CARLOS ALBERTO MAZIERO

UM MODELO LaTeX PARA DISSERTAÇÕES E TESES (ESCREVI UM TÍTULO MAIS LONGO PARA VER COMO SE COMPORTA A QUEBRA DE LINHAS E O ESPAÇAMENTO ENTRE ELAS)

(*pre-defense version, compiled at August 7, 2024*)

Tese apresentada como requisito parcial à obtenção do grau de Doutor em Ciência da Computação no Programa de Pós-Graduação em Informática, Setor de Ciências Exatas, da Universidade Federal do Paraná.

Área de concentração: *Computação*.

Orientador: Donald Knuth.

Coorientador: Leslie Lamport.

CURITIBA PR

2018

RESUMO

O resumo deve conter no máximo 500 palavras, devendo ser justificado na largura da página e escrito em um único parágrafo[1] com um afastamento de 1,27 cm na primeira linha. O espaçamento entre linhas deve ser de 1,5 linhas. O resumo deve ser informativo, ou seja, é a condensação do conteúdo e expõe finalidades, metodologia, resultados e conclusões.

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Palavras-chave: Palavra-chave 1. Palavra-chave 2. Palavra-chave 3.

[1] E também não deve ter notas de rodapé; em outras palavras, não siga este exemplo... ;-)

ABSTRACT

The abstract should be the English translation of the “resumo”, no more, no less.

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Keywords: Keyword 1. Keyword 2. Keyword 3.

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LIST OF ACRONYMS

3DSSL	3D Soccer Simulation League
RL	Reinforcement Learning
ML	Machine Learning
DINF	Departamento de Informática
UFPR	Universidade Federal do Paraná

LIST OF SYMBOLS

α	alfa, primeira letra do alfabeto grego
β	beta, segunda letra do alfabeto grego
γ	gama, terceira letra do alfabeto grego
ω	ômega, última letra do alfabeto grego
π	pi
τ	Tempo de resposta do sistema
θ	Ângulo de incidência do raio luminoso

CONTENTS

1 INTRODUCTION

Robocup is an international initiative that promotes scientific advances on robotic intelligence through competition, the initiative is divided into several different leagues, each one with it's own set of problems and focus, the subject of our work is the 3D Soccer Simulation League (3DSSL) who provides a simulated enviroment, physics and humanoid robots.

Within 3DSSL rich environment and tools, the challenge focused in this work is motor control of the humanoid robot in several tasks utilizing Reinforcement Learning (RL) as the training method. RL is a machine learning technique inspired by the natural idea of learning by trial-and-error, selecting actions that maximizes the reward.

Since RL is heavily dependent on sample size, the simulated environment is a cheap and efficient way of generating a great quantity of data when compared to real life, as it can lean on paralelism, can run faster than real-time, does not depend on an external agent to restart the task if the robot falls and the only hardware needed is the computer to run the simulation.

The 3DSSL current league champion is the *FC Portugal* team, as it was shown in (Abreu et al., 2023) they were able to successfully train the agent in a skill-sets such as *sprint-kick* and *locomotion* that allowed the agents to perform in the competition. All the skills are represented by one or two neural network policies trained by RL.

The codebase for the *FC Portugal* provides a strong foundation to develop new skills and behaviors, so it was utilized and modified to train the agent to achieve our goals.

1.1 OBJECTIVE

This study aims to showcase how RL performs in training a policy to perform a long-jump skill.

1.2 STUDY OUTLINE

2 BACKGROUND

This chapter reviews the literature

2.1 REINFORCEMENT LEARNING

2.2 PROXIMAL POLICY OPTIMIZATION

2.3 3D SIMULATION LEAGUE

3 RELATED WORK

This chapter shows related work

3.1 EXAMPLE

4 RELATED WORK

This chapter shows related work

4.1 EXAMPLE

5 RELATED WORK

This chapter shows related work

5.1 EXAMPLE

6 RELATED WORK

This chapter shows related work

6.1 EXAMPLE

REFERENCES

Abreu, M., Reis, L. P., and Lau, N. (2023). Designing a skilled soccer team for robocup: Exploring skill-set-primitives through reinforcement learning. *arXiv preprint arXiv:2312.14360*.