An Approach to Customize Haptic Guidance for the Aged Power-Wheelchair Riders

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The aged power-wheelchair riders often need guidance not only to control the speed and direction of the wheelchair but also to navigate through obstacle-free path. However, simultaneous consideration of both criteria to determine a guidance policy of the power-wheelchair has not been considered yet. To address this problem, we propose an approach to modeling rider's strategy to optimize driving-related features such a speed/steering control and boundary/obstacle avoidance. The modeled cost functions via inverse optimal control techniques can provide customized haptic force feedback for each user. Thirty nine adults participated in this study. A custom-developed simulator of a power-wheelchair was used which can provide haptic feedback to users. Subjects were seated at the simulator which provides visual display and force feedback by a monitor screen and a 2D haptic interface, respectively. Subjects were given tasks in which they drive a virtual power-wheelchair as fast and safe as possible while avoiding obstacles and boundaries under various scenarios. In the first session, each subject's driving characteristics with no haptic feedback was identified. In the second session, subjects' task-completion times under three haptic-assistance modes (no assist, customized assistance, and non-customize assistance) were recorded. The result showed that not all subjects' task-completion times were improved with customized haptic feedback. However, subjects whose completion times improved with customized assistance had slower baseline completion times and higher completion time variability than those whose completion times did not improve with customized assistance. These findings imply that customized haptic guidance may work either as disturbances for skilled subjects or as beneficial assistances to novice subjects. For the novice subjects, nonetheless, the customized guidance outperform non-customized guidance.

The Older Driver and Advanced Driver Assistance Systems: Insights from a Naturalistic Driving Field Operational Test

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In a society where the population is aging and mobility and driving are often equated with independence, problems of older driver safety is of increasing concern. At the same time advances in automotive technology promise to simplify the driving task and it more safe. How these systems affect older drivers, and whether they can compensate for some of the age-related declines in the ability to drive safety are still open questions. This study investigates the effect of a set of advanced driver assistance systems (ADAS) on older drivers' travel patterns and compares these patterns to those of younger drivers. Naturalistic driving data from the Integrated In-vehicle-based Safety program (IVBSS) are examined for changes in a set of driving measures including those associated with exposure such as the amount of driving, travel times, road types,