DETERMINING THE SHAPE OF COMMON AND UNCOMMON OBJECTS

Arya R[1], Ramesh C R[2]
Student[1] , Assistant professor[2]
aryarajula96@gmail.com[1], ramesh.c.r@vidyaacademy.ac.in[2]

Abstract

Vision is the most advanced of our senses, so it is not surprising that images contribute important role in human perception. Image analysis is one of the most prominent fields in deep learning, Object detection is a well known computer technology connected with computer vision and image processing that focuses on detecting objects or its instances of a certain class(such as humans, flowers, animals)in digital images and videos. Images are easy to generate and handle, and they are exactly the right type of data for machine learning, easy to understand for human beings but difficult for computers. Recognising shapes involves distinguishing among shapes and associating shapes with shape names. The shapes "Triangle" and "Rectangle" can be easily identified by humans but it is very tedious for a computer. Understanding shape properties involves learning the defining characteristics or attributes of shapes. The system is able to predict the shape for which it has no prior information. The procedure of shape detection is actually a natural extension of the edge detection at pixel level to the difficulty of global contour detection. A tool for a systematic analysis of edge based shape detection is provided by this filtering scheme. Shape detection can be used for various purposes including retrieval and surveillance. The system find shapes in the real world from the captured video. The basic 2-D shapes are determined by the technique. The videos are captured by the camera and the RGB image is converted to grey scale image and edges are detected and is compared with the dataset and shapes are predicted.

Index Terms: Edge detection, Machine learning, Object detection.

I. INTRODUCTION

Humans can easily identify objects in the surroundings regardless of their circumstances whether they are upside down, different of colour or texture, partly occluded etc. Even object that appear in many different form like vases or objects that are subject to considerable shape deviations such as trees can easily be generalised by our brain to one kind of object. So detecting the shape of object is our main concern. Many different theories have been developed on how human recognise shape of the objects. Most of them are based on logical reasoning and on clear abstractions.

Shapes that can be easily extracted from the surroundings to a computer will be no more than a cluster of pixels. These can not always easily be separated from the random pixel surrounding it. A lot of processing can help to extract information on the shape of an object but the level of abstraction humans acheive is more when compared to the computer. So the project is to design a robot which can easily identify the shapes of object as humans.

Shape detection obliges pre-programming in a mathematical depiction database of the shapes to detect. For instance, assume composing a program which can recognize
a triangular shape, a square shape, and a circular shape. It can be done in this way: Run contour identification for discovering the boundary line of every shape considered. Then the number of continuous edges is counted. A sharp deviation

in line detection implies an alternate line does this by determining the average vector between adjoining pixels. In the event that three lines identified, then it's a triangle. In the event that four lines, then a square. In the event that one closed line, then it is a circle. We can focus more information by measuring angles between lines (rhombus, square, equilateral triangle, etc.).

Complex shapes obliges pattern recognition that is probability analysis. For instance, assume our algorithm expected to perceive between 10 distinct natural products (just by shape), for example, an orange, a bunch of grapes, an apple, a cherry, and so on. How will this be achieved? Since, all of these are circular, however none of them is seamlessly circular. Also, neither all fruits appear to be identical. By utilizing probability, an investigation can be run that says gracias, this natural product matches 85% of the attributes of a cherry, yet just 65% the qualities of an apple, so it's more probable a cherry. It is the computational form of an educated guess. We can likewise say if some specific characteristic is available, then it has a 30% higher likelihood of being an orange. The characteristic can be a stem, for example, spikes like on a pineapple, or fuzziness like on a coconut, and so on. This strategy is known as feature detection.

II. LITERATURE SURVEY

Zakaria et. al. 2012. proposed shape recognition method where circle, square and triangle object in the image will be recognizable by the algorithm. This proposed method utilizes intensity value from the input image then thresholded by Otsus method to obtain the binary image. Median filtering is applied to eliminate noise and Sobel operator is used to find the edges. Thinning method is used to remove unwanted edge pixels where these pixels may be counted in the parameter estimation algorithm, hence increase the false detection. The shapes are decided by compactness of the region. The experimental results show that this method archives 85% accuracy when implemented in selected database.

Singh et. al. 2012. presents new approach of shape recognition from the tactile images by touching the surface of various real life objects. Here four geometric shaped objects (viz. a planar surface, object with one edge, a cubical object i.e. object with two edges and a cylindrical object) are used for shape recognition. The high pressure regions denoting surface edges have been segmented out via multilevel thresholding. These high pressure regions hereby obtained were unique to different object classes. Some regional descriptors have been used to uniquely describe the high pressure regions. These regional descriptors have been employed as the features needed for
the classification purpose. Linear Support Vector Machine (LSVM) classifier is used for object shape classification. In noise free environment the classifier gives an average accuracy of 92.6%. Some statistical tests have been performed to prove the efficiency of the classification process. The classifier performance is also tested in noisy environment with different signalto-noise(SNR) ratios.

Ehsan Moomivand,2011 proposed a method in which the main property of shape (centroid) is considered as a basic point for recognition. Then, two structural properties such as distance and angles between the centroid and shape contour are calculated. Finally, by combining these two structural features,a new Feature Space is constructed. The proposed shape descriptor can measure periodical, smoothness and symmetry of shapes and can be used as a modified method for shape recognition.

Kulikova, 2009 study the shapes of tree crowns extracted from very high resolution color aerial infra-red images. For this study, they choose a methodology based on the shape analysis of closed continuous curves on shape spaces using geodesic paths under the bending metric with the angle-function curve representation, and the elastic metric with the square root q-function representation. A necessary preliminary step to classification is extraction of the tree crowns. In the second part, they address thus the problem of extraction of multiple objects with complex, arbitrary shape from remote sensing images of very high resolution.

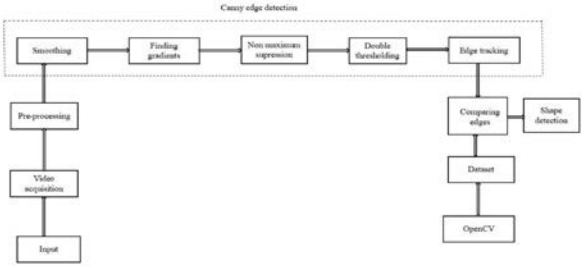
Schindler, and Suter, 2008. present a method for object class detection in images based on global shape. A distance measure for elastic shape matching is derived,which is invariant to scale and rotation, and robust against non-parametric deformations. Starting from an over-segmentation of the image, the space of potential object boundaries is explored to find

boundaries, which have high similarity with the shape template of the object class to be detected. An extensive experimental evaluation is presented. The approach achieves a remarkable detection rate of 83%-91% at 0.2 false positives per image on three challenging data sets.

C.Rong Wang,2007 proposed a toe shape description method based on geometric characteristics values of toe images. Corner detection is carried out on toe region, and the characteristic points which can describe the toe shape are confirmed by the edge of toe image. Through finding characteristic points whose distances to the centre are stable and which can distinguish different toe shapes and the correlation among them.

III. DESIGN OVERVIEW

The proposed algorithm have been designed for detecting shapes of objects. The main motivation for the recognition by shapes is that in reognition of an object as a whole every discrepancy, even if it is only a small one, can disrupt the recognition process. As such, trying to recognize an object as a whole is possible as long as the object is not partly covered or seen from a point of view that exposes a different side of the object than the system has been trained for.Even small parts can indicate the presence of an object.The proposed system consists of camera module and further image processing takes place.



1) Input-Any object regardless of shape can be shown to our system which will predict the shapes present in that object.Object may consist of several shapes such as triangle, rectangle, square, circle, polygons and so on. The term shape and objects differ. Object is something that we can see or touch but a object is described by set of shapes. So we can tell that the objects can be divided into various geons.

2) Video Acquisition-The camera is used to capture the video or image.

3) Image pre-processing-Pre processing an image is a necessary process. It generally involves running through images pixel by pixel and performing numerous calculations using this pixel and its surrounding pixels. Then it is given to canny filter. The RGB image is converted into gray with the help of white balancing and chromatic enhancement.

4) Canny filter-Canny filter will filter the image and produce only the necessary edges which is helpful for detecting the shapes.

5) Edge detection-The edge detection algorithm is used to find the edge pixels in the image. The generated edge pixels to create contours of the shapes present in the image and the resulting image is used to extract the shapes.

6) Comparing and prediction-The edges are determined and the shapes are compared with the dataset and the corresponding are being predicted. The common shapes predicted are circle, rectangle, square, triangle and polygons.

IV. HARDWARE OVERVIEW

A. Webcam-A webcam is a video camera that feeds or streams its image in real time to or through a computer to a computer network. The term ”webcam” (a clipped compound) may also be used in its original sense of a video camera connected to the Web continuously for an indefinite time, rather than for a particular session, generally supplying a view for anyone who visits its web page over the Internet. Some of them, for example, those used as online traffic cameras, are expensive, rugged professional video cameras. Webcams typically include a lens, an image sensor, support electronics, and may also include one or even two microphones for sound.

B. RASPBERRY PI-Raspberry Pi Compute Module (CM1), Compute Module 3 (CM3) and Compute Module 3 Lite (CM3L) are DDR2-SODIMM-mechanically-compatible System on Modules (SoMs) containing processor, memory, eMMC Flash (for CM1 and CM3) and supporting power circuitry. These modules allow a designer to leverage the Raspberry Pi hardware and software stack in their own custom systems and form factors. In addition these module have extra IO interfaces over and above what is available on the Raspberry Pi model A/B boards opening up more options for the designer.

V. SOFTWARE OVERVIEW

A. Python-It is a powerful modern computer programming language. It bears some similarities to Fortran, one of the earliest programming languages, but it is much more powerful than Fortran. Python allow to use variables without declaring them implicitly and it relies on indentation as a control structure. python are not forced to define classes in Python (unlike Java) but are free to do so when convenient . Python was developed by Guido van Rossum, and it is free software. Free as in free beer, in that can obtain Python without spending any money. But Python is also free in other important ways, for example free to copy it as many times as like, and free to study the source code, and make changes to it. There is a worldwide movement behind the idea of free software, initiated in 1983 by Richard Stallman. Python is a good choice for mathematical calculations and can write code quickly, test it easily, and its syntax is similar to the way mathematical ideas are expressed in the mathematical literature. Python is a major tool used by many web developers.

B. Open CV-Open CV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. Open CV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, Open CV makes it easy for businesses to utilize and modify the code. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc.OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 14 million. The library is used extensively in companies, research groups and by governmental bodies OpenCVs application areas include 2D and 3D feature toolkits, Egomotion estimation, Facial recognition system, Gesture recognition, Human computer interaction (HCI), Mobile robotics, Motion understanding, Structure from motion (SFM), Motion tracking, Augmented reality.

VI. RESULTS AND ANALYSIS

This chapter comprises the analysis and interpretation of the results from the study. The live video is captured by the camera. The RGB image is converted into gray scale image using contrast enhancement and white balancing techniques. The edges of the images are identified and contours are detected. The obtained shape is compared with the dataset and the shapes are being predicted. Basic shapes such as circle, triangle, rectangle, square and polygons are determined. Initially as the python program gets executed the camera gets turned on and the live video window as well as canny filter window get appears on the computer screen.

The edges are detected and contours are extracted and thus the shapes get predicted in the live video window. Canny edge detection takes place. Here the first step that takes place in the edge detection technique is the smoothing of the image which can be treated as removing the noise in the images. Next step in the method is finding the intensity gradients in the image. The to get rid of spurious response, non-maximum supression is performed. Then double threshhold is applied and finally the edges are detected. After the edges being determined the computer which will behave as humans with the help of dataset from open CV it is able to predict shapes. Basic 2-D shapes such as triangle, circle, square, rectangle and polygons are determined.

The size of the image is kept constant and the distance of the object from camera is varied and accuracy of prediction is plotted represented in fig1.Now the distance of the object from the camera is kept constant and the size of the object is varied and accuracy of prediction is verified represented in fig2.The shapes are determined by the edge detection techniques. A triangle is being determined when three edges are identified. Similarly all shapes are identified and compared with the dataset to predict the shapes. The proposed method helps to predict the shape of

any objects without the prior information abouth the object as well as shape. From this it is clear that shapes are identified perfectly with the proposed
method.

Distance from camera(in cm)	Accuracy(in %)
10	100
20	100
40	100
80	100
160	66
320	33

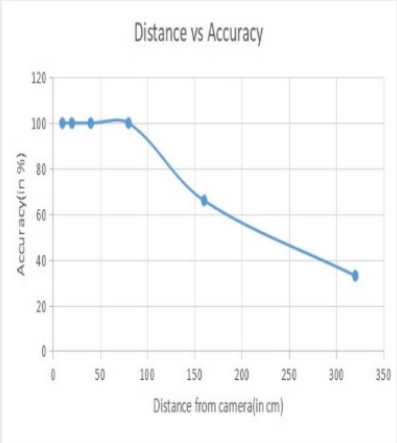


Fig1:Representing the relation between distance and accuracy keeping size constant

Size of shape for rectangle at distance=46cm	Accuracy
l=2cm,b=4cm	1
l=8cm,b=16cm	1
l=16cm,b=20cm	1
l=40cm,b=26cm	1
l=80cm,b=38cm	0.3

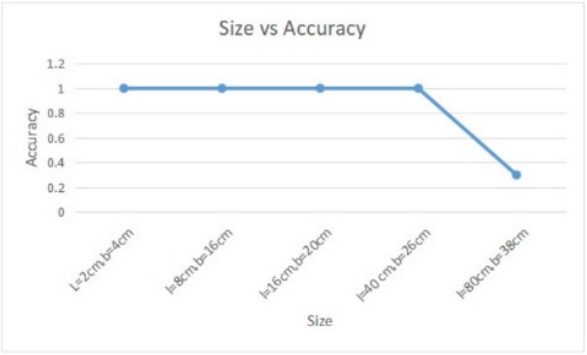


Fig2: Representing the relation between size and accuracy keeping the distance constant.

VII. CONCLUSION

The humans are able to identify objects regardless of their surroundings ie they are able to identify trees even if they are upside down. But for a computer the images are just a cluster of pixels.So the proposed method helps us to predict shapes without prior information. In the previous works only single shapes with fixed size can be detected. But the proposed system is able to predict basic shapes such as circle, triangle, rectangle, square and polygons of different shapes. The shape detection is different from object recognition. Object are set of shapes. So when shapes are predicted the chance of the presence of certain object is identified. The following system can be implemented with low cost and very efficient.

VIII. FUTURE SCOPE

Revolving around this topic, new descriptors can be included, preprocessing methods can be replaced and neural systems can be developed.
1)Dissecting multiple objects-The program can be extended to work with multiple objects. Due to its shape based approach the program can easily change the way it looks at a picture. Since in the current situation all shape combinations are mapped into single one we can decide to take a sub-section of this. With this we could explore a picture in further depth rather than assuming there is just one object in it. Techniques could, for instance try combinations of shapes that have close proximity to each other.
2)Neural preprocessing-Another option for preprocessing an image is using a neural network. Not much work has been done in this area, yet some applications can be found. The neural network can gets a block of pixels at its input, on which it outputs corresponding values of the original filter.

IX. ADVANTAGES

1)Triangle, circle, square, rectangle, polygons are predicted.
2) Low cost implementation.
3)High accuracy.
4)User friendly

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