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Feature Extraction

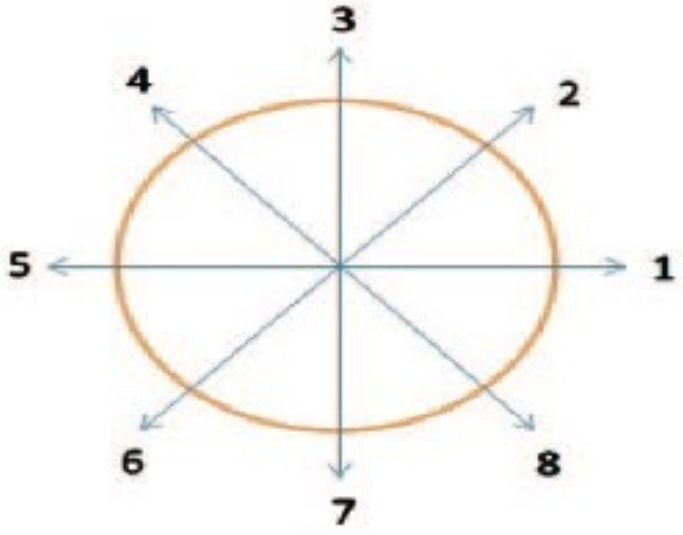
- Transforming the input data set into a set of features is called feature extraction.
- Considered data of 128 sample points as the feature set for each isolated gesture and data of 256 sample points as the feature set for each continuous gesture.

Feature Extraction

- The extraction features are
  - Orientation.
  - Gesture trajectory length,
  - Velocity and acceleration.

Feature Extraction

- Orientation
  - Input is the sequence of centroids.
  - orientation feature can be calculated from a coordinate geometrical formula.
  - Each angle is then converted into one of the eight directions codes.



Feature Extraction

- Gesture trajectory length
  - This feature is extracted by considering the centre of gravity (CoG) of the trajectory to be the point of reference from which the distance of other points on the trajectory is found out.

Feature Extraction

- Velocity and acceleration
  - each alphabets the velocity and the acceleration of change and transition is different.
  - Acceleration (a) is time derivative of velocity.
  - The acceleration and velocity are together considered.

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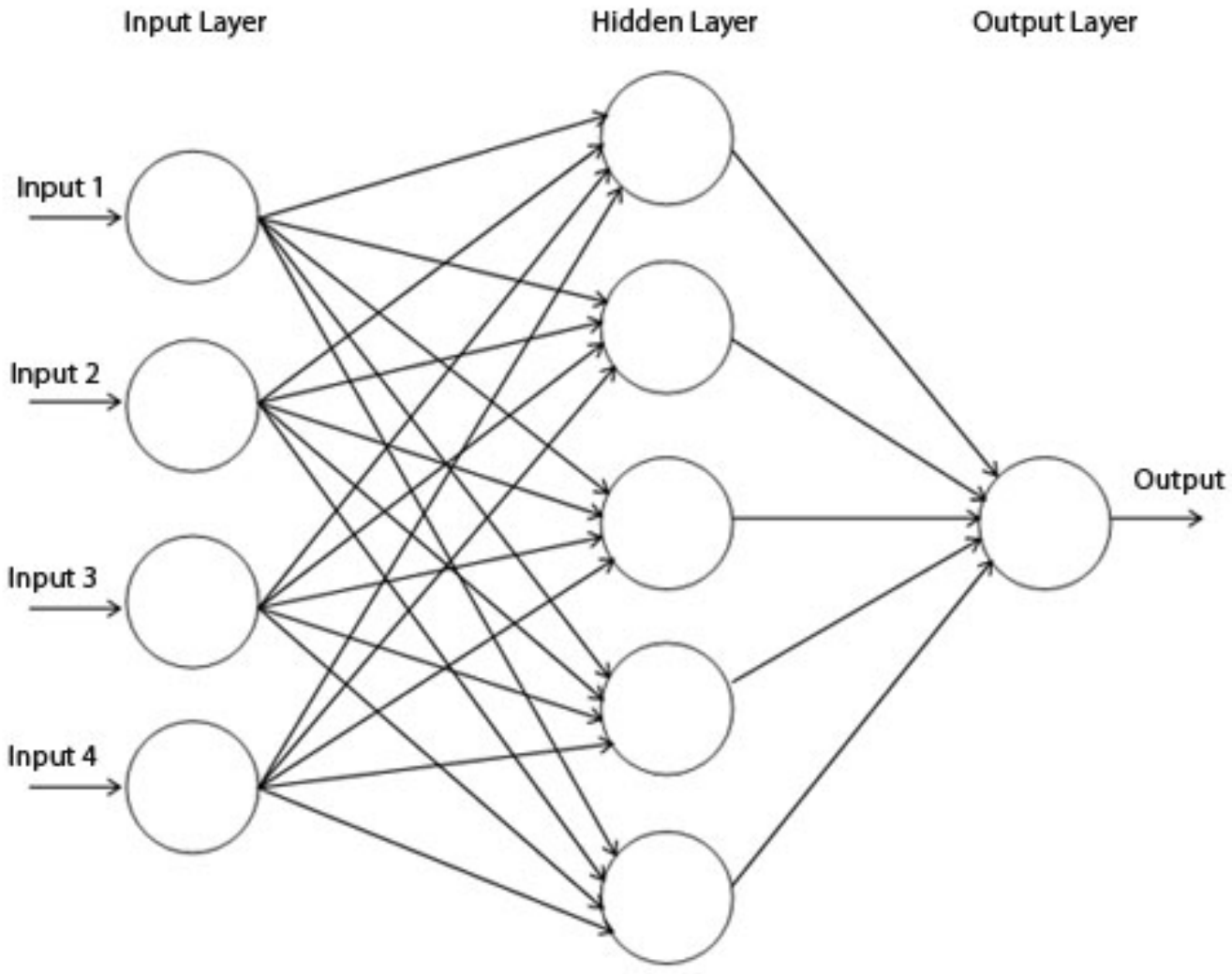
Classifier

- Classifiers are those systems which accept feature set as input and provide class-labeled output[1].
- A multilayer perceptron artificial neural network (MLP-ANN) and focused time delay neural network (FTDNN)is considered.

Classifier

- MLP is a feed-forward ANN which is trained with back propagation algorithm.
- The MLP used in the work is a 3 layered network for both isolated and continuous gestures.
  - Inputlayer
  - Hidden layer
  - Output layer

Classifier


Input Layer
Hidden Layer
Output Layer
Input 1
Input 2
Input 3
Input 4
Output

Classifier

- The input layer contains 128 nodes for isolated gestures.
- 256 nodes for continuous gestures
- one input node per sample point per gesture.

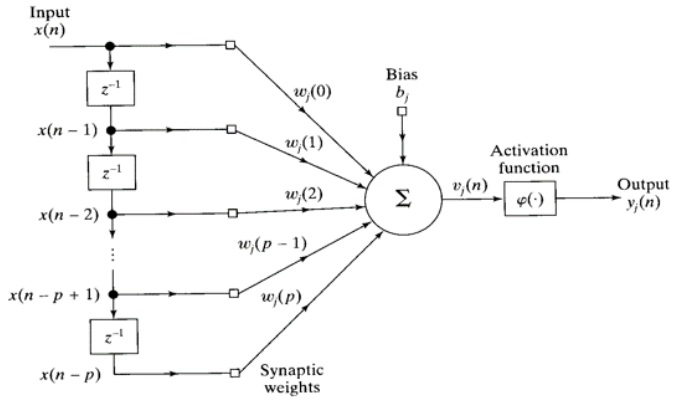
Classifier

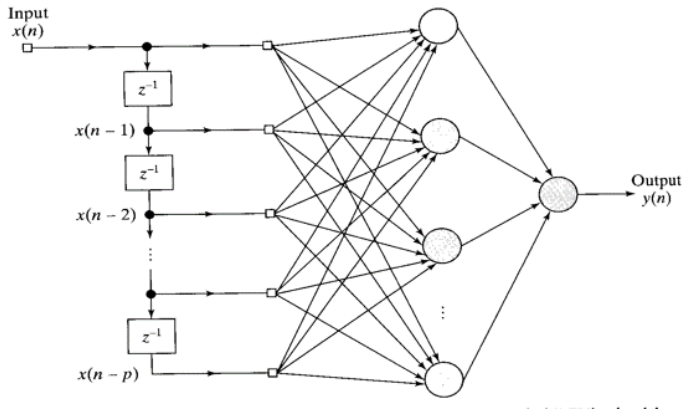
- output layer contains as many nodes as the number of classes of alphabets.
- The maximum number of epochs chosen is 200 and minimum square error (mse) goal is 0.0001.

Classifier

- TDNN
  - Multilayer feed forward neural network whose hidden and output layers are replicated across time.
  - The FTDNN, focus in the sense that the entirely network structure is located at the input end of the unit[3].
  - Use tapped-delay line with delays from 1 to 8 with 10 neurons in the hidden layer. The maximum number of epochs chosen is 500 and mse goal is 0.0001.

Classifier


Input
$x(n)$
z^{-1}
$x(n-1)$
z^{-1}
$x(n-2)$
$x(n-p+1)$
z^{-1}
$x(n-p)$
$w_j(0)$
$w_j(1)$
$w_j(2)$
$w_j(p-1)$
$w_j(p)$
Synaptic weights
Bias
b_j
Σ
$v_j(n)$
Activation function
$\varphi(\cdot)$
Output
$y_j(n)$


Input
$x(n)$
z^{-1}
$x(n-1)$
z^{-1}
$x(n-2)$
z^{-1}
$x(n-p)$
Output
$y(n)$

PROPOSED GESTURE RECOGNITION METHODOLOGY

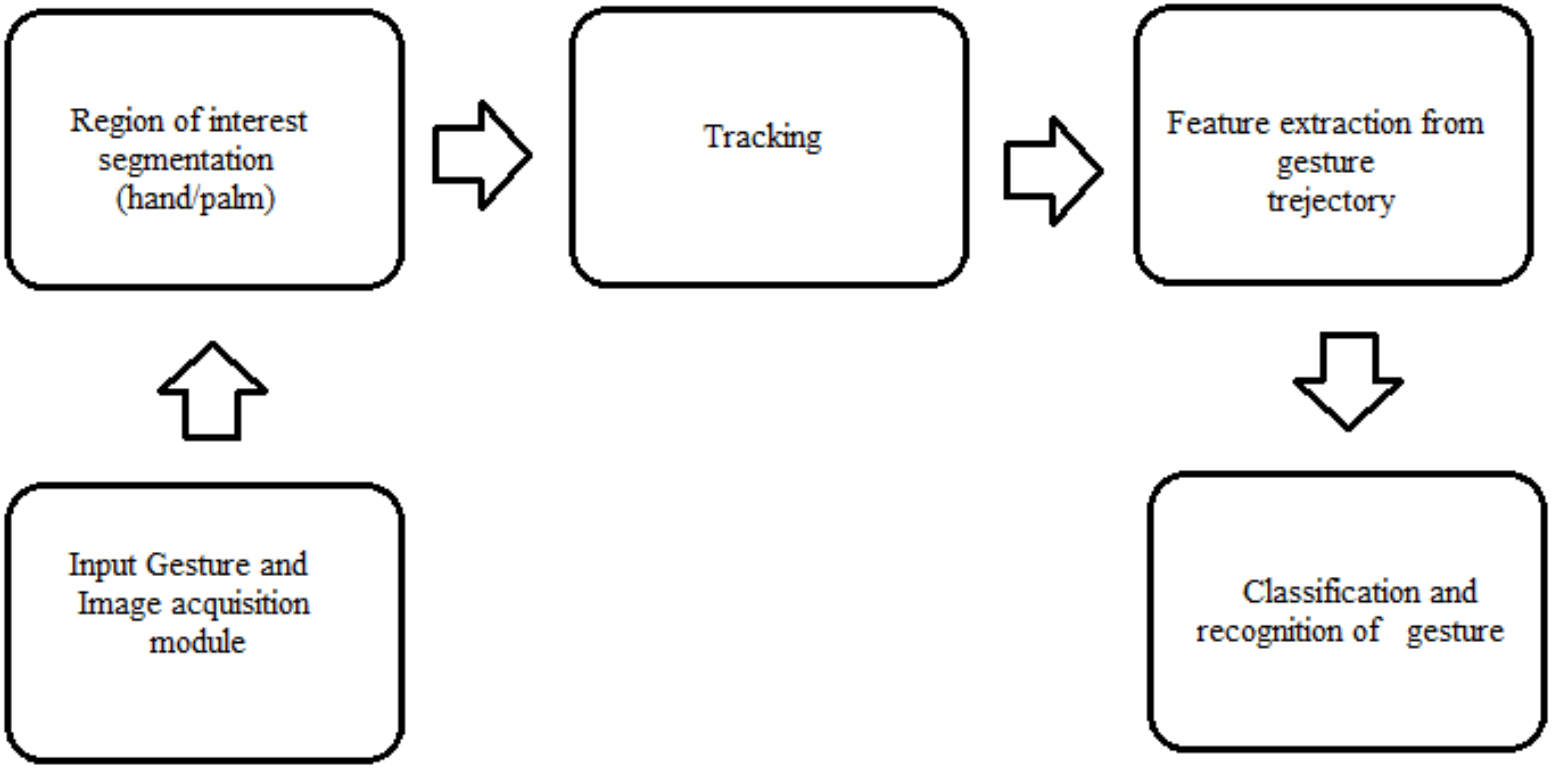


Figure : Block diagram for hand gesture recognition system

PROPOSED GESTURE RECOGNITION METHODOLOGY

- The steps in SLR system are,
  1. The captured RGB frame which is the input frame here is first converted into the corresponding HSV and YCbCr frame which are the outputs in this step[4].
  2. Skin pixels are extracted by skin thresholding applied on both the frames obtained from Step 1 to result in skin-colour thresholded frames.
  3. Both the frames obtained from Step 2 are then converted into binary frames which contain pixel value either 0 or 1 and these binary frames are the outputs of this step which contain only the contour of the segmented hand.
  4. Morphological operations (e.g erosion, dilation etc) are performed on the frames obtained in Step 3 to remove unwanted noisy pixels.

PROPOSED GESTURE RECOGNITION METHODOLOGY

- The steps in SLR system are,
  5. Logical AND operation is performed between the planes obtained from Step 4 to remove the background noise and to get the most-connected regions in the planes.
  6. Centroid of segmented hand portion is calculated and found from the frames obtained in Step 5 using moment calculation[4].
  7. Gesture trajectories are found by connecting the centroids of the segmented hand during the gesticulation at different time instants which results in the gesture alphabets we intend to draw.
  8. The features already mentioned are found out for each gesture alphabet.
  9. The feature vectors are then used as input to MLP and FTDNN classifiers for recognition of the gesture alphabets.

PROPOSED GESTURE RECOGNITION METHODOLOGY

- Recognition of Continuous Gestures
  - The detection and recognition techniques involved with continuous gestures are different from that of isolated gestures.
  - In case of continuous recognition the time interval between 2 gestures must be know.
  - Here is take velocity of the actions is constant ie, acceleration is 0.

PROPOSED GESTURE RECOGNITION METHODOLOGY

- After extracting the boundary information in the continuous gestures with the help of acceleration feature, the neural network have been trained with these information to recognize these gestures.

- Here 30 samples video for training.

CONCLUSION

- Provide some insights into certain methods to recognize isolated and continuous English alphabets hand gestures.
- Here the system uses both MLP and FTDNN
- The recognition rate achieved with MLP in this case is 89.05 while that achieved with FTDNN is 87.14

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[4] G. Bradski and A. Kaehler, *Learning OpenCV*. OReilly Media Inc, 2008.

thank you!