Development of Online Driving Skill Evaluation System (ODSES) for Driver-Vehicle Interaction Control

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Background

- Current research progress about driver behavior identification

  - Driving **style** characterization

  Based on individual's driving characteristics, build reference models (library) with ideal characteristics of vehicle dynamics.
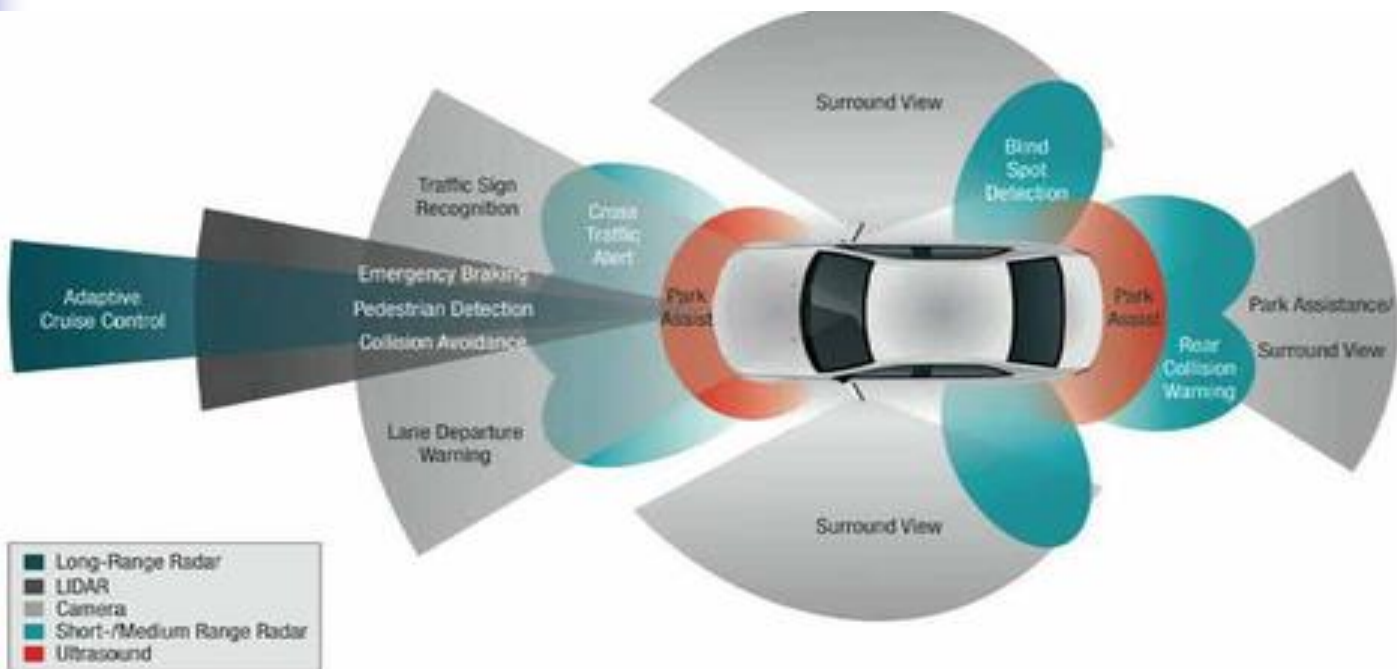
  - Driving **state** identification

  Real-time detecting driver's state, provide timely assistance. `

  - Driving **skill** identification

  Saturating drivability and providing assistance individually.

Background

Current ADAS normally ignore the differences of individual driver's driving skill, which means it will badly influence the 'good' drivers' driving experience and reduce the vehicle's maneuverability.

Background

You want to be gentle with the gas pedal, gentle with the brake pedal. You should be able to read the small print in a newspaper with a good driver. You want to be a driver that makes him or herself look good, to your family or your boyfriend or girlfriend.

————Jackie Stewart
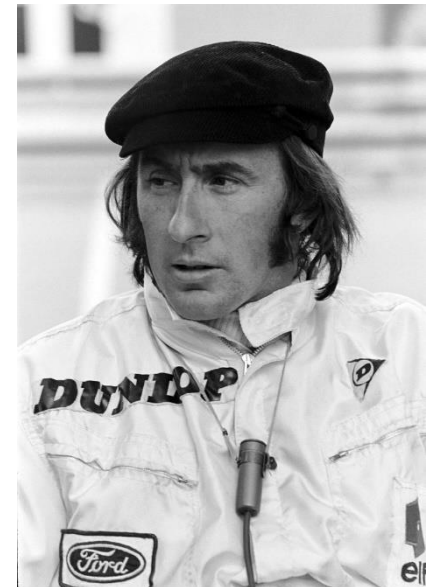
Proposed Hypothesis

➢ The difference between individuals' driving skill does exist and it will influence the vehicle dynamic performance.

➢ A driver with better driving skill can safely complete a same driving task with less use of tire force, which shows as reduced vehicle CoG accelerations, including jerk.

➢ This kind of driver can performance better in critical conditions, which shows as better tracking intended path.

Driving simulator test

Driving simulator testbed and ODSES interface design.

Driving simulator testbed

The interface of ODSES

Driving simulator test

Driver 1: Obtained driving license one year ago, seldom drive.

> Novice driver

Driver 2: Obtained driving license five years ago.

> Normal driver

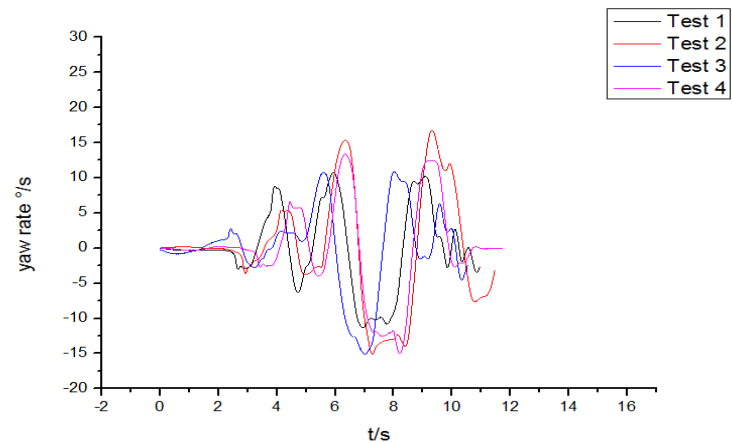Driver 3: Obtained driving license ten years ago, often drive.
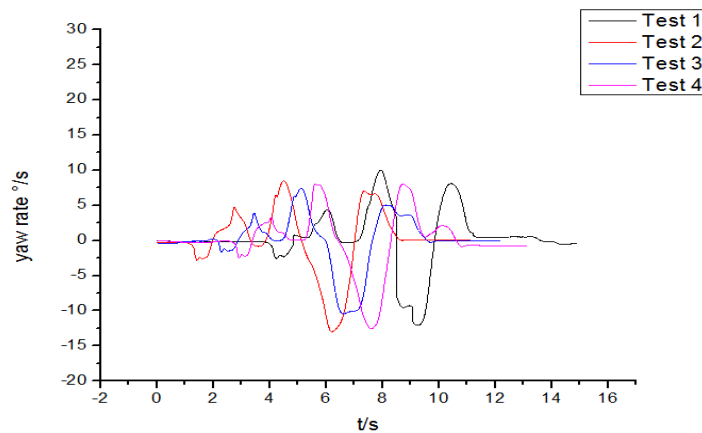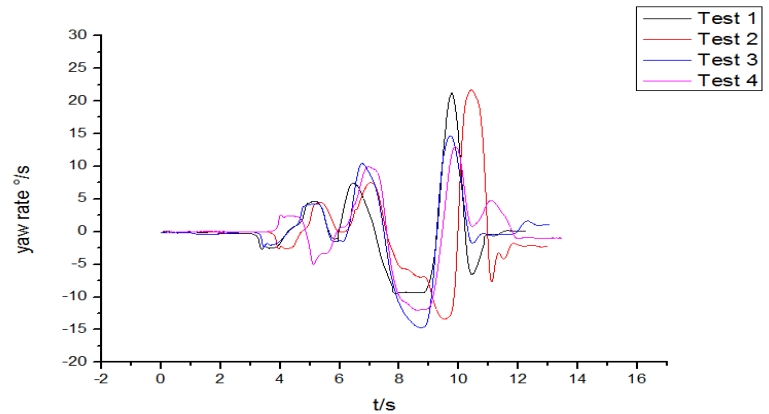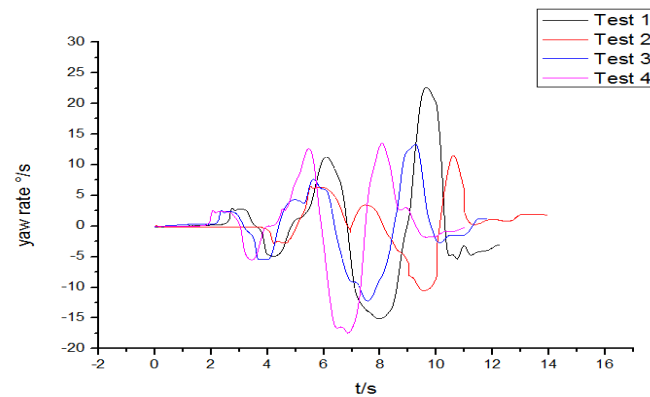
> Skilled driver

Driver 4: Formula race-car driver, rank No.2 in Chinese student formula race.
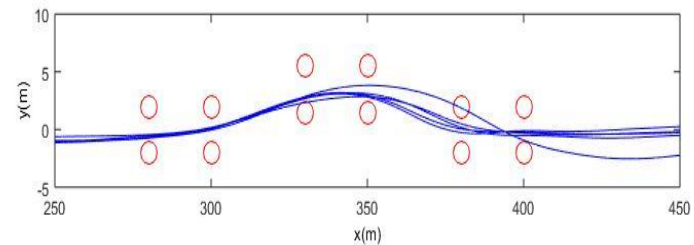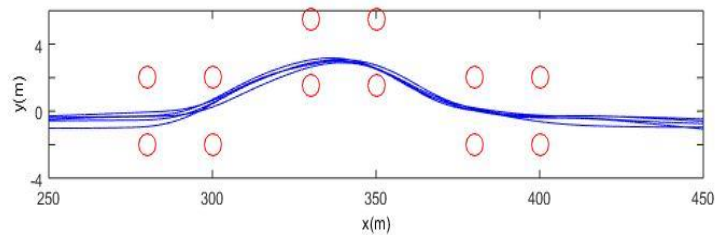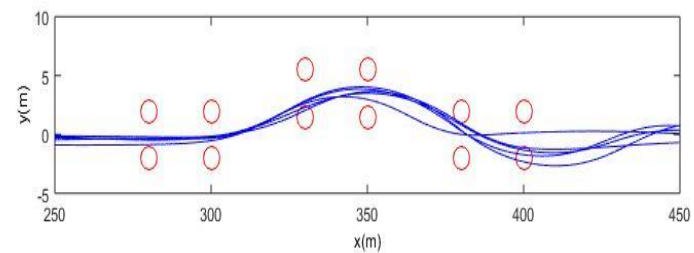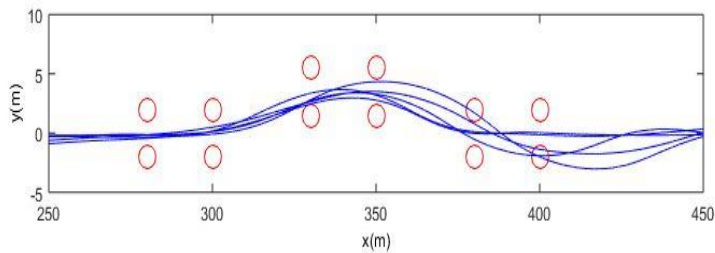
> Professional race-car driver

Driving simulator test
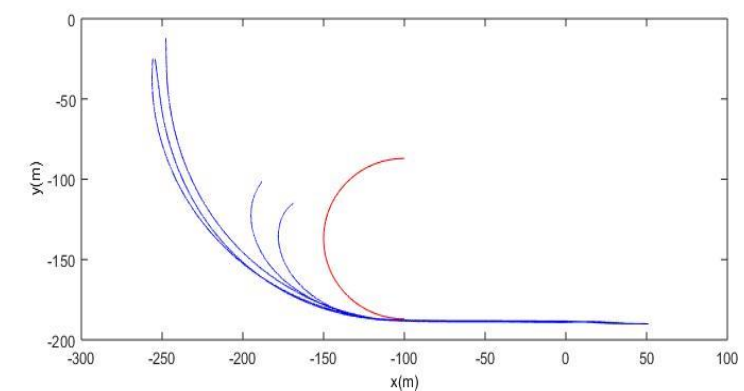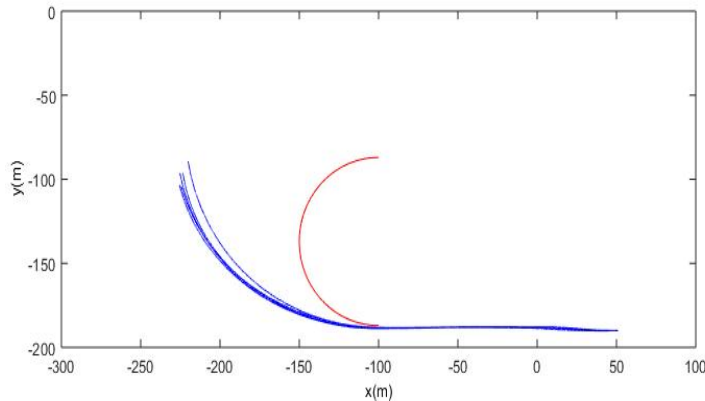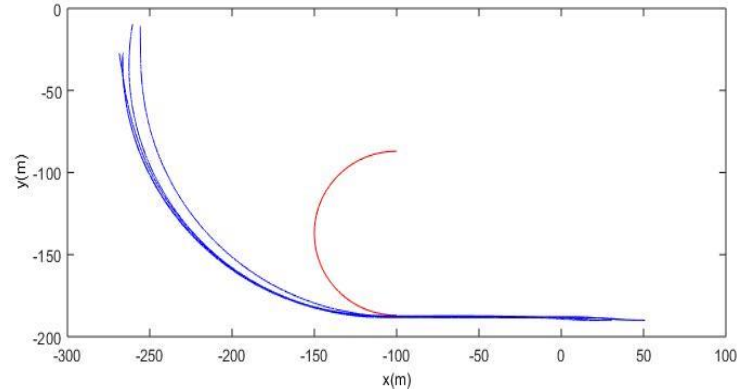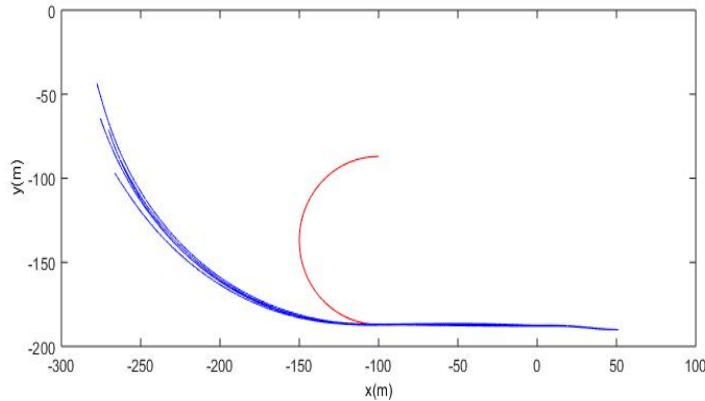
Yaw rate comparisons (DLC maneuver , normal speed)

Driving simulator test

Vehicle motion comparisons (DLC maneuver, high speed)

Driving simulator test

Vehicle motion comparisons (J-shape maneuver, high speed)

Application

Novice Driver

The novice drivers are assumed to be unable to handle most of the emergency conditions within the physical limitation. Hence, ADAS **prefers to** intervene into the driving operation during earlier stages, providing progressive support to avoid the emergency condition.

Normal Driver

The normal drivers are assumed to be able to handle some of the emergency conditions within the physical limitation. Hence, ADAS intervening will provide progressive support also, but **less obviously** compared to the novice driver.

Skilled Driver

The skilled drivers are assumed to be able to handle most of the emergency conditions within the physical limitation. Hence, ADAS **prefer to not** intervene into the driver operation until last second.

Online Scoring System

> In most of the driving situations, it is possible to obtain an optimal vehicle performance based on the vehicle running state and environmental information.

> Hence, the approaching degree to optimal performance could be the measuring standard for online scoring.

Online Scoring System

➢ ODSES with online scoring system shown on the dashboard can markedly improve drivers' driving attention and joy.

➢ ODSES with online scoring system has little bad influence on the other experimenters who are not feeling enjoyable.

➢ Certainly these drivers can manually shut down the scoring display by themselves, but the ODESE will still work in the background.

Conclusion

The advantages of ODSES

- Extended driving simulator experiment demonstrate that the ODSES with online scoring system can markedly improve drivers' driving attention and joy.

- For the driver-vehicle interaction control, the ODSES provide a reliable judgment reference for the intervention of ADAS. Hence the vehicle can achieve maximum maneuverability within the safety margin.

Thanks for your attention!

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