COMPUTATIONAL APPLICATIONS TO POLICY AND STRATEGY (CAPS)

Session 3 – Building a Rule-Based StarCraft II Bot

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Outline

1. Recap
2. StarCraft II Gameplay
3. Strategy for CapsBot
4. Debrief
5. Required Software

Recap – Sarah Sewall on AI Ethics

- > Five year window for U.S. to build and implement holistic AI framework
- > Intersection of AI and IR demands nuanced and complex action
- > Need for collaborative platform and open debate on AI ethics and strategy
- > Strong demand for AI-international-x
- > Translating between engineers and policymakers considered valuable skill

Recap – Decomposing `WorkerRushBot`

```python
import sc2
from sc2 import run_game, maps, Race, Difficulty
from sc2.player import Bot, Computer

class WorkerRushBot(sc2.BotAI):
    async def on_step(self, iteration):
        if iteration == 0:
            for worker in self.workers:
                await self.do(worker.attack(self.enemy_start_locations[0]))

run_game(maps.get("Abyssal Reef LE"), [
    Bot(Race.Terran, WorkerRushBot()),
    Computer(Race.Protoss, Difficulty.Medium)
], realtime=True)
```

load source components

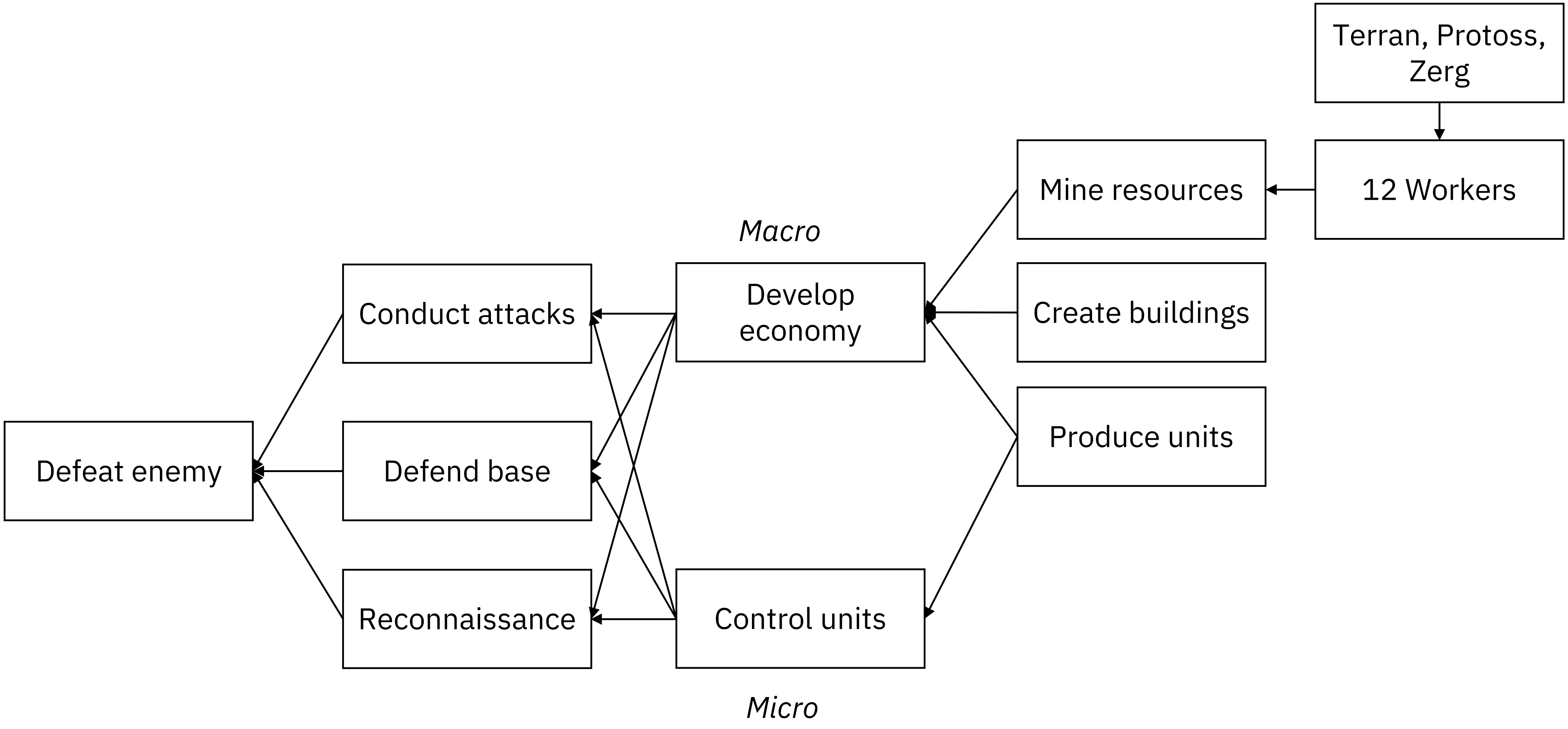
create bot and specify operations

initialize game environment and execute bot

Goals

- Write `CapsBot` ~100 lines of code to defeat hard built-in AI
- Conceptualize the performance of `CapsBot`
  - Decision-making under uncertainty
  - Predictability
  - Operational constraints

StarCraft II Gameplay – Overview



Terran, Protoss, Zerg

12 Workers

Mine resources

Create buildings

Produce units

Macro

Develop economy

Control units

Micro

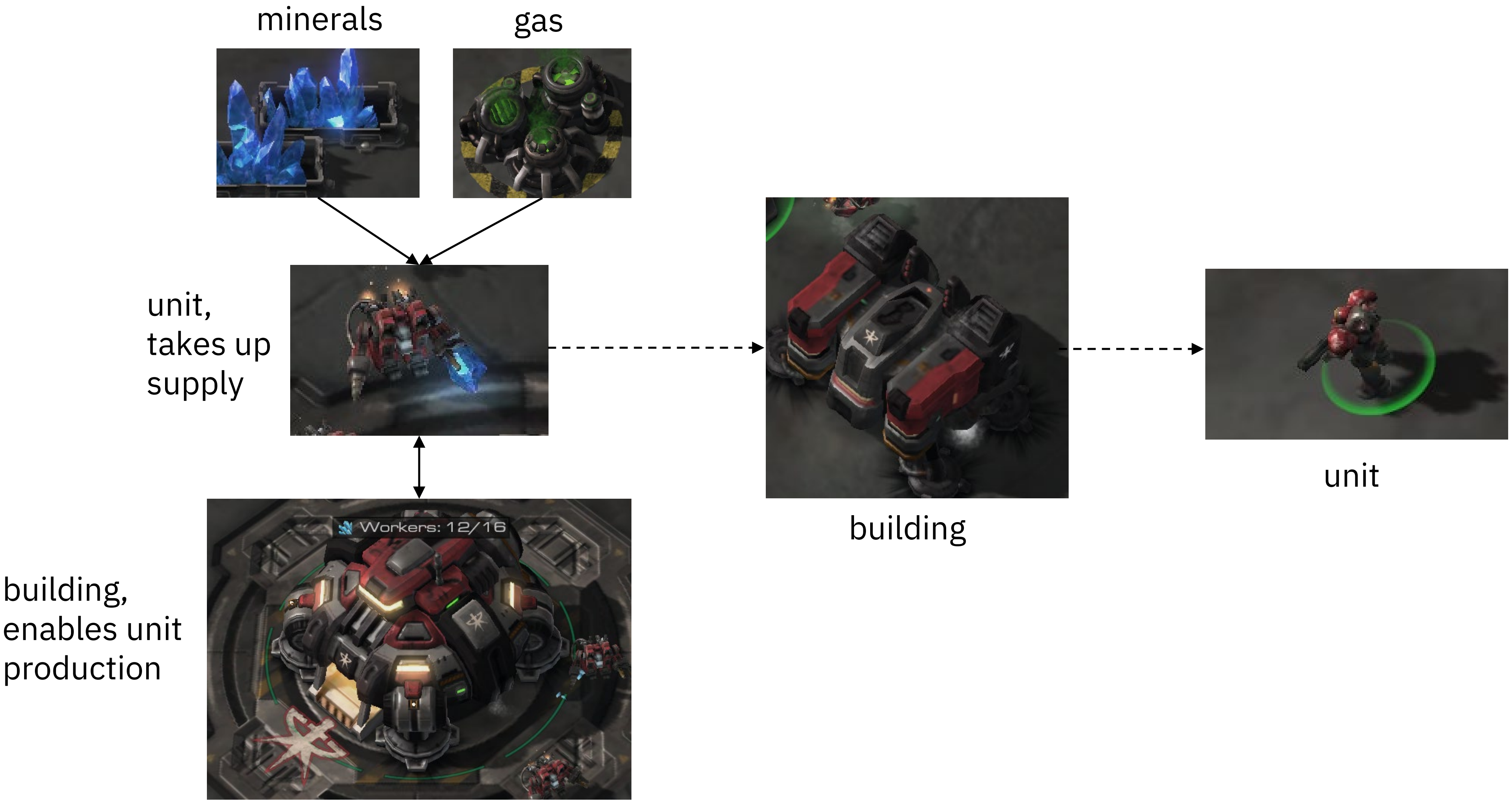
Conduct attacks

Defend base

Reconnaissance

Defeat enemy

StarCraft II Gameplay – Chain of Production



minerals

gas

unit,
takes up
supply

building,
enables unit
production

building

unit

Gameplay – Strategy

- Strategy shaped by complex dependency trees
- Adaptation based on scouting
- Early game, mid game, late game
- Mircro v. macro-intensiv play

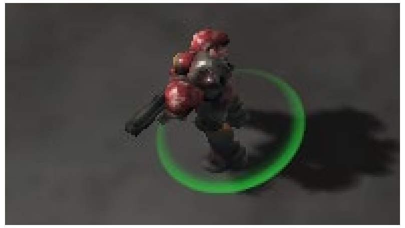
- General pattern
  - Resource production and scouting
  - Fights over map control
  - Max supply, all-in battles between upgraded armies

Gameplay Example

- Maru v sOs (replay video)

Strategy for `CapsBot`

- Marine and Cyclone rush at around 5:30 min into the game
  - Overhelm enemy in one push with 20+ Marines and 4+ Cyclones
  - Reinforce continously until mininum unit level is reached
  - If minimum reached, pause reinforcement to build up second push

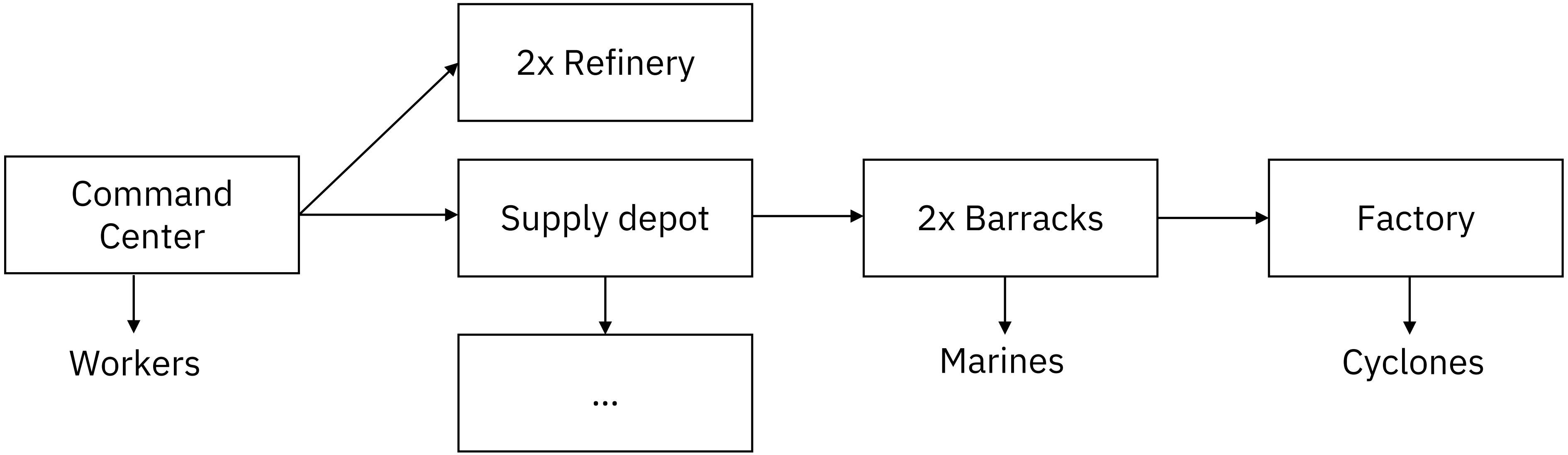


Marine

Cyclone

Fast, expendable and verstaile

Build Order for `CapsBot`



Code for `CapsBot`

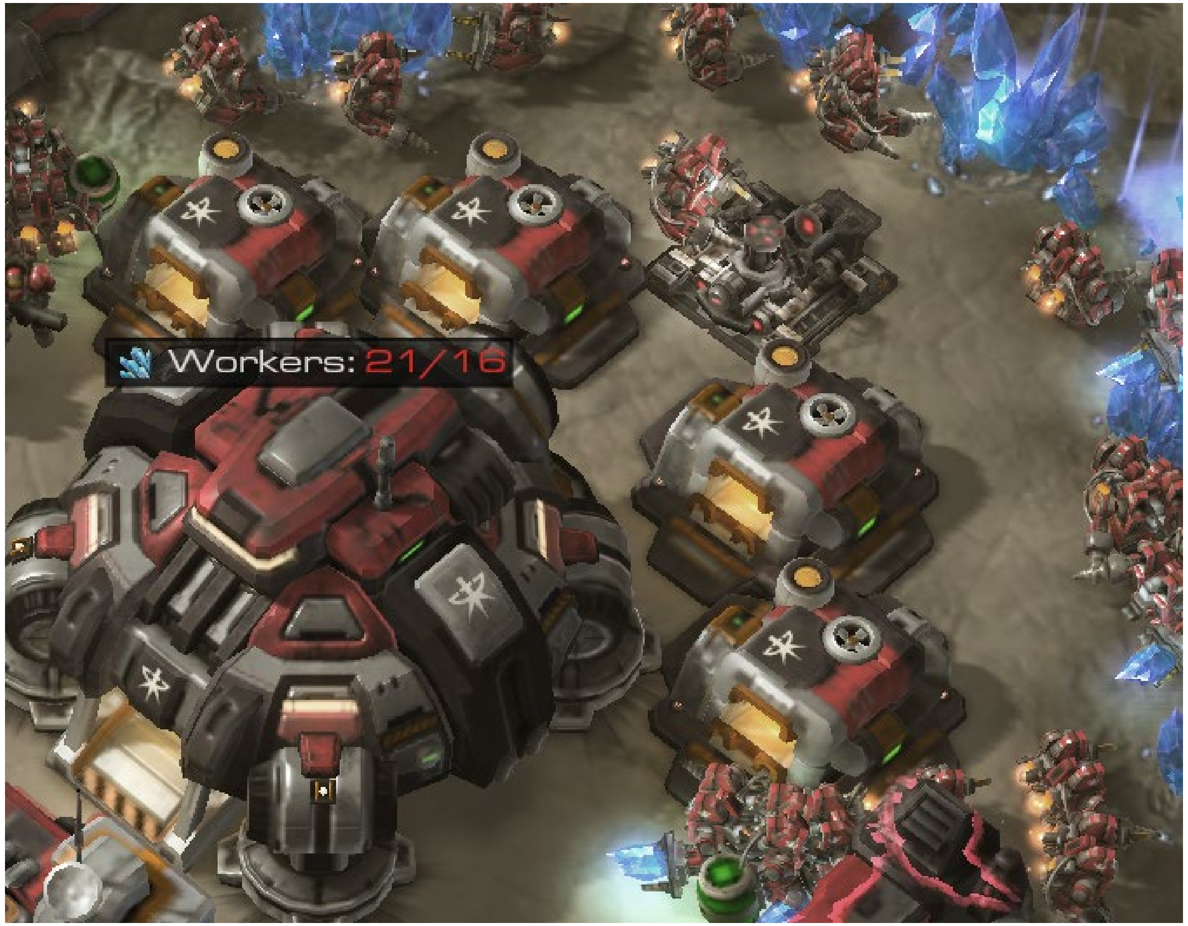
> https://github.com/SAIS-S2S-Technology/Roadmap/blob/master/CAPS/CapsBot.py

> Iterative workflow, we will start with permutations of a simpler build order

Debrief

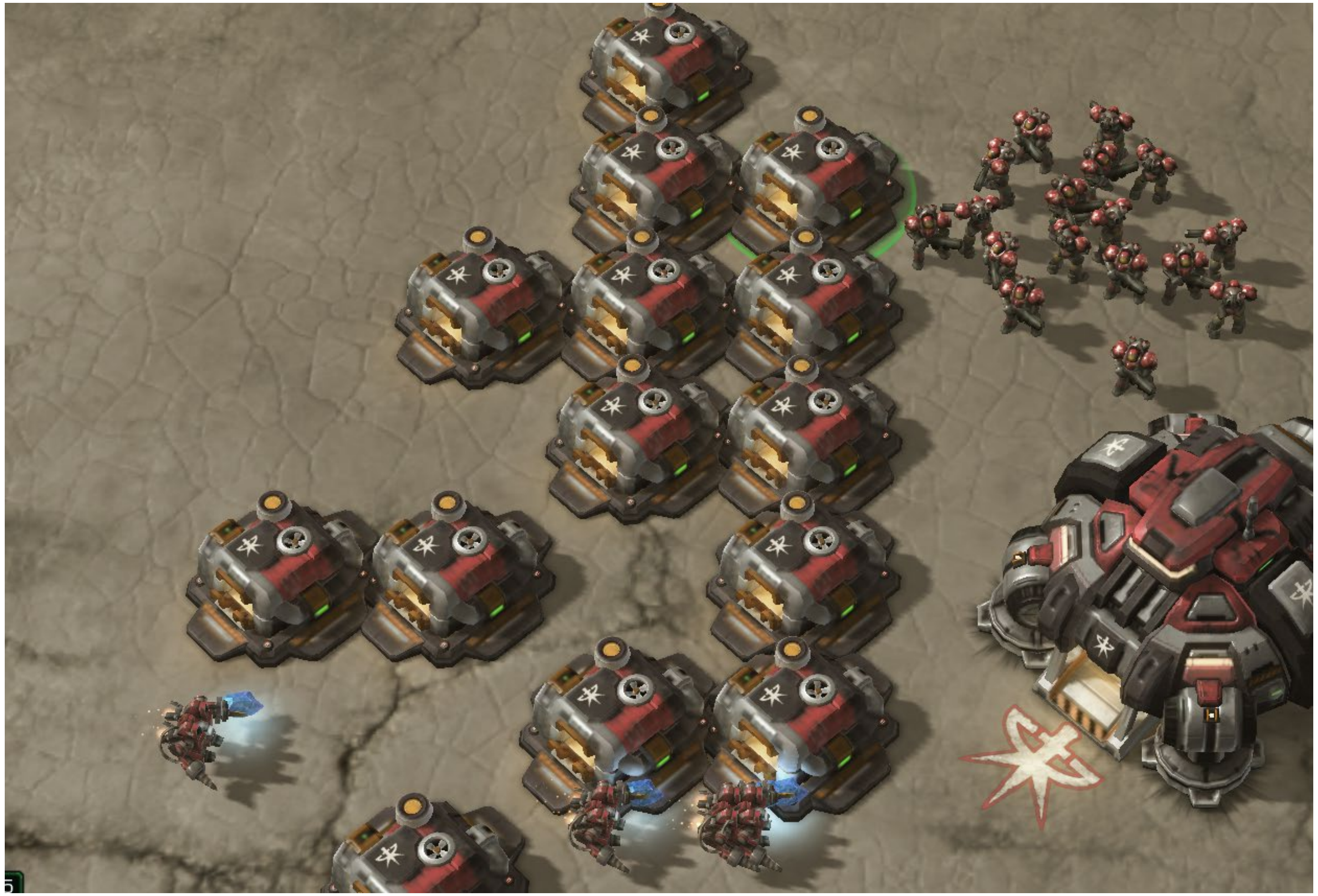
- Performance
- Decision-making
- Robustness
- Predictability

Constraints



> Randomized building placement can lead to substantial trade-offs

Applications of Simple Logic



> Building new supply depot next to last one creates protective wall

Summary

> We built a rule-based agents through a set of iterations to defeat the built-in AI of StarCraft II on hard difficulty

> The performance of the rule-based agent is succesful in the environments we provided, but not necessarily robust

> Although rule-based agents always perform the same actions, changes in the environments will transform these actions

Required Software

- For next week you only need pySC2 (DeepMind)
- From command line

  -
    ```
    pip install pysc2
    ```