論 文 の 内 容 の 要 旨

論文題目

Lane-Change Detection Based on Individual Driving Style and Correlation with Adjacent Vehicles

（個人の運転スタイルおよび周辺車両との関係を考慮した車線変更検知）

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Even though traffic accident rates have been decreasing, they still remain a major cause of mortality. Over 90 % of car crashes are caused by human errors, and late cognition occupies almost half of it. Car crashes often occur when traffic participants try to change lanes. If the driver assistance system of a vehicle can detect lane changes before other vehicles cross the centerline, the accident rate can be significantly decreased.

The performance in lane-change detection can be evaluated by two indices - accuracy and early detection. Considerable research to detect lane changes of other vehicles has also been proposed. However, their performance is still not sufficient for implementation on a driver assistance system.

In order to solve these problems and construct a safe, reliable, and feasible driving assistance system, which can detect dangerous situations and relay alarms to the primary driver, the following points can be discussed as challenges:

- Description of general lane-changing conditions: if it is possible to describe conditions under that drivers generally consider a lane change, it should be effective to improve a detection performance.
- Prediction of target's movement: since a lane change is a continuous process, it would be able to predict movements of a lane-changing vehicle based on the relationship with adjacent vehicles.
- Consideration of personal driving style: each driver has an own driving style and shows a different driving pattern. If the driving style of a driver can be estimated, driver-assistance sytems can be adaptive to personal characteristics.

In this thesis, techniques are proposed to achieve the above challenges. More detailed summaries for each step are as follows.

In Chapter 2, a new feature to describe the characteristic of lane changing is proposed. The proposed method uses an artificial potential method to consider the relationship to adjacent vehicles. Drivers may consider the relative distance and the relative velocity with respect to adjacent vehicles at the moment a lane change is attempted. By this feature, accuracy and early detection can be improved.

In Chapter 3, a method to decrease the number of false alarms by using trajectory prediction is proposed. The proposed method uses the potential field method for trajectory planning and avoiding contact with surrounding vehicles. If a collision with a surrounding vehicle occurs, the trajectory is re-planned. This re-planning in the driving-intention estimation can be expected to decrease false alarms.

In Chapter 4, driving style recognition based on risk taking of the target driver is discussed. The driving style is categorized into three levels: *cautious*, *normal*, and *aggressive*, and the proposed method determines the type of driving style of the target among the three given levels. In this Chapter, a new feature is proposed using a dynamic potential field method wherein the distribution changes depending on the relative number of adjacent vehicles.

In Chapter 5, a technique to predict lane changes considering personal driving styles is proposed. The proposed method evaluates the probability performing lane changes based on the estimated driving style in Chapter 4, and it is integrated with the result in Chapter 2. This approach makes the fast detection possible.

Finally, Chapter 6 gives conclusions of this thesis.