

CS 395-22

Artificial Intelligence  
for  
Interactive Entertainment

Spring 2005

# Overview

- Who we are
- What the course is about
- Syllabus
- Grading
- Resources

# Who we are

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# What this course is about

- Understanding how AI techniques can be used in interactive entertainment
  - Including existing genres of computer games
  - Including future genres of games and other entertainments

# Entertainment is driving computing

- Originally, it was the needs of war and science
  - Internet evolved from the ARPANET
- Then business began to dominate
  - PC business outgrew mainframes, minicomputers
- Now entertainment is taking over as a driver for technological progress
  - Demand for graphics processing driven by games, not scientific visualization or military training!

# AI = Final frontier for game industry

- Graphics used to be a market differentiator
  - What happens when everything is photorealistic in high resolution at high frame rates?
- Physics becoming a market differentiator
  - But limited in scope: Realism is overrated, and problematic in some genres.
  - More realistic physics → more demands on NPCs → need for better AI

# Why the game industry needs better AI, part 1

“Our industry maintains the dubious distinction of being the only popular entertainment medium that uses its audience for target practice. Games are the John Wilkes Booth of entertainment media.”  
--- Paul Tozour, Ion Storm Austin (*AI Games Programming Wisdom*)

# Why the game industry needs better AI, Part 2

- Game industry already has larger gross income than Hollywood
  - But many fewer people play games than read for entertainment
  - What if games and other interactive entertainments were as popular as reading?
  - What will it take for that to happen?



# Why the game industry needs better AI, Part 3

“However, despite the technological, game design and input device difficulties of using natural language, NLU will be an important approach in the future of gaming, and in fact will be necessary to create deeply interactive experiences that, in a sophisticated way, address the human condition. Making NLU work in games is an example of non-incremental game research; if we don’t start building experimental games with NLU now, we’ll never have NLU for commercial games.”

--- Michael Mateas, [grandtextauto.gatech.edu](http://grandtextauto.gatech.edu),  
9/17/04

# Motivation for this course

- Northwestern is one of the bridges between academia and the game industry
- Give students an opportunity to learn how AI techniques are used in games
- Give students an opportunity to push the state of the art, and use new AI techniques to build new kinds of entertainments.

# Foci of the course

- Strategy game AI
  - Involves large number of core AI topics
    - Space, time, resource management, strategy, tactics, planning, ...
  - AI crucial to success of strategy games
- Conversational NPCs
  - Also involves large number of core AI topics
    - Natural language understanding/generation, broad conceptual knowledge, social skills...
  - One of the key frontiers for new kinds of entertainment

# Strategy Game Laboratory: FreeCiv

- Open-source version of Civilization 2
- Client-side AI built at Northwestern
- You will be extending it in assignments



Coal Good Influence  
Shield Good Influence

# Conversational NPC Laboratory: Listener

- Experimental system built at Northwestern
  - Explanation Agent NLU system
  - Large KB derived from Cyc
  - Analogical processing for retrieval, matching complex descriptions

## Session 1:

Tricia: I drink coffee and I inhale smoke at the café.

## Session 2:

Tricia: I inhale smoke.

Ferd: Inhale happens in café?

## Session 1':

Tricia: I am nervous. I inhale smoke. I shake.

## Session 2':

Tricia: I inhale smoke.

Ferd: You have a fairly high amount of Nervousness?

# Syllabus

- The two themes of this course are almost independent of each other
  - Doing first one then the other would bias term projects towards whatever got covered first
  - Solution: Alternate strategy game/NPC material on a weekly basis.

# Terrain Reasoning

- Kinds of problems involving terrain
- Representing terrain
- Position-finding
- Path-planning

# Resource Management

- Properties of different kinds of resources
- Stockpiling versus burn rates
- Investments and Research
  - Cities, transportation networks, ...



# Military Operations

- Basics of combat
- Tactics
- Strategy
- Carrying out a campaign

# Modeling other players

- Plan recognition
- Diplomacy

# Winning the Game

- Situational awareness
- Phases of the game
- Grand strategies

# Cheap Language Tricks

- What the game industry does now
  - Dialog trees
  - Eliza strategies

# Language mechanics

- Words and morphology
- Parsing techniques
- How to be robust
  - Handling fragmentary analyses
  - Semantic grammars
- Natural language generation

# Bridging language to worlds

- Semantic analysis
  - Understanding sentences
  - Coreference and anaphora
- Dialogue and discourse
  - Communication acts
  - Ex: Spoken dialogue systems

# Creating believable personalities

- Episodic memory
- Modeling emotions

# Grading

- Grades based on
  - 45% homework
  - 45% term project
  - 10% class participation



# Term Projects

- One of two types:
  - Build an interesting AI mod to a strategy game
  - Build a language-based game
- More details as the course proceeds
- Presentation based on term project during the last week of class
  - Set aside Monday night, May 30<sup>th</sup>, as a substitute for Wednesday June 1<sup>st</sup> class.

# Homework procedures

- Turn in via email to [cs395gai@cs.northwestern.edu](mailto:cs395gai@cs.northwestern.edu)
  - Softcopy only, no hardcopies will be accepted
- Your code must work, i.e., execute correctly on reasonable test cases. Don't turn in non-working code.
- We will be grading you on style and quality of your code and your explanations.

# Collaboration

- Homework assignments and term projects must be done by individuals working alone, not in collaboration and not by groups.
  - You can discuss assignments in a general way with your peers, but you must do your own programming.
  - Turning in work that is not your own, or other violations of academic honesty, will be treated severely.

# Resources

- Mailing list
  - [cs395gai@cs.northwestern.edu](mailto:cs395gai@cs.northwestern.edu) for private questions
- Blackboard for class discussions, code distribution
  - You are responsible for monitoring the newsgroup for class-related announcements and updates
- Web site:
  - <http://www.cs.northwestern.edu/~forbus/395gai>
  - All lectures notes and homeworks will be posted there
  - Some code will be posted there
  - You are responsible for announcements, material on the web site

# Course software

- All programming will be in Common Lisp
  - The workhorse language of artificial intelligence
  - Used today by some in the game industry
    - [http://www.franz.com/success/customer\\_apps/animation\\_graphics/naughtydog.lhtml](http://www.franz.com/success/customer_apps/animation_graphics/naughtydog.lhtml)
  - Good working knowledge of common lisp essential for AI wizardry
- Knowledge representations will be built using Cyc KB conventions
  - Same KB used in both laboratory systems
  - Good tutorial materials at [www.opencyc.org](http://www.opencyc.org)

# Access to Common Lisp and FIRE

- Allegro Common Lisp for Windows 7.0
  - Preferred version for class
  - Available downstairs in CS undergrad lab
  - Site license for on-campus use
  - Greg will walk you through setup and use
- ACL 7, FIRE will be distributed to class members through Blackboard

# Brushing up on Common Lisp

- Highly recommended books
  - Steele, Guy. *Common Lisp: The Language*. 2nd Ed.
  - Norvig, Peter. *Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp*.
- Various on-line tutorials available
  - <http://www.alu.org/table/learn.htm>
  - <http://www.cs.berkeley.edu/~russell/ai.html>
  - <http://www.norvig.com/luv-slides.ps>