

Week 4

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June 9, 2010

My Project

- Using the Intelligent Driver Model (by Dirk Helbing)
- Two Parts
 - Improve vehicle tracking using the IDM
 - Using tracking data, identify abnormal driving behavior

The IDM

- Developed by Sociologists
- Generally used to simulate traffic patterns.
- We would like to do the inverse and identify traffic behaviors by matching them to the model.
- Robust and accommodates both highway and city traffic patterns.

The IDM

$$\dot{v}_\alpha = a^{(\alpha)} \left[1 - \left(\frac{v_\alpha}{v_0^{(\alpha)}} \right)^\delta - \left(\frac{s^*(v_\alpha, \Delta v_\alpha)}{s_\alpha} \right)^2 \right].$$

$$s^*(v, \Delta v) = s_0^{(\alpha)} + s_1^{(\alpha)} \sqrt{\frac{v}{v_0^{(\alpha)}}} + T^\alpha v + \frac{v \Delta v}{2 \sqrt{a^{(\alpha)} b^{(\alpha)}}}$$

Parameter	Typical value
Desired velocity v_0	120 km/h
Safe time headway T	1.6 s
Maximum acceleration a	0.73 m/s ²
Desired deceleration b	1.67 m/s ²
Acceleration exponent δ	4
Jam distance s_0	2 m
Jam distance s_1	0 m
Vehicle length $l = 1/\rho_{\max}$	5 m

Goals

- Using the IDM, identify drivers who exhibit “aggressive behavior”
 - Excessive accelerating or braking
 - Tailgating other drivers
 - Excessive or unsafe lane changes
 - Speeding
- Use the IDM to estimate vehicle position and track vehicles more accurately

Current Progress

- Using known vehicle data (position, acceleration, velocity, etc) the current model can identify vehicles with excessive acceleration/braking.
- The model is currently simplistic and too sensitive. Many more cars are recognized as “aggressive” than is reasonable