IMAGE AND VIDEO PROCESSING

SURVEILLANCE SPOTTING HUMAN MOVEMENT

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OBJECTIVES

Human Detection is a branch of Object Detection. Object Detection is the task of identifying the presence of predefined types of objects in an image. This task involves both identification of the presence of the objects and identification of the rectangular boundary surrounding each object (i.e. Object Localisation). An object detection system which can detect the class “Human” can work as a Human Detection System.

Surveillance is an integral part of security and patrol. For the most part, the job entails extended periods of looking out for something undesirable to happen. It is crucial that we do this, but also it is a very mundane task.

DATA USED

The data was collected manually from various sources across the campus. We took video from different angles, with different obstacles and at different duration to thoroughly test how our model responds in each case.

The program was unable to detect human movements when the video was taken from the very top of the building. The program detects well when the surveillance is from a less distance.

We also tested video with obstacles like tress blocking the path, but the model was able to detect the movement fairly.

Data was collected during the night hours, with less amount of light.

OUR PERFORMANCE

The processing is slow because of the hardware constraints. for For better performance, recommended hardware configuration requires Intel Core i7 7700 HQ (up-to 3.8 GHz), 16 GB Memory, nVidia Geforce GTX 1060 6GB VGA.

We took multiple video samples at different time of the day to test our model under various situations. The model was successfully able to detect human movement and tracking.

The model was able to draw rectangle and count the number of people in the video sequence accurately. We also took video samples with blocking obstacles likes trees to test our model.

This model performs reasonably well in detecting close-by-objects occupying a large view space (such as a person standing in front of the camera). But it performs poorly on our test video since it contains a large number of persons each occupying a small space of the view. We reduced the detection threshold significantly to obtain reasonable detection for our test video.

PREVIOUS SOLUTION IN LITERATURE

Haar Cascades for Human Detection

Most object detection algorithms are based on Haar Cascades algorithm by Paul Violaand Michael Jones for Human Detection. This approach is also widely used for Face Detection.These approach are also susceptible for detecting non human objects as humans.

Histograms of Oriented Gradients for Human Detection

HOG pedestrian detection approach is proposed by N. Dalal and B. Triggs. This approach perform fairly well on detecting persons from front view and back view. However, detection from side views of persons are generally poor.

The detection boundary provided by Haar cascade and Histograms of Oriented Gradients does not tightly fit the detected person. In fact, the margin of the boundary is not consistent between detection.

ALGORITHM USED

The algorithm needs a lot of positive images (images of human) and negative images (images without human) to train the classifier. Then we need to extract features from it.

- Read the video file using OpenCV
- Process each frame of the video one by one.
- For each frame try to detect the human.
- If the human is detected draw a rectangle surrounding him/her and count the number of rectangles drawn.
- If human is detected, output the number of persons and time of the day.
- Move to step 3 again for the next frame.

SOFTWARE LIBRARIES

Python 3.7.2
OpenCV 4.1
Numpy
Scipy
Cascade Classifier

RESULTS

In this project, we were able to successfully detect human movement from a video source in real-time.

Looking at some of the draw-backs of the earlier approaches such as missed detections, false detections, duplicate detections and unreliable detection boundary our model was able to detect surveillance from high up in the building, and figure out if there is human movement below on the roads.

We choose a couple vintage point from our hostel window and took video shots of the roads around. Some shots in which a single person is moving around, or 2-3 persons are going together.

Our program was able to put rectangles around each person in the scene, and output number of persons and time of the day.

SHORTCOMINGS

Model performs fairly well on detecting persons from front view and back view. However, detection from side views of persons are generally poor.

Susceptible for detecting non human objects as humans. A trade-off between Missed Detection and False Detection can be achieved by adjusting the threshold parameters. Certain false detection can be avoided by defining thresholds on minimum detection box size.

Model does not tightly fit the detected person. The margin of the boundary is not consistent between detection.

Quite often it is observed that a person detected in one frame is not detected in the following frame and vice versa. Thereby, detentions are susceptible to flickering.

CONCLUSIONS

Surveillance is an integral part of security and patrol. For the most part, the job entails extended periods of looking out for something undesirable to happen. It is crucial that we do this, but also it is a very mundane task.

Human detection and tracking in a complex environment is a hard task, since people interact with each other, form groups and may move in unexpected ways. This requires a robust method, which copes with the different motions, without being affected by occlusions and changes of environment features. To overcome changes in the environment monitored by the system, we have to design a robust background model that can deal with slow illumination changes like light changes between day and night, fast illumination changes like clouds blocking the sun.

In this project we successfully detected human movement in a video sequence using computer vision and concepts of image and video processing.