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A SURVEY OF THE POTENTIALS OF MODEL-BASED REINFORCEMENT LEARNING ALGORITHMS IN MEDICINE

Abstract

Contemporary reinforcement learning research teams have made remarkable progress in games and comparatively less in the medical field. Most recent implementations of reinforcement learning are focused on model-free learning algorithms as they are relatively easier to implement. This paper seeks to present model-based reinforcement learning notions, and articulate how model-based learning can be efficient in medical image processing in juxtaposition to model-free learning.

Introduction

Medical Image processing is vital in professional diagnosis. Doctors are able to identify the nature of an ailment in a matter of minutes simply by examining a computed tomography or a magnetic resonance imaging scan result. A cancer diagnosis based on computed tomography scan is potentially wrong by a thirty percent average [1]. This leads to misdiagnosis and improper prescriptions for patients. Reinforcement learning proffers means to ameliorate medical image processing, there by mitigating misdiagnosis.

Model-based Reinforcement learning

Reinforcement learning has encountered remarkable progress in the course of the new millennia, attaining homo sapiens level performance in several domains including Atari games, the ancient game of Go and Chess [2]. Model-based reinforcement learning is at the fore front of social robotics advancement, but little attention is shown to this concept in the medical sphere.

Most decision making process in the medical field are sequential. Needing multiple test results and practical diagnosis session to understand the nature of the ailment a patient is afflicted with. The progressive transition of diseases are often ignored by most machine learning models implemented in medicine, the doctors also have little perception as to the nature of the conditional transition of an ailment, except from experience. Taking Covid-19 into consideration, it was months before any research team could come up with a theory as to how the virus developed, its metamorphosis in a host and how to treat it. Using model-based reinforcement learning, it is perfectly feasible to model an environment, in this case, that is afflicted with a certain medical condition, an agent which performs different actions on the environment, and the set of actions being any potential treatments for the affliction. In terms of medical image analysis, a computed tomography (CT) scan or a magnetic resonance imaging (MRI) scan produce a 3d image of soft tissues, bones and other detailed images of the inside of the body, a deep model-based reinforcement learning technique can ameliorate diagnosis based on these scans, by learning from existing data collected using fixed strategies. In model-free learning the algorithms typically learn by trail and error strategies, this method exposes the patient to life threatening risk, model-based reinforcement learning on the other hand utilises a virtual environment where the agent can run proposed actions under supervision.

References.

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