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A Self-Organizing Decision Making System for AUVs -First report: A Control System using Self-Organizing Map-

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Summary: Autonomous Underwater Vehicles (AUVs) are attractive tools for maintenance of underwater structures and oceanography, however, there are a lot of problems to be solved such as motion control, acquisition of sensor data, decision-making, navigation without collision, self-localization and so on. In order to realize useful and practical robots, underwater vehicles should take their action by judging the changing condition from their own sensors and actuators, and are desirable to make their behavior, to adapt to the working environment. We have been investigated the application of brain-inspired technologies such as Neural Networks (NNs), Self-Organizing Map (SOM), etc, into AUVs. The motion of AUV is represented by complicated non-linear dynamics in six degrees of freedom with added-mass and hydrodynamic forces, and control systems should be adaptive and robust. In our previous adaptive control method using NNs, a time series of state variables and control signals should be fed into the control system in order to adapt the change of dynamic property and environment, therefore, the obtained information in the previous adaptation is getting less gradually. If the environment of the robot is rapidly changed, the previous control system takes time to adapt new environment and former environmental information does not remain correctly. Therefore, a new method, which keeps the information of initial state or previous environment and adapts to new environment, should be developed to improve the efficiency of the learning and reduce the learning cost with the use of the former environmental information which the robot had already learned. A new self-organizing decision making system for AUVs using modular network Self-Organizing Map (mnSOM) proposed by Tokunaga et. al. is discussed in this paper. The proposed decision making system is developed using recurrent NN type mnSOM. The efficiency of the system is investigated through the simulations.

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