Model-based Reinforcement Learning in Computer Systems

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Declaration

I, Sean J. Parker of Clare Hall, being a candidate for the M.Phil in Advanced Computer Science, hereby declare that this report and the work described in it are my own work, unaided except as may be specified below, and that the report does not contain material that has already been used to any substantial extent for a comparable purpose.

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Abstract

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Introduction

Chapter 2

Background and Related Work

In this chapter, we detail the background and prior research that underpins the work described in later chapters. Further, we include an explanation of the theoretical concepts, both reinforcement learning and graph neural networks, which we have used extensively in this work.

2.1 Approaches to optimising deep learning models

Over the past decade, there has been a rapid development of various deep learning architectures that aim to solve a specific task. Common examples include convolutional networks (popularised by AlexNet then ResNets, etc), transformer networks that have seen use in the modelling and generation of language. Recurrent networks that have shown to excel at learning long and short trends in data.

Importantly, the fundamental building blocks of the networks have largely remained unchanged. As the models become more complex, it becomes untenable to manually optimise the models to reduce the execution time on hardware. Therefore, there is extensive work in ways to both automatically

optimise the models, or, alternatively apply a set of hand-crafted optimisations.

2.2 Reinforcement Learning

2.2.1 Model-Free

2.2.2 Model-Based

2.2.3 Comparison

2.3 Graph Neural Networks

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