Unified Frenet Frame Motion Planning Based Framework for Social Navigation
Karthick Subramanian, Robotics and Autonomous Systems (Mechanical Engineering)
Mentor: Dr. Wenlong Zhang PhD, Associate Professor
Ira A. Fulton School of Engineering, Arizona State University

RESEARCH QUESTION
In a fast paced and complex scenario such as self-driving, what is a computational framework that enables autonomous vehicles (AVs) to interact safely and naturally with human-driven vehicles?

MOTIVATION

Figure 1: Example of incorrect behavior prediction
Figure 2: Real interaction scenario

- AVs are high speed, safety critical application and existing behavior prediction algorithms are computationally expensive based on the planning horizon
- As the dimensionality of the space grows, the computation becomes higher
- Since safety is critical, a simplified planner is not sufficient for deployment in real interaction

APPROACH
Integrate a Stackelberg game-based Sarsa(λ) tree search with predictive motion planning in Frenet frame, activated based on time-to-collision (TTC) for AV-human interaction with real data validation.

RESULTS
- Frenet frame based motion planning yields better results in terms of MAE and MSE for velocity compared to baseline.
- Without the decision making module, the interaction leads to a collision.

<table>
<thead>
<tr>
<th>Metric</th>
<th>Exhaustive Search Motion Planner</th>
<th>Frenet Frame Motion Planner</th>
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</thead>
<tbody>
<tr>
<td>MAE</td>
<td>1.0234</td>
<td>0.5857</td>
</tr>
<tr>
<td>MSE</td>
<td>1.7865</td>
<td>0.6656</td>
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</tbody>
</table>

Table 1: MAE and MSE of velocities from baseline [2] and Frenet Frame

FUTURE WORK
- Integrate the intent inference and decision making module with the frenet frame motion planner, similar to [1]
- Validate the architecture with real data

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