

UNIVERSITY OF CAMERINO
SCHOOL OF SCIENCE AND TECHNOLOGY
MASTER DEGREE IN COMPUTER SCIENCE



Clustered Federated Deep Reinforcement Learning with Selective Aggregation

A Framework for Chess Playstyle Preservation

Supervisor

Prof. Massimo Callisto De Donato

Student

Francesco Finucci

Co-Supervisor

PhD. Student Martina Zannotti

Abstract

This thesis explores the application of federated learning to reinforcement learning in the domain of chess. We investigate how multiple distributed agents can collaboratively learn chess strategies while maintaining data privacy and reducing centralized computational requirements.

Contents

1	Introduction	6
1.1	Motivation	6
1.2	Research Questions	6
1.3	Contributions	6
1.4	Thesis Structure	6
2	Background and Related Work	7
2.1	Reinforcement Learning	7
2.2	Federated Learning	7
2.3	Chess Engines and AI	7
2.4	Related Work	7
3	Methodology	8
3.1	Problem Formulation	8
3.2	Proposed Approach	8
3.3	System Architecture	8
4	Implementation	9
4.1	System Design	9
4.2	Technologies Used	9
4.3	Challenges	9
5	Experimental Setup	10
5.1	Experimental Design	10
5.2	Datasets and Benchmarks	10
5.3	Hyperparameters	10
6	Results and Discussion	11
6.1	Results	11
6.2	Analysis	11
6.3	Discussion	11

7 Conclusion	12
7.1 Summary	12
7.2 Contributions	12
7.3 Future Work	12
A Additional Material	14

List of Figures

List of Tables

Chapter 1

Introduction

1.1 Motivation

1.2 Research Questions

1.3 Contributions

1.4 Thesis Structure

Chapter 2

Background and Related Work

2.1 Reinforcement Learning

2.2 Federated Learning

2.3 Chess Engines and AI

2.4 Related Work

Chapter 3

Methodology

3.1 Problem Formulation

3.2 Proposed Approach

3.3 System Architecture

Chapter 4

Implementation

4.1 System Design

4.2 Technologies Used

4.3 Challenges

Chapter 5

Experimental Setup

5.1 Experimental Design

5.2 Datasets and Benchmarks

5.3 Hyperparameters

Chapter 6

Results and Discussion

6.1 Results

6.2 Analysis

6.3 Discussion

Chapter 7

Conclusion

7.1 Summary

7.2 Contributions

7.3 Future Work

Bibliography

Appendix A

Additional Material