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Object Recognition Using SVM

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Abstract: - **Recognizing Object is the process of finding instances of real-world objects. Object recognition enables innovative systems like self-driving cars, image retrieval, and autonomous robotics. In this paper we explore how MATLAB addresses the most common challenges encountered while developing object recognition systems. This paper will cover new capabilities for recognizing of objects and image processing.**

I. INTRODUCTION

Object recognition is a process for identifying a specific object in a digital image or video. Object recognition algorithms rely on matching, learning, or pattern recognition algorithms using appearance-based or feature-based techniques.Object recognition is useful in applications such as video stabilization, advanced driver assistance systems (ADAS), and disease identification in bioimaging. Common techniques include deep learning based approaches such as convolutional neural networks, and feature-based approaches using edges, gradients, histogram of oriented gradients (HOG), Haar wavelets, and linear binary patterns.You can recognize objects using a variety of models, including: Feature extraction and machine learning models, Deep learning models such as CNNs, Bag-of-words models with features such as SURF and MSER, Gradient-based and derivative-based matching approaches, The Viola-Jones algorithm, which can be used to recognize a variety of objects, including faces and upper bodies, Template matching, Image segmentation and blob analysis. The basic definition of image processing refers to processing of digital image, i.e removing the noise and any kind of irregularities present in an image using the digital computer. The noise or irregularity may creep into the image either during its formation or during transformation. Image Processing systems are becoming popular due to easy availability of powerful personnel computers, large size memory devices, graphics software etc

In general there are five major steps performed in Object Recognition as:
1. Image Input
2. Pre-Processing
3. Codebook Generation Using Vector Quantization
4. Feature Extraction
4. Image Matching Using SVM
5. Precision and Recall

II. LITERATURE SURVEY

Object Recognition method using top down recognition and bottom up image segmentation. Object classification techniques using machine learning model It represents as in depth experimental study on pedestrian classification multiple feature classifier combinations are examined with respect to their performance and efficiency. Object recognition in images by components:The system is structured with four distinct example-based detectors that are trained to separately find the four components of the human body: the head, legs, left arm, and right arm. They have ensured that these components are present in the proper geometric configuration, a second example-based classifier combines the results of the component detectors to classify a pattern as either a person or a non-person .This type of hierarchical architecture, in which learning occurs at multiple stages, an Adaptive Combination of Classifiers (ACC). They have presented results that show that this system performs significantly better than a similar full-body person detector. Object Detection Using Image Processing:Here work is done in Python-OpenCV and can be performed they have prefered Python because we can include it in OpenCV programs and the execution time in Python is lesser and simple. In here this project reports by pointing it use in surveillance and obstacle detection process. Further this program can be used to control the cameras in a UAV and navigate through obstacles effectively. Techniques for Object Recognition in Images and Multi-Object Detection: Here in this paper, the have discussed various object detection techniques. The template matching technique requires large database of image templates for correct object recognition. Object recognition also find their application in fields such as biometric recognition, medical analysis, surveillance, etc. A method for multiple object detection is also presented. Segmentation and object recognition using edge detection techniques: It focuses mainly on the Image segmentation using edge operators. The interaction between image segmentation and object recognition in the framework of the Sobel, Prewitt, Roberts, Canny, LoG, Expectation-Maximization (EM) algorithm, OSTU Algorithm and Genetic Algorithm are studied. MATLAB 7.9. is used for experimentation image. Expectation-Maximization algorithm and OTSU algorithm exhibited stable segmentation effect.

An automatic algorithm for object recognition and detection based on ASIFT keypoints: It presents an object recognition and detection algorithm. Their targets are achieved by combining ASIFT and a region merging segmentation algorithm based on a similarity measure. The merging process is started by using keypoints and presented similarity measure (Euclidean distance). The regions will be merged based on the merging role Here final result is that the more keypoints are obtained, and the more accurate they are, the results will be better and more acceptable.

III. OBJECT RECOGNITION USING IMAGE PROCESSING

The Object passed by the user as an input to the machine. The machine then processes the image from the external noise. The actual image is then obtained as a resultant when the user passes another image as a match for the image passed earlier by the user. In this paper, we are doing research study on Object Recognition using Image Processing. We will be taking an input image and that input image will be pre processed, following to create a Codebook building having get the required co ordinates by matching them with the database. Not just matching but using Precision and Recall method for having accuracy. As there are various means by recognizing a image like the clustering methods, etc. But we are doing a research study on this recognizing by vector quantization using Support Vector Machine (SVM)

Pre Processing:

An input image is pre-processed to normalize contrast and brightness effects. A very common preprocessing step is to subtract the mean of image intensities and divide by the standard deviation. Sometimes, gamma correction produces slightly better results. While dealing with color images, a color space transformation (e.g. RGB to LAB color space) may help get better results.

Pre-processing is a common name for operations with images at the lowest level of abstraction — both input and output are intensity images. These iconic images are of the same kind as the original data captured by the sensor, with an intensity image usually represented by a matrix of image function values (brightnesses). The aim of pre-processing is an improvement of the image data that suppresses unwilling distortions or enhances some image features important for further processing, although geometric transformations of images (e.g. rotation, scaling, translation) are classified among pre-processing methods here since similar techniques are used. Often an input image is pre-processed to normalize contrast and brightness effects. A very common preprocessing step is to subtract the mean of image intensities and divide by the standard deviation. Sometimes, gamma correction produces slightly better results. While dealing with color images, a color space transformation (e.g. RGB to LAB color space) may help get better results.

Codebook Generation Using Vector Quantization:

In Vector Quantization by grouping input sequences together and encoding them as a single block, Here are obtained efficient lossy as well as lossless compression algorithms. Some of the quantization techniques that operate on blocks of data. These blocks are looked as vectors. This kind of quantization technique is called vector quantization in vector quantization we need to build a representative set for the input sequences. If there is an input sequence, we can express it as one of the elements in the representative set. In vector quantization, we first group the input into blocks or vectors. All the operations in vector quantization will be applied to whole vectors. At both the encoder and decoder sides, there is a set of vectors called the codebook. The vector in the codebook is called the codevector or codeword. Normally, the size of the codevector is the same as the input vector. There is a search engine in the encoder to find the codevector that can best match the input vector. The input vector is compared with each codevector in the codebook. The best match codevector is the quantized value of that input vector.

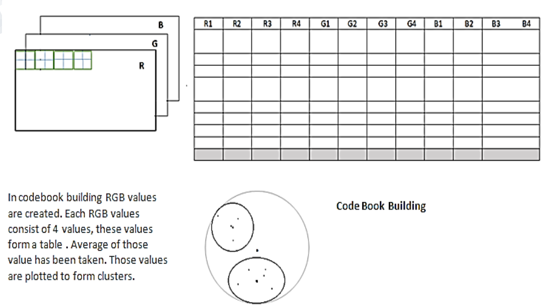

Fig. Code Book Genereation Using Vector Quantization

Feature Extraction:

Feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps, and in some cases leading to better human interpretations. Feature extraction is related to dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be redundant (e.g. the same measurement in both feet and

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meters, or the repetitiveness of images presented as pixels), then it can be transformed into a reduced set of features (also named a feature vector). Determining a subset of the initial features is called feature selection. The selected features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data.

Test Image: A standard test image is a digital image file used across different institutions to test image processing and image compression algorithms. By using the same standard test images, different labs are able to compare results, both visually and quantitatively.

Image Matching Using SVM:

Matching an image from the database withheld by us. Using the code book built by us to match the image so as to extract the proper co ordinates and plot them accordingly. Matching the image by accuracy so as to get a accurate image with good quality and no noise present that affects the image quality. SVMs are helpful in text and hypertext categorization as their application can significantly reduce the need for labeled training instances in both the standard inductive and transductive settings. Classification of images can also be performed using SVMs. Experimental results show that SVMs achieve significantly higher search accuracy than traditional query refinement schemes after just three to four rounds of relevance feedback. This is also true of image recognition systems, including those using a modified version SVM the full SVM classifier (SVMModel) is more than four times the compact SVM classifier (CompactSVMModel). Full SVM classifiers (i.e., ClassificationSVM classifiers) hold the training data. For efficiency, you might not want to predict new labels using a large classifier. Train an SVM classifier. It is good practice to standardize the predictors and specify the order of the classes.

The SVM algorithm uses structural risk minimization to find the hyper plane that optimally separates two classes of objects. This is equivalent to minimizing a bound on generalization error. The optimal hyper plane is computed as a decision surface of the form we use support vector machines (SVM) to classify the data vectors resulting from the Haar wavelet representation of the components. SVMs were proposed by Vapnik and have yielded excellent results in various data classification tasks, including people recognition and text classification .Traditional training techniques for classifiers like multilayer perceptrons use empirical risk minimization and lack a solid mathematical justification. The SVM algorithm uses structural risk minimization to find the hyper plane that optimally separates two classes of objects. This is equivalent to minimizing a bound on generalization error. The optimal hyper plane is computed as a decision surface of the form:

$$f(x) = sgn(g(x)),$$

Where,

$$g(x) = (\sum_{i=1}^{n} yi\ ai\ K(x, xi) + b).$$

In, K is one of many possible kernel functions, yi, ϵ{-1,a} is the class label of the data point xi, and {xi}ni=1 is a subset of the training data set. The xi are called support vectors and are the points from the data set that define the separating hyper plane. Finally, the coefficients ai and b are determined by solving a large-scale quadratic programming problem. One of the appealing characteristic of SVMs is that there are just two tunable parameters, Cpos and Cneg, which are penalty terms for positive and negative pattern misclassification, respectively. The kernel function K that is used in the component classifiers is a quadratic polynomial and is K(x,xi)=(x.xi +1)2. The binary class of a data point is the sign of the raw output g(x) of the SVM classifier.

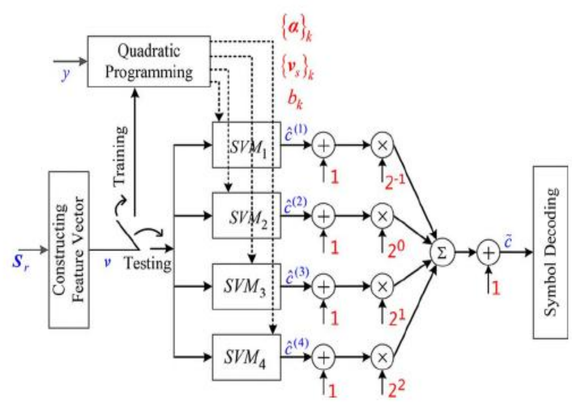

Fig. Process Of SVM

IV. METHODOLOGY

The given flowchart explains the working in easiest and the simplest way:

Step 1: In this step, it will take a input that is of the dataset.

Step 2: The image given as an input is Processed further.

Step 3: The processed image is Pre Processed in order to remove the noise present and get a précised image.

Step 4: Matching the input by the dataset with respect to the values or co ordinates brought upon by the code book which is built getting the RGB values

Step 5: Performance Measure

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Accuracy: For accuracy of a measurement system is the level of proximity measurements of the quantity to the quantity's actual value.

$$\text{Acc} = \frac{\text{True Positive + True Negative}}{\text{Total Number of Elements}}$$

Precision: For information retrieval, precision is the fraction of retrieving actual value.

$$\text{Precision} = \frac{\text{True Positive}}{\text{True Positive+ False Positive}}$$

Recall: Recall in value retrieval is the fraction of the documents that are appropriate to the query that are successfully redeemed.

$$\text{Recall} = \frac{\text{True Positive}}{\text{True Positive+ False Negative}}$$

V. DIAGRAM

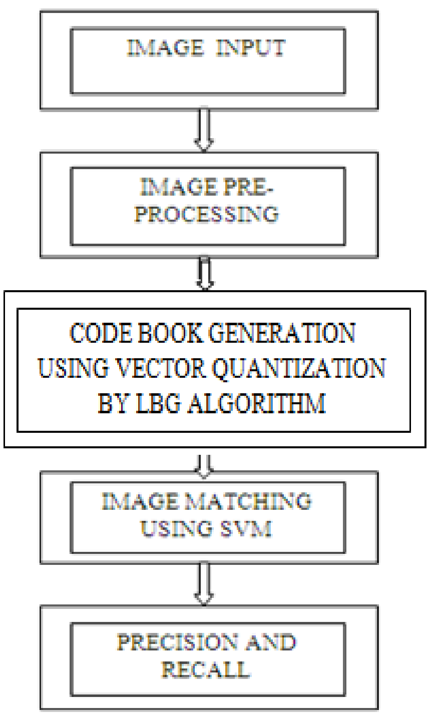

Fig. Process Implementation

VI. CONCLUSION

In Conclusion, this is a research study done on Object Recognition using Image Processing using SVM to retrieve and recognize the image with respect to the database. Here the input image is matched using SVM and by the code book generated by Vector Quantization. For matching of the given image, Precision and Recall is used.

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