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OBJECT IDENTIFICATION USING YOLO FRAMEWORK

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ABSTRACT
Object detection is considered one of the most challenging problems in this field of computer vision, as it involves the combination of object classification and object localization within a scene. Object detection in high resolution remote sensing images is a fundamental and challenging problem in the field of remote sensing imagery analysis for civil and military application due to the complex neighboring environments, which can cause the recognition algorithms to mistake irrelevant ground objects for target objects. It is exercised over a multitude of applications ranging from test and number classification to traffic surveillance. To overcome these issues, YOLO (You Only Look Once) based detection and classification approach for improving the computation and processing speed and at the same time efficiently identify the objects in the video and image. Region-based Convolutional Neural Networks, or R-CNNs, is a family of techniques for addressing object localization and recognition tasks, designed for model performance. You Only Look Once, or YOLO is known as the second family of techniques for object recognition designed for speed and real-time use.

Keywords: Convolution Neural Network, object detection, image classification, deep learning, YOLO.

1. INTRODUCTION

Object recognition is to describe a collection of related computer vision tasks that involve activities like identifying objects in digital photographs[1][2][3]. Image classification involves activities such as predicting the class of one object in an image. Object localization is refers to identifying the location of one or more objects in an image and drawing an abounding box around their extent[4][5][6]. Object detection does the work of combines these two tasks and localizes and classifies one or more objects in an image. When a user or practitioner refers to the term "object recognition", they often mean "object detection". It may be challenging for beginners to distinguish between different related computer visiontasks[7][8][9].

To gain a complete image understanding, we should not only concentrate on classifying different images, but also try to precisely estimate the concepts and locations of objects contained in each image[10[11]. This task is referred as object detection which usually consists of different subtasks such as face detection, pedestrian detection and skeleton detection[33[34][35] .As one of the fundamental computer vision problems, object detection is able to provide valuable information for semantic understanding of images and videos, and is related to many applications, including image classification[12[13][14] ,human behavior analysis ,face recognition and autonomous driving .Meanwhile, Inheriting from neural networks and related learning systems, the progress in these fields will develop neural network algorithms[14][15][16], and will also have great impacts on object detection techniques [31][32]which can be considered as learning systems. However, due to large variations in viewpoints, poses, occlusions and lighting conditions, it's difficult to perfectly accomplish object detection with an additional object localization task. So much attention has been attracted to this field in recent years[17][18]

Image classification also involves assigning a class label to an image, whereas object localization involves drawing a bounding box around one or more objects in an image. Object detection is always more

challenging and combines these two tasks and draws a bounding box around each object of interest in the image and assigns them a class labe[19][20]l. Together, all these problems are referred to as object recognition[21][22].

2. RELATED WORK

With the development of machine learning methods, especially feature extraction and classification methods[23][24], a major breakthrough has been made in the field of computer vision to translate the target detection problem into a classification problem for machine learning. The diagram shows a typical machine learning-based target detection method implementation flow. The training process learns a classifier from the training data set in a supervised, semi-supervised or weakly supervised manner. In the detection process, a series of regional image blocks extracted by a sliding window or candidate region extraction algorithm are extracted by a feature extraction algorithm as a classifier input, and a corresponding prediction class label is output (for example, whether the target is for a binary classification output). Usually, the detection is performed[25][26][27]. The results also need to be corrected and optimized by post-processing operations. Candidate area extraction algorithms include sliding windows, super pixel segmentation, Edge Box, , Bing, etc. Feature extraction algorithms include HOG, BoW, texture features, sparse representation features, Haar features, and CNNs-based methods; classifiers include SVM, AdaBoost , k-nearest neighbors (kNN), conditional random fields (CRF), sparse representations (SRC) and artificial neural networks (ANN); post-processing methods include NMS, Box-fusion, and Bounding-box Regression[28][29][30].

3. CNN BASED OBJECT DETECTION

Traditional CNNs are usually used for classification task, and the output of classification is discrete class label. In object detection tasks for the remote sensing image, more information such as location of object needs to be obtained. Each pixel in the image should be predicted and labeled by classification algorithm [41] [42]. In the field of computer vision, object detection methods for image based on CNN can be divided into two types: object localization and semantic segmentation. As shown in Fig 1, the target of the object localization is to obtain the bounding box of object in input image, and the target of scene segmentation is to obtain a predicted mask for input image [43] [44]. RCNN is a representative method of object location methods which built a framework to solve problem of object location. RCNN consist of a Region Proposal algorithm (such as Selective Search, BING and so on) to extract a large number of ROIs (Region Of Interest) from the input image, a CNN model to extract the features of the ROIs, a classifier to classify the ROIs, and a regression algorithm to correct the border position of bounding box.

YOLO—You Only Look Once

All the previous object detection algorithms have used regions to localize the object within the image. The network does not look at the complete image. Instead, parts of the image which has high probabilities of containing the object [45] [46]. YOLO or You Only Look Once is an object detection algorithm that network predicts the bounding boxes and the class probabilities for these boxes.

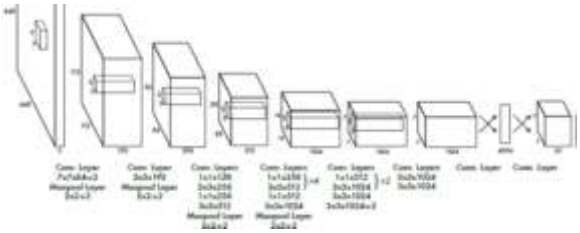

Fig 1 :working of YOLO Framework

YOLO works by taking an image and split it into an SxS grid, within each of the grid we take m bounding boxes. For each of the bounding box, the network gives an output a class probability and offset values for the bounding box [47] [48]. The bounding boxes have the class probability above a threshold value is selected and used to locate the object within the image.

YOLO is orders of magnitude faster(45framespersecond)than any other object detection algorithms. The limitation of YOLO algorithm is that it struggles with the small objects within the image, for example, it might have

difficulties in identifying a flock of birds. This is due to the spatial constraints of the algorithm.

Flow Diagram

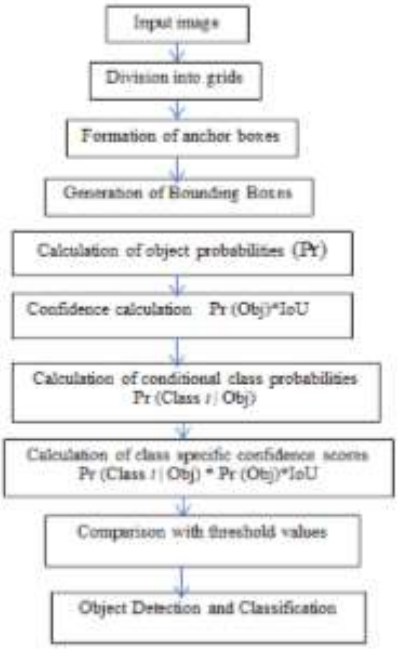

Fig 2 : Working of YOLO

Each prediction composes of a boundary box and 21 scores for each class (one extra class for no object), and we pick the highest score as the class for the bounded object. Conv4_3 makes total of 38 × 38 × 4 predictions: four predictions per cell regardless of the depth of feature maps. A expected, manypredictionscontainnoobject.SSDreservesaclass“ 0”toindicate

SSD does not use the delegated region proposal network. Instead, it resolves to a very simple method. It computes both the location and class scores using small convolution filters. After extraction the feature maps, SSD applies 3 × 3 convolution filters for each cell to make predictions. (These filters compute the results just like the regular CNN filters.) Each filter gives outputs as 25 channels: 21 scores for each class plus one boundary box.

Beginning, we describe the SSD detects objects from a single layer. Actually, it uses multiple layers (multi-scale feature maps) for the detecting objects independently. As CNN reduces the spatial dimension gradually, the resolution of the feature maps also decrease. SSD uses lower resolution layers for the detect larger-scale objects. For example, the 4× 4 feature maps are used for the larger-scale object.

SSD adds 6 more auxiliary convolution layers to image after VGG16. Five of these layers will be added for object detection .In which three of those layers, we make 6 predictions instead of4.In total, SSD makes 8732 predictions using 6 convolution layers.

Multi-scale feature maps enhance accuracy. The accuracy with different number of featur re map layers isused fo robject detection

4. EXPERIMENTAL RESULTS

4.1 Hardware and software environment

The model is implemented by Keras with Tensorflow backend. Keras is a high-level neural networks API, written in Python and capable of running on top of TensorFlow, CNTK, or Theano. Tensorflow developed by the Google Brain team is an open-source software library for dataflow programming across a range of tasks. Many 3rd party libraries are required such as Tifffle for reading remote sensing imagery, OpenCV for basic image processing, Shapely for handling polygon data, Matplotlib as visualization tool, Imglabel for dataset construction. The experiments run on a Sugon W560-G20 Server with E5-2650 v3 CPU, 32GB memory, and Quora k2000 GPU.

4.2 Experimental process

Images Labels Model Construction Dataset Construction Model Training Model Prediction

The experimental process can be divided into four steps:

FIG 3: Experimental Process

Dataset construction. The remote sensing images (gain from open source data source such as GoogleEarth, USGS, DigitalGlobe and so on) are animated using imgLabel to obtain standard

PASCAL_VOC format dataset. Divide labeled dataset into training, validation, and test sets.
Model construction: Constructing a CNN structure and setting its hyperparameters.
Model training:. Training with training sets and validation sets.
Model prediction. :Testing with the test set, and the result is used for evaluates mode

```
detections=detector.detectObjectsFromImage(input_image=os.path.join(execution_path,"image3.jpg"),output_image_path=os.path.join(execution_path,"image3new_nodetails.jpg"),
minimum_percentage_probability=30,
display_percentage_probability=False,display_object_name=False)
```

Fig.4 :Before Object Detection

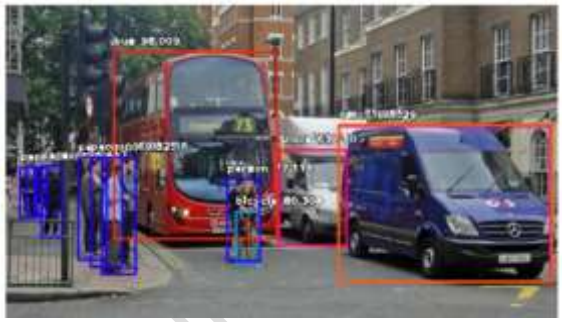

Fig 5:After Object Detection

5. CONCLUSION

This work addresses the problem of rapid object detection for high-resolution remote sensing image with CNNs. A YOLO model is used in this paper for object detection in high resolution remote sensing images. Experiments on different datasets, like airport dataset and airplane dataset gain from Google also demonstrate that YOLO model has a strong applicability for remote sensing image, especially in speed of prediction. The main disadvantages of YOLO are its poor positioning accuracy, bad training approximation and generalization for images of unusual aspect ratio and objects that are very close to each other. It needs a large number of high quality Ground Truth labels for the model training, which relies on professional interpretation experiences and lots of manual work. Therefore, to solve these problems is orientation of the future research.

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