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, 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

```python
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://sijielu.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://avielmetter.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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