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CURIOSITY-DRIVEN MULTI-AGENT COMPETITIVE AND COOPERATIVE LDA LEARNING

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Abstract. *This paper presents a novel multi-agent competitive and cooperative learning method using curiosity-based incremental linear discriminant analysis (cILDA). The curiosity in psychology here is modelled mathematically as a discriminability residue in-between instance space and its corresponding eigenspace. As learning proceeds, the curiosity of an individual agent updates over time as a result of two incremental learning processes: One updates the characterization of eigenspace and another re-calculates the curiosity; local agents compete at every learning stage and cooperate to discover the discriminant characterization of the entire pattern at the final stage. In the experiment, we describe how the significantly discriminative instances could be selected based on the curiosity. We also compare independent versus cooperative learning over classification problems with different levels of information redundancy. The experimental results show that the proposed curiosity learning performs gracefully under different levels of redundancy, and the proposed multi-agent competitive and cooperative learning system is capable of learning fewer instances, but has more often an improved discrimination performance.*

Keywords: Multi-agent cooperative learning, Curiosity, Instance selection, Linear discriminant analysis, Incremental LDA agent

1. **Introduction.** As far as conventional intelligent systems are concerned, development has been inadequate on those systems to initiate an action according to internal conditions. This study proposes to embed intrinsic motivation, a psychological concept, into a system in which external information and internal conditions will be integrated to induce some action. Specifically, we focus on curiosity, the central concepts of intrinsic motivation as the curiosity, to achieve effective incremental learning by collecting discriminative information only [1, 2]. Curiosity is classified into two categories: diversive curiosity and specific curiosity. Diversive curiosity refers to the curiosity that is aroused when one is bored or hungry for information. These exhibiting diversive curiosities seek information broadly without any distinct focus or direction. Specific curiosity is aroused when new information cannot be readily incorporated into, or it conflicts with, one's existing cognitive structure.

For supervised machine learning for class discrimination, the Linear Discriminant Analysis (LDA) for example [3, 4, 28, 29] seeks a transformation towards a maximum separation between classes and minimum separation within classes. The LDA has assumed that the