Object Detection Using Yolo

1st Md Rizwan Ahmad
Guide Name:Mr.Akhilesh kumar singh
email : Md.21scse1010811@galgotiasuniversity.edu.in
Name of Organization : Galgotias University

2nd Anuj sati
Guide Name:Mr.Akhilesh kumar singh
email : Anuj.21scse1011428@galgotiasuniversity.edu.in
Name of Organization : Galgotias University

3rd Abhijeet samal
Guide Name:Mr.Akhilesh kumar singh
email : abhijeet.21scse1011284@galgotiasuniversity.edu.in
Name of Organization : Galgotias University

Abstract— 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. There are various applications of object detection that have been well researched including face detection, character recognition, and vehicle calculator. Object detection can be used for various purposes including retrieval and surveillance. In this study, various basic concepts used in object detection while making use of OpenCV library of python 2.7, improving the efficiency and accuracy of object detection are presented.

I. Introduction

Object detection and location in digital images has become one of the most important applications for industries to ease user, save time and to achieve parallelism. This is not a new technique but improvement in object detection is still required in order to achieve the targeted objective more efficiently and accurately.

The main aim of studying and researching computer vision is to simulate the behavior and manner of human eyes directly by using a computer and later on develop a system that reduces human efforts. Computer vision is such kind of research field which tries to perceive and represents the 3D information for world objects. Its main purpose is reconstructing the visual aspects of 3D objects after analyzing the 2D information extracted. Real life 3D objects are represented by 2D images.

The process of object detection analysis is to determine the number, location, size, position of the objects in the input image. Object detection is the basic concept for tracking and recognition of objects, which affects the efficiency and accuracy of object recognition. The common object detection method is the color-based approach, detecting objects based on their color values [4]. The method is used because of its strong adaptability and robustness, however, the detection speed needs to be improved, because it requires testing all possible windows by exhaustive search and has high computational complexity.

OpenCV library implemented in python2.7 along with the help of Numpy is used and the world of object detection is explored, a virtual Artificial Neural Network is created using Sci-kit tool.

II. Deep learning and computer vison

Deep Learning (DL) was introduced in the early 2000s after Support vector machines (SVM), Multilayer perceptron (MLP), Artificial Neural Networks (ANN), and other shallower neural networks became popular. Many researchers termed it as a subset of Machine learning (ML) which is considered as a subset of Artificial Intelligence (AI) in turn. During its inception period, deep learning didn't draw much attention due to scalability and several other influential factors such as demand of huge compute power. After 2006, it has changed its gear and became popular as compared to its contemporary ML algorithms because of two main reasons: (i) Availability of abundance of data for processing and (ii) Availability of high-end computational resources. The success stories of deep learning in various domains includes weather forecasting , stock market prediction , speech recognition , object detection , character recognition , intrusion detection , automatic landslide detection , time series prediction , text classification , gene expression , micro-blogs , biological data handling , unstructured text data mining with fault classification , video processing such as caption generation , and many more.

Computer vision is a predominant and versatile field in the current era and lots of research is being carried out by various researchers in this field. Computer vision instructs machines to understand, grasp, and analyze a high-level understanding of visual contents. Its subfields include scene or object recognition, object detection, video tracking, object segmentation, pose and motion estimation, scene modeling, and image restoration . In this review, we focus on the object detection and its relevant subfields such as object localization and segmentation, one of the most important and popular tasks of computer vision. The common deep learning models can be utilized for any computer vision task includes Convolution Neural Network (CNN), Deep Belief Networks (DBN), Deep Boltzmann Machines (DBM), Restricted Boltzmann Machines (RBM), and Stacked Autoencoders .

III. Object classification and localization

Image Classification is a task of classifying an image or an object in an image into one of the predefined categories. This problem is generally solved with the help of supervised machine learning or deep learning algorithms wherein the model is trained on a large labelled dataset. Some of the commonly used machine learning models for this task includes ANN, SVM, Decision trees, and KNN [2]. However, on the deep learning side, CNNs and its architectural successors and variants dominate other deep models for classifying images and related works. Apart from well-defined machine learning and deep learning models, one can also witness the usage of other approaches such as Fuzzy logic and Genetic algorithms for the aforementioned tasks [2].

Object Localization is the task of determining position of an object or multiple objects in an image/frame with the help of a rectangular box around an object, commonly known as a bounding box. However, Image segmentation is the process of partitioning an image into multiple segments wherein a segment may contain a complete object or a part of an object. Image segmentation is commonly utilized to locate objects, lines, and curves viz. boundaries of an object or segment in an image. Generally, pixels in a segment possess a set of common characteristics such as intensity, texture, etc. The main motive behind image segmentation is to present the image into a meaningful representation. Moreover, Object detection can be considered as a combination of classification, localization, and segmentation. It is the task of correctly classifying and efficiently localizing single or multiple objects in an image, generally with the help of supervised algorithms given a sufficiently large labelled training set. Figure 1 presents the clear understanding of classification, localization, and segmentation for single and multiple objects in an image in the context of object detection.

Proposed Method

In this work, we aim to solve a particular object instance recognition by using methods based on CNNs and nearest-neighbor classification. By changing the paradigm from local descriptors to global descriptors based on CNNs, we aim to recognize objects that are very hard to recognize by using just local descriptors. Thus, the proposed method is based on four main blocks: (i) computation of region proposals, (ii) computation of global descriptors, and (iii) recognition of object instances using an open-set nearest-neighbor classification scheme, which can reject detections generated by objects outside the training dataset, and (iv) suppression of redundant detections. The blocks that define the method are shown in Figure 1 .

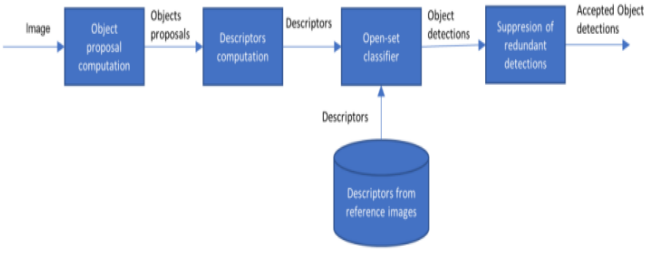

Fig.1.Block diagram of the system

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ACKNOWLEDGMENT

I would like to thank the MR AKHILESH KUMAR SINGH for providing me with their guidance throughout the assignment.

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[3] https://2019.robocup.org/downloads/program/LoncomillaRuizdelSolar2019.pdf