

Developing a Dividual Model Using a Modular Neural Network for Human-Robot Interaction

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Abstract

Currently, in the field of human-robot interaction (HRI), robots have a problem that can only interact the same at all times with humans. In this paper, therefore, we introduce the concept called a dividual and build a model of the dividual to grow through interactions with others. In addition, using a modular neural network and reinforcement learning (actor-critic), we confirmed the process to choose an appropriate dividual out of plural dividuals.

Keywords: Model of dividual, Human-robot interaction, Robot, Modular neural network, Reinforcement leaning.

1. Introduction

In recent years, many types of robots have been developed and successfully applied to a variety of fields, such as medical care and disaster relief. And robots are getting into life place without realizing^{1,2,3}. For example, a voice recognition agent using artificial intelligence technique on a smart phone, and a humanoid communication robot manufactured by a major communication company. In Japan, Prime Minister Abe added “robot revolution” to economic growth strategy⁴.

Currently, in the field of human-robot interaction (HRI), robots have a problem that they can only interact with humans in a stereotypical way. Humans can however change correspondence depending on a human to be interacted, and realize a variety of interactions (communications). On conventional interaction between humans and robots, robots receive unilateral orders by performing prearranged movement and utterance from humans, and perform given tasks^{5,6,7,8,9}. This cannot

however realize robots which live together and support humans.

As one of researches on HRI, Kojima tried to have a mind like human for building a social relationship and proposed a model of development to obtain communication skills through social interactions¹⁰. Shibata made robots play a role in human society. Then he developed a seal-shaped robot and reported that elderly people get pleasure and spiritual comfort through physical interactions such as touching and petting¹¹. Naya et al. also presented a system dealing with haptic interactions between humans and robots¹².

In the present paper, in the field of HRI, we develop a dividual model to grow through interactions with others. Then, we introduce a concept of dividual that it is formed into a self with respect to another human through repetitive communications with others^{13,14,15}. Individual cannot divide anymore whereas dividual can divide into plural ones. We use two machine learning techniques to construct the dividual model. Then, we confirm the process to choose an appropriate dividual out of plural dividuals when we appropriately prepare

