Playing StarCraft II with reinforcement learning

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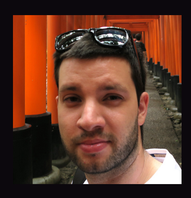
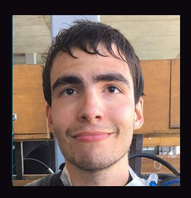

Carlos Roig

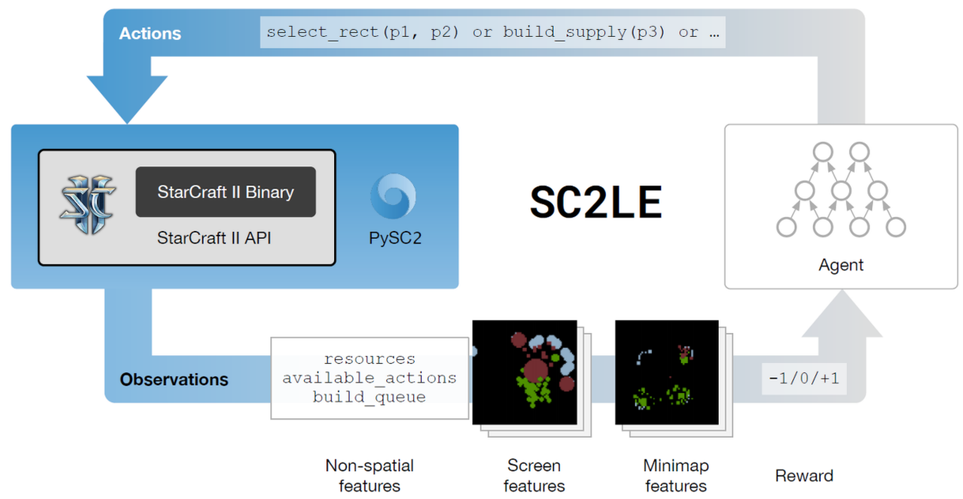

Alejandro Suárez

StarCraft II is real time strategy (RTS) game.
Defeating top human players therefore becomes a meaningful and measurable long-term objective.

Difficulties:

- Multi-agent problem
- Imperfect information game
- Wide range of actions
- Long term strategies

Environment: StarCraft 2 Learning Environment



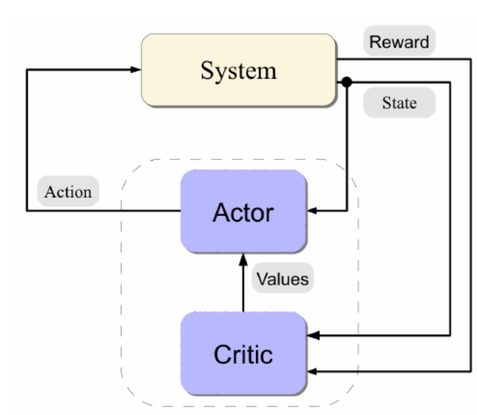
- Binaries of StarCraft2
- Starcraft II API
- PySC2: DeepMind's Python component of the StarCraft II Learning Environment (SC2LE). Uses TensorFlow.

Objectives:

- Training and evaluating a RL agent focused on small mini-games.
- Mini-game: Find and defeat Zerlings. This minigame consist in manage 3 marines in a map. They have to explore the map and find and destroy enemies (Zerlings)
- Experimentation with reward system
- Experimentation with hyperparameters

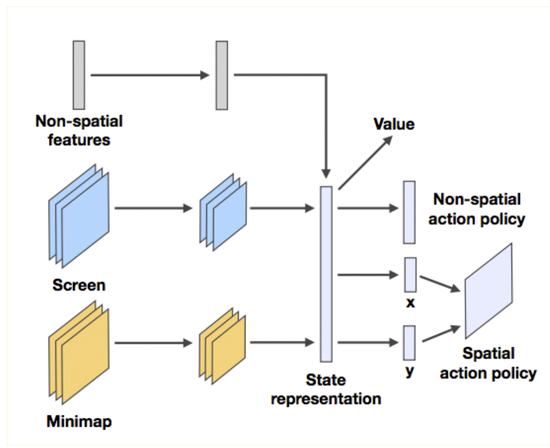
Implementation:

A3C algorithm



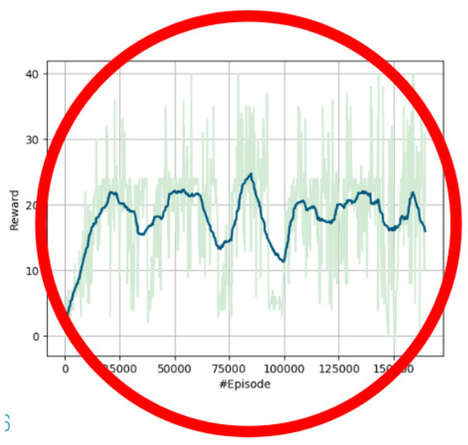
A3C is a policy based RL algorithm, in which the policy is encoded by a neural network that is shared and updated asynchronously by several parallel workers.

AtariNet Neural Network

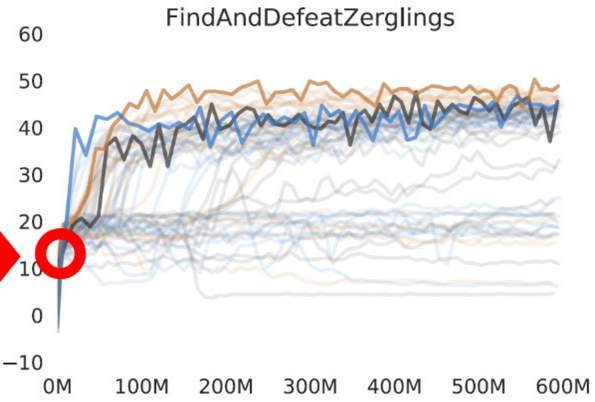


First experiment: comparison with Google Deepmind results

Our results

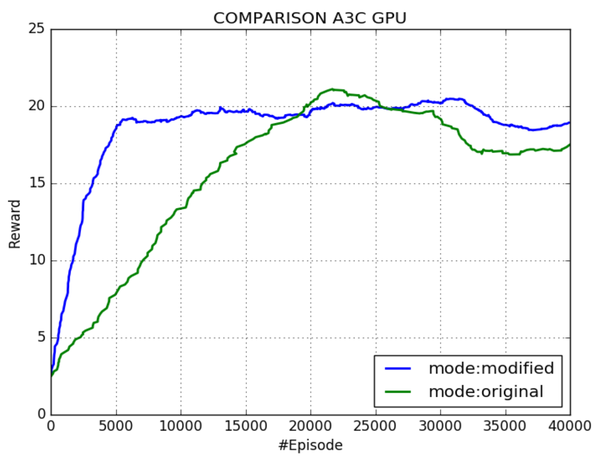


Deepmind results



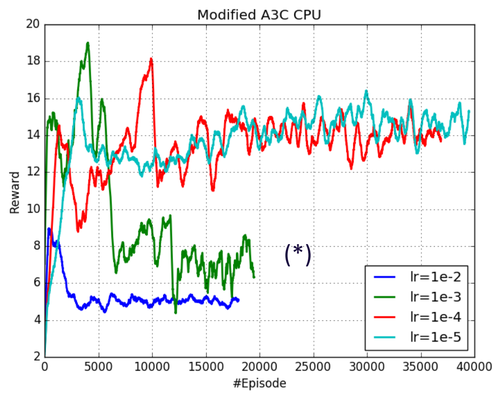
In order to achieve Deepmind results more simulations are needed. But is so expensive: in time (more than 63 years of simulations with our setup) and in cash (640k $ in Google fees)

Second experiment: reward hacking



The agent with the modified reward learns faster than the original one.
It needs fewer iteerations to achieve similar rewards

Third experiment: learning rates



Optimal Learning Rate:

1e-4 / 1e-5

Bigger LR make the algorithm not converge

(*) Stopped early because of bad performance

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