

Enhanced Human Computer Interaction using hand gesture analysis on GPU

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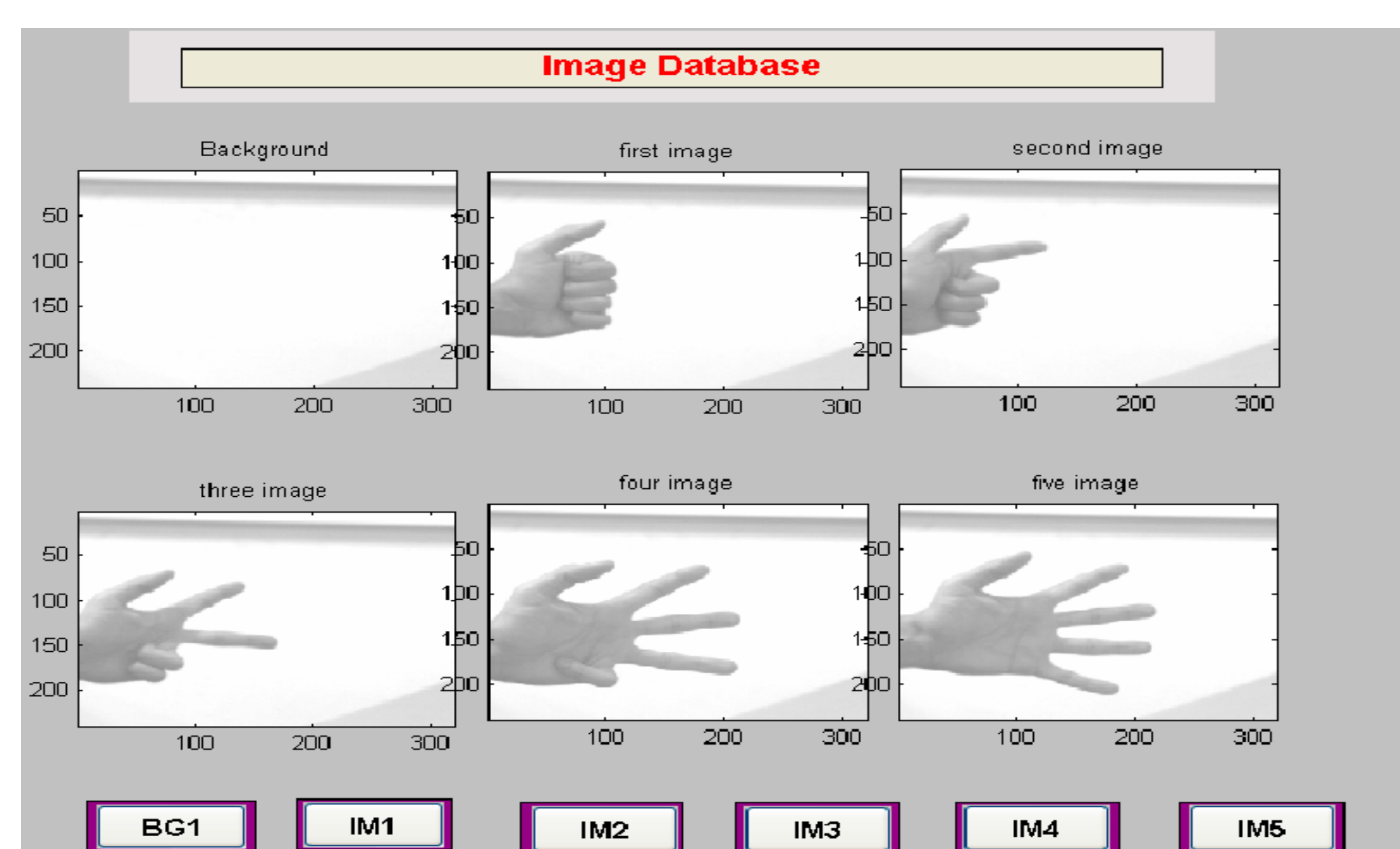
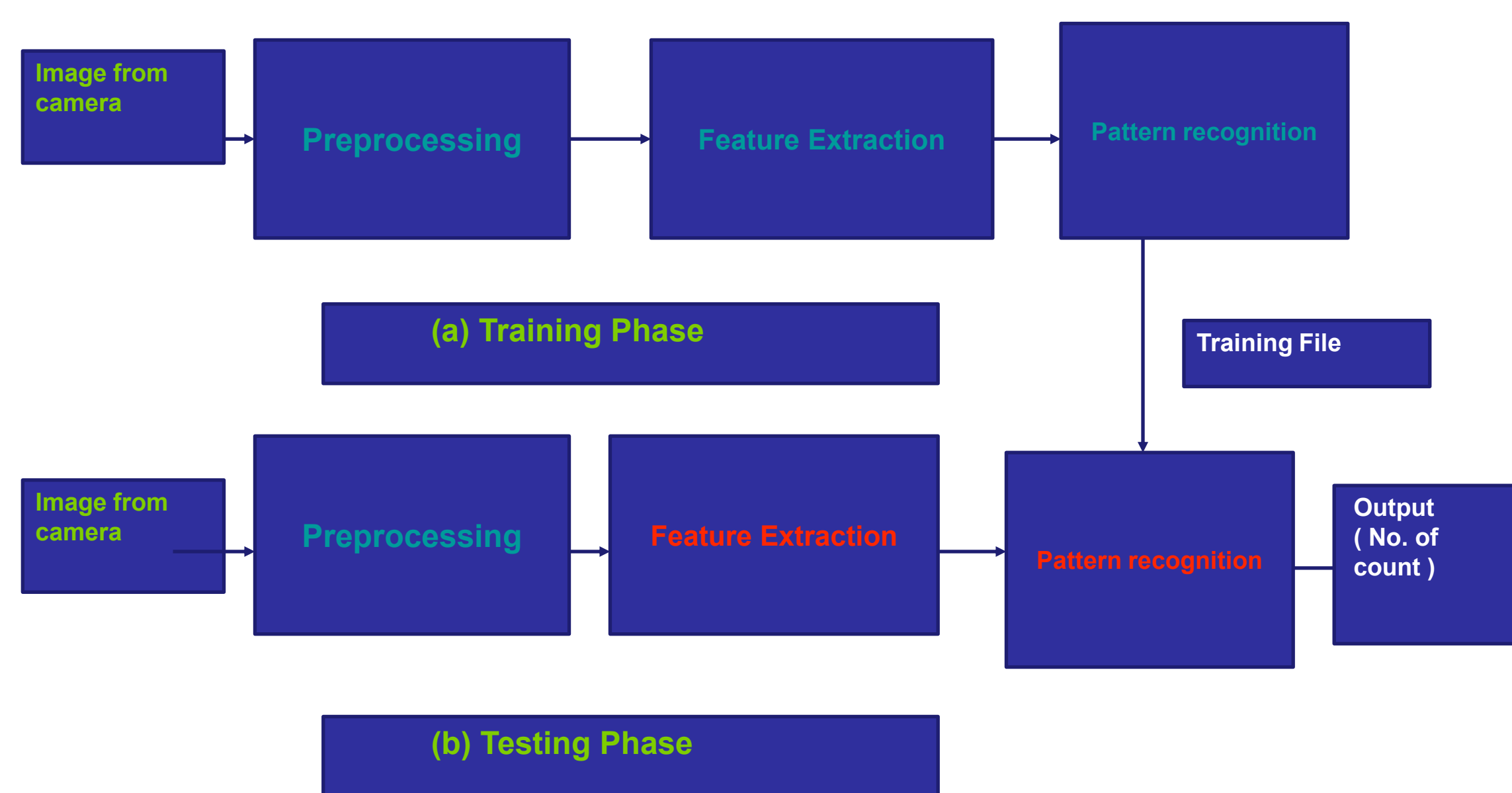
Abstract

This poster represent very active research topic in human computer interaction (HCI) as automatic hand gesture recognition using nvidia GPU. In this work neural network based video gesture are processed and recognize the finger counts. Due to real time requirement algorithm need to optimize and computationally efficient. We implemented the MATLAB code, it perform slow when neural network processing started. Implementing them in a parallel programming model such as GPU-CUDA would provide the necessary gain in processing speed. Algorithmic result validation is done using standard video data set and recognition rate is calculated. A performance improvement of **15x** speed is achieved which is faster than Intel quad core processor.

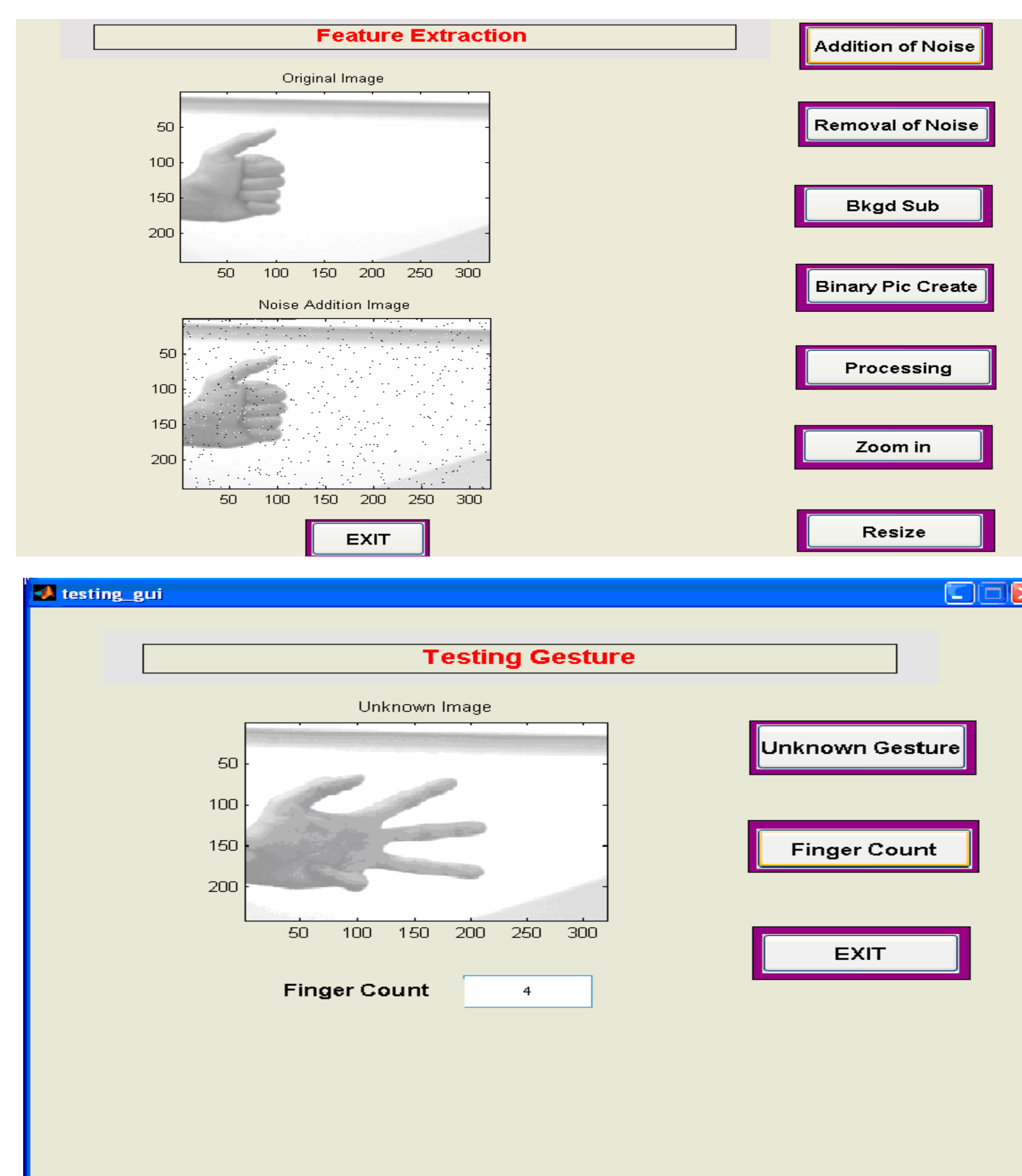
Introduction

The goal of this project is to develop a program implementing gesture recognition. At any time, a user can exhibit his hand doing a specific gesture in front of a video camera linked to a computer.

The program has to collect pictures of this gesture, analyze it and to identify the sign. In order to lighten the project, it has been decided that the identification would consist in counting the number of fingers that are shown by the user in the input picture.



Database And MATLAB Results

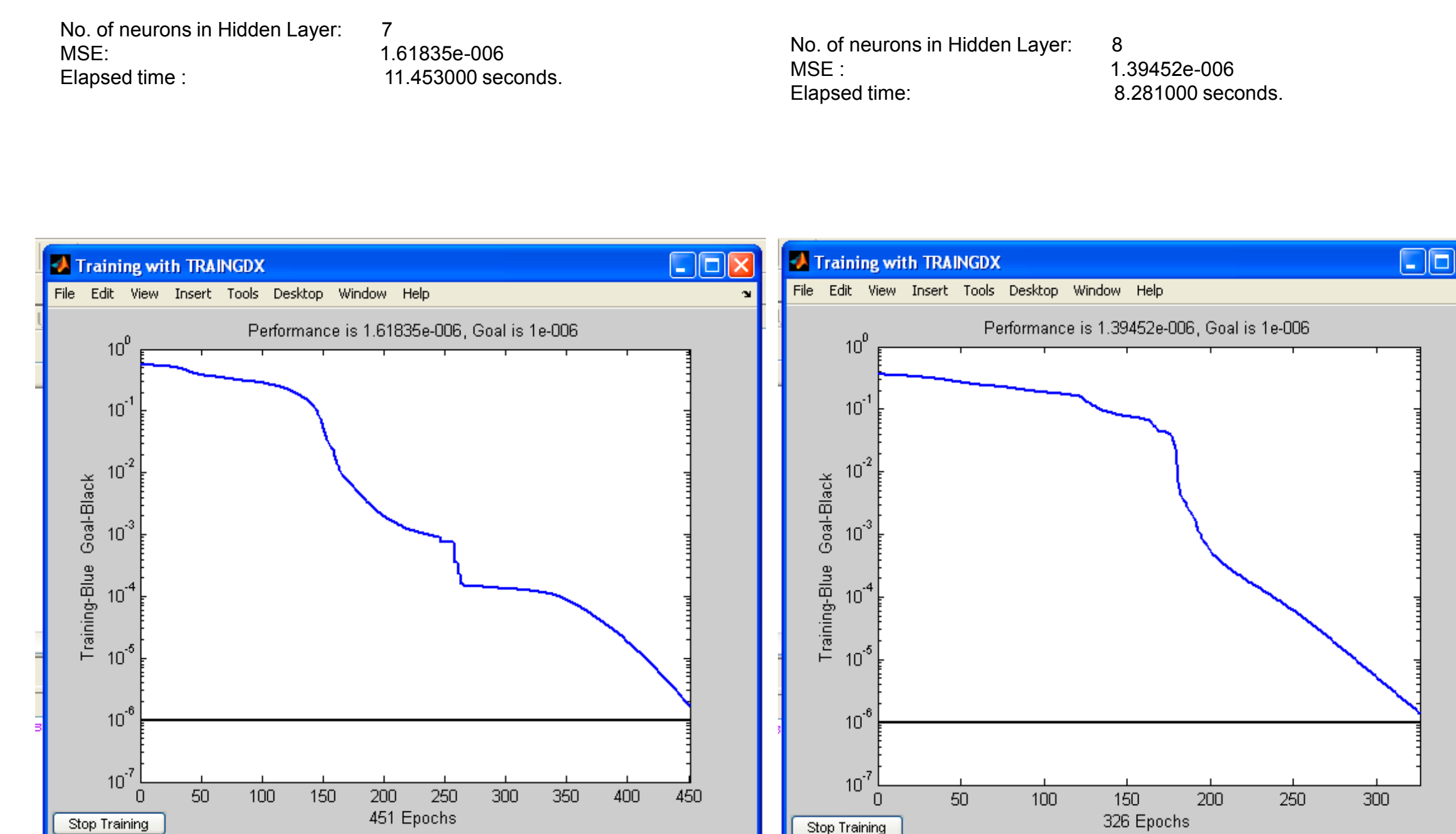


CUDA Approach

1. Camera capture video – process frame by frame image
2. Extract features from the image using various segmentation techniques implemented in MATLAB, CUDA. Output features then written to a text file.
3. Use the matrix obtained in step 2 to train the neural network(on CPU using MATLAB).
4. Once the network is trained , we test it on GPU.
5. GPU implementation :-
 - a. Load the test image into GPU global memory
 - b. Process it as in step 2, output will be matrix of size (262144 x1).
 - c. Pad the matrix with 0's - output will be a matrix of size (262144 x16) - Inputs matrix.
 - d. This is all done on the GPU. Now pass the neural network weights matrix, to the GPU.
 - e. Multiply neuralnetwork_weights matrix by Inputs matrix - which will give a 16 x 16 matrix. Extract the first five values from it. The index of the value which has maximum value + 1 gives us the count.

No of epochs	MSE	Time in seconds
2000	1.64272e-006	12.62
5000	1.58837e-006	19.875
8000	1.41844e-006	8.359
12000	1.92353e-006	9.484

NN Training Results



Flow	CPU (ms)	GPU (ms)	Speedup
Preprocessing	45	2.12	21.22
Feature Extraction	52	3.54	14.68
Neural Network Training	192	25.21	7.61
Neural Network Testing	62	12.23	5.06
Total	351	43	8.16

GPU (GeForce GT 525M)

References

- [1] Malima, A.; Ozgur,E.; Cetin,M.; [2006] “A Fast Algorithm for Vision-Based Hand Gesture Recognition for Robot Control”, Signal Processing and Communications Applications, IEEE
- [2] A Neural Network on GPU, <http://www.codeproject.com/KB/graphics/GPUNN.aspx>
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