Google’s DeepMind AI learning to walk

Playing Pacman
Container Scaling with Deep Reinforcement Learning

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Related Work

PRedictive Elastic reSource Scaling (PRESS)

FFT
AGILE
### Related Work using Reinforcement Learning

Dutreilh et al. use an appropriate initialization of the Q-values to obtain a **good initial policy** for autonomic resource allocation in clouds. They also achieve convergence speedups.

Arabnejad et al. compare two different reinforcement learning approaches: fuzzy **Q-learning** (FQL) and fuzzy **SARSA learning** (FSL) for fuzzy cloud auto-scaling.

Tesauro et al. combine SARSA learning approach and **queuing network model** to build a hybrid learning system capable of making resource allocation decisions based on application workload and response time.
Related Work using Deep Reinforcement Learning

System Overview

Container Scaling with Deep Reinforcement Learning

- Deep Neural Network Learning Module
- Reinforcement Learning Service
- Metrics Monitoring Module
  - Scaling Driver
- Scaling Module
- Virtual Machine
- Docker Containers
## Task list

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Introducing Reinforcement Learning

Reinforcement learning is learning what to do — how to map situations to actions — so as to maximize a numerical reward signal.
Why Reinforcement Learning?

1. Online adaptive unsupervised learning
2. Previous work using reinforcement learning to do auto-scaling successfully
Deep Reinforcement Learning

Deep Reinforcement Learning has been applied in many areas: e.g. Alpha Zero

![Graph showing Elo ratings for AlphaGo Zero 40 blocks, AlphaGo Lee, and AlphaGo Master.](image)
Deep Reinforcement Learning

Deep Neural Network will decide what best action is.
Benefits of Using Deep Reinforcement Learning

1. Possible speed up with GPU
2. Better accuracy with finer gain control and state of the art research in neural network.
Infrastructure overview

1. Containers are spanned on demand across VCL machines based on metrics.
2. Centralised controller that connects to all containers.
Why container?

1. Benefits of being lightweight. (precise decision making)
2. Most used technology these days in most cloud systems.
Centralised container

1. Helps to get metrics.
2. Running algorithm
3. Span new containers on demand.
Why VCL?

1. Considering our previous experience
2. Free for students