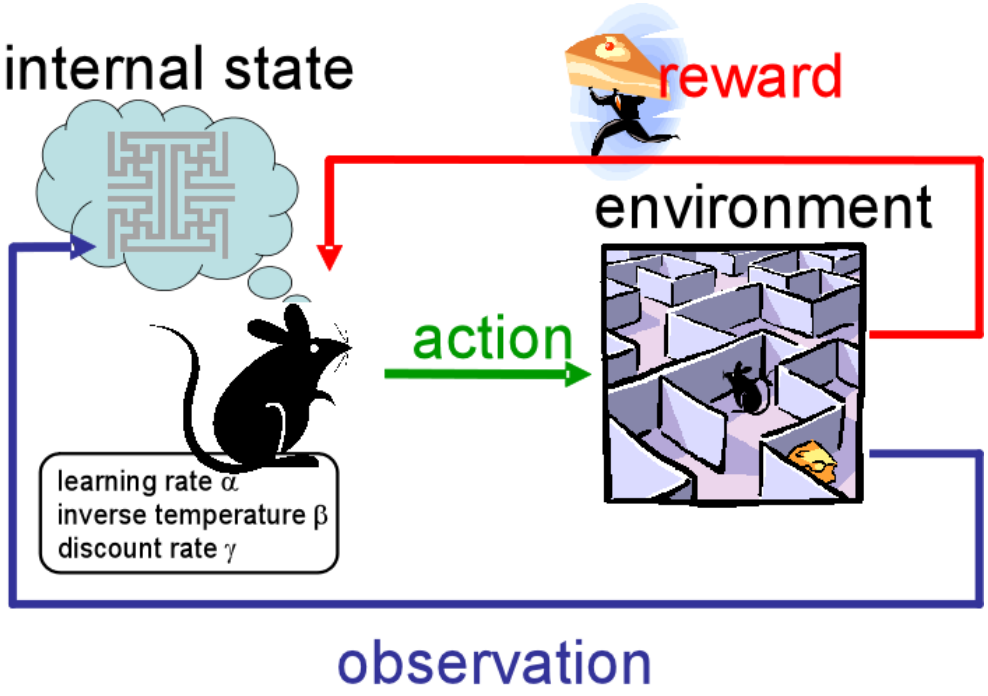
Aarhus University Department of Engineering 2017

Thesis

Title of project



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Contents

Chapter 1

Introduction

Getting in touch with the most promising and hottest topic in artificial intelligence represents a challenge

To be continued...

Chapter 2

Theoretical Background and State of the Art

2.1 Theoretical Background in Reinforcement Learning

Reinforcement learning is an approach in artificial intelligence for goal-directed learning from interaction, which makes it different from the other approaches in machine learning.

2.2 Previous Research

This section summarizes four important papers, which all have made a big impact in the area of deep reinforcement learning. Each paper is described with the important concepts in the represented paper. It will give a overview of state of the art in the area of deep reinforcement learning.

2.2.1 Playing Atari with Deep Reinforcement Learning

This paper was published in 2013 by DeepMind Technologies. It is the first paper to make a deep learning model to successfully learn control policies directly from sensory input using reinforcement learning.

The paper present some of the challenges by using deep learning to do reinforcement learning. One of the challenges is deep learning algorithm requires large amount of handlabelled training data. Another challenge is the delay between action and resulting reward, which can be thousands timesteps long.The paper demonstrates that a convolutional neural network can overcome these challenges.

The goal is to connect a reinforcement learning algorithm to a deep neural

network which uses RGB images and process training data by using stochastic gradient update. The starting point for this approach is to use Tesauro's TD-Gammon (link) architecture. The network is different from TD-Gammon and other online approaches, because it uses a technique known as experience replay, where the agent store the agents experiences at each time-step.

The input to the neural network is an $84x84x4$ image. The output from the neural network is a single output for each valid actions. The architecture of the network can be seen on Figure 2.1

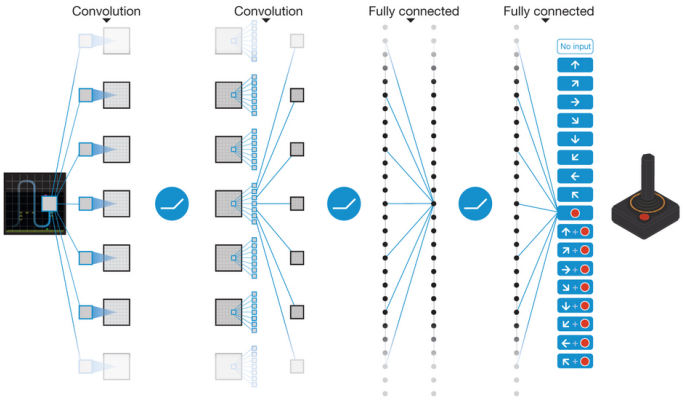

Figure 2.1: *The arhitecture of the network used in the article "Playing Atari with Deep Reinforcement Learning"*

This network is tested on seven Atari games, and the approach in this paper gave state-of-the-art result in six of the seven games. Finally it showed better performance than a expert human player in three out of the seven games.

2.2.2 Go 2016

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2.2.3 A3C 2016

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2.2.4 Framework 2017

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Chapter 3

Project Framework

This project is about learning a car or robot to control and navigate it self. This should be done so the robot don't hit walls or obstacles. To do this a system is created. This system is created as inspiration from [1]
Can be seen on Figure 3.1.

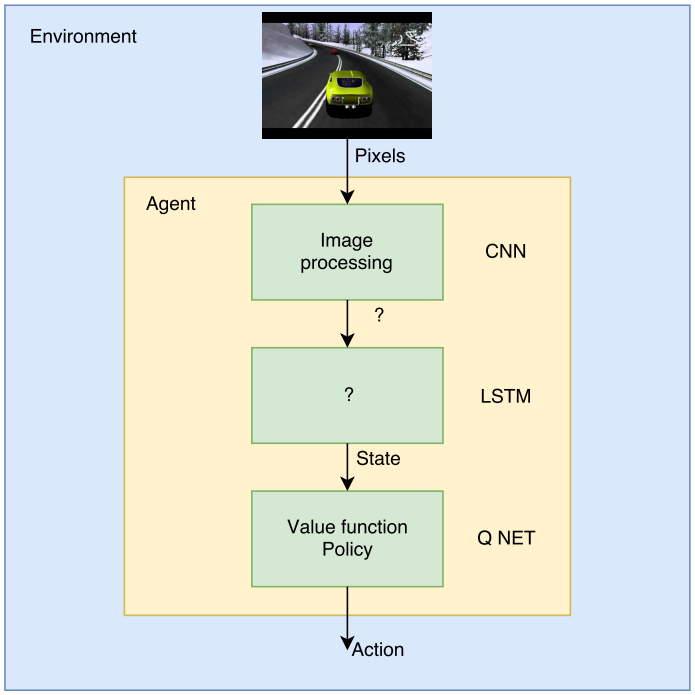

Figure 3.1: *The block diagram of the system*

3.1 Convolution Neural Networks

CNN is here

3.2 Recurrent Neural Networks

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3.2.1 Long Short Term Memory

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Bibliography

[1] V. Mnih, A. P. Badia, M. Mirza, A. Graves, T. P. Lillicrap, T. Harley, D. Silver, and K. Kavukcuoglu, "Asynchronous methods for deep reinforcement learning," *CoRR*, vol. abs/1602.01783, 2016. [Online]. Available: http://arxiv.org/abs/1602.01783