ROBOT BASED OBJECT IDENTIFICATION

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ABSTRACT

In this paper, a new approach for detecting and matching the overlapping symmetric and asymmetric real objects and multiple patterns obtained in various views *using an automated robot sensing is proposed. The proposed system introduces a system supervising using sensors and a webcam or mobile camera to record, transmit and analyze the objects.* The goal of the proposed system is to recognize the identity, position, and orientation of randomly oriented objects. *In order to identify and match the symmetric and asymmetric overlapping objects, an automated robot must be equipped with a set of sensors that provide information about the presence of a matching object around.*

Keywords: Object Identification, Feature Extraction, Robot Sensing, Pattern Matching, Robot Vision.

INTRODUCTION

Robot vision is an interesting and rapidly growing field. The Robots are used in several places which are helping humans in several aspects of life. The rapid progress has reduced the coverage of less significant areas. The main focus is to develop simple descriptions from captured and sensed images using some automated system. To recognize an object refers to fact of assigning a set of symmetric, asymmetric overlapping point to the known classes for identification. Autonomous robots operating in human environments give some extremely challenging research topics in planning and dynamic perception whether it is in any field the workplace, a play ground or in a household. In order to navigate and interact with, such an environment, accurate and strong dynamic observation is a must.

Predicting shapes represents an important domain of recognizing image objects, based on their shape information and object characteristics. [1] The identification of the object by efficient and accurate automated system for connected or overlapping objects in an image leads to the decreased execution time and elapsed time. Each sensed image contains up to several hundred objects, which were manually arranged not to overlap or touch each other. The proposed approach is divided into three stages. In the first stage the robot will capture the image and will send the image to the main computer, in this stage multiple thresh-holding values for the image are defined. Over segmentation and erosion is applied on binary image to erode away the boundaries of regions of foreground pixels.[9] match the object with prescribed dimensions. In the second stage features of the current object whose user is going to predict the shape are matched with the preloaded features in data set of known classes.[7] in the Third stage, the equivalence distance to which the current object matched in data set is considered. In this stage, the robot will move towards the identified object, the distance travelled by the robot to capture the object depends upon the diameter of the wheel of the robot. Robot will bring the required object to the player.

MORPHOLOGY

The term Morphology refers to set of image processing operations that process images based on shapes. Morphological operations apply a structuring element to an input image, creating an output image of the same size. In a morphological operation, the value of each pixel in the output image is based on a comparison of the corresponding pixel in the input image with its neighbors. By choosing the size and shape of the neighborhood, you can construct a morphological operation that is sensitive to specific shapes in the input image.[2] Morphological operations affect the structure or shape of an object. All these operations are applied on binary images.

STRUCTURING ELEMENT

Structuring element consists of matrix of 0’s and 1’s. Its size is smaller than the image and its origin identifies the pixel to be processed. The structuring element used for processing the images under prediction is disk shaped.[10]

If A and B be two sets in Z^2 then,

$$A \oplus B = \{ | (B)_z \cap A \neq \phi \}$$

Where A is image and B is the structural element.

MORPHOLOGICAL OPERATIONS

The two principal morphological operations are dilation and erosion. The proposed work is based on the implementation of erosion on to extract features of objects.

EROSION

Erosion shrinks objects by etching away (eroding) their boundaries. When using erosion structural element also passes through all pixels of the image.[4] if at a certain position every single pixel structuring element coincides with a single pixel binary image, then the logical disjunction of the central pixel structuring element with the corresponding pixel in the output image. The method of erosion for prediction of overlapping and connecting images is specially used in this algorithm to increase the efficiency and improve execution time.

$$a \oplus b = \{z \mid [(b)_z \ \varepsilon \ a]+$$

Where a is an image and b is structuring element in z^2.

FUZZY LOGIC

A fuzzy system is represented by if-then rules in the form:

$$if\ i_1\ is\ vi_1,1\ and\ \ldots\ and\ i_m\ is\ vi_m,1$$

$$then\ o_1\ is\ vo_1,1\ and\ \ldots\ and\ o_n\ is\ vo_n,1$$

where m is input and n is output, r is fuzzy rules in the system. The rules r defines the fuzzy rules which is an exponential function of the number of the inputs *i* and the number of linguistic values *l* taken by input.

$r = l^i$

if a fuzzy system has n inputs and single output then its fuzzy rules can be of the form:

if x_1 *is* a_{1j} *and* x_2 *is* a_{2j} *... and xm is* a_{jm}

then y is b_j

Dataset

It is a collection of data elements. The following name/value pairs are used when a dataset is constructed:

1. varnames: this gives the variables with the specified variable names.

{name_1,...,name_m}

2. obsnames: this gives the n observations in a with the specified observation names.

{name_1,...,name_n}

II. OPERATIONAL STAGES

The proposed technique is to identify the expected object using a robot on the basis of estimated values for dependent variables from previously unseen predictor values based on the variation in a learning database are used to predict the objects in the shape. Main focus of work is to predict the shape by using a automated machine on the basis of defining morphological operation which describes all boundary points of a shape. Prediction of the object by an automated efficient, accurate, computationally fast and invariant technique for connected or overlapping objects in an image is the main consideration so that execution time and elapsed time is decreased.

BASIC STEPS

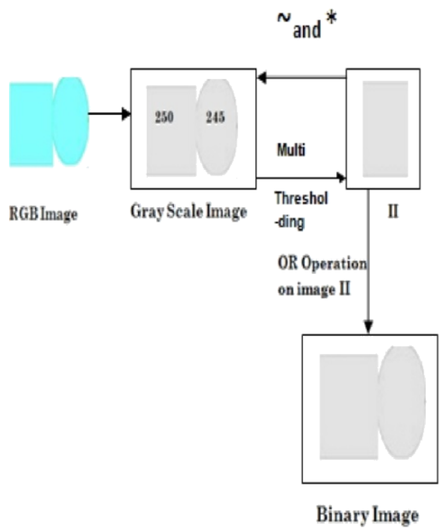

Figure 1: Basic Steps

Levels of Proposed Technique:

In the first stage the robot will capture the image and will send the image to the main computer, in this stage multiple thresh-holding values for the image are defined. Over segmentation and erosion is applied on binary image to erode away the boundaries of regions of foreground pixels.[9] match the object with prescribed dimensions.

LEVEL I

I. **Acquire Image:** First step is to ACQUIRE AN RGB image USING WEBCAM OR ANDROID MOBILE and convert that image to gray scale image by defining multi-thresholding.

II. **Over segmentation:** Apply over-segmentation and convert the image to binary image.

III. **Erosion:** Apply erosion on binary image to erode away the boundaries of regions of foreground pixels.

IV. **Feature finding:** Find the features and edges for the current image with the help of fuzzy logic operations and will be loaded into memory for use whenever it is needed.

Working Steps for Level I

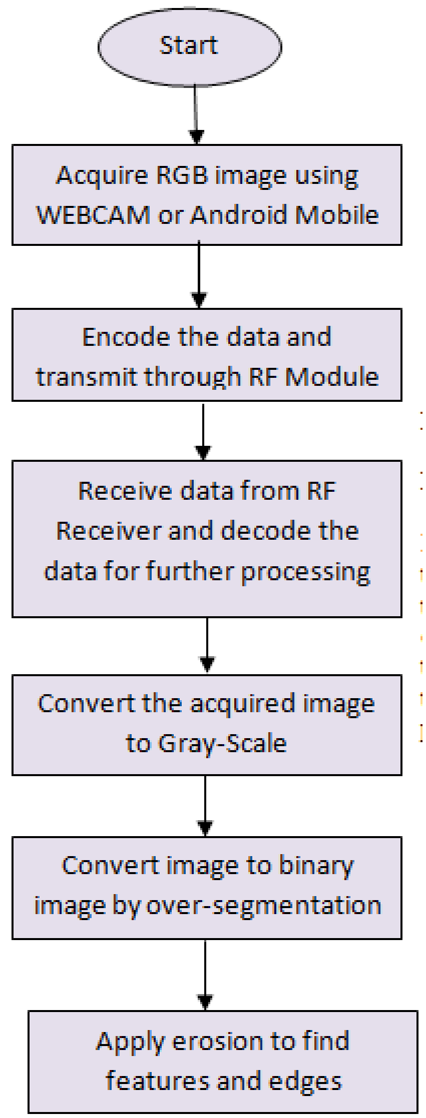

Figure 2: Working Steps for Level I

LEVEL II

In the second stage features of the current object whose user is going to predict the shape are matched with the preloaded features in data set of known classes.

Working Steps for Level II

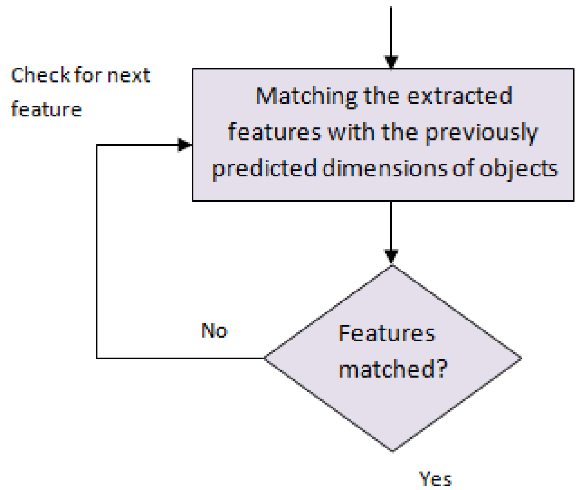

Figure 3: Working Steps for Level II

LEVEL III

In the Third stage, the equivalence distance to which the current object matched in data set is considered. In this stage, the robot will move towards the identified object, the distance travelled by the robot to capture the object depends upon the diameter of the wheel of the robot. Robot will bring the required object to the player.

Working Steps for Level III

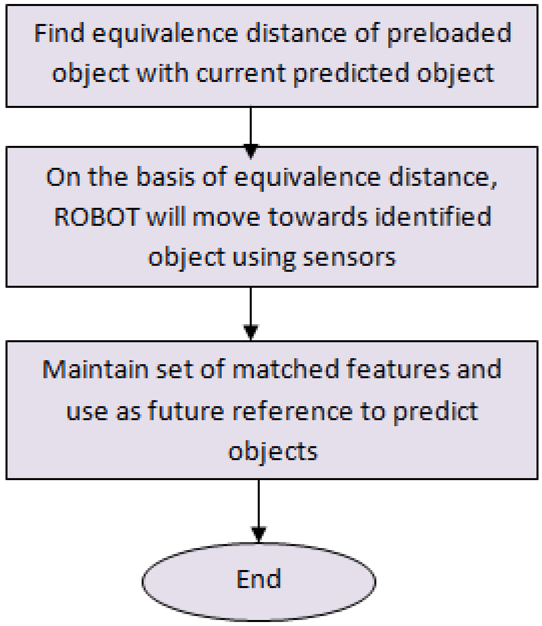

Figure 4: Working Steps for Level III

III. EXPERIMENT SETUP

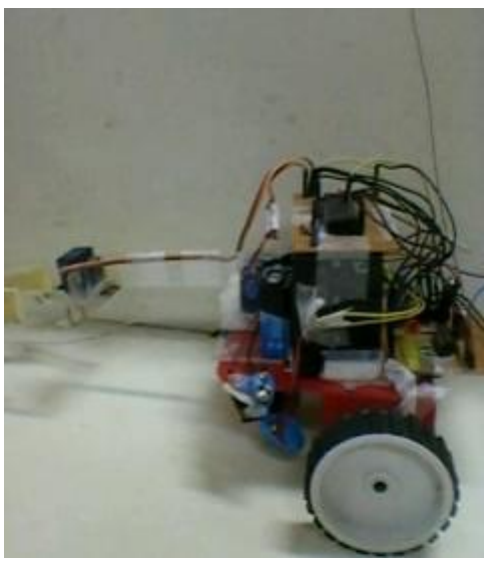

Figure 5: Working model of IMGROB robot

Figure 6: Remote to control the functionalities of IMGROB robot

IV. RESULTS

For the purpose of testing the experimental results, different input values are considered and the results obtained from the IMGROB robot are graphically analyzed.

Table1: Table imgrobtbl for the predicted time values

Objects per captured image	Time taken for predicting the objects				
	Triangle	Rectangle	Eclipse	Circle	Polygon
10	5.22	5.28	5.43	5.77	6.18
13	7.21	7.22	7.50	7.86	8.18

15	8.60	8.62	8.75	9.13	9.72
22	29.49	23.20	13.24	13.94	33.50

The predicted time values Table1 above shows the predicted values for time which may vary depending upon the distance among objects of input images and number of objects per image.

1. Output surface for Triangular shaped objects by robot

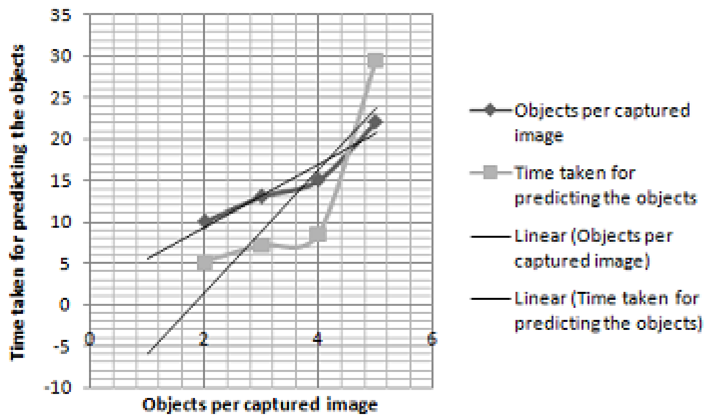

Figure 7: Output surface for Triangular shaped objects by robot

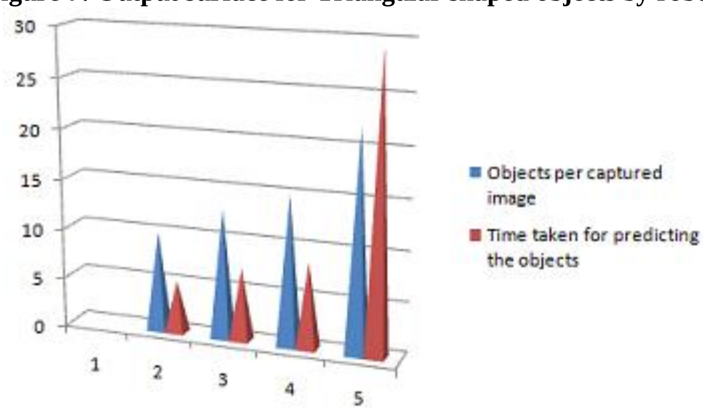

Figure 8: Point description of Triangular shaped identified objects

This output surface shows the variation in the values of triangle predicted in all the images. The predicted values vary as the number of objects in the image increases.

2. Output surface for Rectangular shaped objects by robot

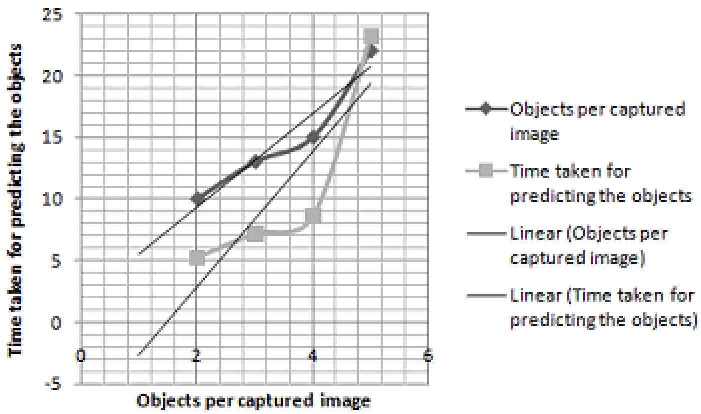

Figure 9: Output surface for Rectangular shaped objects by robot

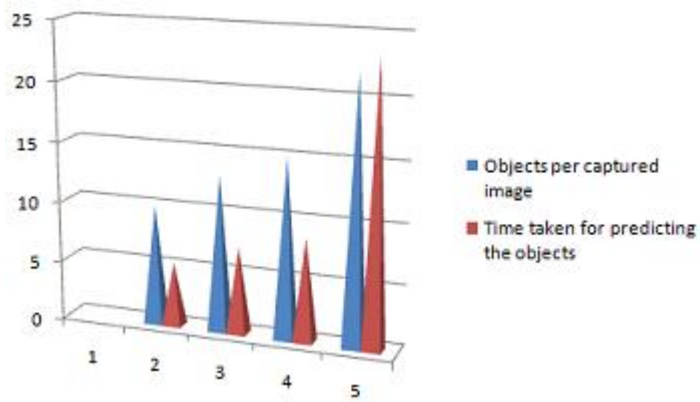

Figure 10: Point description of Rectangular shaped identified objects

This output surface shows the variation in the values of rectangle predicted in all the images. The predicted values vary as the number of objects in the image increases.

3. Output surface for Eclipse shaped objects by robot

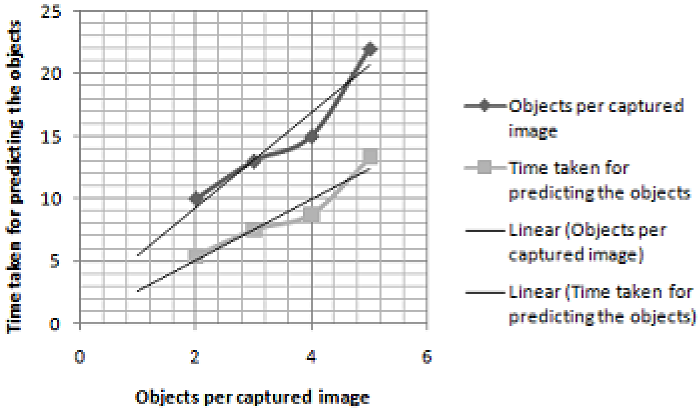

Figure 11: Output surface for Eclipse shaped objects by robot

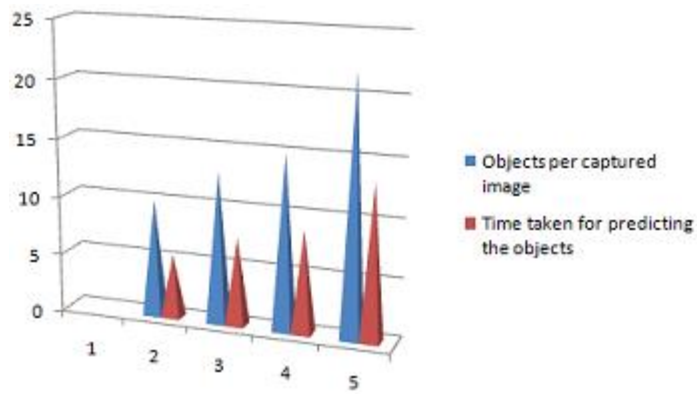

Figure 12: Point description of Eclipse shaped identified objects

This output surface shows the variation in the values of eclipse predicted in all the images. The predicted values vary as the number of objects in the image increases.

4. Output surface for Circular shaped objects by robot

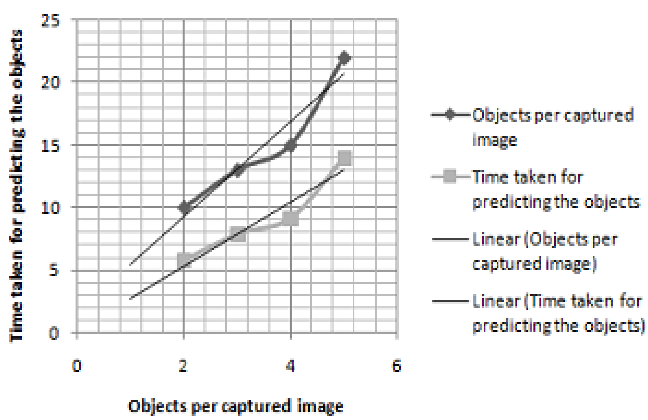

Figure 13: Output surface for Circular shaped objects by robot

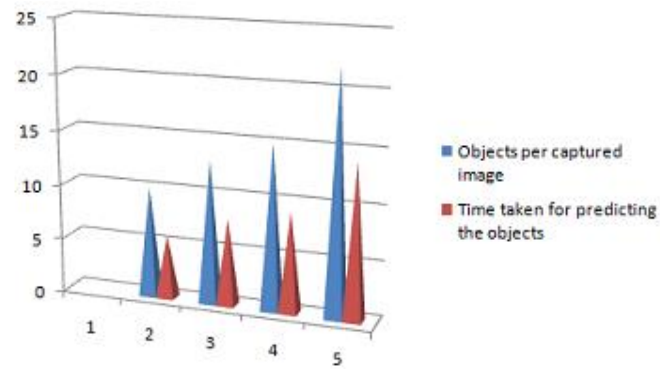

Figure 14: Point description of Circular shaped identified objects

This output surface shows the variation in the values of circle predicted in all the images. The predicted values vary as the number of objects in the image increases.

5. Output surface for Polygon shaped objects by robot

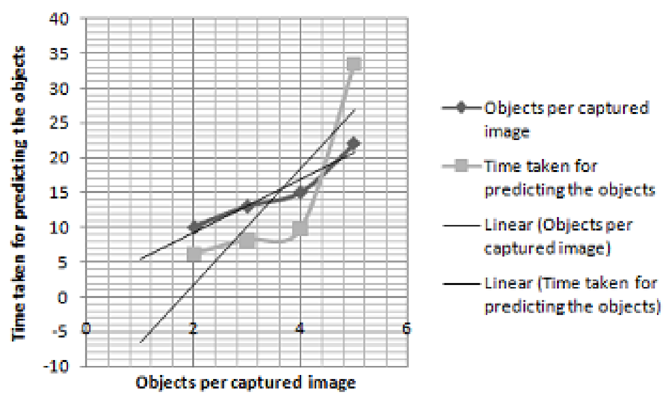

Figure 15: Output surface for Polygon shaped objects by robot

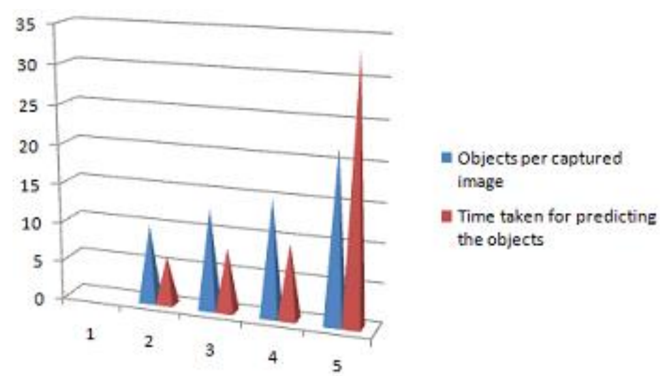

Figure 16: Point description of Polygon shaped identified objects

This output surface shows the variation in the values of polygon predicted in all the images. The predicted values vary as the number of objects in the image increases.

V. CONCLUSION AND FUTURE SCOPE

The proposed technique is an efficient technique for identifying the common objects which may be present in any play ground. The idea proposed is based on the fact that the designed robot is capable to identify even the adjoining or overlapping objects correctly. The proposed work can be extended to do and enhance Image definition to define the image based on characteristics of objects predicted.

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