# Traffic Analysis with Drone Videos

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## Motivation
Traditionally, traffic incidents are reported by police and witnesses manually, which is inefficient, imprecise, and limited in survey area. Meanwhile, the lack of efficient traffic incident reporting makes the process of vehicle insurance claims slow and sometimes erroneous. So we propose a system and a method for traffic analysis with drone videos, such as (a) a software package to process drone videos for traffic analysis, (b) a dataset of traffic videos taken by drones with annotations to achieve fine-grained traffic statistics for regulators and set up driving behaviour modelling for insurance companies.

## Drone Video Processing

**Pipeline:**
1. **Calibration** of the camera and the map (once per video track)
2. **Vehicle detection** on each image (Mask RCNN neural network).
3. **Vehicle association** between adjacent video images.
4. **Vehicle orientation** and **bounding box calculation** from object masks.
5. **Vehicle speed calculation**.
6. **Trajectory smoothing**.

![Original Image](image1.jpg)  
![Object Mask](image2.jpg)  
![Bounding Box](image3.jpg)  

- **Map Segmentation**
  - A map is segmented into **lanes**.
  - Each lane has an unique **lane ID**.
  - At any time, a vehicle with its location on the map can be associated with a lane.
  - A vehicle's trajectory is represented in a **string of lane IDs**.

## Fine-Grained Traffic Counting

Given vehicle trajectories in strings, the number of vehicles traveling in a certain way can be found using a custom made **string pattern match program**, e.g.,
- starting at **south inbound lane 1** and ending with **north outbound lane 2**.  
  - pattern: `s_in1, (any)*, n_out2`  
- switching between **west inbound lane 1** and **west inbound lane 2**.  
  - pattern: `(any)*, w_in1, w_in2, (any)*`

## Contribution
In this project we build a system that can count the traffic in fine-grained lane level using drone videos in four different types of traffic sites. a) roundabout  b) intersection  c) local road  d) freeway