Effect of Input Data on Model Accuracy in NARX Driver Model

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Since Advanced Driver-Assistance System controls are uniformly applied regardless of a driver's driving characteristics or traffic environment, it may differ from the driver's driving operation, and may cause the driver to feel uncomfortable with the system. It is necessary for driver assistance systems to be adaptable to each individual driver's characteristics. For constructing a driver model corresponding to various driving environment conditions, it will be necessary to investigate whether a driver model constructed under the conditions of one driving environment can be applied to other driving conditions with high accuracy, and to know how accurate the driver's driving operation can be simulated.

The purpose of this study is to investigate the accuracy of the driver model constructed under one experimental condition when the driving speed and deceleration of the preceding vehicle are changed in the simulation of the driver's operation under other experimental conditions.

We used Nonlinear AutoRegressive network with Exogenous (NARX) to build the driver model, utilizing the capabilities of machine learning for this experiment (Fig.1). In order to examine the effect of parameter settings on NARX on model accuracy, the coefficients of determination were calculated when the number of learning, number of hidden units, number of input delays, and number of output delays were changed. A driver model was constructed using experimental data with a vehicle speed of 80 km/h and a deceleration rate of 3 m/s^2 of the preceding vehicle, and the accuracy of the simulation was examined when the driver model was applied to other driving environments (Table 1).

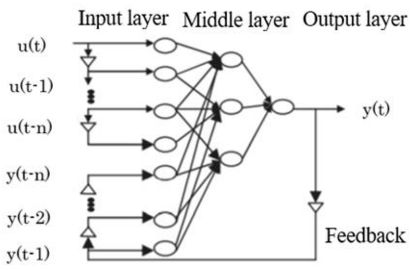

Fig.1 NARX structure

Table1 Scenario patterns

Scenario	Forward vehicle speed [km/h]	Forward vehicle deceleration [m/s^2]
1	80	3
2	80	4
3	80	5
4	90	3
5	90	4
6	90	5
7	100	3
8	100	4
9	100	5

As a result of the experiment, we constructed a driver model based on an experimental scenario in which the driver followed a preceding vehicle traveling at 80 km/h, encountered traffic congestion, and then decelerated at a maximum deceleration rate of 3 m/s^2 of the preceding vehicle (Fig.2). Also, we verified that the model was adapted with high accuracy to other experimental conditions and a driving environment, and confirmed the trend of model accuracy (Fig.3).

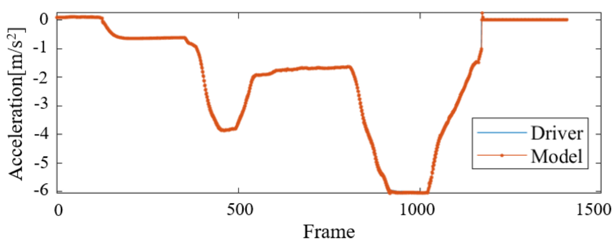

Fig.2 Example of simulation result
(Input delay 5, Output delay 5, Neuron number 3, Learning number 50)

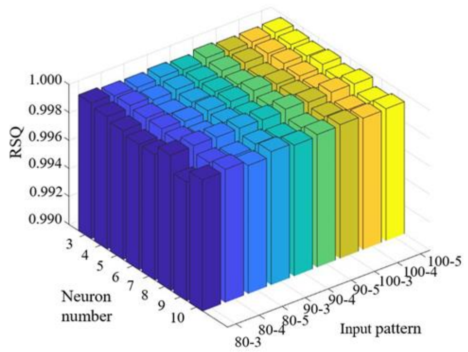

Fig.3 Result of simulation
(Input delay 5, Output delay 5, Learning number 200)