

SHORT COMMUNICATIONS

DUAL-DYNAMICS BASED GENERATIVE INTERFACE

Yoshihiro MIYAKE

Tokyo Institute of Technology
Dept. of Computational Intelligence and Systems Science,
Interdisciplinary Graduate School of Science and Engineering
Tokyo Institute of Technology
4259 Nagatsuta, Midori-ku, Yokohama, 226-8502, Japan
E-mail: miyake@dis.titech.ac.jp, URL: <http://www.myk.dis.titech.ac.jp>

What is the most difficult problem to realize interface between human and agent? It is probably the fact that human is not a separable and static environment for the agent. Especially mutual interference between them is the most essential difficulty, and similar situations are widely observed in human communication process. However, since conventional framework of cybernetic approach, such as master-slave system, is based on one-sided action, it cannot be applicable to these mutually interfering situations.

In former studies, observation of agent is regarded as an identification of environment. In other words, agent optimize its internal state under fixed constraints corresponding to static environment, and it has been approximately modeled as a minimizing process of potential under fixed potential field. Even in the computational theory of brain, such as regularization theory, similar framework was used. Therefore, in this study, we extend this conventional framework to the mutual interference. Under this situation, the agent should identify internal state of itself and state of environment from one dynamical relationship. This is a kind of ill-posed problem, and the agent should generate some hypothetical constraints to interpret such interference.

However, it has not been clarified how to generate such constraints by the agent. Thus, we propose "duality model" based agent, which is composed of dual-dynamics, and its fundamental structure is based on our previous studies in biological pattern formation and biological time generation. In the model, one dynamics is to self-organize dynamical coherence in mutual interference between the agent and its environment, and the other is to separate the coherent relation into two one-sided actions by using internal model. Through mutual constraint between these two dynamics, the agent generates hypothetical internal model to be relevant to its own historical process of the mutual constraint.

Using this framework, temporal development in two agents was investigated as a generation process of interface. Furthermore, it was realized in cooperative behavior between human and machine, especially, walk support robot, which achieves

synchronized walk with desired phase relationship, is constructed as an example. This kind of design principle could provide a new framework for human interface and human communication. In this presentation, the dual-dynamics model is explained in detail, and the results obtained in simulations and experiments are shown.