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Application to Monitor and Manage People In Crowded Places Using Neural Networks

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Abstract:

From the introduction of computers, to providing them human like capabilities, to the upcoming trends in computer vision and natural language processing, these abilities are now been started to replicate by the computers. Use of Artificial Intelligence is currently the prime focus of industry in development of such core abilities for computers. The Application being developed in this research is the product of such analysis and understanding various aspects of subjected scenario and helps to provide reliable solution to the whole monitoring and management process

Keywords **—Artificial Neural Networks, Deep Learning, Crowd Management, Computer Vision, TensorFlow**

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I. INTRODUCTION

The issue that has been put forth for concern here is that, many places which are prime locations for people gathering like temples, company placement drives or other important places, sometimes get heavily crowded resulting in unpredictable mishaps. To avoid such mishaps, an application that involves advanced resource usage to tackle this problem is developed. Rigorous use of video technology to monitor the people is backed by advanced analytics through Artificial Neural Networks.

II. GOALS AND OBJECTIVES

A. Goals

1) Detection of human in the video feed.

2) Classifying humans and differentiating from other objects present.

3) Monitor and count the number of people.

4) Operate the entry gates to the place accordingly.

B. Objectives

1) To develop an application, capable of detection and classification of objects(person) from camera video feeds.

2) To accompany the use of Artificial Neural Networks for performing specified task.

3) To generate patterns based on the classification for object recognition.

4) To Monitor the crowd of people in a particular place, avoiding the issues regarding overpopulated spaces.

5) To actuate required measures (entry control) based on the head count of people.[7]

III. READINGS AND SURVEY

A. Object Detection with Deep Learning: A Review

Authors: Zhong-Qiu Zhao, Member, IEEE, Peng Zheng, Shou-tao Xu, Xindong Wu
Publication:IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNINGSYSTEMS, April 16,2019
Review: This paper provides a detailed review on deep learning-based object detection frameworkswhich handle different sub-problems, such as occlusion, clutter and low resolution,with different degrees of modifications on R-CNN. The review starts on genericobject detection pipelines which provide base architectures for other related tasks.Then, three other common tasks, namely salient object detection, face detection andpedestrian detection, are also briefly reviewed. Finally, we propose several promisingfuture directions to gain a thorough understanding of the object detection landscape.This review is also meaningful for the developments in neural networks and relatedlearning systems, which provides valuable insights and guidelines for future progress [1].

B. Research on Daily Objects Detection Based on Deep Neural Network

Authors: Sheng Ding, Kun Zhao
Publication:IOP Conf. Series: Materials Science and Engineering, 2018
Review: With the rapid development of deep learning, great breakthroughs have been madein the field of object detection. The deep learning algorithm is applied to the detectionof daily objects, and some progress has been made in this direction. Comparedwith traditional object detection methods, the daily objects detection method basedon deep learning is faster and more accurate. The main research work of this article:1. collect a small data set of daily objects; 2. in the TensorFlow framework tobuild different models of object detection, and use this data set training model; 3. Thetraining process and effect of the model are improved by tuning the model parameters[5].

C. Moving object detection and tracking Using Convolutional Neural Networks

Authors: Shraddha Mane, Prof.SupriyaMangale
Publication: International Conference on Intelligent Computing and Control Systems(ICICCS, 2018)
Review: In this paper, novel approach for object detection and tracking has been presentedusing convolutional neural network. The moving object detection is performed usingTensorFlow object detection API. The object detection module robustly detectsthe object. The detected object is tracked using CNN algorithm. Considering humantracking as a special case of detection of objects, spatial and temporal classes the facilitieswere learned during offline training. The shift variant architecture has extendedthe use of conventional CNNs and combined the global features and local characteristicsin a natural way. The proposed approach achieves the accuracy of 90.88% [3].

D. Scene Graph Generation from Objects, Phrases and Region Captions

Authors: Yikang Li, Wanli Ouyang, Bolei Zhou, Kun Wang, Xiaogang Wang
Publication: International Conference on Intelligent Computing and Control Systems,2017
Review: This paper targets on scene understanding by jointly modeling three vision tasks, i.e.object detection, visual relationship detection and region captioning, with a singledeep neural network in an end-to-end manner. The three tasks at different

semanticlevels are tightly connected. A Multi-level Scene Description Network (MSDN)model is proposed to leverage such connection for better understanding image. InMSDN, given an input image, a graph is dynamically constructed to establish thelinks among regions with different semantic meaning. The graph provides a novelway to align features from different tasks [6].

E. Application of Deep Learning in Object Detection

Authors: Xinyi Zhou, Wei Gong, WenLong Fu, Fengtong Du
Publication:IEEE ICIS, 2017
Review: This paper expresses the importance of deep learning technology applications and theimpact of dataset for deep learning through the use of the faster r-cnn on new datasets.In recent years, the technology of deep learning in image classification, object detectionand face identification and many other computer vision tasks have achieved greatsuccess. Experimental data shows that the technology of deep learning is an effectivetool to pass the man-made feature relying on the drive of experience to the learningrelying on the drive of data. Large data is the base of the success of deep learning,large data just as fuel to the rocket for deep learning. More and more applicationsare continually accumulating increasingly rich application data, which is critical tothe further development and application of deep learning. However, the quality of thedata affects the deep learning in deed, of course, in addition to these real data, maybewe can also consider some of synthetic data to increase the amount of data in the further[2].

IV. PROPOSED ARCHITECTURE

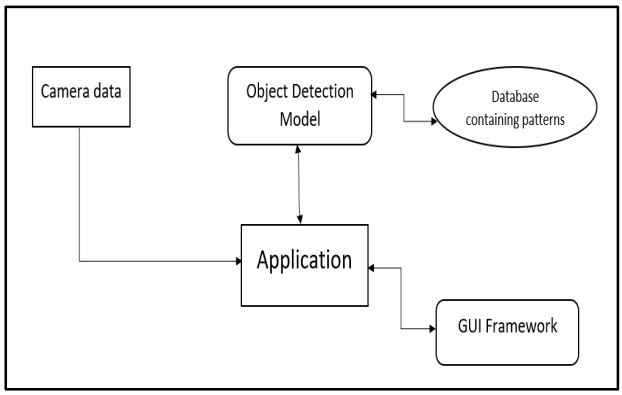


Fig. 1 Architecture Proposed

The proposed architecture for the application involves following Components:

A. ***Camera Module:***

This Module Consists of the main camera unit. It provides the live video feed of the place where it is deployed for the application purpose. Feed can be either live or a video clip so as to directly perform the detection from video feed or analysis work in previously recorded video file respectively.

B. ***Object Detection Module:***

This module Consists of the trained Object detection model and tracking model. The main purpose of this module is to receive the feed from camera system or individual file to perform the detection work and further track the objects in runtime to monitor their movements and keep the count of people.

C. ***Storage For Data:***

This Unit performs the task of storing all the required information related to this application. It stores the created model for the implementation of detection and tracking of objects. Likewise, it also stores the runtime object classified and keep track of their count that could be further used.

D. ***Application Script:***

This Module acts as the centre for everything to be connected in the application. It performs the tasks like initiating the video feed from camera, checking availability of camera, passing video information and frames to the model, deploying the detection model and recognising video frames. It controls almost all of the modules and automate and regulate their performance.

E. ***GUI Element***

This Involves the display of information and live analysis data to the application. Information that is determined by the model about the monitoring process is displayed to the user interface using this module.

V. PROCESS DEFINITION

A. ***Object Tracking over Object Detection***

These points can also be considered as superiority of tracking over detection, or they can beconsidered as to use if the other fails to perform the expected. But both have their functionallimitations and thus cannot be replaced to perform each other's intended tasks.

1)Tracking is faster than Detection: Usually tracking algorithms are faster than detectionalgorithms. The reason is simple. When you are tracking an object that was detectedin the previous frame, you know a lot about the appearance of the object. You alsoknow the location in the previous frame and the direction and speed of its motion. Soin the next frame, you can use all this information to predict the location of the objectin the next frame and do a small search around the expected location of the objectto accurately locate the object. A good tracking algorithm will use all information ithas about the object up to that point while a detection algorithm always starts fromscratch.

2) Tracking can help when detection fails: If you are running a face detector on a videoand the person's face gets occluded by an object, the face detector will most likely fail.A good tracking algorithm, on the other hand, will handle some level of occlusion.

3) Tracking preserves identity: The output of object detection is an array of rectanglesthat contain the object. However, there is no identity attached to the object. Whileusing detection on a frame we have no idea which rectangle corresponds to whichobject. On the other hand, tracking provides a way to literally connect the dots.

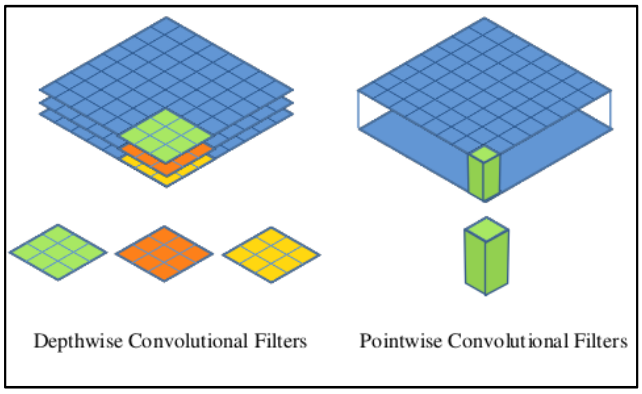


Fig. 2 Different type of Convolutional Neural Networks

VI. OBJECT DETECTION AND TRACKING

Following steps are curated to perform the detection of objects and to perform a tracking with respect to individual objects.

Step 1: we accept a set of bounding boxes and compute their corresponding centroids.(i.e., the center of the bounding boxes). To build a simple object tracking via centroidsscript with Python, the first step is to accept bounding box coordinates and use themto compute centroids. The centroid tracking algorithm assumes that we are passing ina set of bounding box (x, y)-coordinates for each detected object in every single frame.

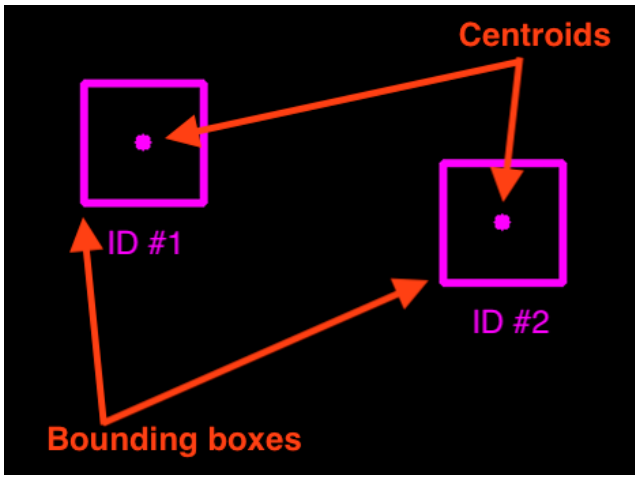


Fig. 3 Step 1 (detection)

Step 2: we compute the Euclidean distance between any new centroids (yellow) and existing centroids (purple). Three objects are present in this image. We need to compute the Euclidean distance between each pair of original centroids (red) and new centroids (green).

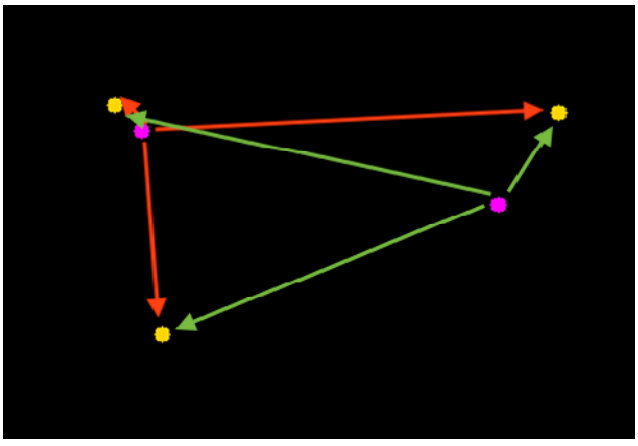


Fig. 4 Step 2 (detection of new objects)

Step 3: Update (x, y)-coordinates of existing objects. Once we have the Euclideandistances we attempt to associate object IDs. Our simple centroid object trackingmethod has associated objects with minimized object distances.

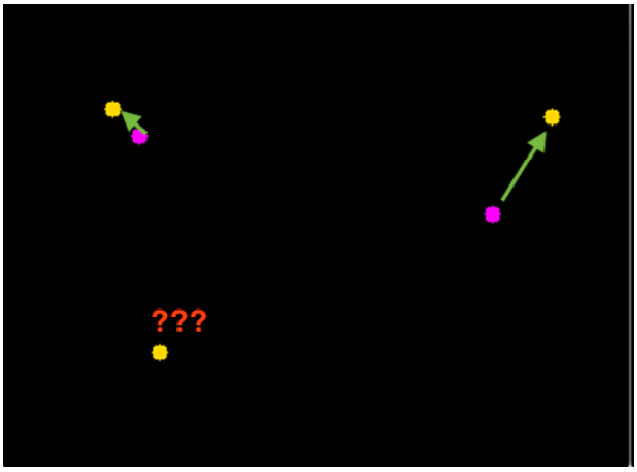


Fig. 5 Step 3 (centroid association)

Step 4: Step to register new objects. In this illustration, we have a new object that was not matched with an existing object,so it is registered as object ID 3.In the event that there are more input detections than existing objects being tracked,we need to register the new object. “Registering” simply means that we are addingthe new object to our list of tracked objects by:

- Assigning it a new object ID
- Storing the centroid of the bounding box coordinates for the new object

In the event that an object has been lost or has left the field of view, we can simplyderegister the object.

Fig. 7 Initialization of program

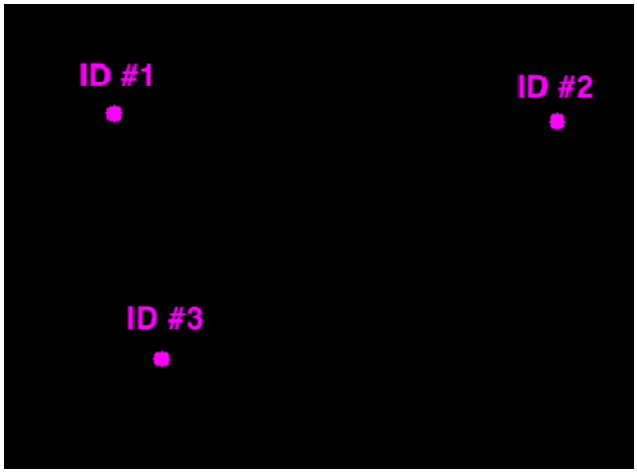


Fig. 6 Step 4 (Registering Objects)

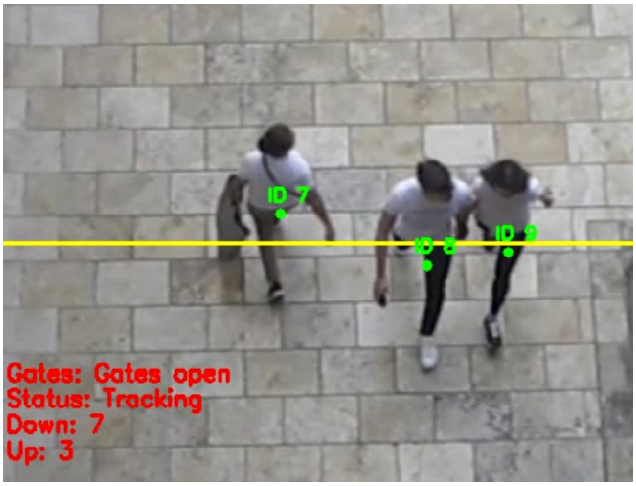
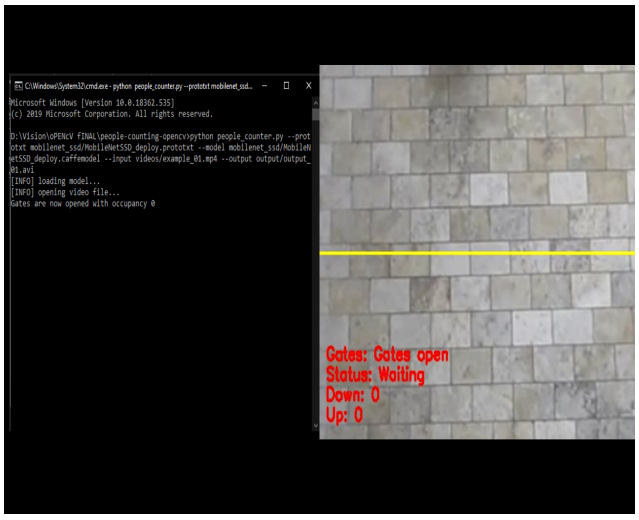


Fig. 8Program handling up and down people count

Step 5: Deregister old objects. Any reasonable object tracking algorithm needs to be able to handle when an object has been lost, disappeared, or left the field of view. Exactly how you handle these situations is really dependent on where your object tracker is meant to be deployed, but for this implementation, we will deregister old objects when they cannot be matched to any existing objects for a total of N subsequent frames.

Fig. 9Maximum threshold reached and gates status closed at terminal

VII. OUTPUT



VIII. CONCLUSION

Here, a system is designed with a prime goal to monitor the crowd in particular place. Motive behind building such application is to avoid various

mishaps that occur in places where extreme amount of crowd gathers that couldn't be accommodated by the place itself. So an object detection technique is considered as the backbone of this project and GUI insights as well as Physical actuation's could be fired in accordance with the need.

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