

Mathematical Models of Human Operators Using Artificial Risk Fields

Emily Jensen (4th year PhD), Sriram Sankaranarayanan

University of Colorado Boulder

Problem and Industrial Relevance

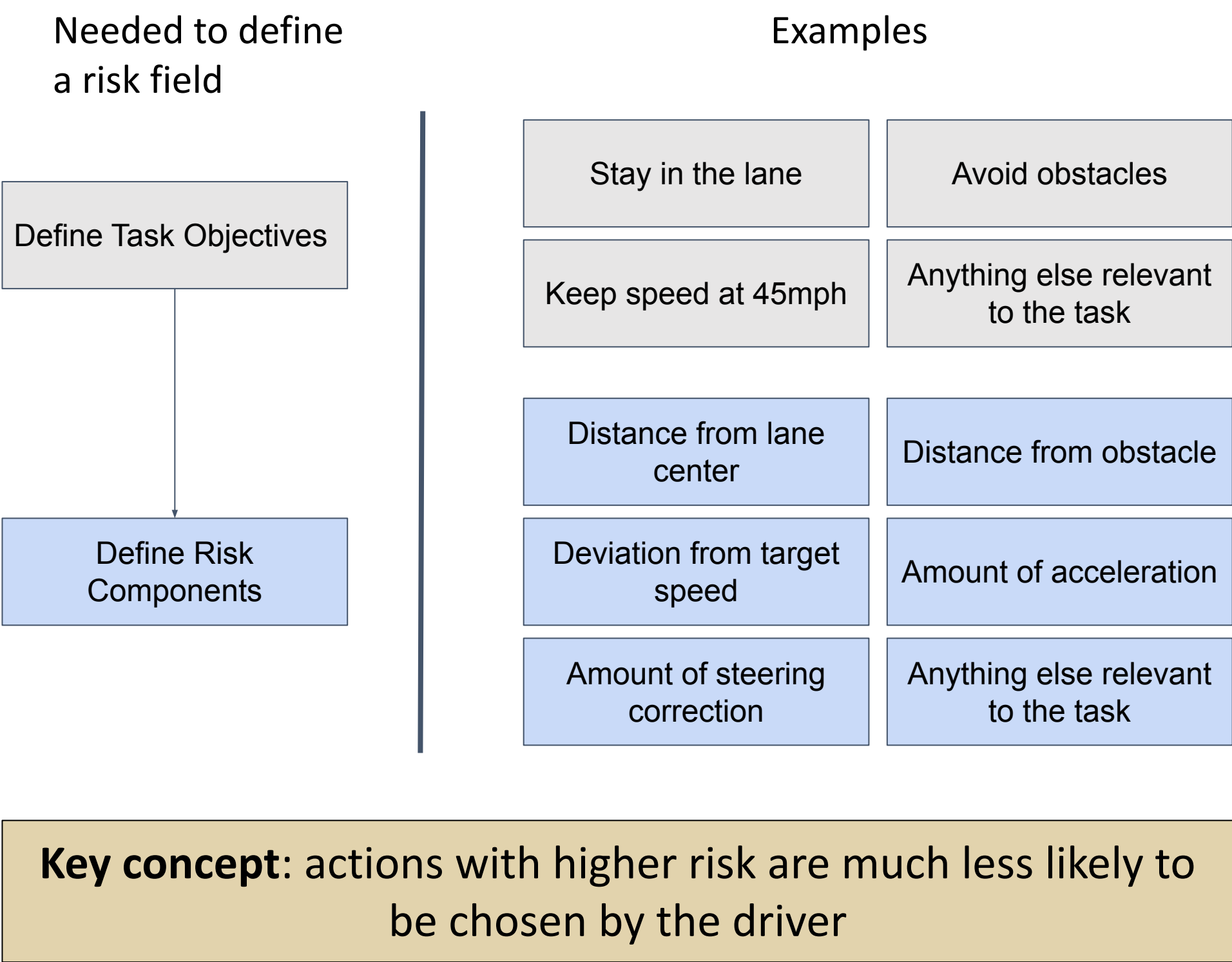


- I want to keep my speed consistent
- I need to avoid the upcoming obstacle

Can we use a simple, interpretable model to predict what a driver is going to do next?

Can we model different classes of driver behaviors?

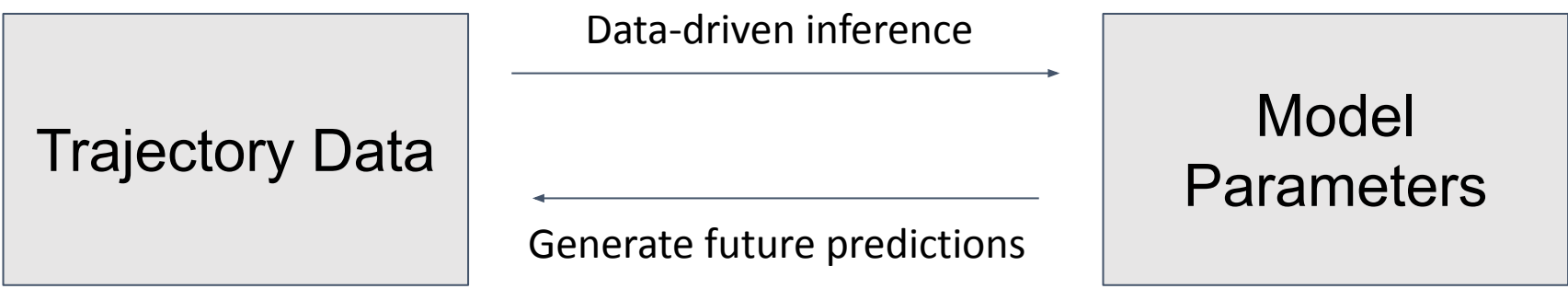
Approach



Contributions

How is this approach novel?

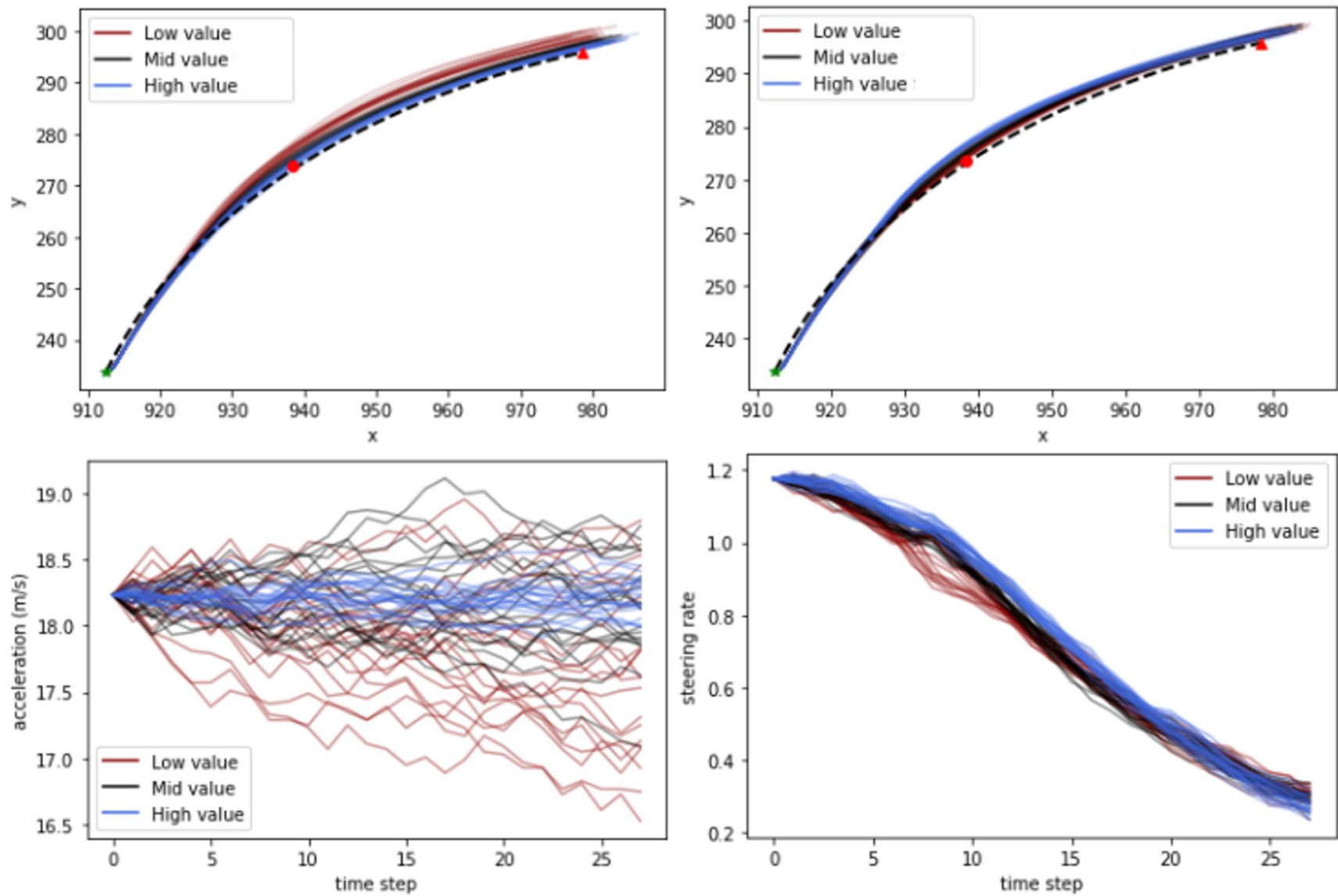
- Risk fields can be applied to a variety of tasks, not just driving in a specific situation.
- Risk is a property of the environment, not just the driver.



Why is this interesting?

- We can predict future position up to 20 seconds in advance, which gives plenty of time for interventions.
- We can estimate the driver’s relative importance of different risk factors based on their data.

Evaluation



Varying model parameters yields different driving behaviors.

Predicted trajectories are within 1 lane distance of actual position up to 20 seconds in the future.

What Follows



- Watch out for that obstacle!
- I'm taking over for a while.

Use predicted behaviors to estimate driver state, such as situational awareness.

Trigger feedback or takeover interventions based on predicted future behaviors.

Executive Summary

- Problem:** model and predict driver behaviors based on their perception of different risk factors in the environment. It should be easy to compute and interpretable.
- Approach:** define “artificial risk fields” based on safety factors like avoiding obstacles and keeping in the lane. Can be used in many complex navigation situations.
- Results:** we can accurately predict future trajectories and generate different driving behaviors (more/less risk tolerant).
- What’s next:** use risk fields to predict upcoming collisions and create an intervention or shared controller to maintain safety.