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Abstract:

There are three different types of AI systems that are capable of distributed machine learning: artificial neural networks, rule-based systems, and multi-agent systems. Up to now learning in each of these system types has been studied separately. As a consequence, nothing is known about basic relations and connections between artificial neural learning, rule-based learning and multi-agent learning. This dissertation aims at overcoming this separation and laying the foundation for an integrated perspective of distributed machine learning.

Two general principles of distributed machine learning are proposed:

- the principle of distributed action-oriented learning according to which learning is based on system-internal estimates of the usefulness of the actions carried out by the system components
- the principle of distributed organizational learning according to which learning is based on the development of system-internal organizational structures imposed on the system components.

The establishment of these principles was largely supported by observations made on available work on artificial neural learning. It is argued that both principles are or can be realized in each of the three system types under consideration. This includes examining considerations on existing approaches to learning in artificial neural networks and the description and analysis of several new action-oriented and organizational approaches to learning in rule-based systems and multi-agent systems.

## Table of Contents:

Abstract .....	i
Zusammenfassung .....	iii
Acknowledgements .....	v
List of Tables .....	ix
List of Figures .....	xi
List of Abbreviations .....	xiii
<b>I Introduction .....</b>	<b>1</b>
1 The Problem Addressed .....	3
2 Research Objective, Methodology, and Related Work .....	5
3 Dissertation Overview .....	7
<b>II Foundations .....</b>	<b>11</b>
4 Centralized and Distributed Machine Learning .....	13
5 Distributed Learning Systems in AI .....	19
5.1 Artificial Neural Networks .....	19
5.2 Rule-Based Systems (Classifier Systems) .....	21
5.3 Multi-Agent Systems .....	27
6 Principles of Distributed Machine Learning .....	31
6.1 The Principle of Action-Oriented Learning .....	31
6.2 The Principle of Organizational Learning .....	32
<b>III Distributed Action-Oriented Learning .....</b>	<b>35</b>
7 Realization in Artificial Neural Networks .....	37
8 Realization in Rule-Based Systems .....	39
8.1 The Algorithms ABB1, ABB2 and APSP .....	39
8.1.1 Motivation .....	39
8.1.2 Description .....	40
8.1.3 Analysis .....	44
8.2 Chapter Summary and Discussion .....	56
9 Realization in Multi-Agent Systems .....	59
9.1 The Algorithms ACE and AGE .....	59
9.1.1 Motivation .....	59
9.1.2 Description .....	61

9.1.3	Analysis .....	64
9.2	Chapter Summary and Discussion .....	68
<b>IV</b>	<b>Distributed Organizational Learning .....</b>	<b>71</b>
10	Realization in Artificial Neural Networks .....	73
11	Realization in Rule-Based Systems .....	79
11.1	The Algorithm HCA .....	79
11.1.1	Motivation .....	79
11.1.2	Description .....	80
11.1.3	Analysis .....	83
11.2	Chapter Summary and Discussion .....	88
12	Realization in Multi-Agent Systems .....	91
12.1	The Algorithm DFG .....	91
12.1.1	Motivation .....	91
12.1.2	Description .....	92
12.1.3	Analysis .....	97
12.2	Chapter Summary and Discussion .....	104
<b>V</b>	<b>Conclusions .....</b>	<b>107</b>
13	Summary, Main Contributions, and Discussion .....	109
14	Research Directions .....	113
	 Bibliography .....	 115
	Keyword Index .....	127