TRANSFER LEARNING BASED ON FORBIDDEN RULE SET IN ACTOR-CRITIC METHOD

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Abstract. *In this paper, we aim to accelerate learning processes in actor-critic method. We proposed the effective transfer learning method, which reduces training cycles by using information acquired from source tasks. The proposed method consists of two ideas, the method to select a policy to transfer, and the transfer method considering the characteristic of each actor-critic parameter set. The selection method aims to reduce redundant trial and error that are used in the selection phase and the training phase. We introduce the forbidden rule set, which are detected easily in the training phase, and concordance rate that measures an effectiveness of a source policy. The transfer method aims to merge a selected source policy to the target policy without negative transfers. It transfers only reliable action preferences and state values that implies preferred actions. We show the effectiveness of the proposed method by simple experiments. Agents found effective policies from the database, and finished their training with less or same episodes than the original actor-critic method.*
Keywords: Reinforcement learning, Actor-critic method, Transfer learning

1. **Introduction.** Reinforcement learning [1] is widely used for optimization problems, for example, object manipulation problems, path search problems. Agents acquire a policy which accomplishes the target task autonomously. Many researchers try to improve reinforcement learning algorithms: reinforcement learning in noisy environment [2], cooperative reinforcement learning for multi agent [3], and so on.

Acceleration of learning processes is one of important issues in reinforcement learning [1, 4]. In reinforcement learning, agents has no information "How to solve a target task" at the beginning of their training, they should get the information from the environment by trial and error. It requires long learning processes to get enough information. Though many researchers try to accelerate learning processes [5, 6, 7], however, there are not decisive methods.

Transfer learning [8] is one of effective methods to accelerate learning processes in some machine learning algorithms. It is based on the ideas that knowledge to solve source tasks accelerate a learning process of a target task. In reinforcement leaerning, knowledge for a source task is called as a source policy. Agents acquire various source policies by training many source tasks one by one, extracts effective information from one or more source policies, and applies the information to the target task. The agent does not need to learn from scratch.

Important processes in transfer learnings for reinforcement learning are selection of effective source policies and training based on the selected policies. Mistakes in these processes make the transfer learning ineffective. Ineffective selected policies would slow