Retraining YOLO

This step involves delving deep into the working of our base algorithm, Yolo. A brief introduction along with some of the goals we seek to accomplish are:

-YOLO (You Only Look Once) is an image detection algorithm that uses the "darknet" framework

-Uses a neural network and machine learning to be able to detect numerous objects

- Developed by Joseph Redmon, Santosh Divvala, Ross Girshick and Ali Farhadi in 2016

-We aim to build further on this algorithm to repurpose and enhance its capability

-Can we train the neural network for better usability in small, embedded machines?

-Can we improve its processing time, make it more reliable?

-Customize yolo with our own datasets and object detection definitions

Object Counting and Tracking

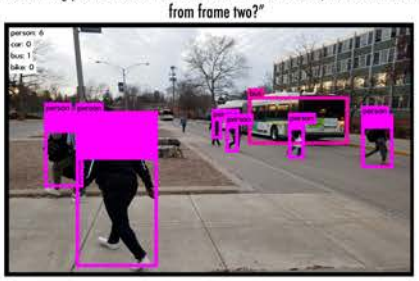
An important aspect of building the "comprehensive information processing engine" is to ensure the vehicle is aware of the real-time conditions around it. Our algorithm aims to:

-Count the number of relevant objects in real time (cars, busses, pedestrians, cyclists)

-Combine this data with GPS and infrastructure information to build traffic models

-Enable object tracking. "Is this the same car from two intersections ago?"

-Enable counting persistence. "Is the blue sedan from frame one, same as the blue sedan from frame two?"



Benchmarks

Below is a comparison of Yolo with other established image recognition algorithms. The table shows the algorithm along with the dataset used to train it (Pascal VOC 2007/2012), the mean average precision (mAP) of correctly identified objects and the frames (processed) per second (FPS)

Real-Time Detectors	Train	mAP	FPS
100Hz DPM [31]	2007	16.0	100
30Hz DPM [31]	2007	26.1	30
Fast YOLO	2007+2012	52.7	**155**
YOLO	2007+2012	**63.4**	45
Less Than Real-Time			
Fastest DPM [38]	2007	30.4	15
R-CNN Minus R [20]	2007	53.5	6
Fast R-CNN [14]	2007+2012	70.0	0.5
Faster R-CNN VGG-16[28]	2007+2012	73.2	7
Faster R-CNN ZF [28]	2007+2012	62.1	18
YOLO VGG-16	2007+2012	66.4	21

Source: You Only Look Once: Unified, Real-Time Object Detection Joseph Redmon et al, 2016.

The Geometry of Autonomous Vehicles

Professors Rich Sowers and Dan Work

Project Brief

This video-as-a-sensor project is a method to focus on the mobility revolution that is currently taking place. With the need for more intelligent data gathering, there is also a growing need for using existing technology and infrastructure to achieve this goal, without incorporating expensive, complicated systems. While the aim of this project is not to build an autonomous vehicle tool, we believe the results could very well help in their development. As single-occupancy vehicles are giving way to Ubers, Lyfts and Bridjs, combined with regular mass transit and pedestrian-aware street infrastructure (traffic lights, crosswalks etc.), there is a large "networked mobility system" that has a potential to be tapped. Moreover, autonomous cars will be here soon, to add to the mix. An enhanced, "comprehensive information processing engine", which makes use of existent automobile technology and some form of embedded computing system that enables object detection is our vision

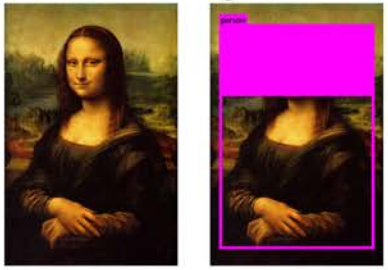
Privacy Concerns

The sensitive nature of the data our algorithm collects makes it imperative to have, out of the box, some information protection features. Two important features we have incorporated in this project are:

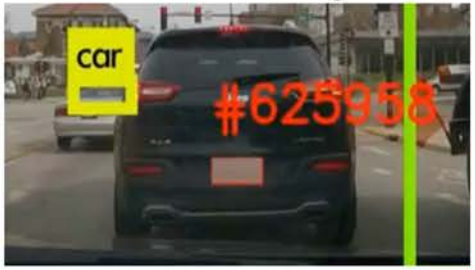
-License plate hashing. We blur out and anonymize license plates for information security, but also preserve their ability to be a unique identifier

-Color out the faces of detected people

Face Recognition



Licence Plate Recognition



Future Plans:

In the vision to build the "comprehensive information processing engine", we have set out on an interesting mission as a possible "step 2" of our project:

-Bicyclist detection we think is an immediate and practical application of our algorithm

-Is there a way to detect the bicyclist while also recognizing what kind he/she is?

-Can we detect the presence of a helmet-wearing bicyclist?

-The ability can help us recognize the level of awareness (and hence risk) on the streets of our cities

-It would help increase awareness and also make the decision maker (driver or car) more informed

-Is it possible to sensitize the neural network framework to recognize helmet-wearing cyclists in various situations?

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