Learning to Play Starcraft II by Mimicking the Pros: Style Extraction in Adversarial Games

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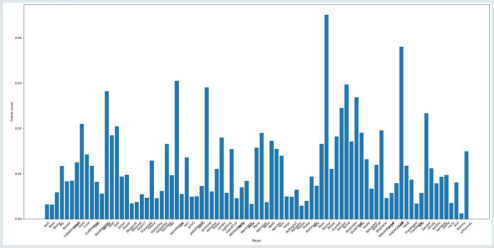
Problem

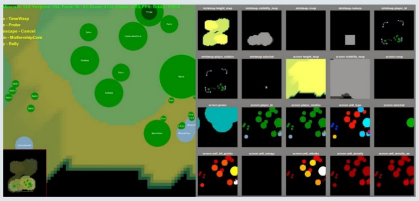
Pro Starcraft players must prepare for weeks in order to face difficult opponents, often devising novel strategies specifically to combat an opponent's particular play-style. Players then practice these strategies anonymously online to hone their advantage. Is it possible to determine a player's identity given a sample of their play?

Data



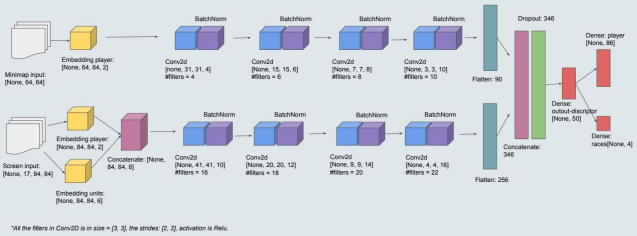
Training data was collected from the WCS Montreal 2018 and IEM Katowice 2018 Starcraft 2 tournaments, consisting of 86 individual pro players playing 884 games. A test set was created from the WCS Global 2018 finals, consisting of 16 players playing 72 total games.

Features



Features were extracted with the help of deepmind's PySC2. Categorical features are interpreted through one-hot embedding layers, Scalar features are interpreted as normalized inputs.

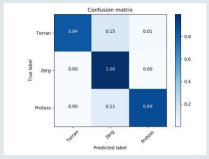
Models



*All the filters in Conv2D is in size = [3, 3], the strides: [2, 2], activation is Relu.

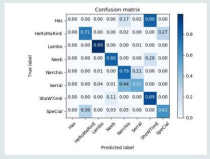
Dual-pathway networks are used to encode both screen features and minimap features. Multi-objective learning is used to force learning of subconcepts.

Results



	precision	recall	f1-score
Terran	1.00	0.84	0.91
Zerg	0.82	1	0.9
Protoss	0.99	0.89	0.93

Predicting races



	precision	recall	f1-score
Has	0	0	0
eRoMaRinE	0.31	0.71	0.43
Lambo	0.5	0.99	0.67
Neeb	0.11	0.8	0.19
Nerchio	0.09	0.79	0.16
Serral	0.64	0.51	0.57
ShoWTimE	0.33	0.89	0.48
SpeCial	0.56	0.61	0.58

Predicting players

Discussion

The styles of some players are very distinct (SpeCial, Lambo), whereas other players tend to have styles which are harder to distinguish (Has, ShoWTimE)

Future Work

- Can temporal information be used to encode strategy as well as style?
- Can a policy network be trained to imitate a style?

Reference

[1] PySC2 - A Starcraft 2 Learning Environment https://github.com/deepmind/pysc2/
[2] Starcraft 2 Machine Learning API https://github.com/Blizzard/s2client-proto
[3]**1702.06762:**Style Transfer Generative Adversarial Networks: Learning to Play Chess Differently. https://arxiv.org/abs/1702.06762
[4]**1708.04782:** StarCraft II: A New Challenge for Reinforcement Learning. https://arxiv.org/abs/1708.04782