INTRODUCTION TO AI
STRIPS PLANNING
.. and Applications to Video-games!

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This course aims to

- Provide an introduction to the AI techniques currently used for the decision making of non-player characters (NPCs) in commercial video games
- Show how a simple AI technique from academic research (STRIPS planning) can be employed to advance the state-of-the-art.
This course aims to

- Get you started with doing a research/programming project related to AI and video games!
  - Using AI tools for STRIPS planning
  - Using state-of-the-art game engines such as Unity3D and Source Engine (Half-life, Counter Strike, …)
Course overview

- Lecture 1: Game-inspired competitions for AI research, AI decision making for non-player characters in games
- Lecture 2: STRIPS planning, state-space search
- Lecture 3: Planning Domain Definition Language (PDDL), using an award winning planner to solve Sokoban
- Lecture 4: Planning graphs, domain independent heuristics for STRIPS planning
- Lecture 5: Employing STRIPS planning in games: SimpleFPS, iThinkUnity3D, SmartWorkersRTS
- Lecture 6: Planning beyond STRIPS
Course overview

- Material based on the following textbooks, research papers, and student projects at University of Athens:
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- Lecture 6: Planning beyond STRIPS
Artificial Intelligence and Video Games

- Is academic AI useful to (commercial) video games?

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Artificial Intelligence and Video Games

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  - Academics say: Yes! ...
  - Game developers say: No! ...

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Artificial Intelligence and Video Games

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- Are (commercial) video games useful to academic AI?
  - Puzzle games: complex logical problems
  - Strategy games: complex resource management and decision making problems
  - First-person games: non-player characters as autonomous agents
Artificial Intelligence and Video Games

- Are (commercial) video games useful to academic AI?
  - Often, the real-world problems are too difficult/complex to handle

- Video games offer a level of abstraction that allows the AI academic community to experiment focusing on one aspect of the problem each time

- E.g., think of an autonomous robotic bartender
  - In a bar in Rome
  - In a controlled environment specifically for this purpose
  - In a MMORPG (massively multiplayer online RPG)
Artificial Intelligence and Video Games

- Performing simple actions in the real world is difficult
Artificial Intelligence and Video Games

- Acting (and sensing) in video-game worlds is easy!
Artificial Intelligence and Video Games

- Acting (and sensing) in video-game worlds is easy!
- ..and AI can focus on, e.g., decision making
Video-game worlds feature common objects and realistic physics.
Video-game worlds feature realistic navigation characteristics.
Video-game worlds feature interaction with other characters!
Artificial Intelligence and Video Games

- Non Player Characters (NPCs)
Are video games useful to academic AI?

- **AI Competitions** for research problems of academic AI based on commercial video games
Annual Starcraft Competition at AIIDE

- [http://webdocs.cs.ualberta.ca/~cdavid/starcraftaicomp](http://webdocs.cs.ualberta.ca/~cdavid/starcraftaicomp)

- Artificial Intelligence & Interactive Digital Entertainment

- Starcraft Real-time Strategy game
Annual Starcraft Competition at AIIDE

- http://webdocs.cs.ualberta.ca/~cdavid/starcraftaicompp

- Brood War Application Programming Interface
  - C++ API
  - Retrieve information about the state of the game
  - Control units and buildings
  - http://code.google.com/p/bwapi/

- Registration deadline: 1 July
Annual Starcraft Competition at AllDE

- Krasi0 vs Skynet (2011): [youtube link]
Ms Pac-Man vs Ghost Team Competition

- [ ] http://www.pacman-vs-ghosts.net

- Build a program that controls Ms Pac-Man or one of the ghosts

- The game server transmits the state of the game as an image, 15 times per second

- Java API

- Registration deadline: 27 May
General Game Playing Competition

- [ ] http://games.stanford.edu/

- You build a program that plays chess

- So, it’s smart!
  Can it play backgammon then?
General Game Playing Competition

- [ ] http://games.stanford.edu/

- Build a program that plays board games.. all of them!

- In the beginning of each match the program receives a description of the game to play in a language that resembles PDDL

- C++, Java, Prolog API, ...
Multi-agent programming contest

- [http://www.multiagentcontest.org/](http://www.multiagentcontest.org/)

- Emphasis on multi-agent systems
- Since 2005 with different scenarios every year that force agents to work as a team
Multi-agent programming contest

http://www.multiagentcontest.org/
Multi-agent programming contest

http://www.multiagentcontest.org/
People do AI research (e.g., M.Sc., Ph.D.) based on techniques and results on such competitions
Artificial Intelligence and Video Games

- Is academic AI useful to (commercial) video games?
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- Path finding
- Realistic motion
- Models of emotion
- Decision making
- Learning
- Nonlinear story telling
- ...
Is academic AI useful to (commercial) video games?

Let’s focus on

Games with non-player characters (NPCs)
E.g., First-Person Shooter (FPS) games

The decision making process of an NPC
Artificial Intelligence and Video Games

- Video Games:
  - Finite State Machines
  - Decision Diagrams
  - Behavior Trees
  - Goal Oriented Action Planning

- Academic AI on agents:
  - Knowledge representation, First-order logic, Classical planning, Planning with preferences, …
  - Belief-Desire-Intention architecture, Agent-based programming, …
  - Probabilistic reasoning, Bayesian networks, Utility theory, Markov Decision Processes, …
Artificial Intelligence and Video Games

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Next:

- Finite State Machines (FSMs)
- Behavior Trees (BTs)
- Goal Oriented Action Planning (GOAP)