Research on pedestrian crossing and vehicle behavior decision under automated driving environment
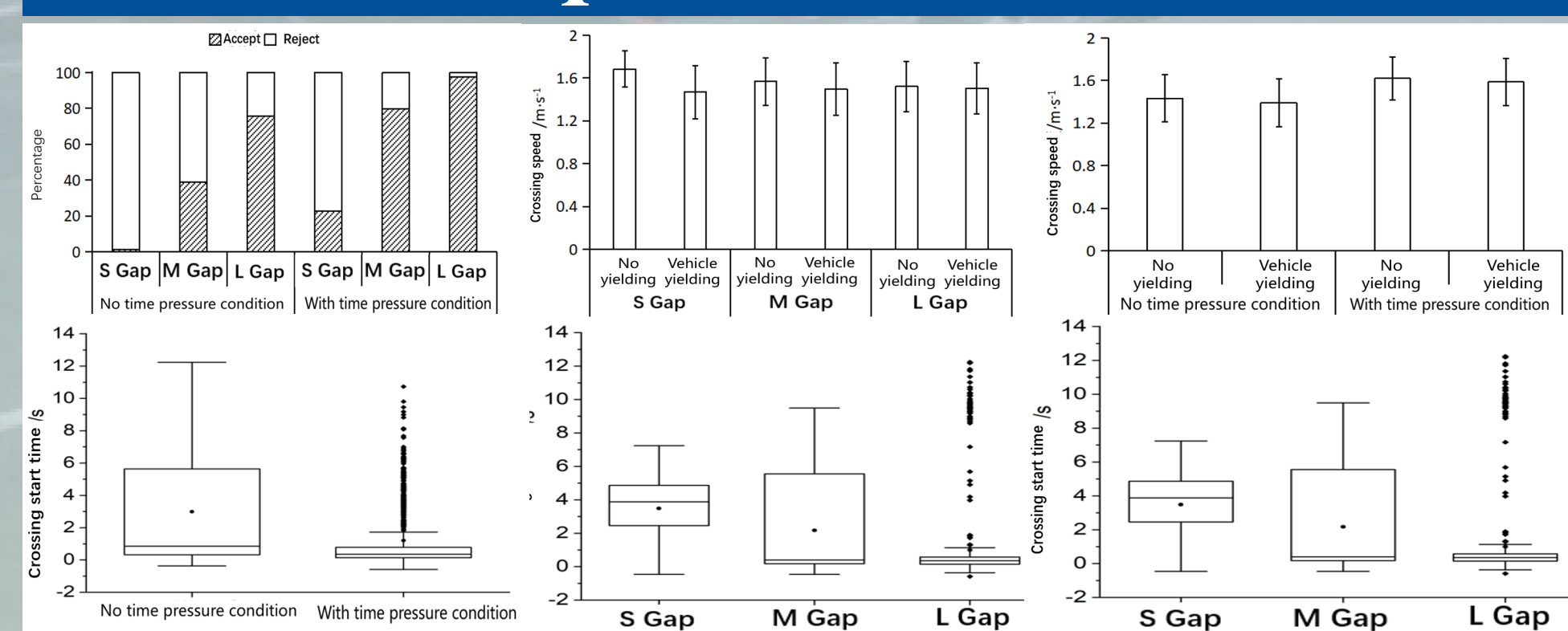
Research Background

The current research on behavior decision-making of autonomous vehicles for human vehicle interaction can predict pedestrian crossing intention/behavior.

However, for the scenarios such as pedestrians waiting to cross the street, the previous motion state information of pedestrians cannot be obtained based on environmental feedback.

It is worth discussing how to infer the pedestrian's intention to cross the street while waiting at the edge of the lane and ensure that the autonomous vehicle makes reasonable behavior decisions.
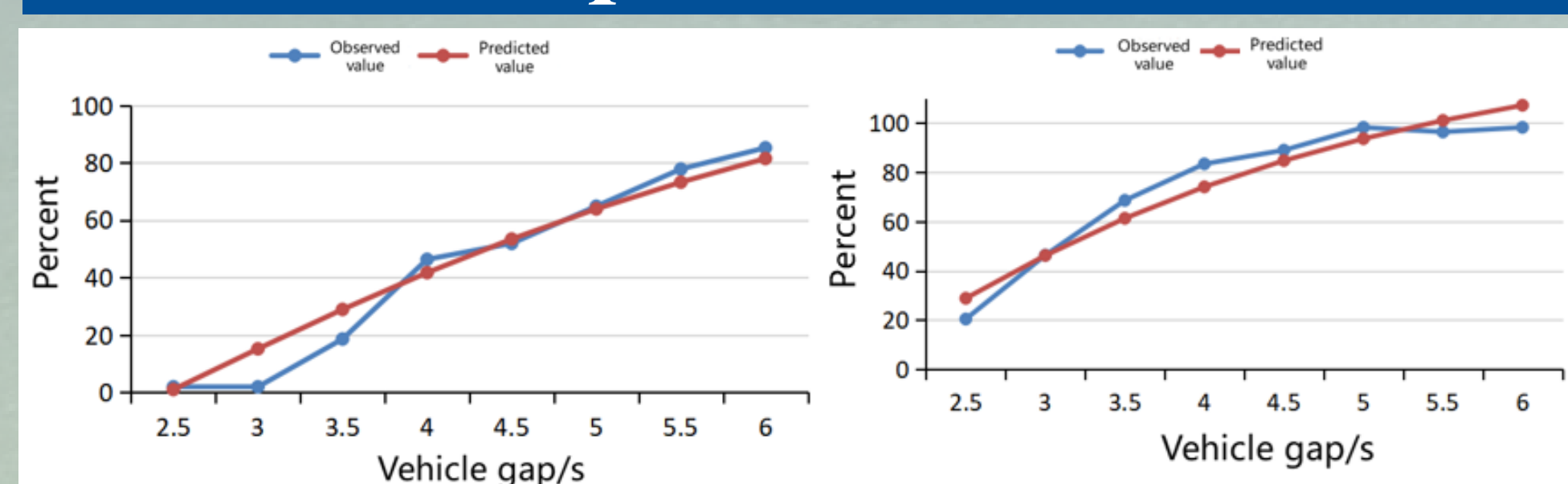

Subjects' experiments

〇The pedestrian crossing simulation test

・Based on the pedestrian simulator, with 54 person times, and 1944 valid experimental data were obtained.
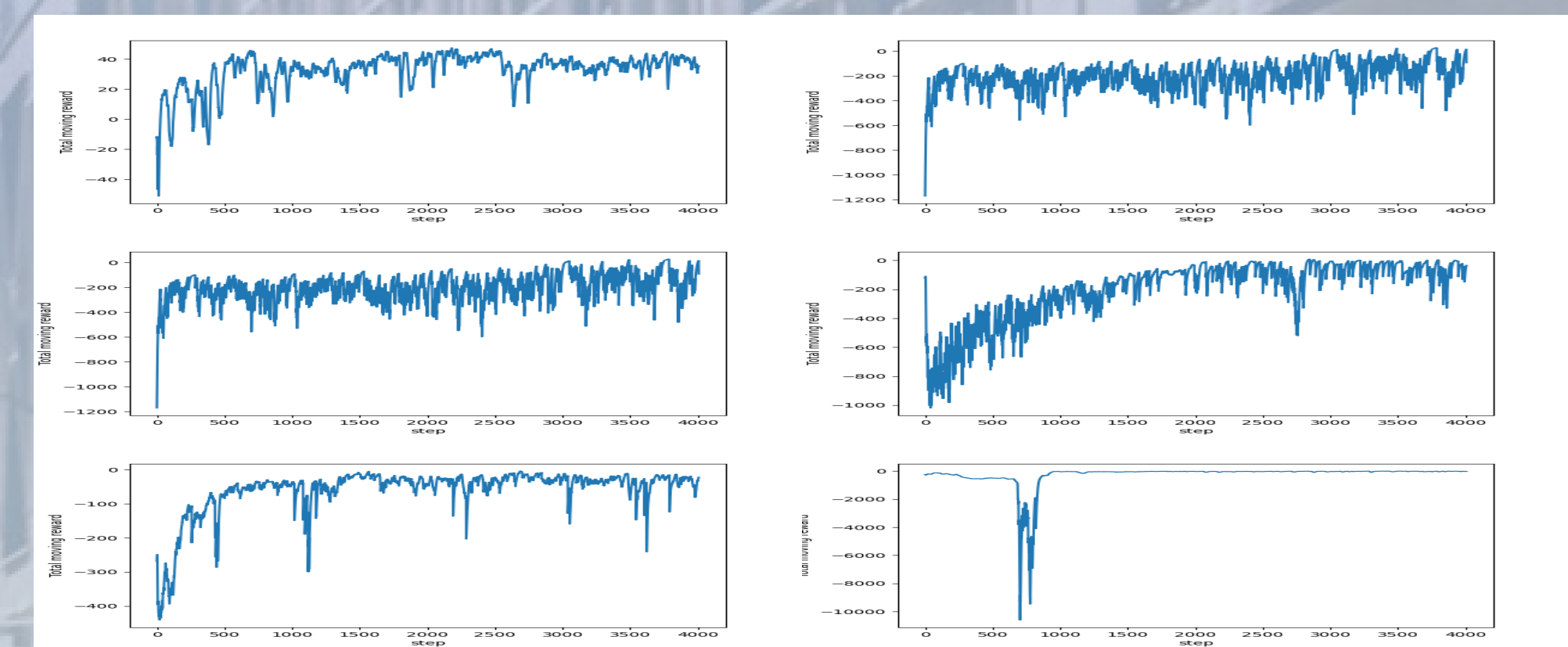
Non-parametric tests

Algorithm
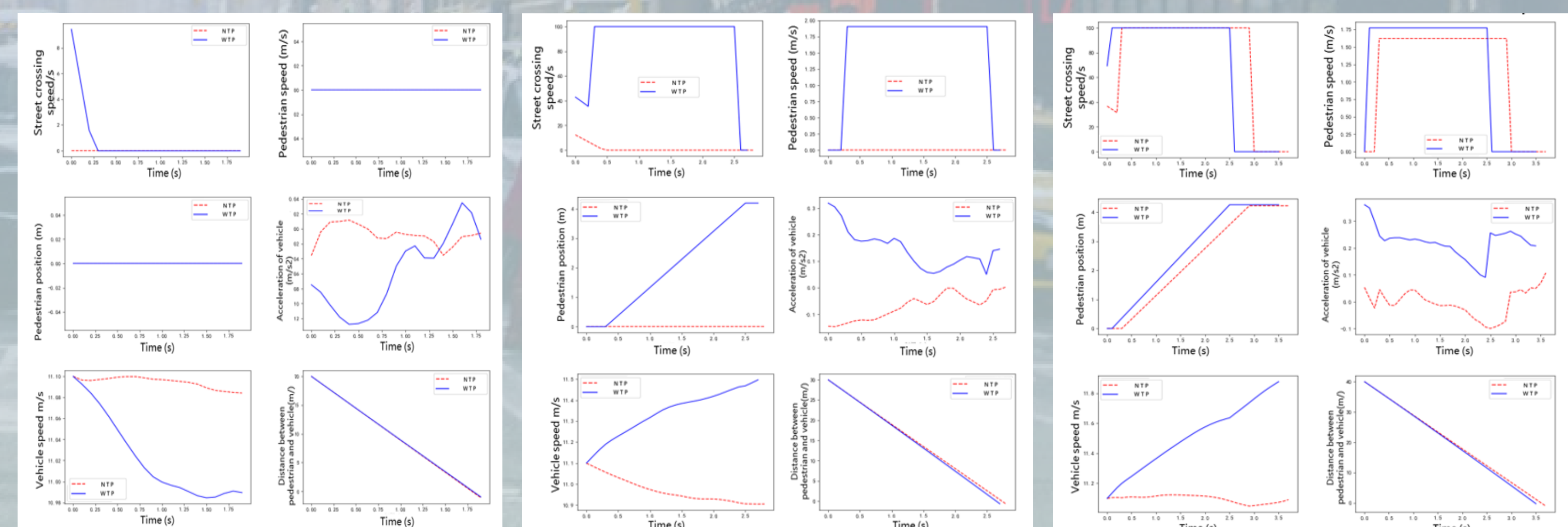

Model prediction result

Vehicle gap ⬆ ⇒ Pedestrian crossing intention ⬆

Awards Encouragement Modeling

Initial pedestrian and vehicle distance =20m
Vehicle speed =40km/h

Initial pedestrian and vehicle distance =30m
Vehicle speed =40km/h

Initial pedestrian and vehicle distance =40m
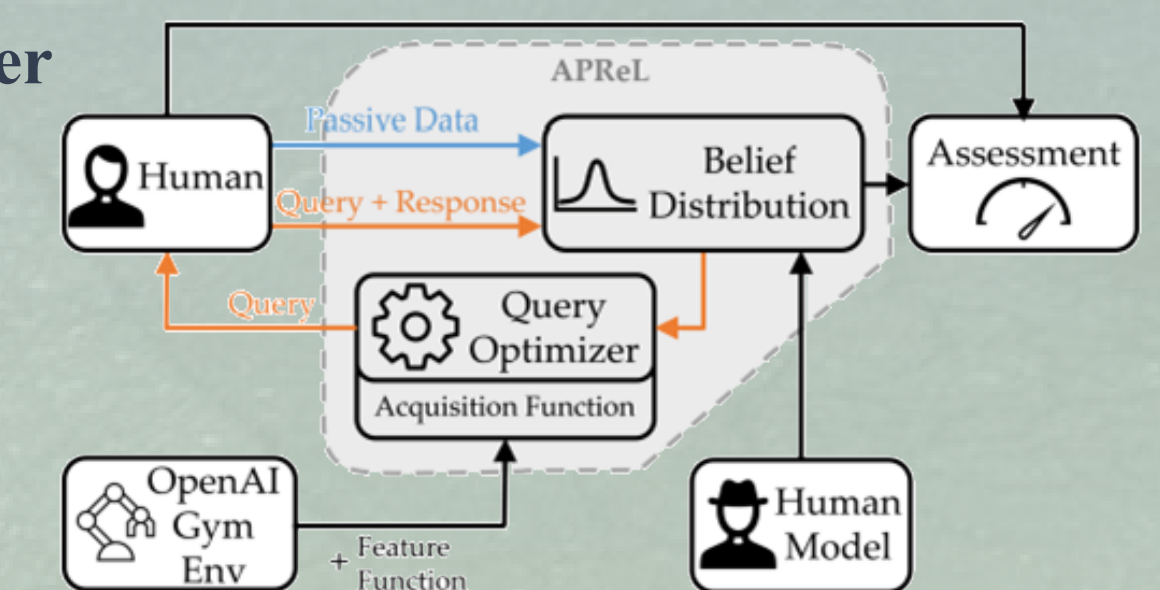Vehicle speed =40km/h

Correlation analysis

Initial pedestrian and vehicle distance =20m, Vehicle speed =40km/h

Initial pedestrian and vehicle distance =30m, Vehicle speed =40km/h

Initial pedestrian and vehicle distance =40m, Vehicle speed =40km/h

Future Work

・Pedestrian intent projections:

There may be significant uncertainty for pedestrians and forecasts should consider the worst case scenario, using the Responsibility-Sensitive Safety (RSS) Model.

・Action, state trans：

Time-varying state transfer probabilities of the state transfer matrix, choosing Semi-MDP.

・Rward:

Exploring return weights using Active Preference-based Reward Learning (APrel) for weight optimization.

The design of Reward Function considers causality and constructs causal structural equations to design the reward function.