Notes

- 10:20 AM
- Iraq, A32, Atrium Side
- 15 Minutes
- w/ 5 Minutes Q&A
- 10% Quality of work
- 5% Quality of presentation

Cross-Game Generalisation Approaches for General Video Game Playing using Deep Reinforcement Learning

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Motivation & Background

Personal Interests

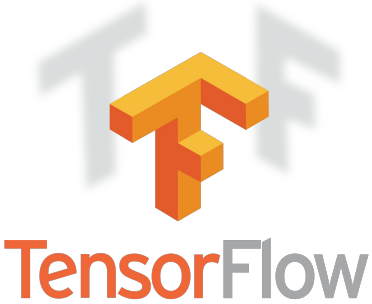
Games and AI

- Playing games
  - GameSoc
- AI
  - On the AI path
- Dissertation Project
  - Explored this area
  - Seen interesting ideas

GVGAI Competition

“explores the problem of creating controllers for general video game playing”

Familiarity w/ Machine Learning



- G53MLE
  - Brief intro to TF
- Complex topic
  - Warranted a deeper dive

Background

Game Playing and AI

- Board Games
  - Tic Tac Toe, Chess, Go
  - General Game Playing Competition
- Video Games
  - Atari, DotA 2, Starcraft II
  - GVGP

The Problem

GVGAI Tracks

- Single Player Planning
- 2-Player Planning
- Single Player Learning
- Level Generation
- Rule Generation

Game Playing Tracks

Same games different rules

- Planning
  - Current Game State
  - Forward Model
- Learning
  - Current Screen Image

Single Player Learning Track

Focuses on RL

- 3 Games
  - Levels 1, 2 - Training
  - Levels 3, 4, 5 - Validation
- OpenAI Gym Integration
  - Recent addition June 2018
  - Common RL framework

Approach

Reading

And some more reading

Deep Reinforcement Learning for General Video Game AI

Ruben Rodriguez Torrado* New York University New York, NY rt2564@nyu.edu

Philip Bontrager* New York University New York, NY philipjb@nyu.edu

Julian Togelius New York University New York, NY julian.togelius@nyu.edu

Jialin Liu Southern University of Science and Technology Shenzhen, China liujl@sustc.edu.cn

Diego Perez-Liebana Queen Mary University of London London, UK diego.perez@qmul.ac.uk

arXiv:1806.02448v1 [cs.LG] 6 Jun 2018

DRL shown to work ...

But only on individual levels and games

- Torrado et al. shown the GVGAI Gym framework works
  - Brand new framework
- Didn't show generalisation
  - Levels
  - Games
- Solid starting point

Replicate Results

On a single game and a single level

- Used A2C Advantage Actor Critic
  - Multiprocessing
- Worked as expected
  - Some successes
  - Some failures

Issues

Hurdles to allow cross game play

- Technical Issues
  - Fixed Input Size
  - Fixed Output Size
- Data Processing
  - Scaling Rewards
  - Removal of alpha channel

Fixed Size

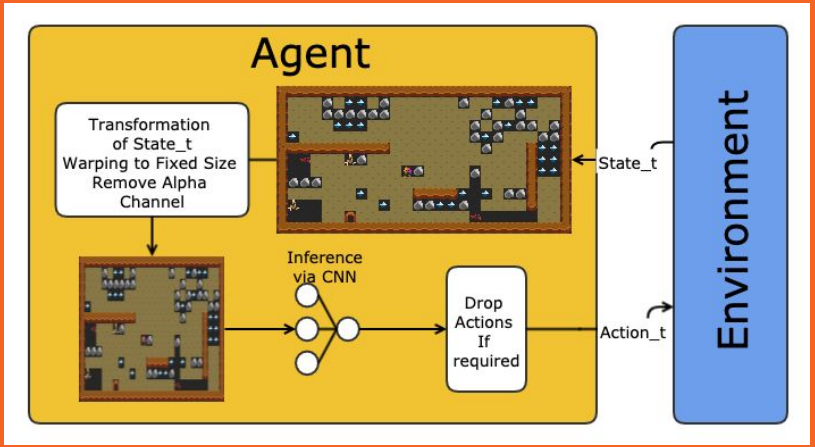
- CNN technically works on any size
- Multi-Layer Perceptron requires fixed sizes
- Process input to be predetermined size
- Ignore unacceptable actions from the output layer

Data Processing

Increasing the efficiency of learning

- Scaling rewards
  - Normalisation
- Removal of alpha channel
  - Dimensionality reduction
  - Performed after data analysis

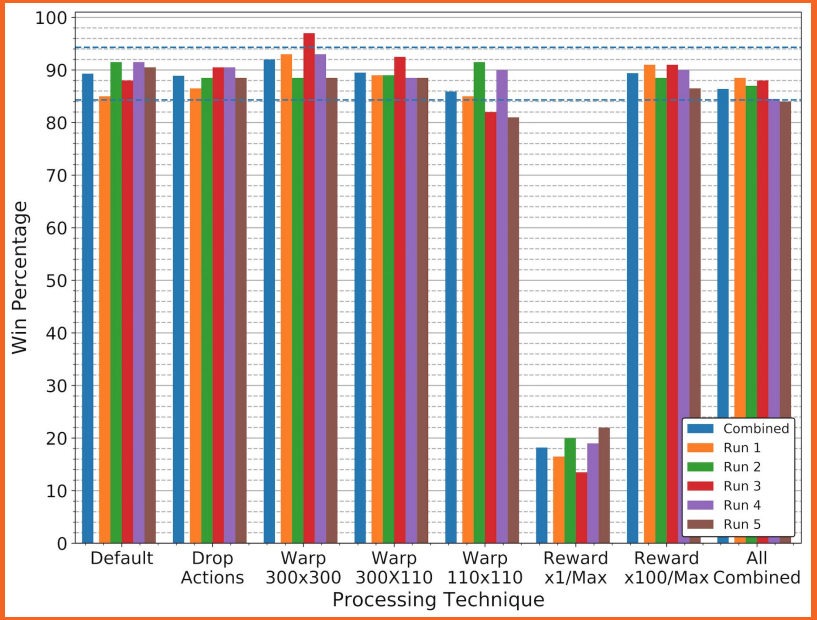
Agent Structure



Results and Conclusions

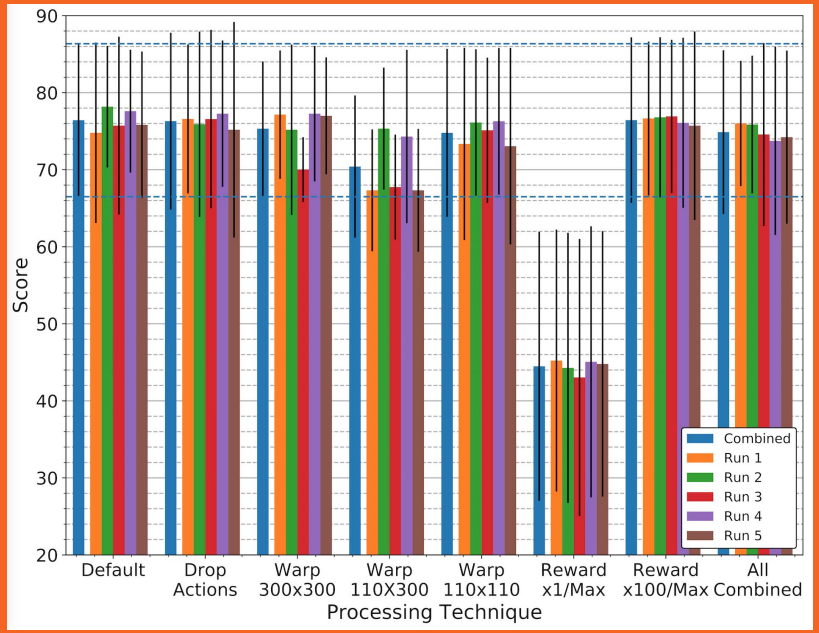
Processing Results

Win%



Processing Results

Score



GVGP Performance

Qualitative Results
Aliens

- Strong on training and validation
- Shots not 100% accurate
- Performs worse when aliens lower
  - Levels spawn from upper left
- Destroys barriers

GVGP Performance

Qualitative Results
Missile Command

- Weak on levels w/ blue missiles
  - Not in the training set
  - Simply ignores them
- Strong on final level
  - Very similar to first level
  - Increased difficult not an issue

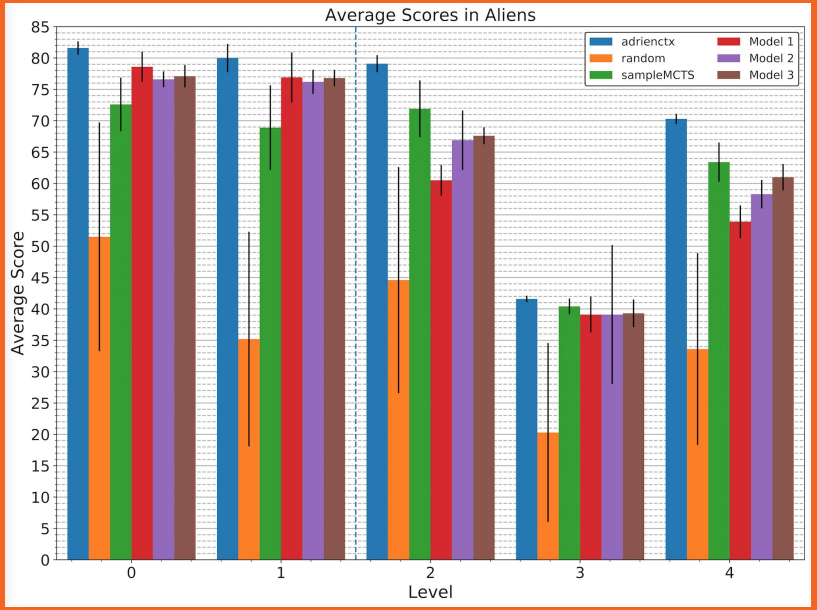
GVGP Performance

Qualitative Results
Boulderdash

- Gained high scores in training
- Struggled to win on any level
  - Win condition not tied to reward
- Appears to overfit training
  - Few random elements

GVGP Performance

Quantitative Results



Conclusions

- NN can work with minor modifications
- No forward model required
- Screen Observation is sufficient
- Fixed Inference time
- Not Explainable
- Expensive Computational Requirements

Future Work

- Improvements to training methods
- More sophisticated NN
  - Feed in temporal info
  - RNNs
- Transfer Learning
- Online Learning
- Procedural Content Generation
  - Data augmentation
- Submitted to IEEE CEC Competition
  - IEEE COG

Thank You
Q&A