Intention-Based Lane Changing and Lane Keeping Haptic Guidance Steering System

Fund: Grant-in-Aid for Scientific Research

Introduction

This study explored a new haptic steering interaction method, including the design and evaluation of an Intention-Based Haptic Steering (IBHS) system. The proposed intention-based method can support both lane keeping and lane changing by detecting a driver's Lane Changing (LC) intention. The system was verified through a driving simulator experiment with 12 participants.

Intention-based lane assistance haptic steering system



Single preview-point method for controlling haptic guidance torque



Unrolled GRU layer with 180 units, the top layer gives the prediction of driver's lane changing intention



 τ_{hapi} is the haptic guidance torque instruction value. It is amplified by the gain K_h and converted to actual haptic supporting torque τ_{hapa} GRU can decide how much the unit update its content through two gates and remember information through the activation h_t^j

Driving simulator experiment





The experiment demonstrated that the supporting system decreased the lane departure risk in the lane keeping tasks and could support a fast and stable lane changing maneuver.

Publications

Yan Z., Yang K., Wang Z., Yang B., Kaizuka T., Nakano K., 2021, "Intention-Based Lane Changing and Lane Keeping Haptic Guidance Steering System," *IEEE Trans. Intell. Veh.*, vol. 6, no. 4, pp. 622–633, Yan Z., Yang K., Wang Z., Yang B., Kaizuka T., Nakano K., 2019, "Time to lane change and completion prediction based on Gated Recurrent Unit



