**A Novel Classifier for Measuring Vehicular Traffic**

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Abstract: Explain what the thesis is about, why it is important, how it was conducted and how it is laid out. (1 pg)

Introduction: Establish a context in which your solution exists by giving background for the problem and why the problem is important. (2 pg)

Literature Review: Outline solutions already developed by other people and show theoretical understanding. (20 pg)

Design: Detail my design and how it works. (15 pg)

Conclusion: Give an assessment of the success of your solution; how significant is it and it's limitations. Discuss future research direction to take/not take. Conclusions should not introduce new points, only summarize points previously mentioned. (1 pg)

# Abstract

- What is this report about?

- Why is this important?

- How was the task undertaken?

# Introduction

**-** Give background information on the problem

- Explain why the problem is important to try to solve

- **Explain the link between industrialization, carbon emissions, urbanization and traffic congestion.**

Economies of the world have been industrializing unceasingly for the last two centuries. The consequent advent of machinery and the factory have seen a great migration of humanity from rural fields to urban cities. Such concentrations of people have posed infrastructural challenges leading to many iconic innovations like the skyscraper, subway train and **something**. One metropolitan trait, however, continues to cause grief for millions of urbanites every day, traffic.

Road transport contributes 16.5% of global CO2 emissions [1] and costs the US $305 billion of productivity per year alone [2] [3]. Any small improvement in this situation will yield great benefit to society and the future of the planet.

There is no single solution to the problem of traffic congestion, whether it be the building of tunnels, the conversion of traffic lights to roundabouts, the widening of roads or the narrowing of roads [4]. The integration of several lightweight and inexpensive techniques is a far more attractive and effective approach [4]. A ‘Smart City’ is such an initiative [5], where in IoT devices are deployed in an urban area and used to collect data. This technology could be applied to collect traffic data and use it inform the nature of investment in a traffic network.

A versatile and inexpensive method of data collection in a traffic network is computer vision. This technique requires as input only raw images of a traffic network and could therefore piggyback onto existing surveillance cameras. The intention is to mimic the ability of human vision to rapidly identify distinct objects from the real world. A human’s ability to separate a vehicle from its surroundings and track its movement is one example of this.

The implementation of a robust computer vision algorithm for traffic monitoring is not trivial. The dependence on only one feature in an image will not yield accurate results, however the combination of several different features will, features like object edges, object area, hue, contrast and reflectance. There are a great many and varying number of ways in which to infer meaning from these features. Whatever method of implementation is selected must provide consistent accuracy, and in the case of traffic monitoring, real time results.

Therefore, it is the objective of this report to explain the design and operation of a novel computer vision algorithm that can effectively count and estimate the speed of vehicles in traffic, in real-time, given raw images of a traffic network.

# Literature Review

- Give a brief history of the problem and the computer vision

- Discuss the theoretical premise behind the theory

**Template Correlation**

If the objects of interest have a specific shape or set of shape features than a method called ‘template correlation’ can be exploited to identify these objects in an image. This method works by creating a filter that matches the outline of the feature or shape that belongs to the target object. By passing the filter over an image and correlating it with the image’s pixels, areas of the image with high correlation (areas that match the template) will give high valued intensities in the resulting image.

**Gaussian Mixture Model**

**Background Subtraction**

**Contours**

**Centroid Tracking**

**Correlation Tracking**

# Design

* Block Diagram describing system
* Detail the components of the design
* Explain how the components work

- OCR on vehicle number plates.

- Possibility for hybrid system of neural network and template recognition

- Color contour and gradient based matching

Design overview

* Multiple test components
  + Templating and edge detection
    - Structured Forest for Fast Edge Detection
    - Background subtraction
    - GATE threshold algorithm and Sobel Edge detection
  + Hue Detection
  + Saturation
  + OCR on license plates
  + Colour contour and gradient matching
  + Area and perimeter matching
  + OCR on number plates
    - Possible hybrid system with neural network and templating

## Edge Detection

1. Highlight the useful edges

2. Generate a template from that edge

3. Identify the vehicle using that template cross-correlation peaks or image subtraction

4. Maybe implement neural network for recognition on edge images.

# Conclusion

- Assess how successful my solution was in solving the problem  
- How significant is my solution in the context of the problem  
- Why is the solution limited  
- Describe possible future directions that the solution could be taken in  
*-* **Do no introduce new points reflect only on those already made**

# Bibliography

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| --- | --- |
| [1] | The WHO, “Climate Impacts,” 2008. [Online]. Available: https://www.who.int/sustainable-development/transport/health-risks/climate-impacts/en/. [Accessed February 2020]. |
| [2] | INRIX, “Congestion Costs Each American 97 hours, $1,348 A Year,” 2019. [Online]. Available: https://inrix.com/press-releases/scorecard-2018-us/. [Accessed February 2020]. |
| [3] | CITYLAB, “Traffic’s Mind-Boggling Economic Toll,” 2018. [Online]. Available: https://www.citylab.com/transportation/2018/02/traffics-mind-boggling-economic-toll/552488/. [Accessed 2020]. |
| [4] | S. C. Transport, “Reducing Traffic Congestion and Pollution in Urban Areas,” Cambridge , 2016. |