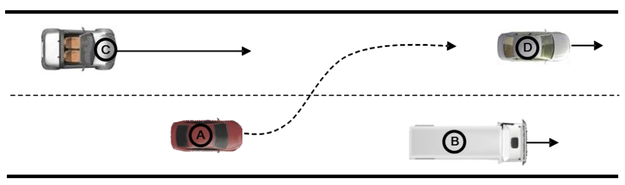
Driver Intention Recognition for Adapted Assistance

HOLISTIC HUMAN FACTORS AND SYSTEM DESIGN OF ADAPTIVE COOPERATIVE HUMAN-MACHINE SYSTEMS

Domain

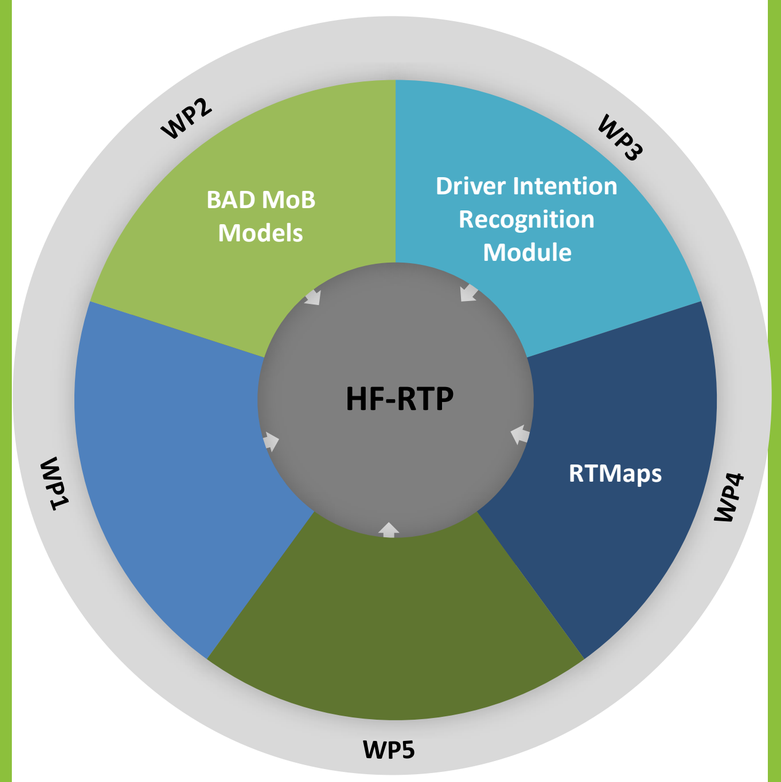
Motivation

The AdCoS "Adapted Assistance" focusses on the advanced cooperation between the human driver and machine-agents in overtaking scenarios by adapting the system functionalities to the driver's capabilities, needs, and intentions.



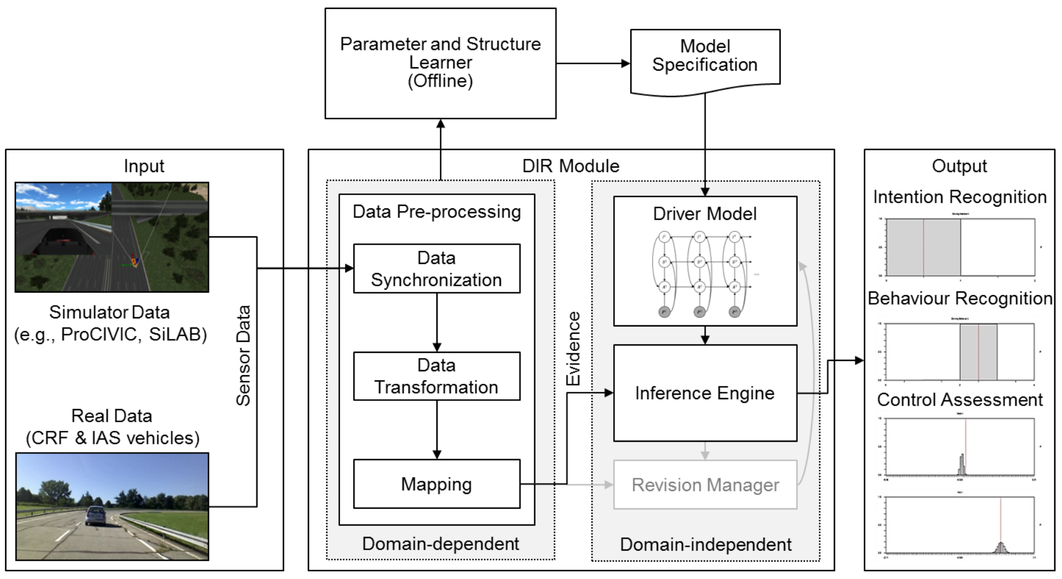
As such, the AdCoS requires the integration of **predictive models** of the human driver that are able to provide the AdCoS with context-dependent estimations about the current **lane-change intentions** of the human driver. Within the AdCoS, this ability will be provided by a **Driver Intention Recognition** (DIR) module.

Applied MTTs

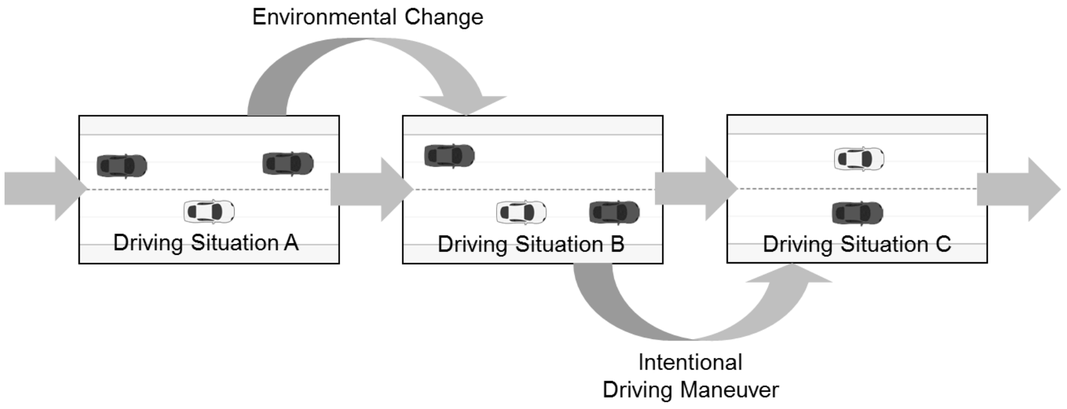


Current State: Tailored HF-RTP

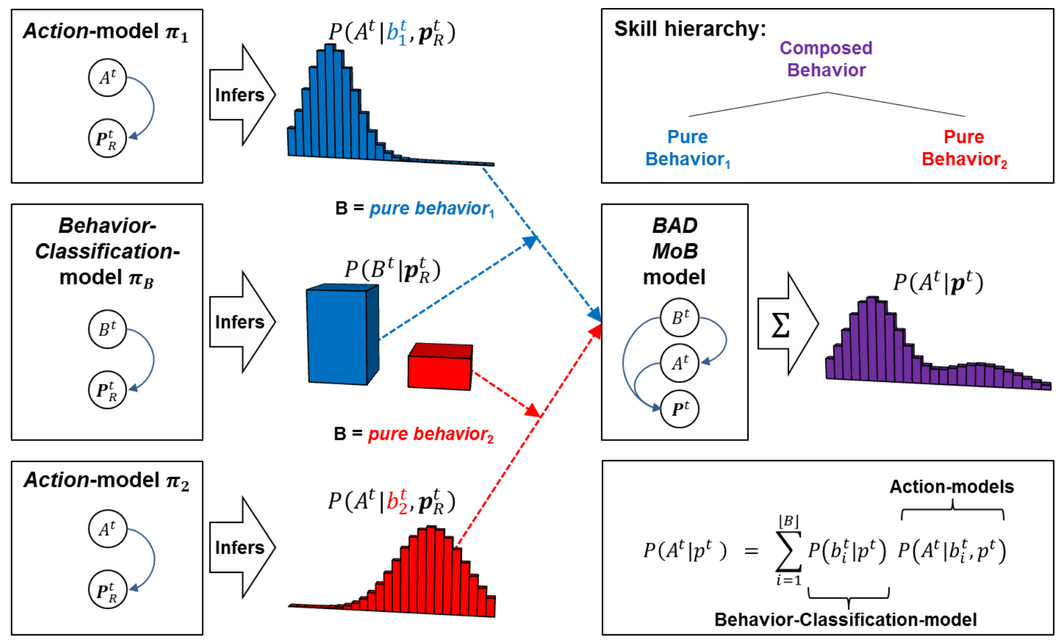
The DIR module is composed of a domain-dependent component for data pre-processing and domain-independent component for probabilistic inferences.



The DIR module utilizes a **Bayesian Autonomous Driver Mixture-of-Behaviors** (BAD MoB) model that implements the complex sensorimotor system of human drivers in a **modular** and **hierarchical probabilistic architecture**. The model is based on the assumption that the complex human driving behavior can be decomposed into a collection of simpler driving behaviors and maneuvers, of which some are triggered intentionally (e.g., lane-changes), while others follow from environmental changes (e.g., car-following).

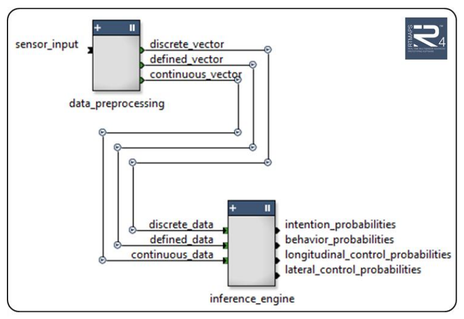


BAD MoB models are conceptualized as hybrid **Dynamic Bayesian Networks** (DBNS) that combine multiple simpler DBNs for **context-dependent prediction**, **assessment,** and **generation** of complex human driving behavior.



Results

A first version of the DIR module is implemented in the WP4 MTT **RTMaps**, realized as a set of RTMaps components. Provided with all necessary inputs, the implemnted DIR module can provide belief states over intentions, behaviors, and control actions to other components.



Based on datasets for highway scenarios obtained in simulator studies prior to HoliDes, we used **machine-learning methods** to develop a proof of concept BAD MoB model for the DIR module. For the classification of lane change intentions on unseen testsets, the model achieves an accuracy of approx. 0.89.

Accuracy: 0.890		"Correct" Lane Change Intention	
		Yes	No
Predicted Lane Change Intention	Yes	TP = 15310 TPR = 0.824	FP = 12091 FPR = 0.100
	No	FN = 3279 FNR = 0.176	TN = 109225 TNR = 0.900

As a next step, we will use **real traffic data** provided by CRF and adapt our machine-learning algorithms to develop BAD MoB models for the CRF demonstrator vehicle.

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