Minecraft as a Platform for Project-Based Learning in AI

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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, reinforcement learning, search/planning, Bayesian methods, …
- Too many application domains: text, images, games, puzzles, robotics, time series, …

Existing courses mostly define the problem and techniques for the students ☹

Minecraft

An open-world sandbox game with elements of:
- Exploration
- Resource gathering
- Crafting
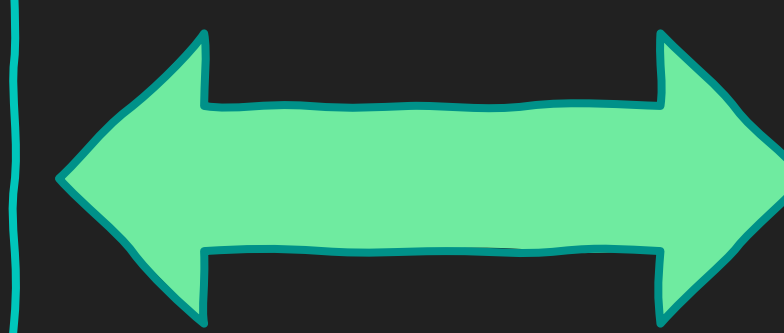- Construction
- Combat

https://www.minecraft.net/

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, ~120 students
- Teams: Groups of a maximum of 3 students
- Open-ended: students have to define their own projects, no constraints
- Real-world skills: submit webpages, Github repos and YouTube videos

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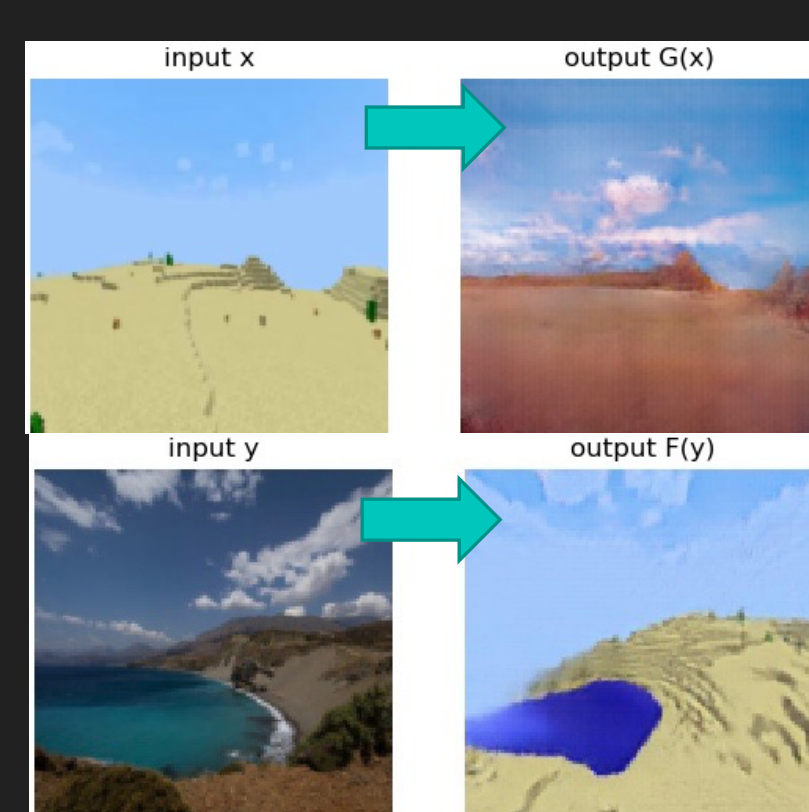offered 3 times (currently 4th)
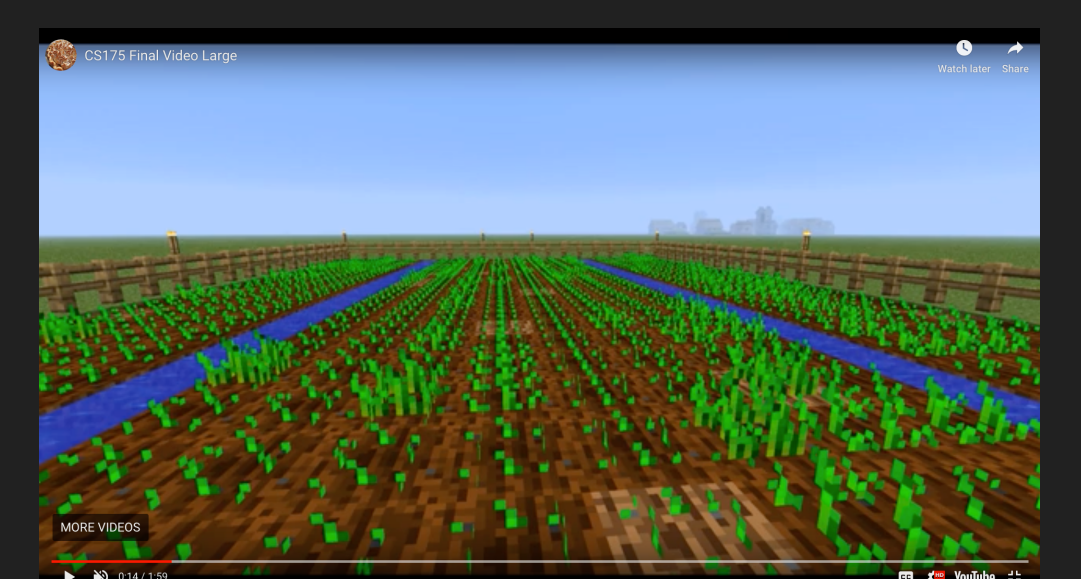260 students, 90 projects

Example Projects

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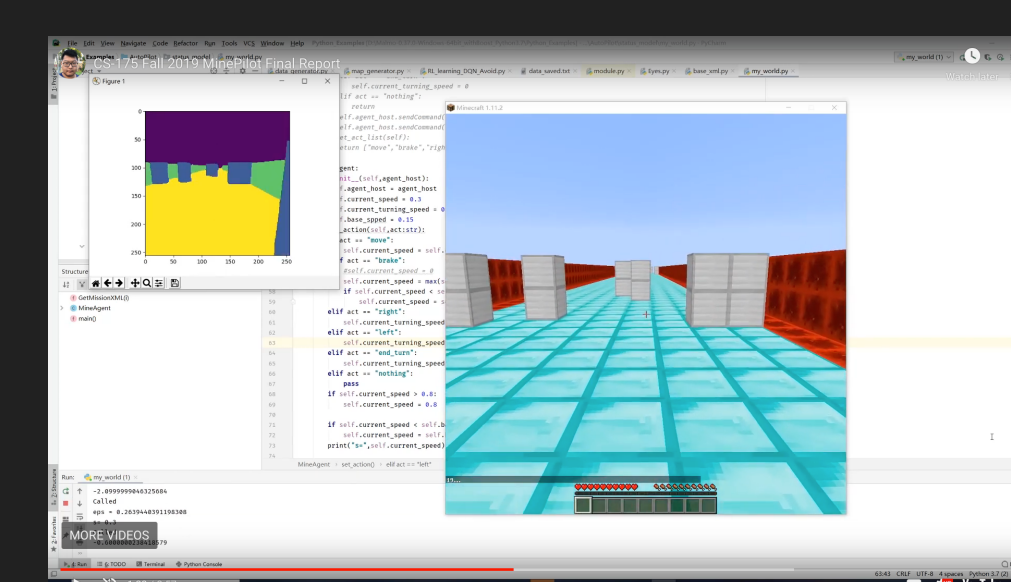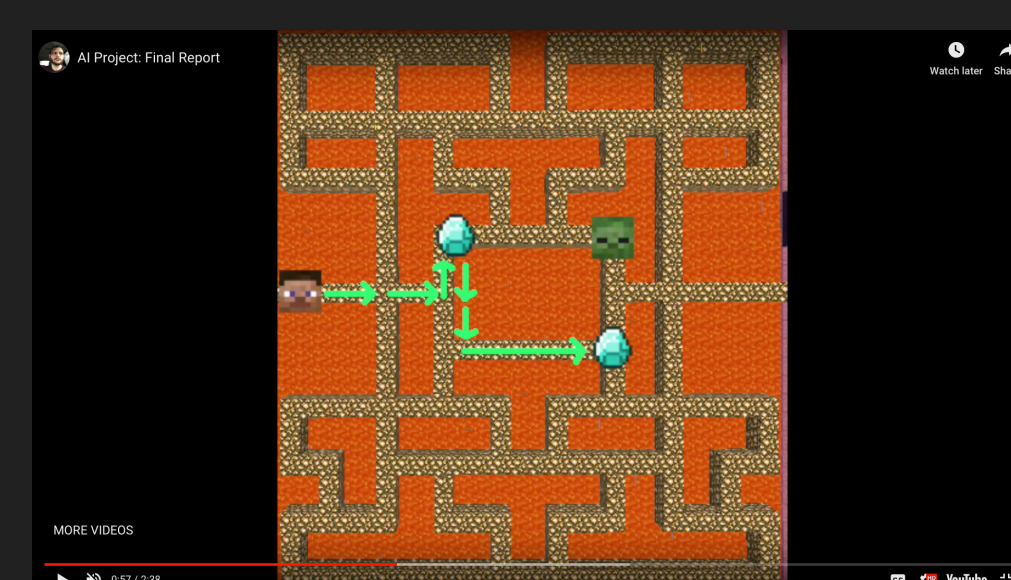- real photos ↔ Minecraft
- CycleGANs
- https://sijielu.github.io/Revival/

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

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/

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/

Acknowledgements

http://sameersingh.org/courses/malmo