Apply object detection to detect and count cars on the road and use reinforcement learning to control traffic congestion.

Mtandu Ibrahim S.

Background

Traffic congestion is one of the serious problems facing Most of developing country especially Tanzania, In Dar es Salaam City this challenge caused with a number of factors including rapid population increase, inadequate and poor road infrastructure, city structure, rapid increase of the number of automobiles and lack of physical plan to control city development.

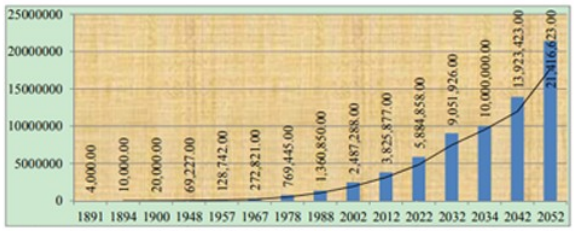


Figure 3. Trends of population growth for the Dar es Salaam city (1891-2052)

Problem

The city is already implementing a number of strategies in order to minimize traffic congestion.

However, many of the strategies are focusing on improving the capacity of roads in terms of increasing number of lanes, implementing flyovers and bypass roads, main road intersections and improving public transport, introduction of traffic light system

The existing traffic light system complicate the traffic jam problem because it does not depend on real time traffic flow and understand the behavior that can alter best cars flow like road accident, crucial issues like emergence vehicles with higher priority like ambulance, rescue vehicles, fire brigades, police and VIP person that could stuck on the crowd. The system makes use of hard coded delays where the lights transition time slots are regularly fixed. Beside all of these strategies the optimization of heavy traffic is still a major issue to be faced.

Solution

Applied object detection to count the cars and understand the environment around it and using the reinforcement learning based reward system to control traffic congestion.

Using YOLO single convolutional network that simultaneously predicts multiple bounding boxes and class probabilities for those boxes. We trained classifier on full images and directly optimizes detection performance. We simply run our neural network on a new image at test time to predict detections.

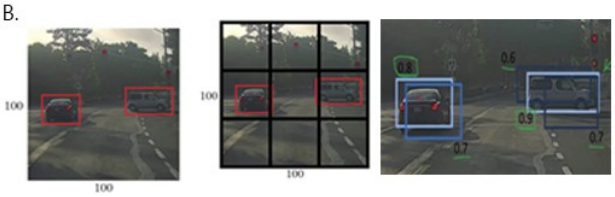
Experiment procedure

Our system divides the input image into an S × S grid. If the center of an object falls into a grid cell, that grid cell is responsible for detecting that object. Each grid cell predicts B bounding boxes and confidence scores for those boxes. These confidence scores reflect how confident the model is that the box contains an object and also how accurate it thinks the box is that it predicts.

Formally
we define confidence as Pr(Object) * IOU

If no object exists in that cell, the confidence scores should be zero. Otherwise we want the confidence score to equal the intersection over union (IOU) between the predicted box and the ground truth.

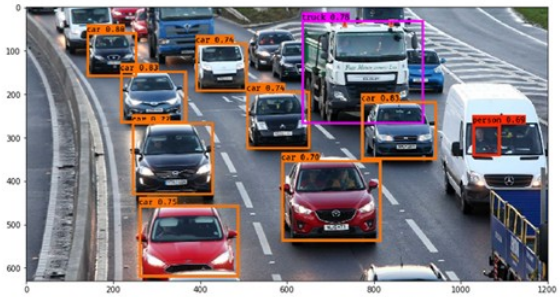
Each bounding box consists of 5 predictions: x, y, w, h, and confidence. The (x, y) coordinates represent the center of the box relative to the bounds of the grid cell. The width and height are predicted relative to the whole image. Finally, the confidence prediction represents the IOU between the predicted box and any ground truth box. Each grid cell also predicts C conditional class probabilities, Pr(Classi |Object). These probabilities are conditioned on the grid cell containing an object. We only predict one set of class probabilities per grid cell, regardless of the number of boxes B.



On working process based on data processed from classifier I plan to come up with reinforcement learning based reward system that can control the traffic to favor the roads with more condition to cause congestion.

Results

This network runs at 45 frames per second with no batch processing on a Titan X GPU and a fast version runs at more than 150 fps. I tried to run network in my computer and reach 12 fps with no GPU. This means we can process streaming video in real-time with less than 25 milliseconds of latency.



Benefit

The conventional system need to be smart enough to control the severe traffic congestion, alleviate transportation troubles, reduce traffic volume and waiting time, minimize overall travel time, optimize cars safety and efficiency since it can understand the whole road behavior and act accordingly to insure the safe and optimized movement.

Basically based on the data we collected about the road each day it can be leading platform for delivering company to select the best path, new way of understand the better place to keep petrol stations and hotels and to predict better place to keep other specific business like malls etc since it can understand the behavior of the roads in every single minutes.

-It can be used to track the road crimes by checking anomaly in car movement using OCR

Refference:
http://www.ccsenet.org/journal/index.php/jsd/article/view/24345/15400
https://arxiv.org/abs/1506.02640