CHESS
CENTER FOR HYBRID & EMBEDDED SOFTWARE SYSTEMS

COLLEGE OF ENGINEERING, UC BERKELEY

Transitioning Control and Sensing Technologies from Fully-autonomous Driving to Driver Assistance Systems

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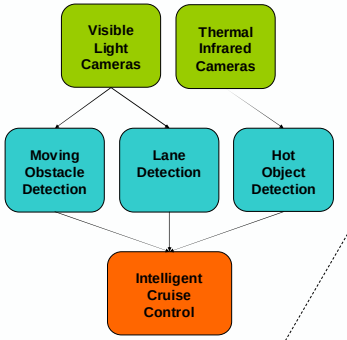
Next Generation of Cruise Control Using Model Predictive Control

Goal

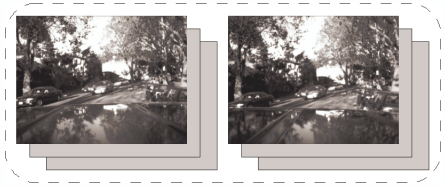
Apply advances in autonomous vehicles to improve human driver convenience and safety by developing a next-generation cruise control that is aware of its surroundings, using economical sensors such as visible light and thermal infrared cameras.

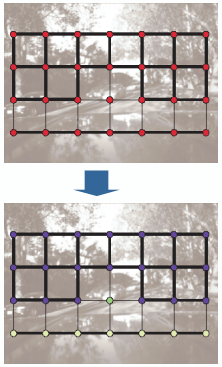
Solution

Real-time Model Predictive Control (MPC) allows us to utilize complex control objectives and constraints, such as obstacle avoidance and lane-following. Environmental awareness is achieved using visible-light and thermal-infrared cameras.



Moving Obstacle Detection Using Computer Vision





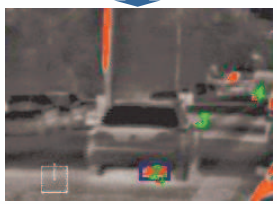
Goal

Detect and estimate the trajectories of moving obstacles, in particular pedestrians and other vehicles, for use by the next-generation cruise control.

Properties

- Finds objects that are moving in scene, not easier problem of finding objects that are moving relative to cameras.
  - Detection of obstacles that are both near and far (no planar or non-planar assumption).
  - Single parameter trades off between inter- and intra-object similarities.

Heat-producing Obstacle Detection Using Thermal Infrared Imaging



Goal

Detect and estimate the trajectories of heat-producing obstacles, in particular other running vehicles, for use by the next-generation cruise control.

Properties

- Active in all lighting conditions: 55% of all traffic fatalities occur when it is dark [1].
- Heat signatures of active cars stand out on thermal infrared imaging.
- Many luxury cars are already equipped with ‘Night Vision’ technology that features a thermal infrared camera display for the driver; we add intelligence to this sensor.

Based on: H. Gonzalez, E. I. Grøtli, T. R. Templeton, J. O. Biermeyer, J. Sprinkle, and S. S. Sastry. “Transitioning Control and Sensing Technologies from Fully-autonomous Driving to Driver Assistance Systems.” In Proceedings of Automatisierungs-, Assistenzsysteme und eingebettete Systeme für Transportmittel (AAET), 2008.

[1] Traffic safety facts 2000. A compilation of motor vehicle crash data from the Fatality Analysis Reporting System and the General Estimates System. National Highway Traffic Safety Administration, Publication no. DT HS 809 337. Washington, DC: NHTSA, 2002.

Photo of Ford Escape Hybrid courtesy of Ford Motor Company.