

Adaptive Intelligence for Cyber-Physical Automotive Active Safety System Design and Evaluation (CPS Award #: 1544814)

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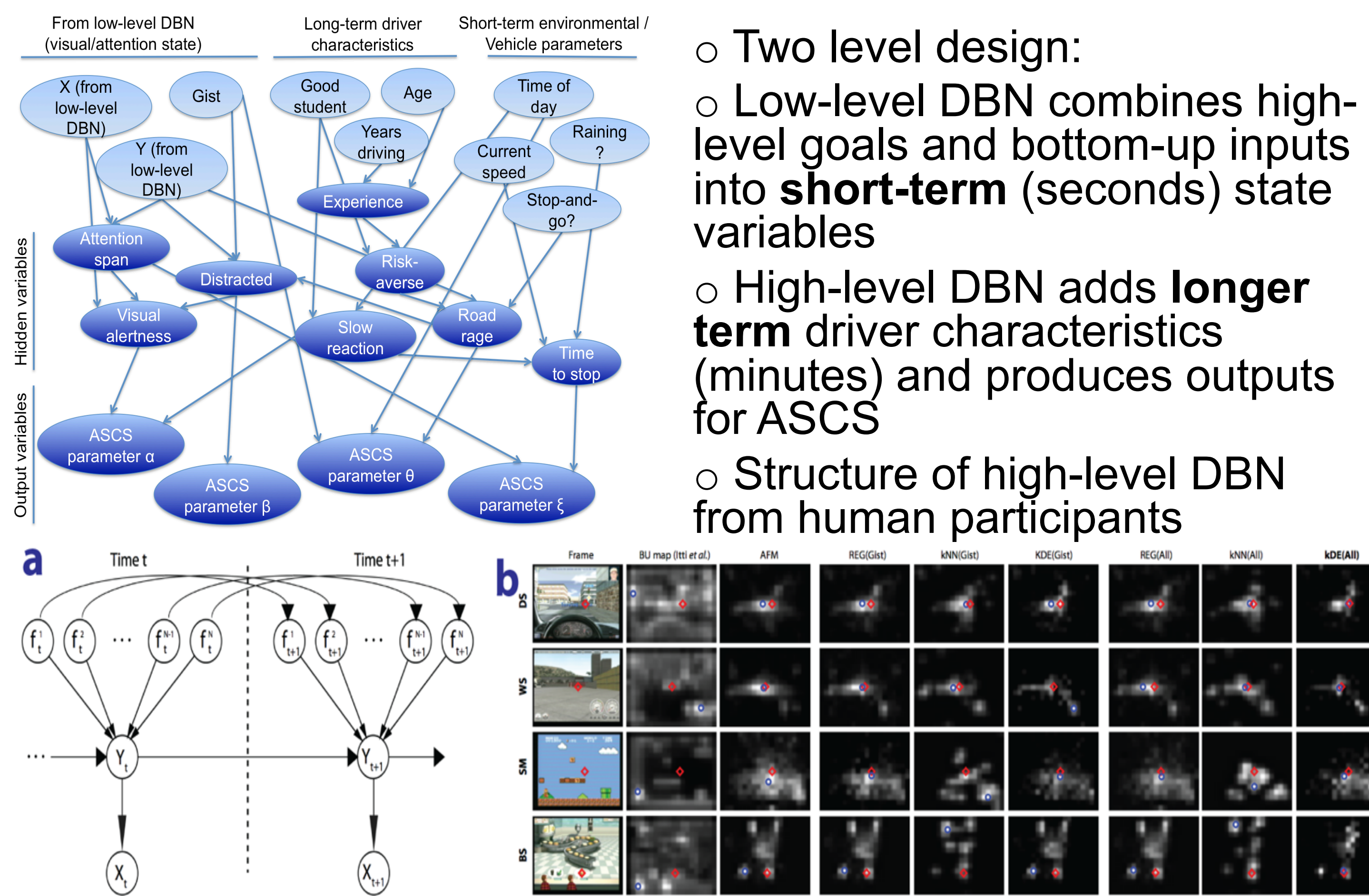
Objective: Improve capabilities of automotive active safety control systems (ASCS) by taking into account the interactions between driver/vehicle/ASCS/environment.

Research Approach

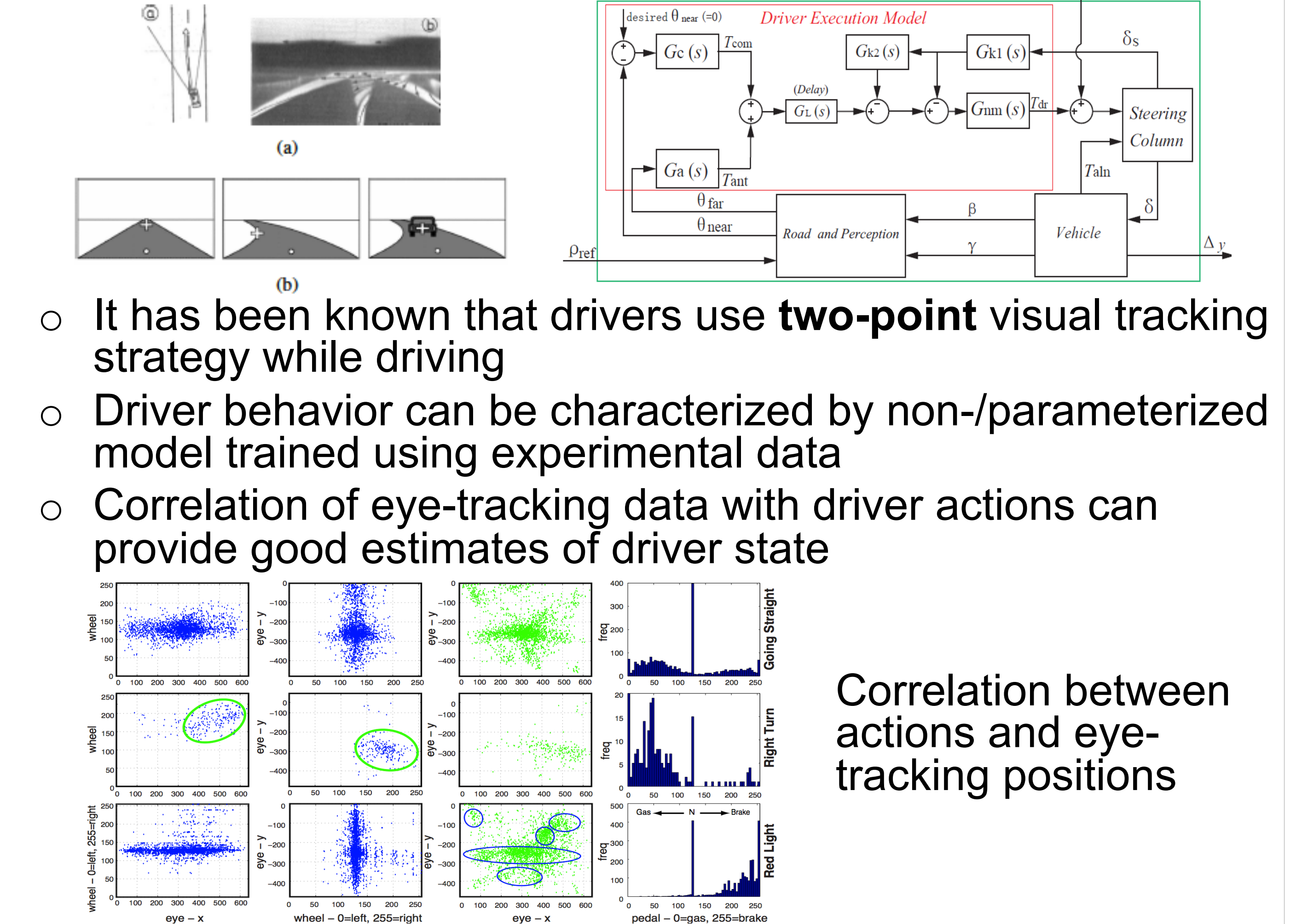
- New methodologies to infer long-term and short-term behavior of drivers
- Use of Bayesian networks and neuromorphic algorithms to estimate the driver's skills and current state of attention
- Inject this information into the ASCS operation to enhance its performance
- Determine correct level of autonomy and workload distribution
- Test and validate developed theory



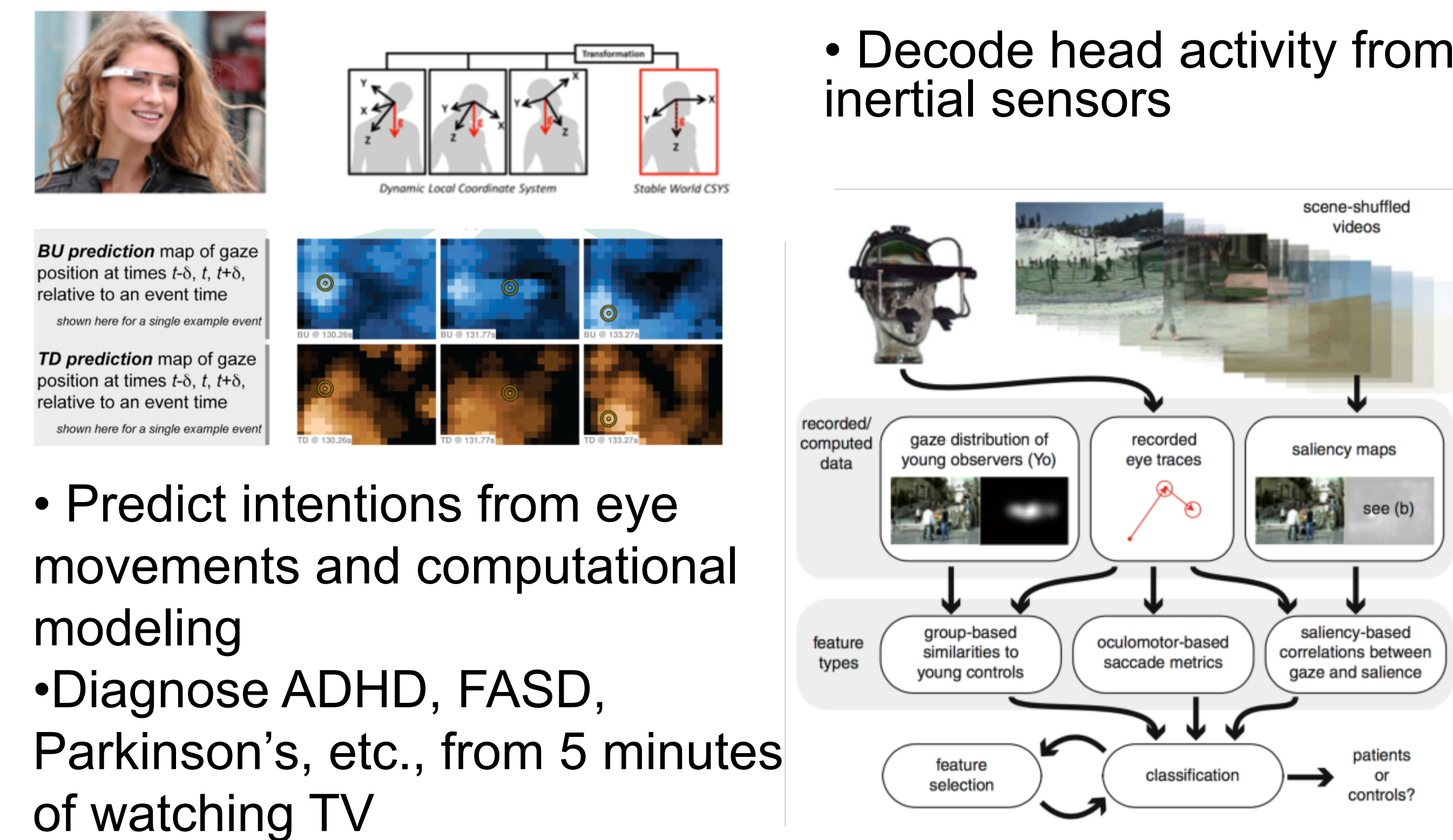
Determine the Driver's Current State and Intrinsic Skills



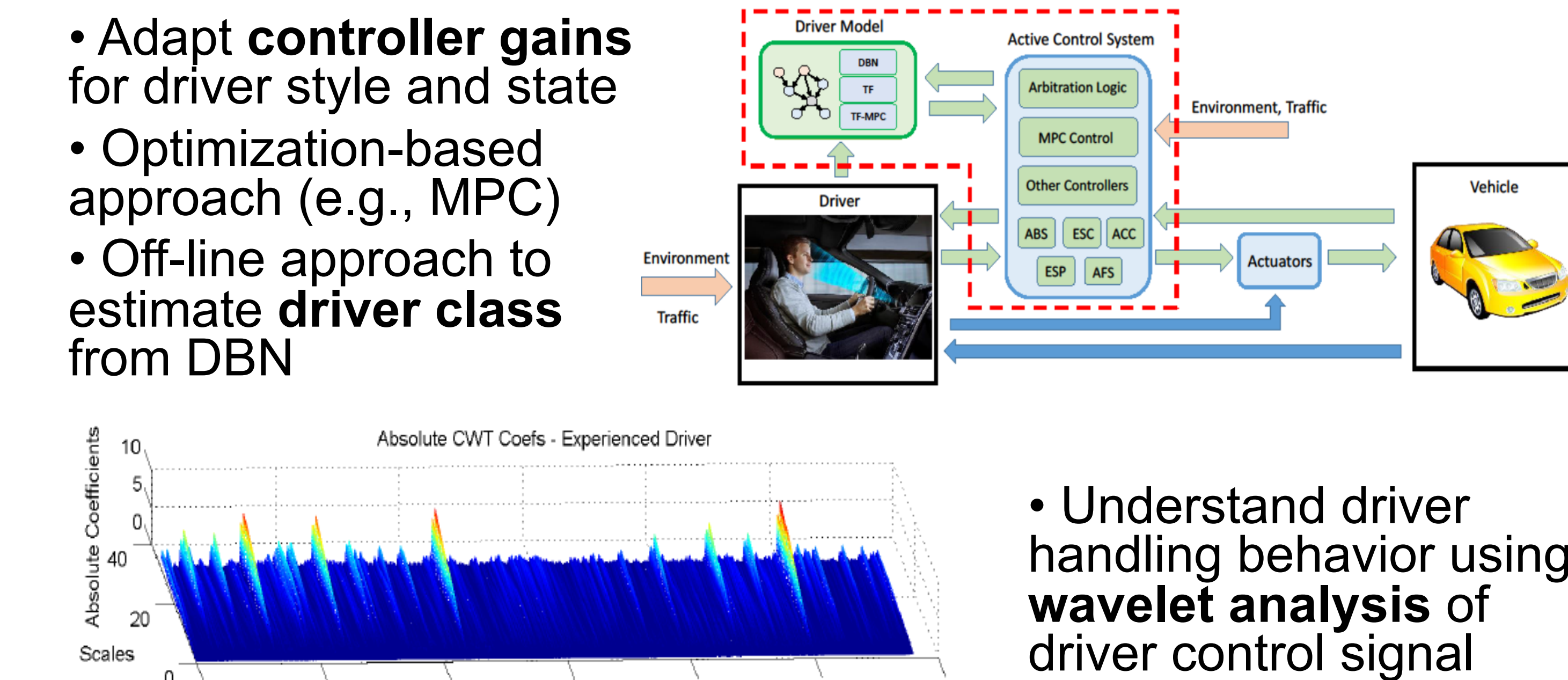
Eye-tracking reveals long/short-term habits



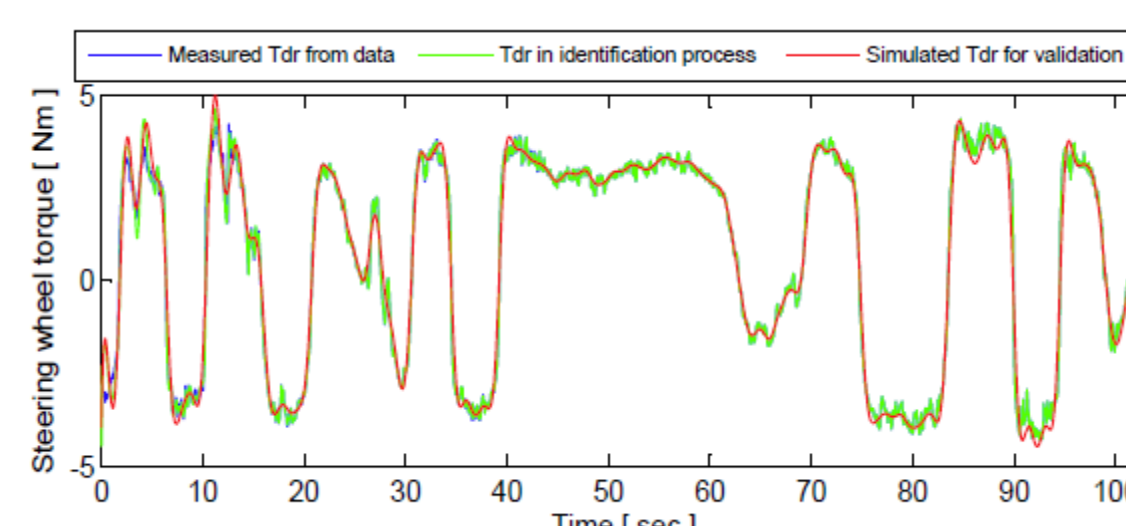
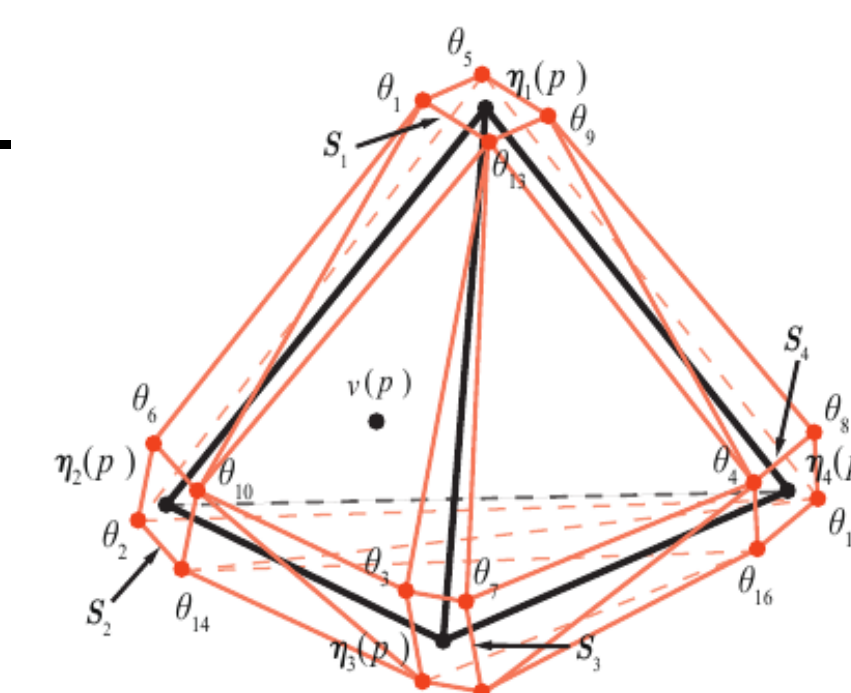
Capture Eye-Movements



Adaptive Automation for ASCS



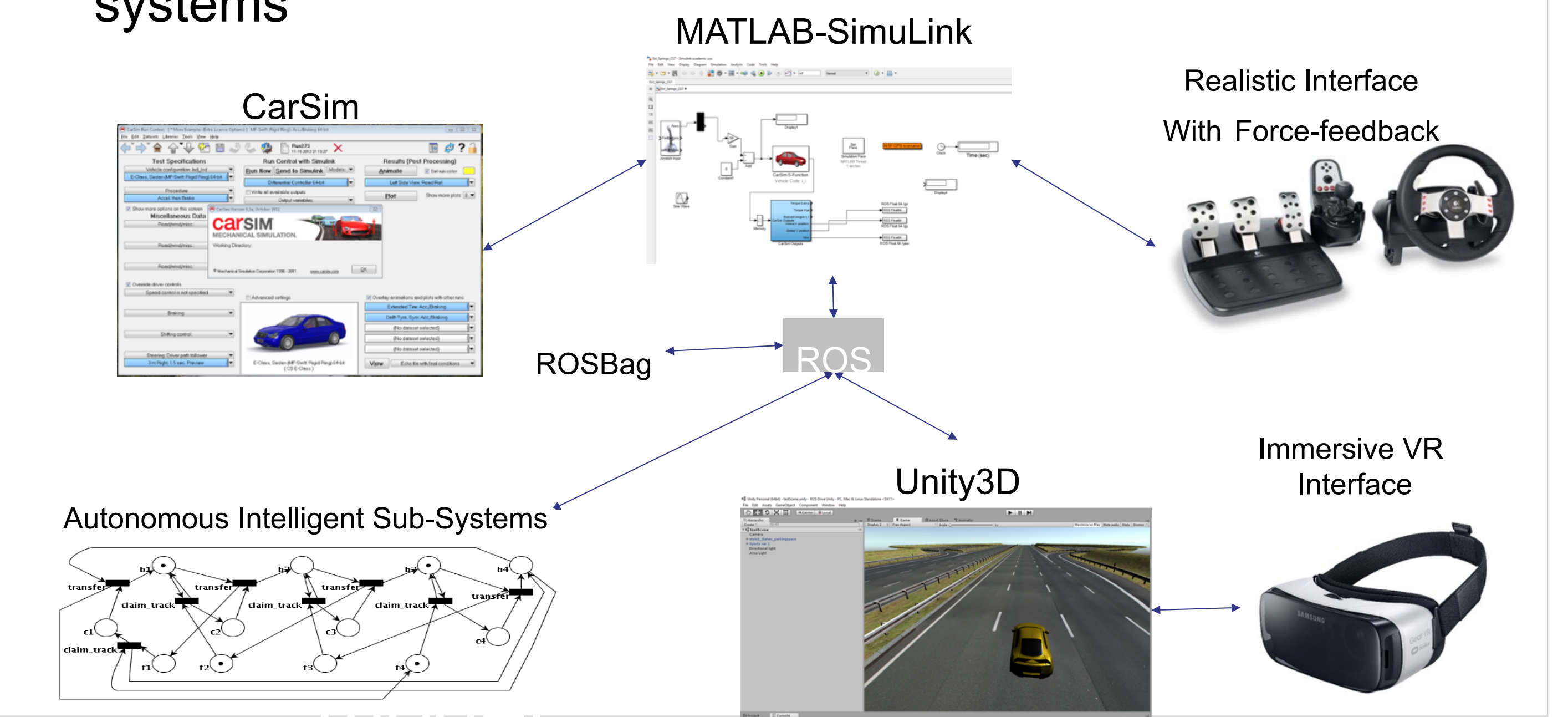
- Driver parameter estimation using Joint-state/dual EKF/UKF
- Develop adaptive Kalman filter for time-varying parameter online estimation
- Robust ADAS controller for LPV system (i.e., MPC, ORT)



Experimental validation at Ford MPG

Flexible Integrated Driving Simulator

Realistic testbed for human-in-the-loop validation that allows quick testing of semi-autonomous intelligent sub-systems



Testing and Validation

- Use driving simulator to:
 - Collect training data
 - test data
- Record driver commands
- Test overall closed-loop

