Project
on

SVM BASED CLASSIFICATION BY USING MOMENT AS FEATURE VALUE

Prepared
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ABSTRACT

- Take images for several categories as input.
- Extract feature for several image categories by second order moment calculation.
- Save this feature matrix for classification.
- Classify several image categories by using the concept of support vector machine.
- Plot for linear discriminant analysis.

INTRODUCTION

Ø Gray scale Image

It is an image in which the value of each pixel carries only intensity information. Pixel value ranges from 0 to 255.

Ø Feature

Features are extractable measurements summarizing the information content in an image. Feature can refer to two categories of image properties:-

1. Global Properties
2. Local Properties

INTRODUCTION (contd..)

Ø Moment

Moments are scalar quantities used to characterize a function and to capture its significant features.

Ø Second Order Moment

In image processing, second order moment describes the rate of change in a shape's area. It is invariant to certain class of image degradations:-

1. Rotation, translation, scaling
2. Affine transform
3. Elastic deformations

INTRODUCTION (contd..)

Ø Support Vector Machine (SVM)

The key concept in SVM is *maximizing the margin* i.e. maximizing the distance between the decision boundary and the nearest data points in the sample.

Advantages:-

- Effective in high dimensional spaces.

- Availability of both linear and non-linear SVM.

LITERATURE SURVEY

Ø [1] **Fukunuga, K., Introduction to Statistical Pattern Recognition, 2nd ed., Academic Press, San Diego, CA, 1990.**

- Fukunuga states that computational object classification is such a hard problem is that machines take sensory information very literally.

Ø [2] **Jain A K, Fundamentals of Digital Image Processing, Prentice Hall, Englewood Cliffs, NJ 1989.**

- A. K Jain introduced feature extraction theory and said that features are very application oriented and often found by heuristic methods and interactive data analysis.

Ø [3] **Levine M D, Vision in Man and Machine, McGraw Hill, Inc., New York, 1985.**

- Levine M D reviews number of techniques for feature extraction which can be used in image processing application.

LITERATURE SURVEY (contd..)

Ø [4] **Liang-Chi Chiu, Tian-Sheuan Chang, Fast SIFT Design for Real-TimeVisual Feature Extraction, IEEE Transcations on Image Proseccing, V22 N8, August 2013.**

- Liang-Chi Chiu categorized feature types as follows:
  - § Structural features
  - § Statistical features
  - § Global features

Ø [5] **Schalkoff R J, Digital Image Processing and Computer Vision, J. Wiley, Inc. NewYork, 1989.**

- Schalkoff R J states that, feature extraction is a special form of dimensionality reduction. Feature extraction approach is most convenient method of object classification.

PROBLEM DEFINITON

- The main task of our system is to classify images of different categories.

- The system must be able to group images into same category even if the image suffers from transformations like rotation, translation, illumination variations etc.

- The system should plot linear discriminant graph showing a large gap between two classes of images.

SOLUTION STRATEGY

- There is no well-developed theory for feature extraction.

- Strategy is found by heuristic methods and interactive data analysis.

- We tend to extract feature from gray scale image and then with help of extracted feature, we classify images using SVM.

SOLUTION STRATEGY (contd..)

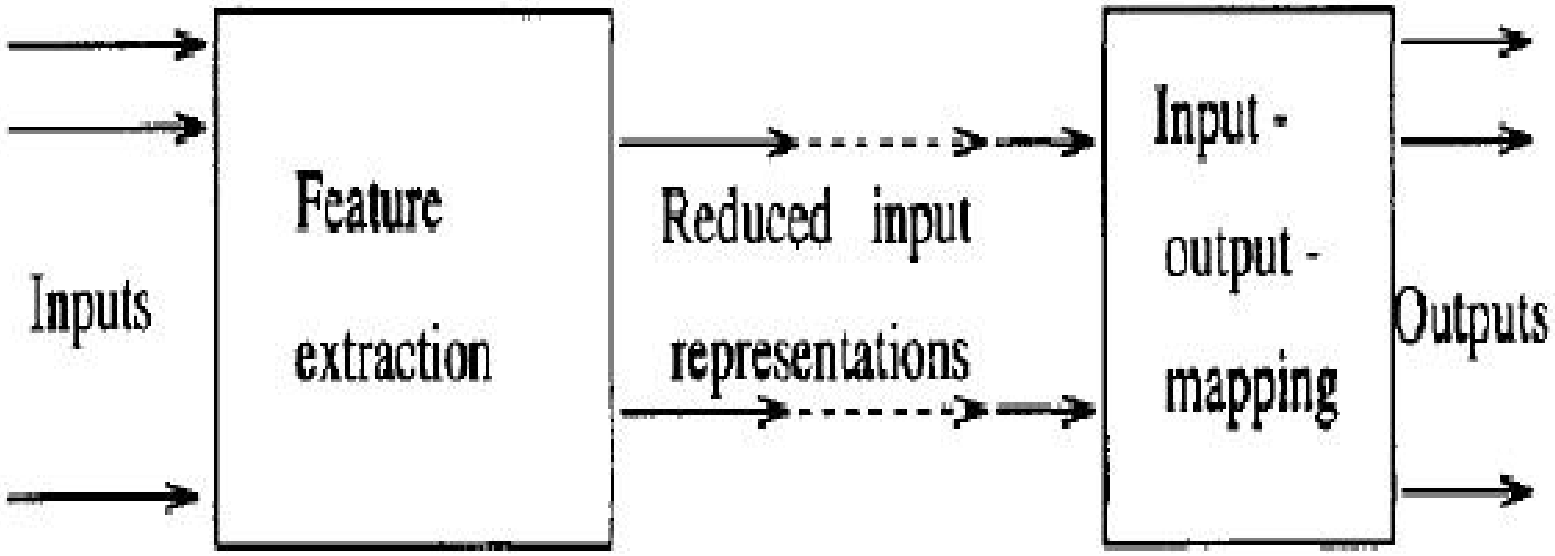
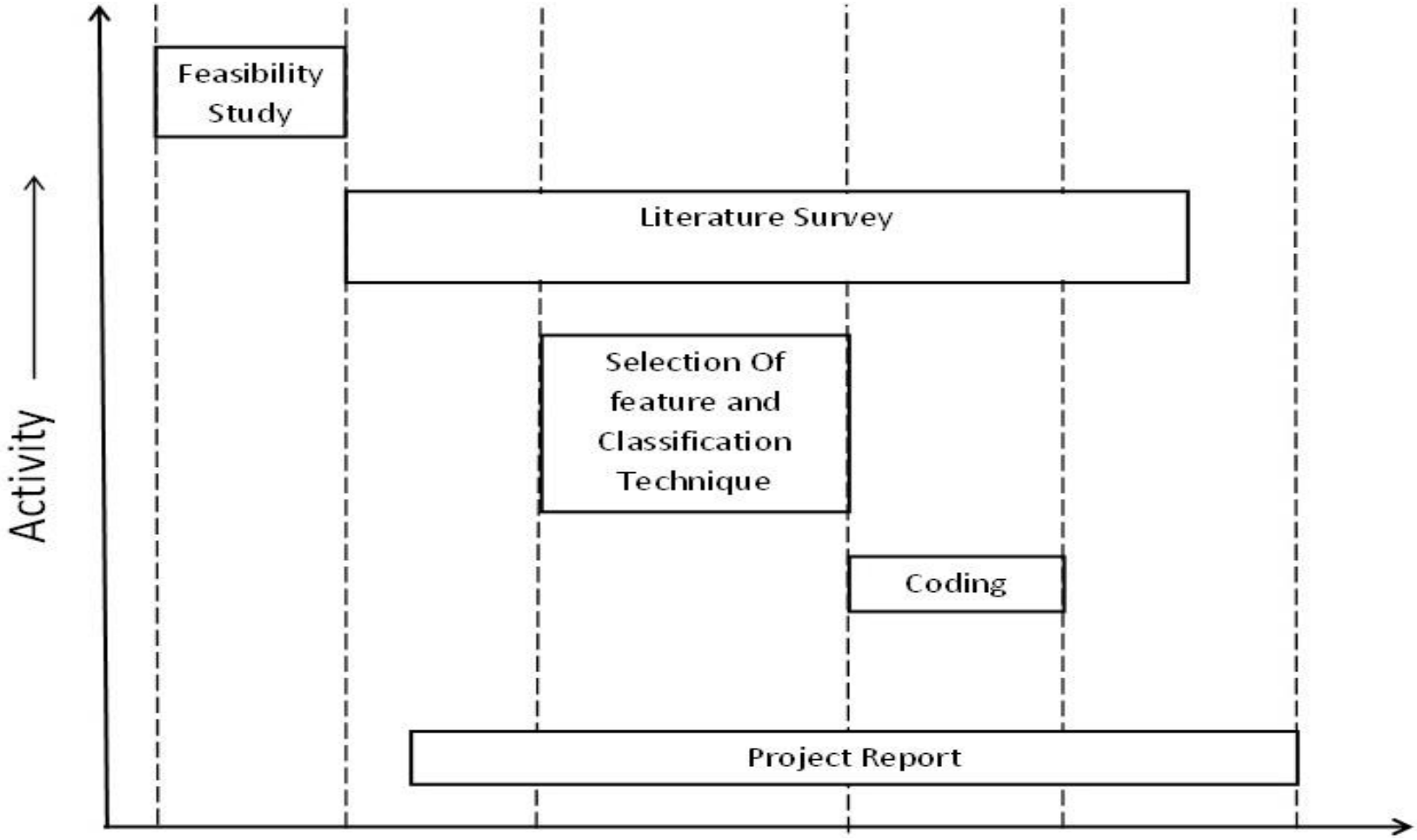


Figure 1: The Feature Extraction Approach

GANTT CHART


Activity
Feasibility Study
Literature Survey
Selection Of feature and Classification Technique
Coding
Project Report

PROPOSED METHODLOGY

Block Diagram

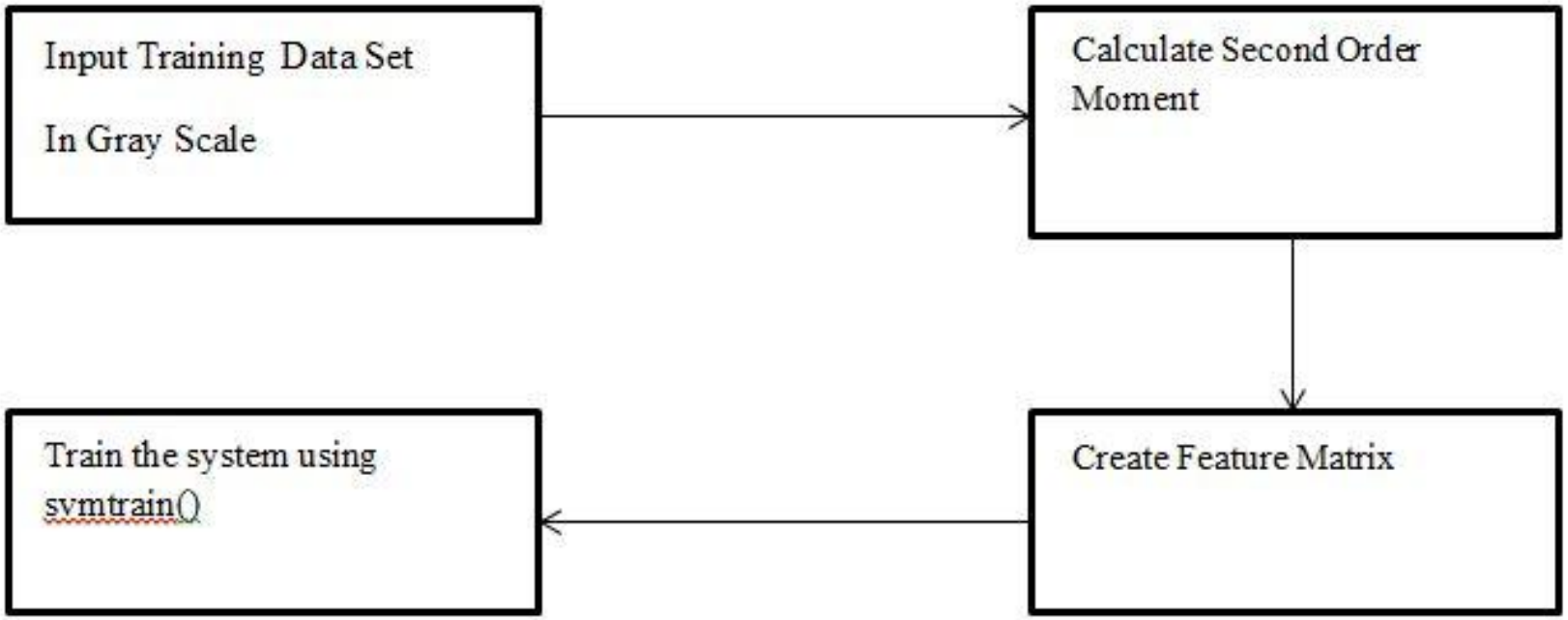


Figure 2: Training module of the project

Block Diagram (contd..)

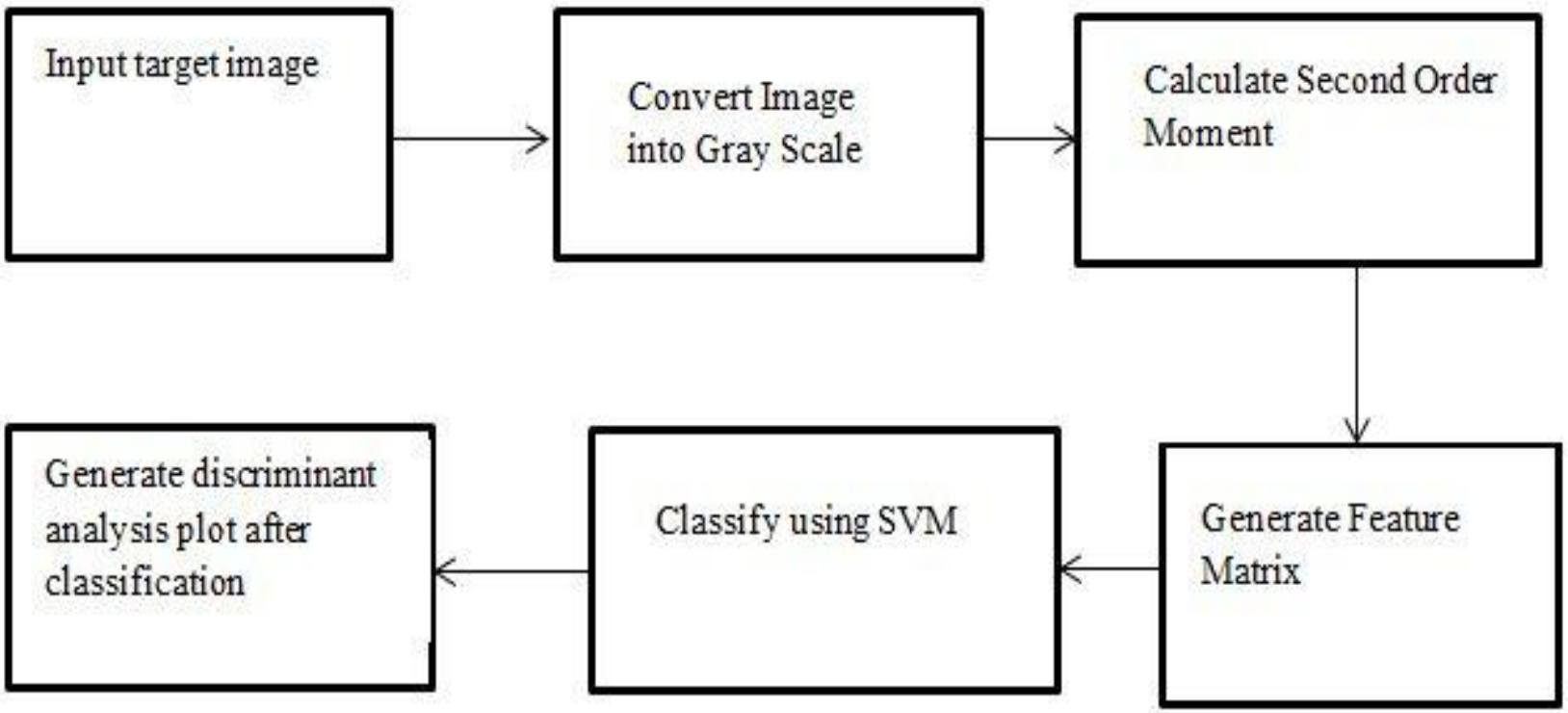


Figure 3: Testing module of the project

Algorithm

Input: {Training data set, testing data set}

Output: {Line separating the two classes of objects}

Step1. Start

Step2. Read all image in training data set.

Step3. Convert all images in training data set in gray scale image.

Step4. Resize all gray scale images to size (50*50).

Step5. Plot colour image, gray scale image & histogram in single window.

Step6. Extract feature for each gray scale image by calculating second order moment.

Step7. Generate feature matrix for training data set.

Algorithm (contd..)

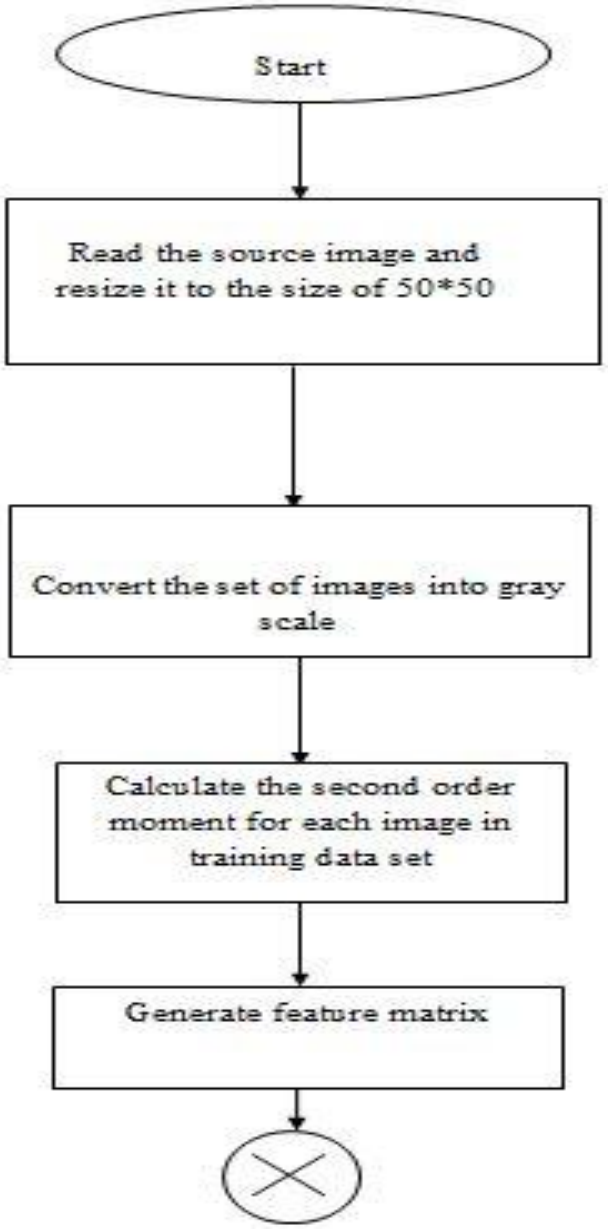
Step8. Read all image from testing data set.

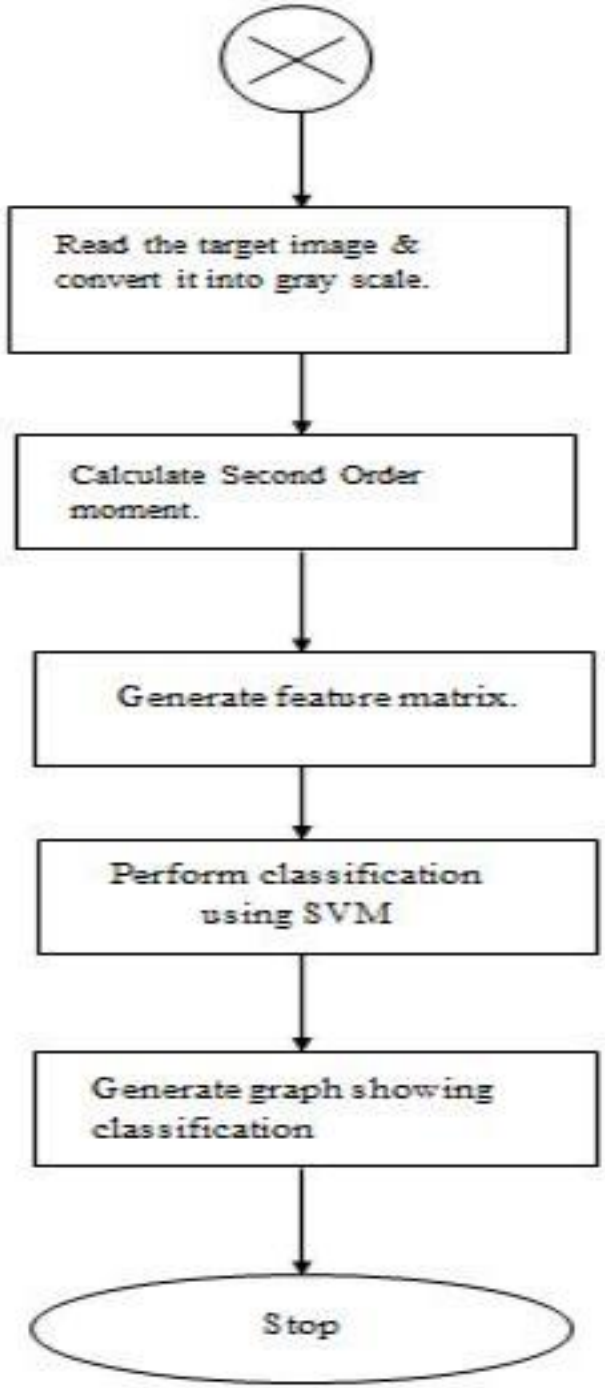
Step9. Convert all images in testing data set to gray scale image.

Step10. Use SVM to classify two classes of objects.

Step11. Generate plot with line separating two classes of objects.

Flowchart


Start
Read the source image and resize it to the size of 50*50
Convert the set of images into gray scale
Calculate the second order moment for each image in training data set
Generate feature matrix


Read the target image & convert it into gray scale.
Calculate Second Order moment.
Generate feature matrix.
Perform classification using SVM
Generate graph showing classification
Stop

RESULTS

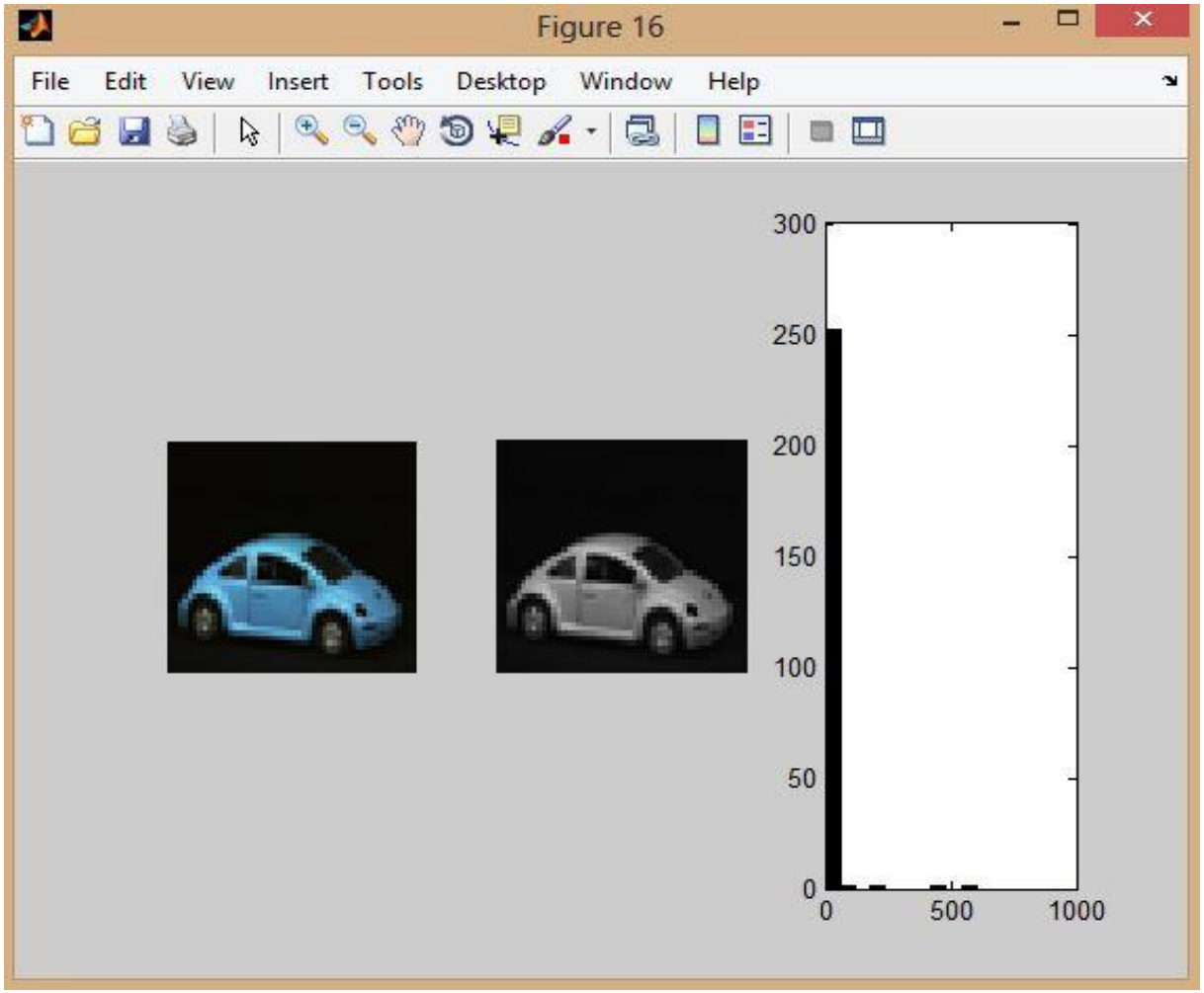
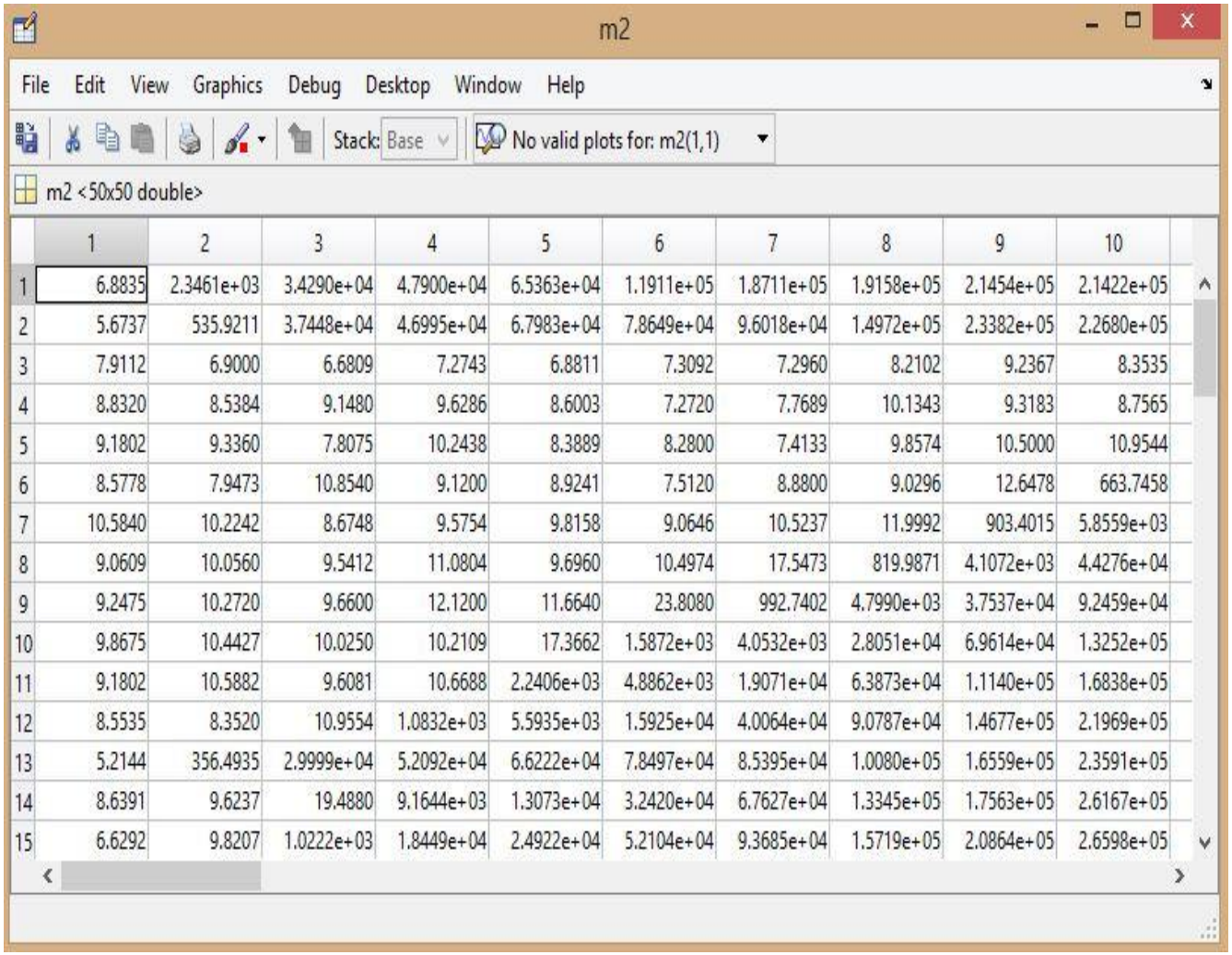


Figure 4: Snapshot showing colour image, gray scale image and histogram

RESULTS (contd..)



	1	2	3	4	5	6	7	8	9	10
1	6.8835	2.3461e+03	3.4290e+04	4.7900e+04	6.5363e+04	1.1911e+05	1.8711e+05	1.9158e+05	2.1454e+05	2.1422e+05
2	5.6737	535.9211	3.7448e+04	4.6995e+04	6.7983e+04	7.8649e+04	9.6018e+04	1.4972e+05	2.3382e+05	2.2680e+05
3	7.9112	6.9000	6.6809	7.2743	6.8811	7.3092	7.2960	8.2102	9.2367	8.3535
4	8.8320	8.5384	9.1480	9.6286	8.6003	7.2720	7.7689	10.1343	9.3183	8.7565
5	9.1802	9.3360	7.8075	10.2438	8.3889	8.2800	7.4133	9.8574	10.5000	10.9544
6	8.5778	7.9473	10.8540	9.1200	8.9241	7.5120	8.8800	9.0296	12.6478	663.7458
7	10.5840	10.2242	8.6748	9.5754	9.8158	9.0646	10.5237	11.9992	903.4015	5.8559e+03
8	9.0609	10.0560	9.5412	11.0804	9.6960	10.4974	17.5473	819.9871	4.1072e+03	4.4276e+04
9	9.2475	10.2720	9.6600	12.1200	11.6640	23.8080	992.7402	4.7990e+03	3.7537e+04	9.2459e+04
10	9.8675	10.4427	10.0250	10.2109	17.3662	1.5872e+03	4.0532e+03	2.8051e+04	6.9614e+04	1.3252e+05
11	9.1802	10.5882	9.6081	10.6688	2.2406e+03	4.8862e+03	1.9071e+04	6.3873e+04	1.1140e+05	1.6838e+05
12	8.5535	8.3520	10.9554	1.0832e+03	5.5935e+03	1.5925e+04	4.0064e+04	9.0787e+04	1.4677e+05	2.1969e+05
13	5.2144	356.4935	2.9999e+04	5.2092e+04	6.6222e+04	7.8497e+04	8.5395e+04	1.0080e+05	1.6559e+05	2.3591e+05
14	8.6391	9.6237	19.4880	9.1644e+03	1.3073e+04	3.2420e+04	6.7627e+04	1.3345e+05	1.7563e+05	2.6167e+05
15	6.6292	9.8207	1.0222e+03	1.8449e+04	2.4922e+04	5.2104e+04	9.3685e+04	1.5719e+05	2.0864e+05	2.6598e+05

Figure 5: Snapshot of feature matrix of training data set

RESULTS (contd..)

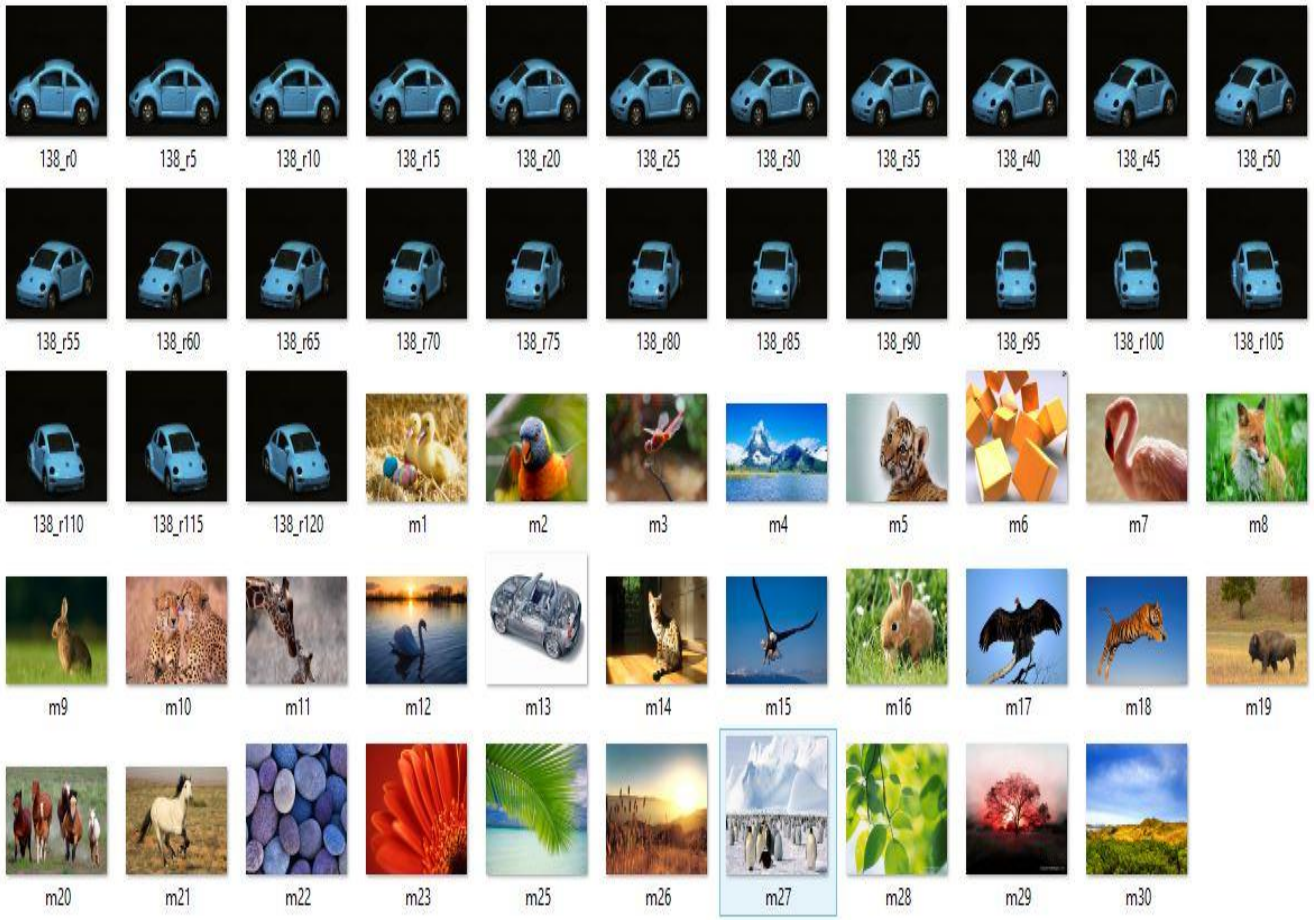


Fig 6: Testing data set considering rotation

RESULTS (contd..)

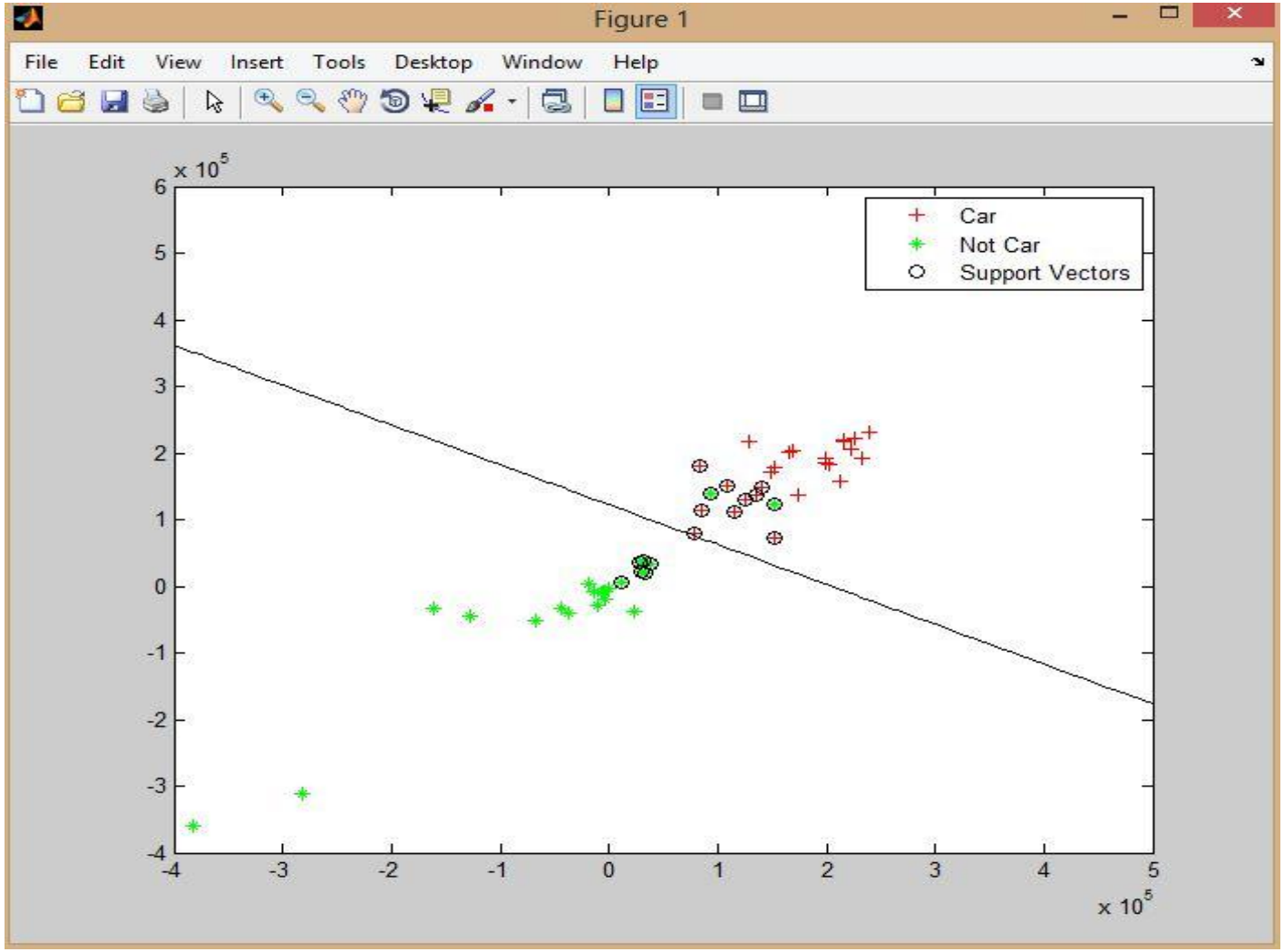


Figure 7: Snapshot for classification of car from other objects (considering rotation)

RESULTS (contd..)

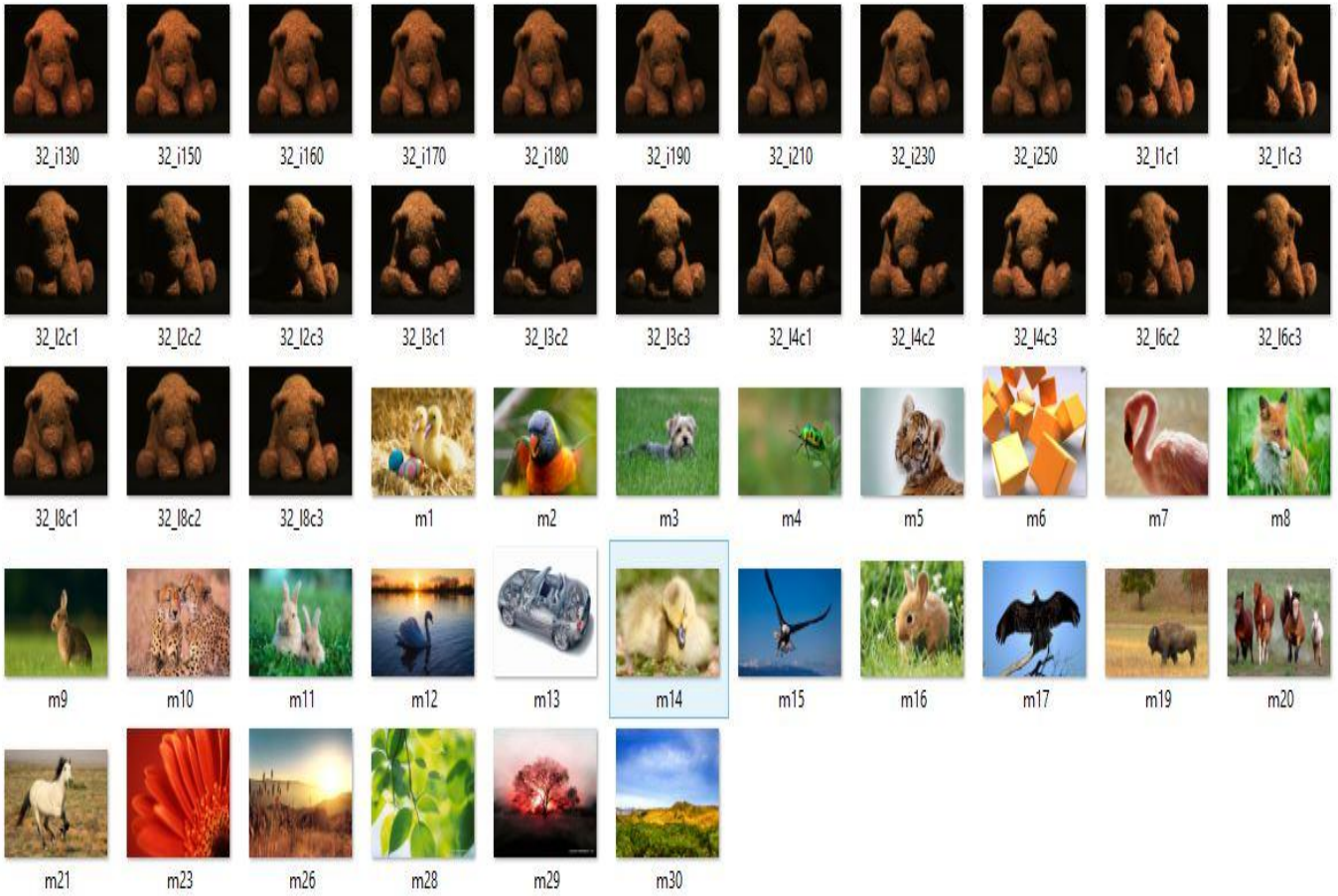


Fig 8: Testing data set considering illumination variation

RESULTS (contd..)

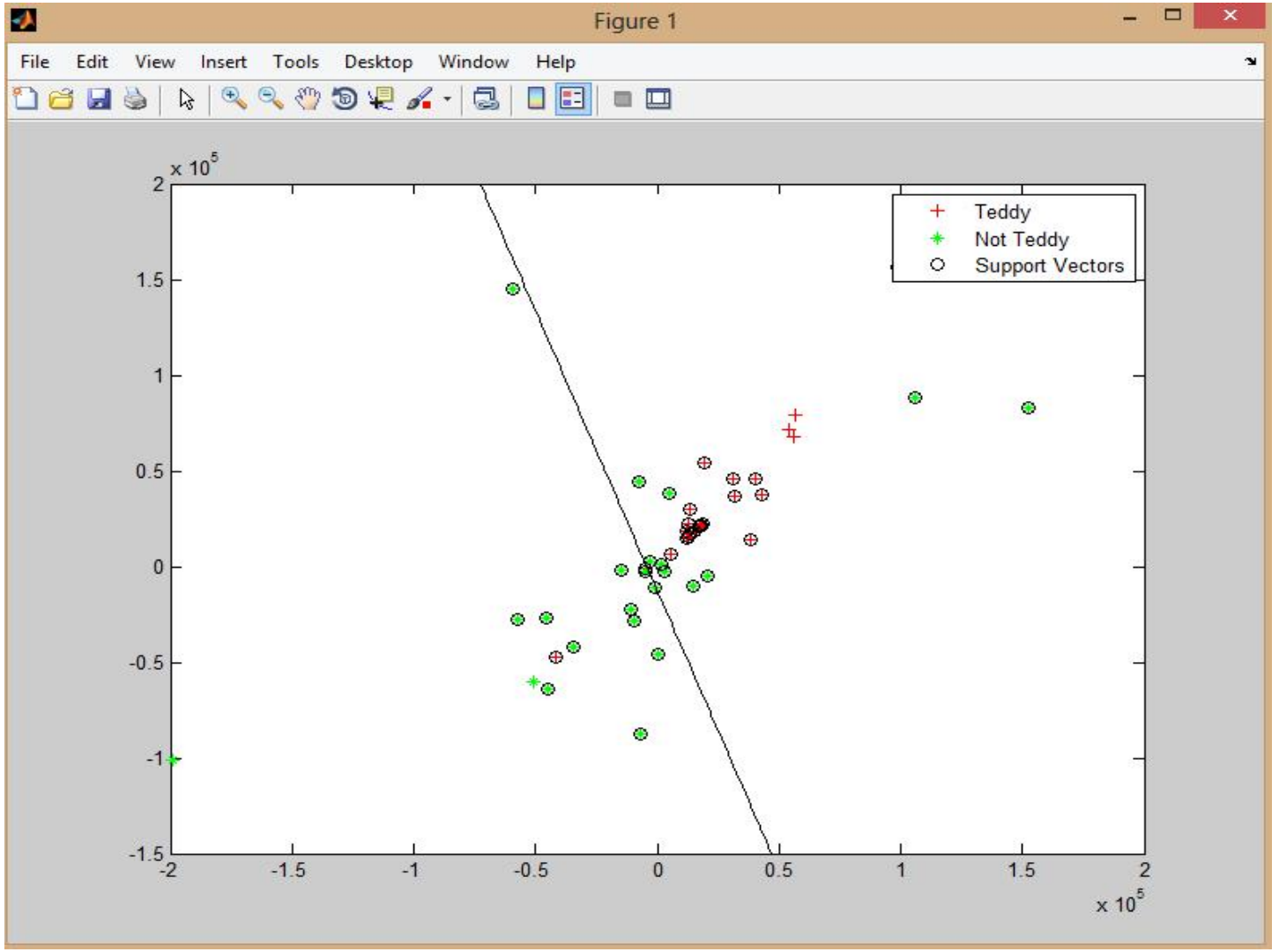


Figure 9: Snapshot for classification of teddy from other objects (considering illumination variation)

DISCUSSION

Ø We successfully tested our system for following variations:-

- Classification of object rotated by various degrees.
- Classification of object with different illumination variations.

Ø Limitations:-

Our system can classify objects into only two categories.

Example:- “CAR” (category 1) or “NOT CAR” (category 2)

CONCLUSION

Ø Able to extract features that is invariant to image degradations like rotation, translation and illumination variations.

Ø Able to classify the colour images from different classes in the testing data set.

Ø Finally being able to plot linear discriminant graph classifying images into categories.

REFERENCES

[1] Fukunuga, K., Introduction to Statistical Pattern Recognition, 2nd ed., Academic Press, San Diego, CA, 1990.

[2] Jain A K, Fundamentals of Digital Image Processing, Prentice Hall, Englewood Cliffs, NJ 1989.

[3] Levine M D, Vision in Man and Machine, McGraw Hill, Inc., New York, 1985.

[4] Liang-Chi Chiu, Tian-Sheuan Chang, Fast SIFT Design for Real-TimeVisual Feature Extraction, IEEE Transcations on Image Proseccing, V22 N8, August 2013.

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[6] Subhransu Maji, Alexander C. Berg, and Jitendra Malik, Efficient Classification for Additive Kernel SVMs, IEEE Transcations on Pattern Analysis And Machine Intelligence, 2012.

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THANK YOU