



Application Control Using 3D Gesture Recognition

By:

Ashutosh Verule

Shrivardhan Suryawanshi

Poonam Rajput

Prof. Rajashri Itkarkar

OBJECTIVES



- Primary Goal: To create a system which can identify specific human gestures from their 3D images

- Other major objectives of our model are:
 - Image Segmentation using YCbCr and HSV models
 - Feature extraction using covariance matrix, Eigen values and Eigen vectors, covering all the features of the entire image
 - Giving the respective text output, and, executing the application consorted to the identified gesture

LITERATURE SURVEY



| AUTHORS | TITLE | RESEARCH WORK | DESIRED RESULTS |
|---|---|---|-----------------------|
| Padmanabham Patki & Nagasrikanth Kallakuri | British Sign Alphabet Recognition System | Using PCA, LDA, SVM And Correlation Filter For Gesture Recognition | Recognition Rate: 90% |
| Hazem Khaled, Sayed, El Sayed Mostafa & Hossam Ali | Hand Gesture Recognition Using Average Background And Logical Heuristic Equations | Background Subtraction Where The Fingertip Is Detected Using Logical Heuristics Equations | Recognition Rate: 84% |
| Dharani Mazumdar, Anjan Kumar Talukdar & Kandarpa Kumar Sarma | A Colour Fingertip-based Tracking Method For Continuous Hand Gesture Recognition | Use Of Fingerpen and A Glove Based System For Segmentation | — |
| Joyeeta Singha & Karen Das | Indian Sign Language Recognition Using Eigen Value Weighted Euclidean Distance Based Classification Technique | Eigen Value Weighted Euclidean Distance As A Classification Technique For Recognition | Recognition Rate: 97% |

PREREQUISITES



1] American Sign Language

- Predominant Sign Language Of Deaf Communities In USA, Canada, West Africa, South Asia And Many Other Parts Of The World

[Alphabets](#)

[Numbers](#)

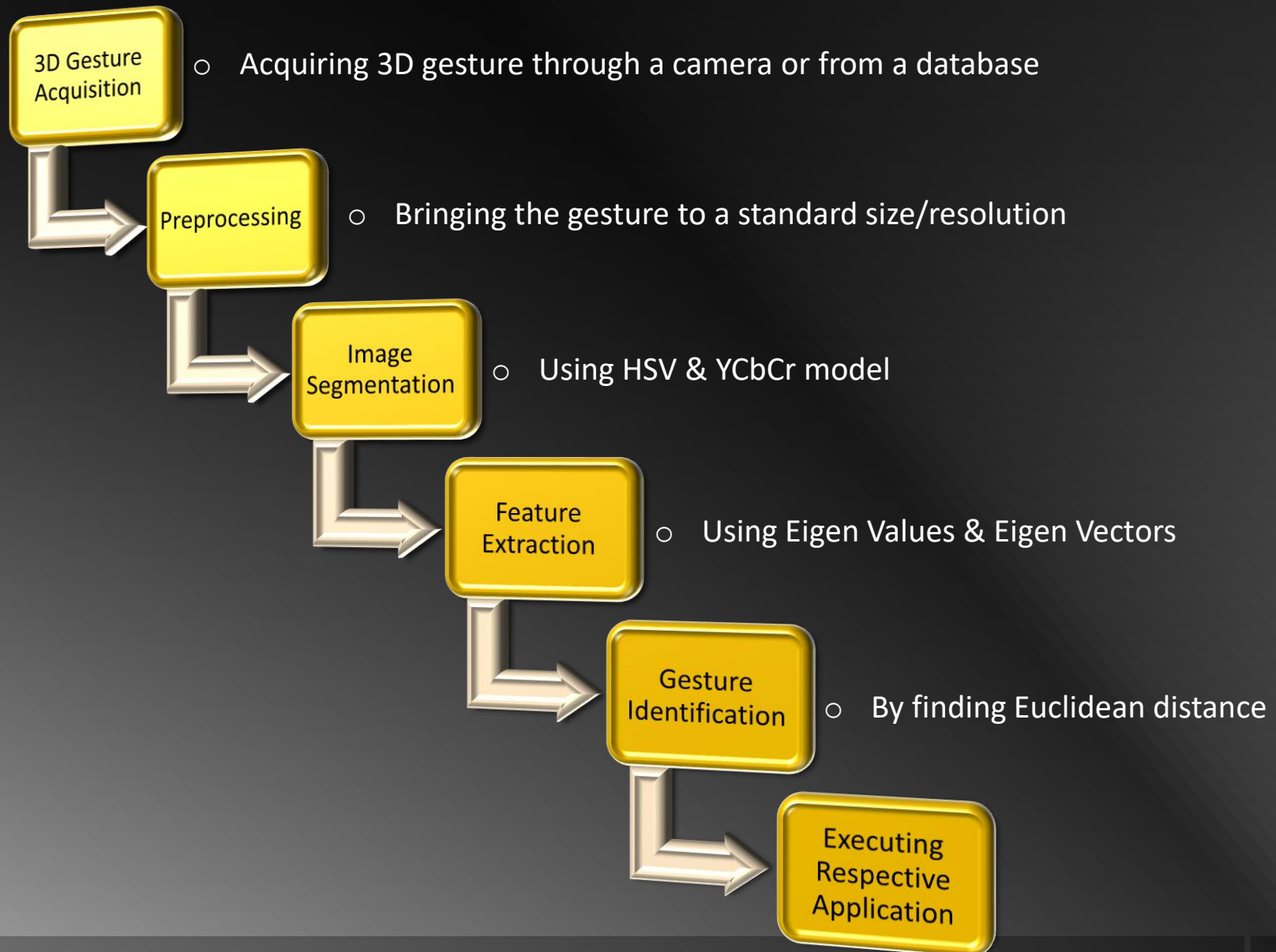
2] Eigen Values & Eigen Vectors

- An Eigen vector of a square matrix A is a non-zero vector v that, when the matrix is multiplied by v , yields a constant multiple of v , the multiplier being commonly denoted by λ . That is:

$$Av = \lambda v$$

- The number λ is called the Eigen value of A corresponding to Eigen vector v
- Eigen values and Eigen vectors are a part of linear transformations
- The more the Eigen vectors the better the information obtained from the linear transformation
- Eigen values measures the variance of data of new coordinate system

PROPOSED SYSTEM : BLOCK DIAGRAM



PROPOSED SYSTEM

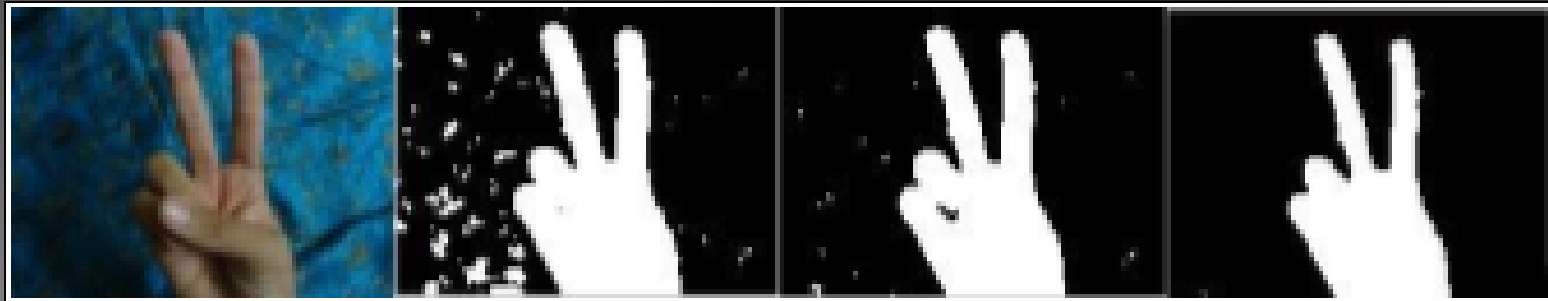


■ Stage 1:

- Acquiring 3D image of the input gesture through a camera or a readymade database
- Specifications Of The Camera Used For Our Model:
 - Cybershot (DSC-HX-20V)
 - Gross Pixels: Approx. 18.9 Mega Pixels
 - 3D Still Image extension: '.mpo'
- Pre-processing the acquired image to bring it to a standard resolution

■ Stage 2:

- Image segmentation by combining the results of HSV and YCbCr segmentation models



Test image followed by YCbCr binary image, HSV binary image and the final binary image (in order from left to right)

PROPOSED SYSTEM



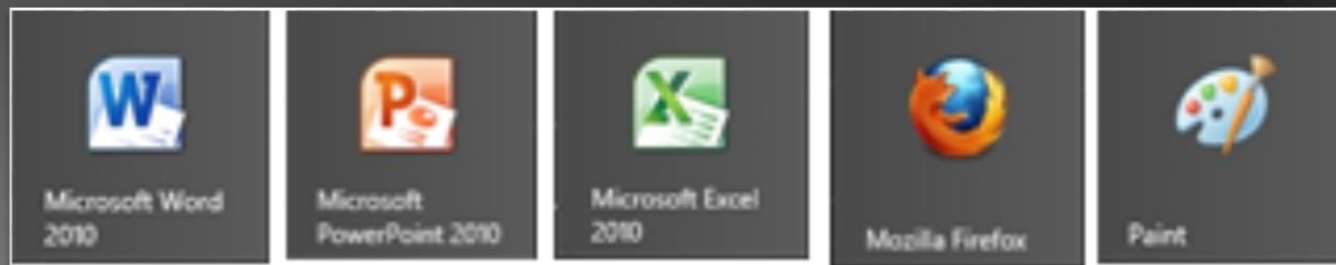
■ Stage 3:

Feature Extraction using

- Covariance Matrix : $\text{CovMatTrainImage}(i,j,k) = \text{TrainImage}(i,j,k) - \text{Mean}$
- Eigen Values And Eigen Vectors: $A v = \lambda v$
- Euclidean Distance: $\text{EucDist} = \text{ProjTestImg}() - \text{ProjTrainImg}()$

■ Stage 4:

Giving the respective text and audio output, and, executing the application consorted to the identified gesture



Gesture 1

Gesture 7

Gesture 2







Gesture 5

Gesture 8

RESULTS



- Following table shows the results of our model calculated for a few numerical gesture images
- The image with the minimum Euclidean distance (shown in **bold font**) is classified as the 'Recognized Gesture'

| Test Image | Euclidean Distance with Train image 1 | Euclidean Distance with Train image 2 | Euclidean Distance with Train image 3 | Euclidean Distance with Train image 4 | Euclidean Distance with Train image 5 | Gesture Recognized | Application opened as per gesture |
|---|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---|-----------------------------------|
|  | 2.3576 X e^{11} | 2.3571 X e^{11} | 2.3698 X e^{11} | 2.3668 X e^{11} | 2.3654 X e^{11} |  | MS Excel |
|  | 4.0995 X e^{11} | 6.3094 X e^{11} | 2.7352 X e^{11} | 3.5371 X e^{11} | 1.0453 X e^{11} |  | Mozilla Firefox |
|  | 0 | 5.8744 X e^{11} | 4.7386 X e^{11} | 5.7671 X e^{11} | 2.3354 X e^{11} |  | MS Word |

CONCLUSIONS & FUTURE SCOPE



- Identification of gesture after the removal of background using covariance matrix & applying it to find the Eigen values and Eigen vectors for each test and train image
- Using the Eigen matrices to give desired output declaring the identified gesture, by finding the minimum Euclidean distance between the test and train images
- Advantages of our system:
 - Overall recognition rate : 92%
 - Additional equipment like gloves not required
 - Independent of background unless it is not in skin colour
- Although our gesture recognition algorithm is advantageous, it has following limitations which can be worked upon for future work:
 - If the background is of skin colour, then the YCbCr and HSV results fail to show complete background suppression. Techniques like Gaussian filtering are being worked upon
 - Execution time for our algorithm is around a minute per gesture recognized since being 3D gestures with large file size. Work carried upon compression of 3D image



REFERENCES

- Reza Hassanpour, Asadollah Shahbahrami, *“Human Computer Interaction Using Vision-Based Hand Gesture Recognition”*, Journal of Advances in Computer Research, 2010
- Dharani Mazumdar, Anjan Kumar Talukdar & Kandarpa Kumar Sarma , *“A coloured fingertip-based tracking method for continuous hand gesture recognition”*, International Journal of Electronics Signals and Systems (IJESS), ISSN: 2231- 5969, Vol-3, Iss-1, 2013
- Hazem Khaled, S. Sayed, El Sayed Mostafa ,Hossam Ali , *“Hand Gesture Recognition Using Average Background and Logical Heuristic Equations”*, International Journal Of Computers & Technology, ISSN 2277-3061, Vol. 11 No. 5, 2013
- Joyeeta Singha, Karen Das, *“Indian Sign Language Recognition Using Eigen Value Weighted Euclidean Distance Based Classification Technique”*, International Journal of Advanced Computer Science and Applications, Vol. 4, No. 2, 2013
- Padmanabham Patki, Nagasrikanth Kallakuri, *“British Sign Alphabet Recognition System”*
- Aisha Meethian, B.M.Imran, *“Real time gesture recognition using hand tracking system based on GMM”*

THANK YOU!