Introduction & Overview

Artificial Intelligence for
Interactive Media and Games

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What this course is *not* about

- It is not about artificial intelligence
  - "real" AI practitioners would find everything we are going to talk about very boring
    - take CS 4341 if you want to learn about AI
  - in games, pretty much *everything* except graphics (sound) and networking is called the "AI"
    - even game physics often lumped into "AI"
    - game AI mostly about controlling non-player characters
    - but sometimes operates more broadly, e.g.,
      - > civilization games
      - > interactive story generation

Academic AI vs. Game AI

(From Buckland Introduction)

- Academic (Research) AI – two flavors
  - "strong": tries to mimic human thought processes
    - branch of cognitive science
    - e.g., modeling memory, learning, emotion
  - "weak": focuses on solving real-world problems
    - e.g., computer vision not same as human vision
    - more optimal solution is usually more desirable
- vs Game AI?
  - much more stringent time/memory resource limitations (though increasing)
  - *bad* if "too smart", i.e., player must be able to have fun and win
  - AI is always in service of the *game design*

The Illusion of Intelligence

(From Buckland Introduction)

"If the player believes the agent he's playing against is intelligent, then it is intelligent."

- Lots of "cheap tricks" which have nothing to do with academic AI, e.g.,
  - simply increasing number of hits to kill
  - adding player-responsive utterances/actions, such as "Who's there?" or head tracking
- Illusion is also easy to destroy, e.g.,
  - running into walls, stuck in corners
  - seeing through walls (and other kinds of "cheating")

Game AI and the Illusion of Intelligence

Conclusion:

The use of AI in games (like many other aspects of game design) requires a careful balancing, which ultimately needs to be verified by play testing.

What this course is also *not* about

- It is not about using game engines
  - you did/will do plenty of that in IMGD 3000/4000
  - you are going to do "hard core" C++ programming
    - directly on top of standard system libraries
    - which is what professional AI game programmers still mostly do
- It is not about fancy graphics
  - we focus on the game AI programming techniques
  - a text-only game
  - two simple 2D top-down games
    - programmed directly on top of window system

What this course is also *not*

- It is not a chance to expand your game portfolio
  - that's what IMGD 4000 and your MQP are for
  - you won't have the stress of doing homework programming assignments and trying to develop a final game project at the same time
- It is not another chance to practice your team software development skills
  - you've had a lot of those already
  - team skills are very important, but not a replacement for really excellent individual programming skills

The Goals of this Course

1. To develop deep, practical knowledge of current AI game programming techniques
   - concrete algorithms and data structures you can use in your first development job
   - applying best software engineering practices
2. To make you aware of future trends in applying AI to game programming

This is a senior level course and I will expect a high level of participation and effort!

How are we going to achieve these goals?

1. Deep, practical knowledge
   - read and discuss lots of good AI code
     - Buckland's "industrial strength" source code
     - you will probably end up keeping this code to cut & paste into future projects
     - you will be expected to read a portion of Buckland's code before each class and will be called on in class to discuss what you have read
   - write and explain lots of your own AI code
     - programming assignments (of varying sizes) will be due almost every Weds and Sun night
     - you will be called on in class to explain some of your and Buckland's code

Text Books

- ***Required:*** *(dog-eared, highlighted)*

  Mat Buckland, Programming Game AI by Example, Wordware, 2005.

- ***Reference:*** *Electronic version available at the library (link on course home page):*

  Ian Millington and John Funge, Artificial Intelligence for Games (2nd Edition), Morgan Kaufmann, 2006.

About Buckland's Code

- What do I mean by "industrial strength" code ?
  - *not too good*
    - you are not going to see carefully polished textbook code in the real world
    - due to time pressures in industry
    - due to extreme performance requirements
  - *not too bad*
    - Buckland is a very experienced C++ developer
    - good comments
  - thinking about how his code could be improved (both in structure and function) is a good learning experience

How are we going to achieve these goals?

1. Deep, practical knowledge (cont'd)

- read and discuss lots of good AI code
- execute and critique lots of AI code
  - we're going to have two "tournaments" in which your AI code competes against Buckland's and your classmates' code (for bonus grade points!)
  - class *brainstorming* sessions before each tournament regarding how to improve on Buckland's AI design
  - *post mortem* after each tournament to figure out what distinguished winners and losers

How are we going to achieve these goals?

2. Future AI awareness

- two lectures on future AI topics, e.g.,
  - highlights of AI in Interactive Digital Entertainment conference
  - interactive narrative planning MQP ("PCG for stories")
- evolving AI middleware
  - groups of students will be assigned an AI middleware engine to download and evaluate
  - and will give a 15 minute presentation in class (near end of term)

Day	Book	Lecture (with links to notes)	Homework (with links)
Tue, Oct 25		Intro/Overview/Admin	
Wed, Oct 26			1 - Hello West World [3%]
Thu, Oct 27	Chapter 2	State Machines	
Fri, Oct 28	Chapter 2	Event Messages	
Sun, Oct 30			2 - Bar Fly [5%]
Mon, Oct 31	Chapter 4	Simple Soccer Anatomy	
Tue, Nov 1	Chapter 4	Simple Soccer Anatomy	
Wed, Nov 2			3 - Tank States [5%]
Thu, Nov 3	Chapter 4	Simple Soccer Anatomy	
Fri, Nov 4		**Research:** AIIDE Conference	
Sun, Nov 6			4 - My Team [3%]
Mon, Nov 7		**Brainstorming:** Simple Soccer Strategy	
Tue, Nov 8	Chapter 6	LUA Scripting	
Wed, Nov 9			5 - Team Design [3%]
Thu, Nov 10	Chapter 6	LUA Scripting	
Fri, Nov 11		Procedural Content Generation	
Sun, Nov 13			6 - Scripting [5%]
Mon, Nov 14		Procedural Content Generation	
Tue, Nov 15	Chapter 7	Raven Anatomy	
Wed, Nov 16			7 - Tournament Team [10%]
Thu, Nov 17	Chapter 7	Raven Anatomy	
Fri, Nov 18		**Soccer Tournament (HL 230 !)**	

Mon, Nov 21		Natural Language and Dialog	
Tue, Nov 22		Natural Language and Dialog	
Wed, Nov 23		*Thanksgiving Break*	
Mon, Nov 28	Chapter 9	Goal-Driven Behavior	
Tues, Nov 29	Chapter 9	Goal-Driven Behavior	
Weds, Nov 30			9- Steal Health [5%]
Thu, Dec 1	Chapter 9	Goal-Driven Behavior	
Fri, Dec 2		**Brainstorming:** Raven Bot Strategy	
Sun, Dec 4			10 - Bot Design [3%]
Mon, Dec 5	Chapter 10	Fuzzy Logic	
Tue, Dec 6		**Research:** Narrative Planning / Course Eval	
Wed, Dec 7			11 - AI Middleware [10%]
Thu, Dec 8		**Presentations:** AI Middleware	
Fri, Dec 9		**Presentations:** AI Middleware	
Sun, Dec 11		**(Due 6pm!)**	12 - Tournament Bot [10%]
Mon, Dec 12		**Raven Tournament (GH 012 !)**	
Tue, Dec 13		**Guest Speaker:** Damian Isla	
Thu, Dec 15		**Final Exam** [30%]	

Book Chapters Not Covered in Class

Ch 1 A Math and Physics Primer
- should already be well known to tech students

Ch 3 ... Autonomously Moving Game Agents
- steering behaviors (including “flocking”)
- covered in IMGD 3000/4000

Ch 5 The Secret Life of Graphs
- basic graph data structures and algorithms
- covered in basic computer science courses

Ch 8 Practical Path Planning
- navigation meshes, etc.
- covered in IMGD 3000/4000

You are responsible for learning/reviewing this material on your own as it is used in the code of other chapters !

Other Resourcs – AIIDE Conferences

PROCEEDINGS OF THE AAAI CONFERENCE ON ARTIFICIAL INTELLIGENCE AND INTERACTIVE DIGITAL ENTERTAINMENT

Sponsored by the Association for the Advancement of Artificial Intelligence

AIIDE is intended to be the definitive point of interaction between entertainment software developers interested in AI and academic and industrial AI researchers. Sponsored by the Association for the Advancement of Artificial Intelligence (AAAI), the conference is targeted at both the research and commercial communities, promoting AI research and practice in the context of interactive digital entertainment systems with an emphasis on commercial computer and video games.

| 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | 2005 |

Current holdings in the AAAI Digital Library include papers from the following conferences:

- Eleventh AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE-2015)
- Tenth AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE-2014)
- Ninth AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE-2013)
- Eighth AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE-2012)
- Seventh AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE-2011)
- Sixth AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE-2010)
- Fifth Artificial Intelligence and Interactive Digital Entertainment Conference (AIIDE-2009)
- Fourth Artificial Intelligence and Interactive Digital Entertainment Conference (AIIDE-2008)
- Third Artificial Intelligence and Interactive Digital Entertainment Conference (AIIDE-2007)
- Second Artificial Intelligence and Interactive Digital Entertainment Conference (AIIDE-2006)
- First Artificial Intelligence and Interactive Digital Entertainment Conference (AIIDE-2005)

 http://www.aaai.org/Library/AIIDE

Other Resources - AIGPG

 http://gameai.com

Grading

- Programming homework *(individual)* **55 %**
  - 5 small @ 3 pts
  - 4 medium @ 5 pts
  - 2 large @ 10 pts
  - ***late penalty:*** ***1*** *day = 50%, >1 day = no credit*
- Class preparation/participation **5 %**
  - ***everyone*** should be prepared to be called upon in class
  - you need to read chapter ***before*** class to be prepared
- AI middleware presentation (groups) **10 %**
- Final exam **30 %**
- Plus tournament bonus points

Logistics

- Teaching assistants – Office Hours (FL A22) TBD
  - (TA) – Hongzhu Cui (hcui2)
  - (SA) Richard Hayes (rhhayes)
- My office hours (FL B25b): Mon 11-12pm, Thu 1-2pm
- Home page http://www.cs.wpi.edu/~rich/courses/imgd4100-b16
  - lecture notes will be posted after lecture
  - homework details posted one or two homeworks ahead
- Homework submission
  - via https://turnin.cs.wpi.edu
  - due 11:59pm (or 6pm) of due date (late submission time logged, site closes 24 hours after due date)

Communication

- my.WPI forum for general and homework questions
  - strongly recommend subscribe option
  - post all course/homework questions here
  - do not post your code (other than 1 or 2 lines or an error message)
  - *do not send me email directly* with questions unless personal/confidential
  - TA's and I will reply as promptly as possible, but do not expect answers at 11:00pm on due date!
- Email list: cs4100-all@cs.wpi.edu
  - only for urgent announcements

Academic Integrity

- You are encouraged to talk about programming assignments with classmates, even to help each other debug code. However, cutting and pasting someone else's code or emailing your code to someone else crosses the line.
- Cheating is a serious offense, punishable by an automatic NR for the course.
- Institute policy on academic integrity will be followed in all cases.

First Homework due Weds midnight!

1. Read Chapter 2 in preparation for Thur/Fri classes: "State Driven Agent Design"

2. Download source code from course home page
   - compile and run it in Visual Studio 2015
   - VS 2015 on all WPI public and lab machines and free Microsoft download (see course website)
   - code has been tested and will be supported in this development environment only
   - see details on course home page (click on first homework in syllabus table, "Hello West World")

Questions?