Week 10

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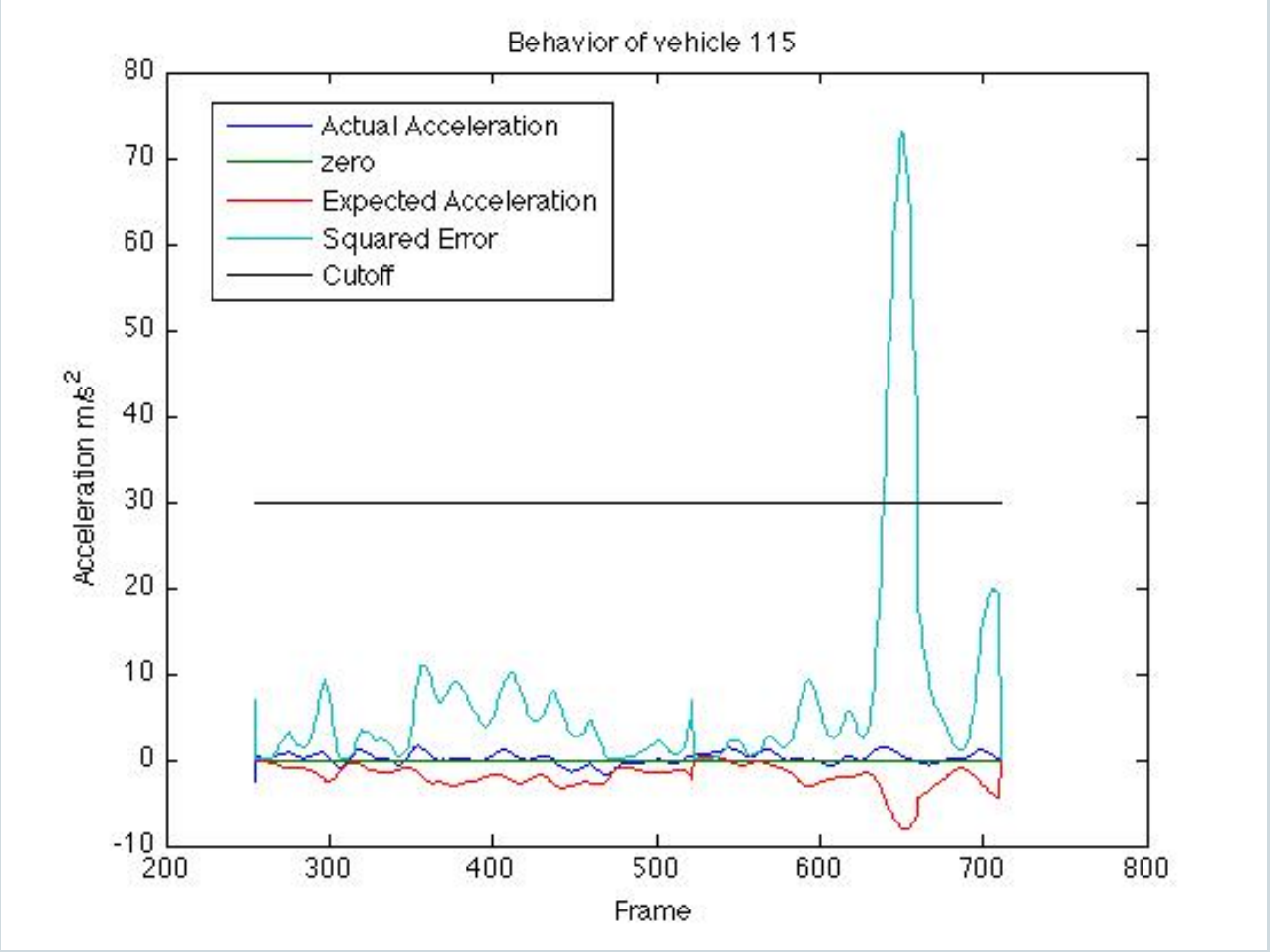
Overview

- Moved back toward looking at the IDM and identifying vehicles that do not conform to the model (these are called ‘abnormal’).
- Started to use a new method to calculate the difference between actual and expected acceleration
- Plotted abnormal vehicles along with heuristic results for tailgating and speeding on first 1925 frames of each camera for the US101 sequence.
- Analyzed the results, by hand, made some new discoveries.

Calculating difference between Accelerations

- Old Method
  - Based on rules and had two thresholds
  - If the expected accel was negative, one threshold would be used, another for positive
  - The idea was that different behaviors would trigger different results when comparing actual to expected accel
  - Too complicated to tune much
- New Method
  - Simple, easy to adjust threshold accurately
  - `error = (a_actual – a_expected)^2;`
  - Squaring the difference helps distinguish between minor differences and significant differences

An example of the error graph



Plotting Vehicle Behaviors

- Speeding
  - `v > 24.6 m/s (55 mph)`
- Tailgating
  - `T < .95 s`
- Abnormal (does not fit IDM)
  - `(a_actual – a_expected)^2 > 30;`
- The tailgating threshold was selected so that only the most extreme examples were identified
- The abnormality threshold was selected so that the number of abnormal instances was similar to the number of tailgating instances

Analytical Results

- 386 counts of tailgating/speeding/abnormal vehicles across 8 cameras, 159 unique vehicles
  - Either the behaviors occurred on a transition between two cameras or the vehicles had multiple offenses
- Behavior Breakdown (some may be counted twice as they continued across cameras)
  - Abnormal: 147
  - Abnormal and TG: 291
  - Abnormal and Speeding: 1 (tracker failed)
  - TG: 148
  - Speeding: 9

Discussion

- Many vehicles were marked simultaneously as abnormal and TG, in these cases, the vehicle is very close to the leading vehicle
- Of the vehicles marked only abnormal:
  - Many were accelerating towards the leader and were later marked as TG as well
  - In many cases, lane changes were involved. A vehicle would speed up and make a lane change
- Of the vehicles marked only TG:
  - Sometime the vehicle was not close enough to be marked as abnormal
  - Some vehicles were initially both Abnormal and TG, but then the gap between the cars increases, indicating that the vehicle may be slowing down

Discussion

- Speeding is difficult to detect:
  - The behavior is rare, due to congestion in the road
  - The behavior is not as extreme in it's impact on the error
- There are several cases where the tracking data is incorrect, leading to incorrect classifications as abnormal and/or TG
  - Particularly in Camera 1, many vehicles get tracked into the wrong lane