

Surrogate Safety Analysis

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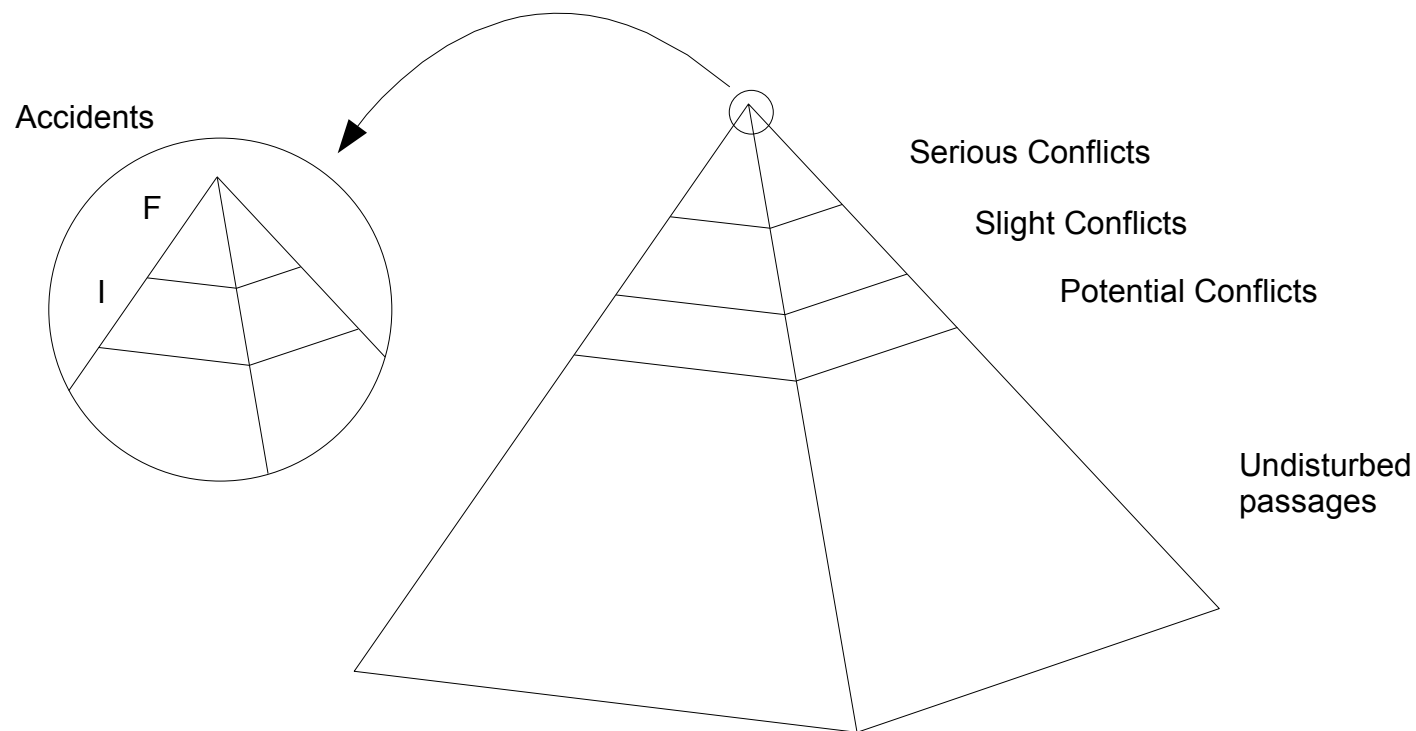
Microscopic Data Collection

- Proactive safety analysis requires detailed measures of road users' interactions.
- Automated sensing systems can already provide detailed traffic data and are improving.
- Need for a framework and well-defined indicators for automated systems.



The Safety/Severity Hierarchy

- Most promising surrogate safety concepts are related to traffic conflict research.



The Collision Probability

- For two interacting road users, there are various chains of events that can lead to a collision.
- Given extrapolation hypotheses for road users,

$$P(\text{Collision}(A_1, A_2) | H_i, H_j) = e^{-\frac{\Delta_{i,j}^2}{2\sigma^2}}$$

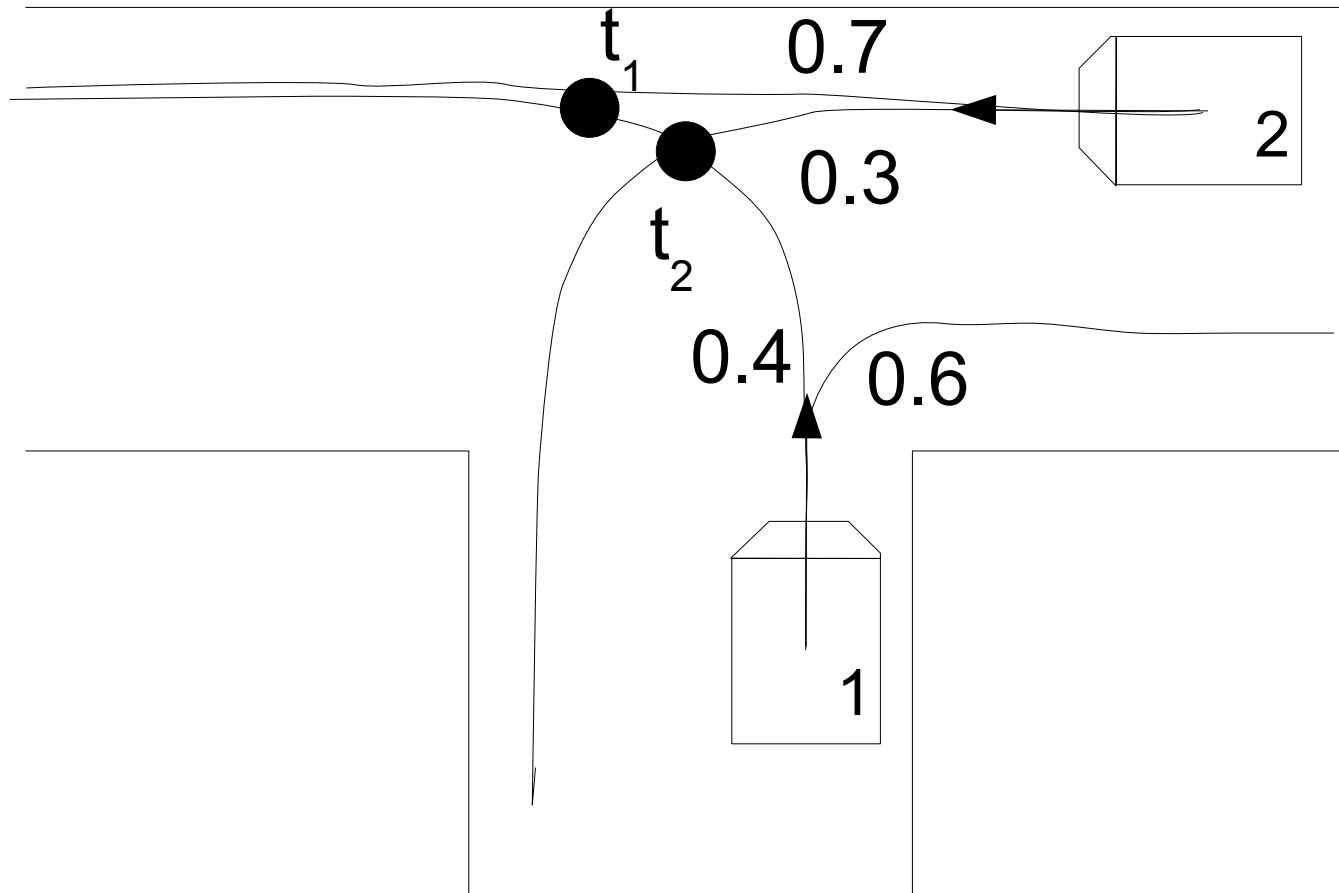
$$P(\text{Collision}(A_1, A_2) | Q_{1,t \leq t_0}, Q_{2,t \leq t_0}) =$$

$$\sum_{i,j} P(H_i | Q_{1,t \leq t_0}) P(H_j | Q_{2,t \leq t_0}) e^{-\frac{\Delta_{i,j}^2}{2\sigma^2}}$$

(N. Saunier and T. Sayed 2008, Transportation Research Record)

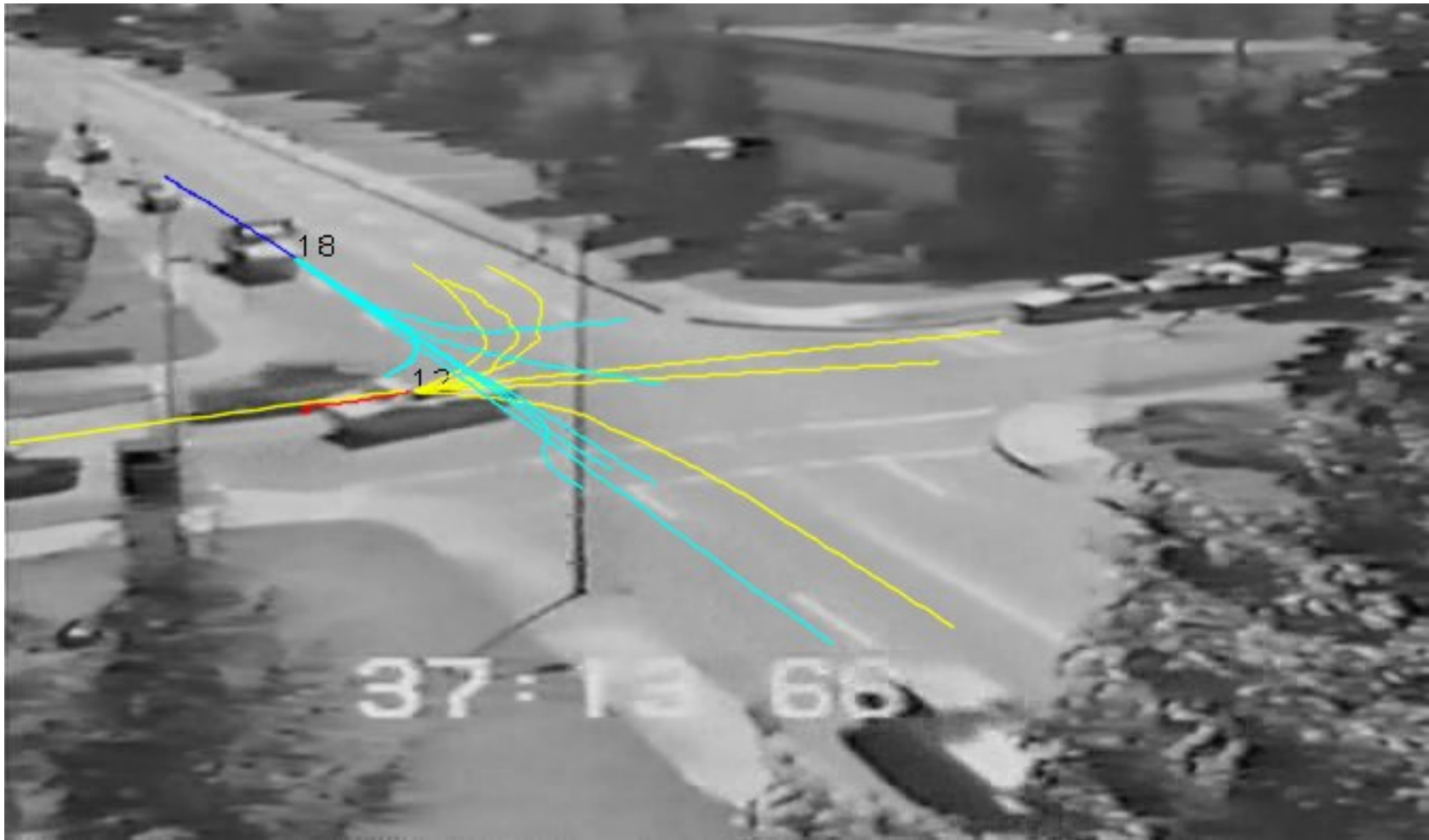


Simple Example

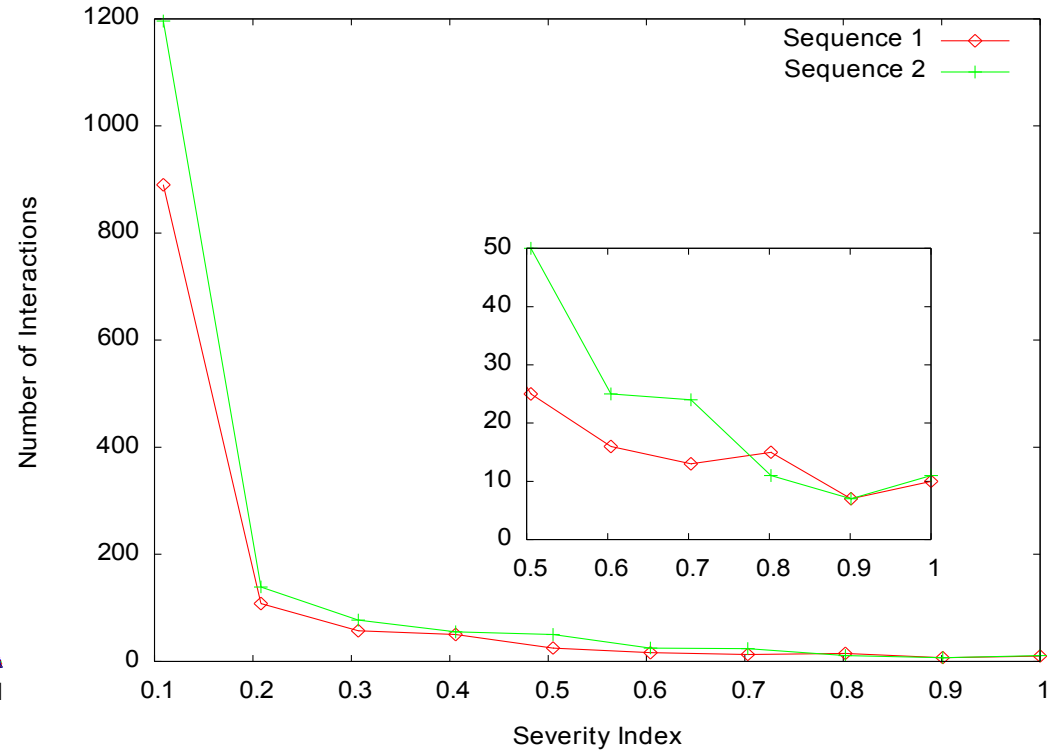
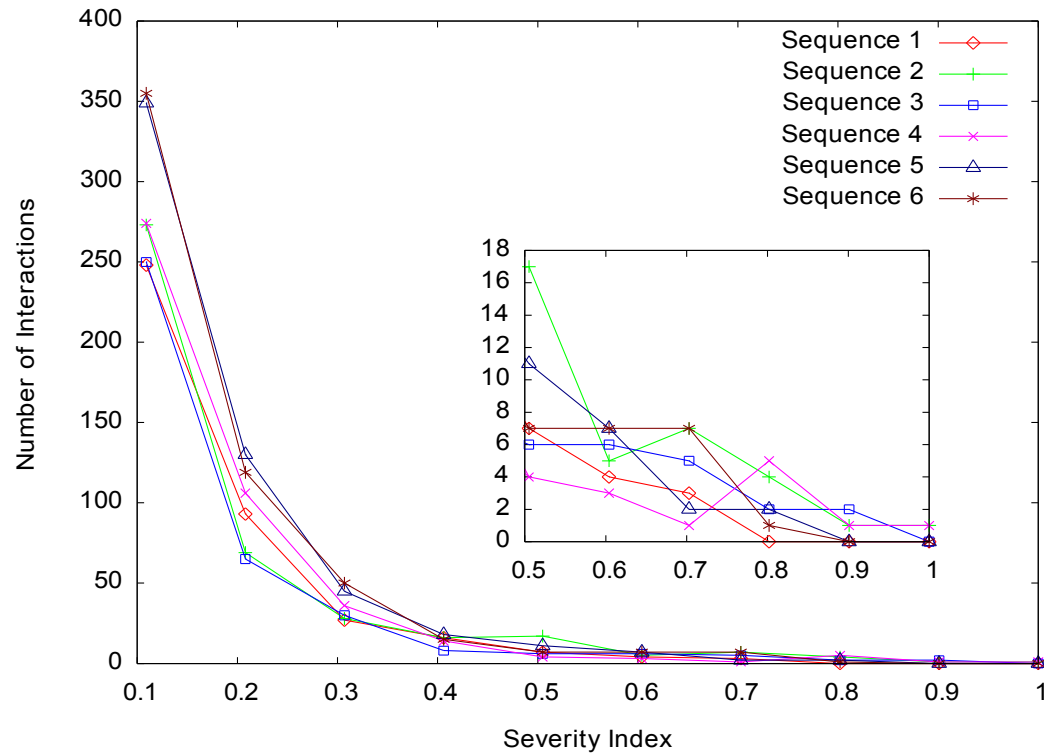


$$P(\text{Collision}) = 0.4 \times 0.7 \times e^{-\frac{(t_1 - t_0)^2}{2\sigma^2}} + 0.4 \times 0.3 \times e^{-\frac{(t_2 - t_0)^2}{2\sigma^2}}$$

Real Example



Severity Index Distribution



Ase Svensson's Work

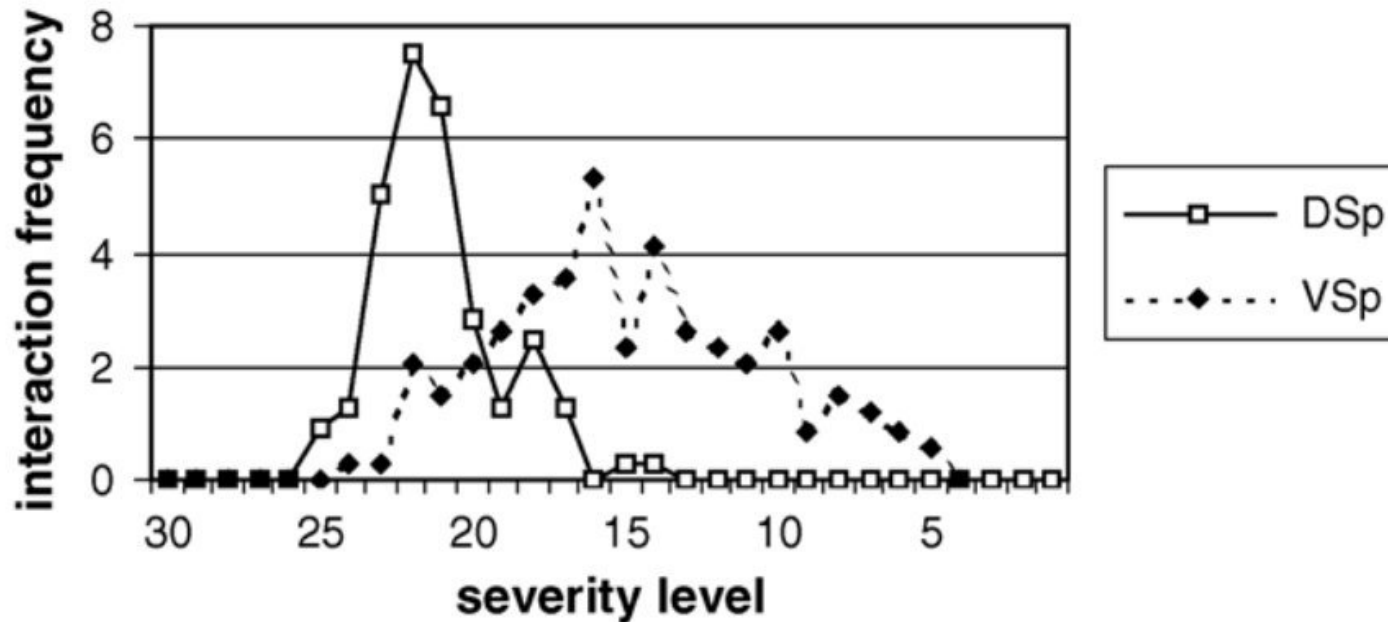


Fig. 6. Interaction frequency (interactions per observation hour) for different severity levels. Straight ahead driving vehicles versus pedestrians. The pedestrian is taking evasive action. A non-signalised intersection (DSp) and a signalised intersection (VSp).

(A. Svensson and C. Hyden 2006, Accident Analysis & Prevention)

Other Approaches

- Generalized Traffic Conflict (GTC) method.
 - P. Songchitruksa and A.P. Tarko 2004.
- Probabilistic approach based on the evasive action.
 - G. A. Davis and J. Hourdos 2008.
- Extract measures from traffic simulation.
 - J. Archer 2004, FHWA SSAM project.
- Rethink exposure, study the safety performance function.
 - E. Hauer 1995.



Conclusion

- Our probabilistic framework is
 - general: there is no need for specific measures for different crash types.
 - suitable for automated computation.
- Challenges:
 - Validate the relationship to safety.
 - Further improve the precision of data collection techniques.



Thank you!

Questions?

