Minecraft as a Platform for Project-Based Learning in AI

Sameer Singh

University of California, Irvine

Project Courses in AI

- Project courses are great for learning!
  - define own goals
  - pick approach
  - abstract concepts → concrete code
  - teamwork
  - evaluate/analyze results, …
- Difficult to create ones for AI and ML
- Too many techniques:
  supervised learning, search/planning, Bayesian methods, RL, …
- Too many application domains:
  text, images, games, puzzles, robotics, time series, …

Most course define the problem and techniques for the students

Minecraft

- An open-world sandbox:
  - Exploration
  - Resource gathering
  - Crafting
  - Construction
  - Combat

Project Malmo (by Microsoft Research)

- AI experimentation platform on top of Minecraft
- Programmatic access to observations/actions

```
def player(obs) {
    …
    return action
}
```

- Observations: pixels, gridworld, objects, inventory…
- Actions: generate world, disc/continuous movt, …

https://www.microsoft.com/en-us/research/project/project-malmo/

Course Description

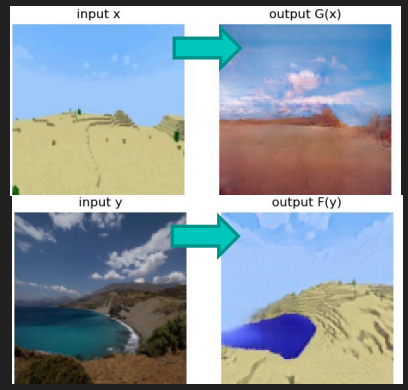
- Duration: 10 weeks long undergraduate course
- Teams: Groups of 3 students
- Open-ended: students define their own projects
- Real-world skills: submit webpages, Github repos, and YouTube videos

So far…
offered 3 times (currently 4th)
260 students, 90 projects

Examples

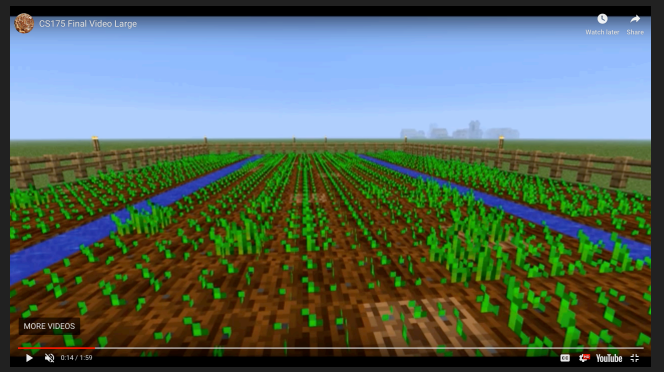
Revival

- Style transfer of images
- real photos ↔ Minecraft
- CycleGANs
- https://sjjielu.github.io/Revival/



RoboFarm

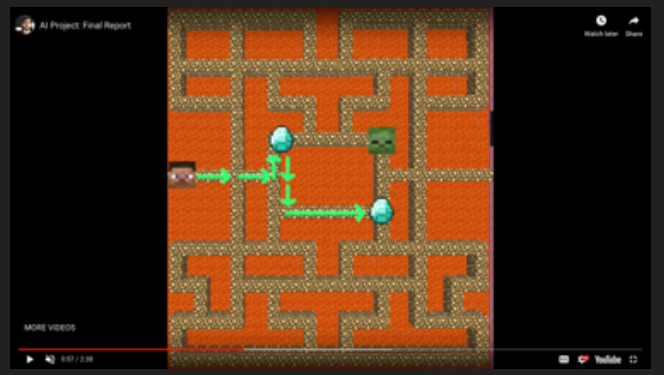
- Efficient Farming
- Planting/harvesting
- Genetic algorithms
- https://daniel-davies.github.io/13-RoboFarm/



Examples

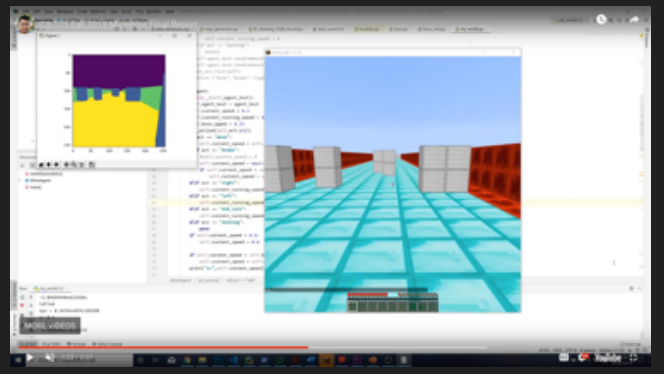
MinePac

- Play Pacman
- Navigation, gathering, etc.
- Local/heuristic search
- https://avielmenter.github.io/MinePac/



MinePilot

- Self-driving car
- Steering, Accel/brake
- Deep RL from pixels
- https://ziyangz5.github.io/MinePilot/



Examples

speech2craft

- Command following bot
- Navigation, gathering, etc.
- Speech recog, NLP parsing
- https://hiroishikawa.github.io/speech2craft/

FireEscape

- Get to exit before fire
- Discrete movement
- Tabular Q-Learning
- https://joshlopez97.github.io/FireEscape/

sameersingh.org/courses/malmo

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Thank you!