

Project Brief

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1 Problem

When computer programs are too large, difficult or time consuming to be run on a normal computer, these programs are often offloaded to cloud providers like Google Cloud Platform, Amazon Web Service, Microsoft Azure and many more. These providers all allow customers to individually request a set of resources to compute their program with. However, this can create a bottleneck on certain resource preventing other jobs from running with this fixed requirement model. This project considers the case where users don't request a set amount of resources but rather the user details the total requirements for the program and a deadline for when the program must be finished. This then means that the cloud provider can effectively balance resource demands as it has complete knowledge of its different user's requirements, allowing more jobs to run simultaneously and lower price as there can be a lower overall demand of individual resources.

This research is being done in conjunction with the DAIS ITA project with previous work done by myself, Dr Sebastian Stein and a team from Pennsylvania State University. The difference between the prior work done and this proposed work is to introduce the idea of time more fully into the problem case. Where previously, all jobs would arrive at the beginning of the program and the resources speeds allocated would be fixed for the rest of the program, in this work, jobs will arrive over time and at each time step then the resource speeds allocated can change.

To do this, I believe that I will have to create two algorithms, the first to evaluate a price to charge jobs for running on the cloud provider and second to know how to allocate resources for each jobs currently allocated to the cloud provider at a given time step.

2 Goals

The goal of the project is to apply reinforcement learning to solve the two problem stated above. This is because to the two functions above are too complex for humans to describe effectively and I believe that a universal function approximation will be able to learn them over time through the use of a reward function based on the revenue caused by finishing a job.

3 Scope

The scope of this project is to investigate the use of reinforcement learning in solving this program and if time allows compare to greedy or handcrafted algorithms. We will test the effectiveness of these algorithms through synthetic data and real world data from a google data center.