Modeling Safer Traffic Light Transitions

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Presentation Overview

• Defining the Problem
• Traffic Light Transition Safety (TLTS)
  • Approaching the Solution
  • Related Work and Potential Improvements
  • Model Shortcomings
Challenge: Reducing Red Light Accidents

- Hundreds killed each year because of red light running
- 100,000+ injured
  - Over half are pedestrians or cyclists
- 3-year study in Sacramento, CA, 94% of violations occurred within 2 seconds after onset of red.
- Only 3% after 5 seconds
Reducing Red Light Accidents: Other approaches

• Red light cameras effectively reduce the rate of accidents
  • Threat of fines reduced violations by 75 percent in 1994 NY red-light camera program.

• Research into predicting if red-light running will occur using yellow light behavior.

• Neither approach actually prevents accidents
Approaching the Solution: Traffic Light Transitions

• Use dL verification to prove the safety of an improved traffic light system.
  • Turn opposite light to green within T only if car is braking at rate which stops it before intersection.

• Capitalize on red light running statistics for efficiency and safety.

• Constrain observation window, [0, T]
  • Nearly all violations occur soon after light change.
  • Account for efficiency
Solution: Traffic Light Transitions

• Observe vehicle dynamics and check stopping distance.
• Constrain observation to time window
  • Used to maintain efficiency. Prevents “starvation” so the other side can go
• \((a<0 \& -v^2/(2*a)\leq w-x)\)
  • Assign light to green
  • Assumes driver maintains acc
• \(\text{oppositeLight}=1 \rightarrow (x\leq -w \mid x=w)\)
  • Safety Condition
Potential Improvements & Model Shortcomings

• Current model neglects possible driver behaviors
  • Classify drivers based on past violations
  • Road conditions, type of vehicle, can braking be realistically maintained?
    • Example: roads are icy, maintaining rate of deceleration unlikely
Summary

• Model targets traffic light violations soon after light color change

• Safety: light is only green within [0, T] when no vehicle in intersection.

• Control established by rate of deceleration.
Questions?