Group No. 1

Traffic Signal Duration Control using Deep Learning

JOHNANAND ABRAHAM 03

PRATIK NERURKAR 52

CALDEN RODRIGUES 63

GUIDE: PROF SUNANTHA

Problem Statement

- In todays scenario, commute is a big part of our life and congestion on the road is increasing due to many factors including too many cars, obstacles (merging of roads), **mistimed traffic signals** etc.
- There exists no system that can **suggest changes** to the flow of traffic in real time or perform any analysis to de-escalate the **congestion** at the junction.
- Signals from **neighbouring** junctions are **not in sync** with each other.

Scope

- **Detect** the number of vehicles and their type(optional) in least amount of time.
- **Emulate** the real time data acquired to get an overview of the current scenario.
- Suggest most ideal timings to switch between Green to Red or Vice-Versa to reduce traffic flow in **real time**.
- Make prediction based on **previous data** of congestion.
- Make prediction based on information gained from **peer signal nodes**.

Comparison of Literature

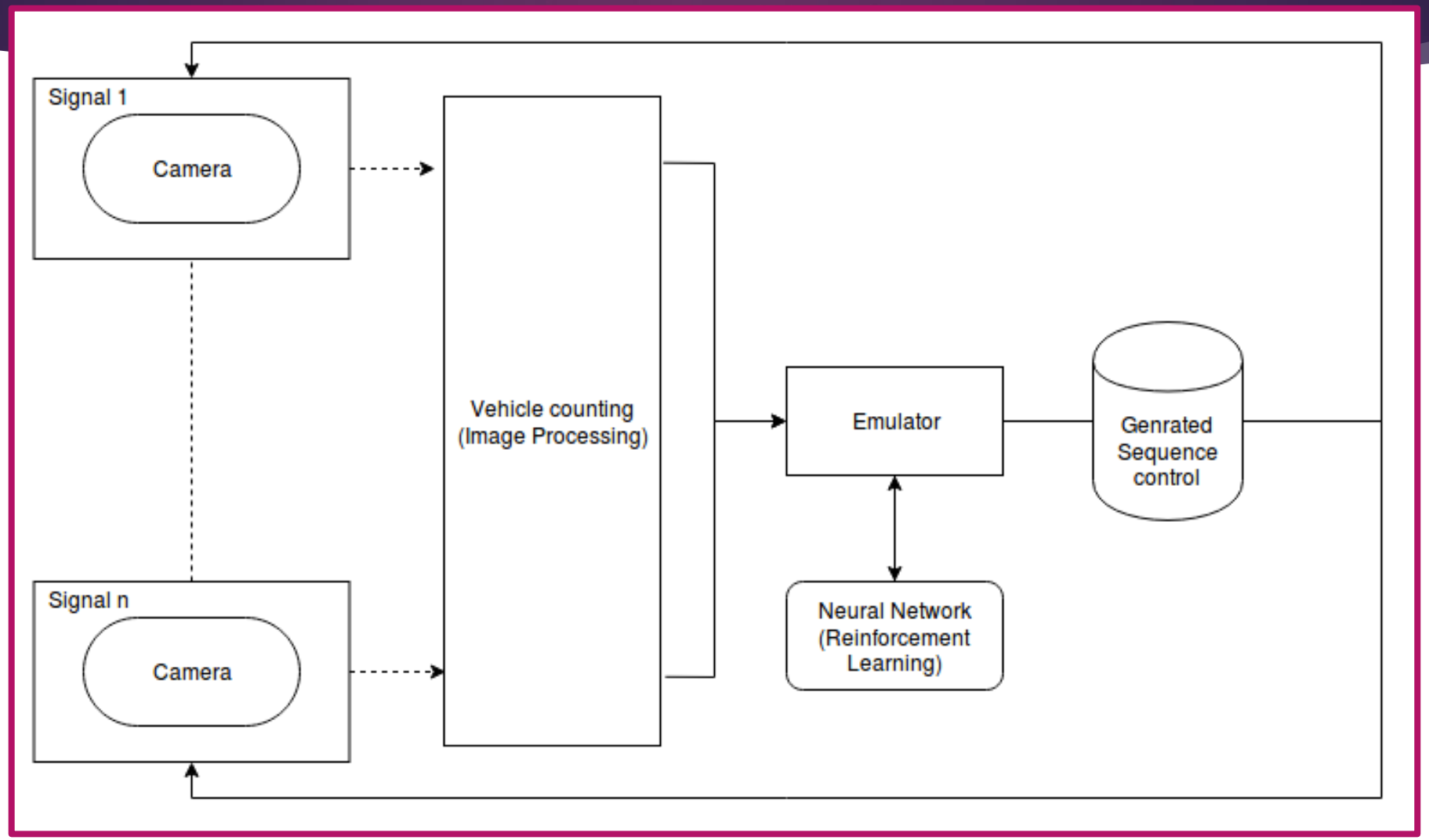
- [1] Use of induction loop traffic detector to determine the **frequencies** of vehicles (outside India)
- Signals are controlled through a **pre-set** timing system which at times result in **pileups** during peak hours or induce drivers to **skip signals** during lean hours, this usually causes a policeman as a replacement for the signal. (in India)
- [2] Use of actuators to trigger vehicle counters and change signal timings accordingly.
- [3] Comparison of the various background subtraction techniques available
- [4] Use of morphology - dilate, findContours, boundingRect, drawing(Rectange, circle, polylines), bit-wise and, createBackgroundSubtractorMOG2.
- [5] Use of genetic algorithm to predict signal timings.

Requirements

- **Hardware**
  - Hikvision 2MP 1080p Night-vision Camera

- **Software**
  - **OpenCV** OR DarkFlow & Keras (YOLO2)
  - Python3 and TensorFlow

Design Details



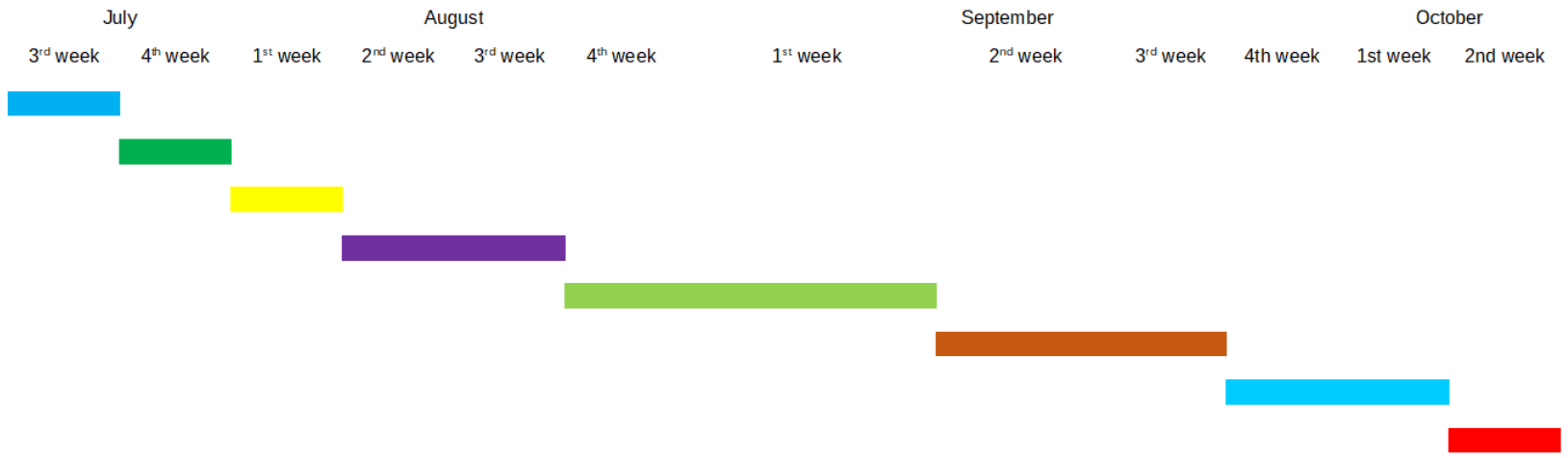
Implementation

1. Input **image** as **img**
2. Generate a **exit mask** based on the size of the image
3. Create **Background subtractor** object of **MOG2** algorithm implemented in **cv2** and **train** it on first 500 frames.
4. **Pass img** in **contour** detection
    1. Generate the **foreground mask** by passing the image in **bg_subtractor()**
    2. Apply **thresholding** of 240
    3. Apply **filters**
        1. closing (fill small holes)
        2. opening (remove noise)
        3. dilation (merge blobs)
    4. Detect **contours** using cv2.findContours() to detect external contours using **chain approximation**
    5. Get **bounding rectangle** i.e (x,y,w,h)
5. **Pass img** in **vehicle counter**:
    1. Create list of **points** that were detected by **contours**.
    2. Create list of **paths** that exist of the vehicles
        1. if(no paths exists) then **add all points** as paths
        2. else find the point that is the **least distance** from the previous path end and add it to the path
        3. add the new points that did not find a path
        4. Save only last **10 points** for each path
    3. Check if the last point in the path is in the **exit_mask** and the second last is not.
6. Visualize the process:
    1. Draw **Bounding boxes** if not in exit_mask
    2. Draw **Paths**
    3. Draw **Vehicle counter**

Project Plan

Traffic Signal Duration Control Using Deep Learning

	Responsibility
T1. Comparing OpenCV and yolo2	Calden
T2. Checking existing projects and finalizing algorithm	John
T3. Implementation of algorithm and comparison of available simulation	Pratik
T4. Vehicle detection and counting and beginning pygames simulation	John, Calden, Pratik
T5. Application of program on real data feed.	Calden, Pratik
T6. Passing data to simulation	John, Pratik
T7. Application of neural network on simulation	John, Calden
T8. Final Presentation	John, Calden, Pratik



References

- [1] S. Sheik Mohammed **A Multiple Inductive loop vehicle Detection System**. 2012 IEEE Transaction on Instrumentation and Measurement.
- [2] R. Scheepjens. **Algorithm Design for Traffic Signal Timings Predictions of Vehicle-Actuated Controlled Intersections**. 2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR)
- [3] Brutzer, S., Hoferlin, B., & Heidemann, G. (2011). Evaluation of background subtraction techniques for video surveillance. CVPR 2011.
- [4] Ivan Culjak ; David Abram ; Tomislav Pribanic ; Hrvoje Dzapo ; Mario Cifrek **A brief introduction to OpenCV** 2012 Proceedings of the 35th International Convention MIPRO
- [5] Foy, Mark D, Benekohal, Rahim (Ray) F, Goldberg, David E, 1992, "Signal Timing Determination Using Genetic Algorithms"