Introduction to AI

CIS 32 : Spring 2007

Mondays and Thursdays 10:50 AM to 12:05 pm

4411 Ingersoll

- **Instructor**: Chipp Jansen (not Elizabeth Sklar as listed)
- **E-mail**: chipp@sci.brooklyn.cuny.edu
- **Office**: 4412 Ingersoll (Educational Robotics Lab)
- **Office Hours:** Mondays AND Thursdays 2:00 pm to 3:00 pm
- **Virtual Office:** AIM username : *chippbot*
- **Virtual Office Hours:** Tuesdays 9 pm to 11 pm

Objectives

This course introduces representations, techniques, and architectures used to build applied systems and to account for intelligence from a computational point of view.

- Short History of Artificial Intelligence
- Autonomous (Rationally) Intelligent Agents
- Problem Solving, Search and Heuristic Methods
- Introduction to Robotics (Includes a Lab)
- Neural Networks, Evolutionary Computation, Trends in Artificial Life
- State-Space Learning, Game Playing, Knowledge Representation, Uncertainty
- Propositional Logic, Predicate Logic, Logic-based Agents (GOFAI)
- Planning, Partial-order planning, Decision-theoretic planning

Your Contribution

- Gain theoretical and applied experience working with Artificial Intelligence.
  - 4 Homework Exercises (30%)
  - 2 Projects (30%)
  - 2 Exams (40%)
- Homework exercise theoretical understanding
- Projects exercise practical techniques

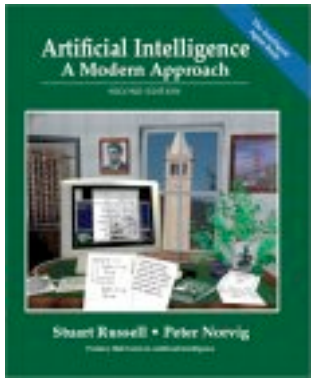
Materials and Resources

(your dependency should be in this order)

1. lectures

2. handouts from papers, and primarily this text:\

   Russell and Norvig, Artificial Intelligence, A Modern Approach (2nd Edition)



3. lecture notes

4. Web: *http://www.sci.brooklyn.cuny.edu/~chipp/cis32/*

Office Hours

- Generous Office Hours
  - Mondays and Thursdays (2 pm - 3pm)
- Questions Before class (I'll try to get here 20 mins early if the room is available)
- NOT After class (I teach back-to-back)
- Virtual Office Hours
  - Tuesday evenings 9pm to 11pm
  - AIM: *chippbot*

Homeworks

- Should be done on your own, as much as possible
- Get help from me, friends, but ***you must acknowledge all help received by citing the names of those who helped you***.
- This not only protects you from being accused of cheating, but also protects you in case your helper gives you misinformation

Homework: Submission

Homeworks are **due** on the day that they are **due**.

• Here are the rules (unless otherwise specified):

1. Homeworks must be TYPED in a READABLE FONT (ex: Times New Roman 11 pt) and written in clearly in English.

2. Hardcopies must be brought to class on the due date and deposited to me at the front of the classroom.

OR

2. Electronically submit the Homework by 6am on the day it DUE by e-mailing the Homework to me (PDF only) - Can everybody do this?

3. If your hardcopy does not make it to me, it will not be accepted and you will get 0 for the homework.

4. If you must miss class, have a friend deposit your hardcopy.

5. You are always allowed to submit homework EARLY!

6. You MAY turn in ONE(1) LATE Homework (within a week) electronically.

Exceptions

- Exceptions and extensions are possible, primarily based on MEDICAL EMERGENCIES.
- Circumstances must be documented and suitable arrangements will be made.
- You must consult me via email on an individual basis.
- You must consult me BEFORE you need the exception/extension, not afterwards.
- Submission details for projects will be posted on the class web page.

Regrade Policy

• If you feel that there was an error in grading your homework, project or exam, then you need to write on a piece of paper a description of the error.

• STAPLE the paper to your homework, project or exam and leave it with me to be regraded.

• Know that I mark with a list of expectations for each homework assignment, project and exam problem, knowing where to take off points — so if your complaint is that too many points were taken off for one kind of mistake or another in your program, then generally those types of things will not change in a regrade.

(Do Not Submit Every Homework for a regrade!)

Regrade Evaluation Policy

If there is a genuine error in the marking, like I thought something was missing, but it is really there, then you will likely get points restored.

- HOWEVER, a regrade means that the entire assignment or exam will be remarked, so be aware that your mark can go DOWN as well as up.

- Regrades take a while to process, so be patient — if you need the work to study from, then make a copy of it before you turn it in for a regrade.

Back It Up

You all know that:

- You should save early and save often!
- Disk drives crash. (MINE DID!)
- Floppies have bad sectors.
- Power supplies fail.
- Monitors die, and
- Paper print-outs are the best form of backup storage known to mankind.

So, you'll know that problems resulting from ignoring the above are not acceptable excuses for late submission of projects or homework.

Lectures

Brief lecture notes will be placed on the web page after every lecture.

- These will be linked to the syllabus page.
- But they are NOT A SUBSTITUTE FOR COMING TO CLASS.
- I know, I used to skip classes too.
- If you must miss a class, YOU are responsible for getting notes from someone who did come to class

Lecture Notes

I will try to post lecture notes on the web before class BUT:

– you learn better when you actually have to write things down yourself.

– just reading along with my notes makes you sleepy.

– everything I say is NOT in the lecture notes, but anything I say MIGHT be on an exam or in a homework, so you need to take notes on what I say

– sometimes there are mistakes in the lecture notes which get caught during class; so you will only get the incorrect version if you come to class and take notes.

Exams

Exams are not a great way of assessing what people know, but they:

- Are the only way I know you are doing your own work.
- Are the only way YOU know you are doing your own work.
- Are not hard if you really know the material.
- Exam weighting scheme:

    1. MID-TERM: 20%
    2. FINAL exam: 20% (pseudo-cumulative)

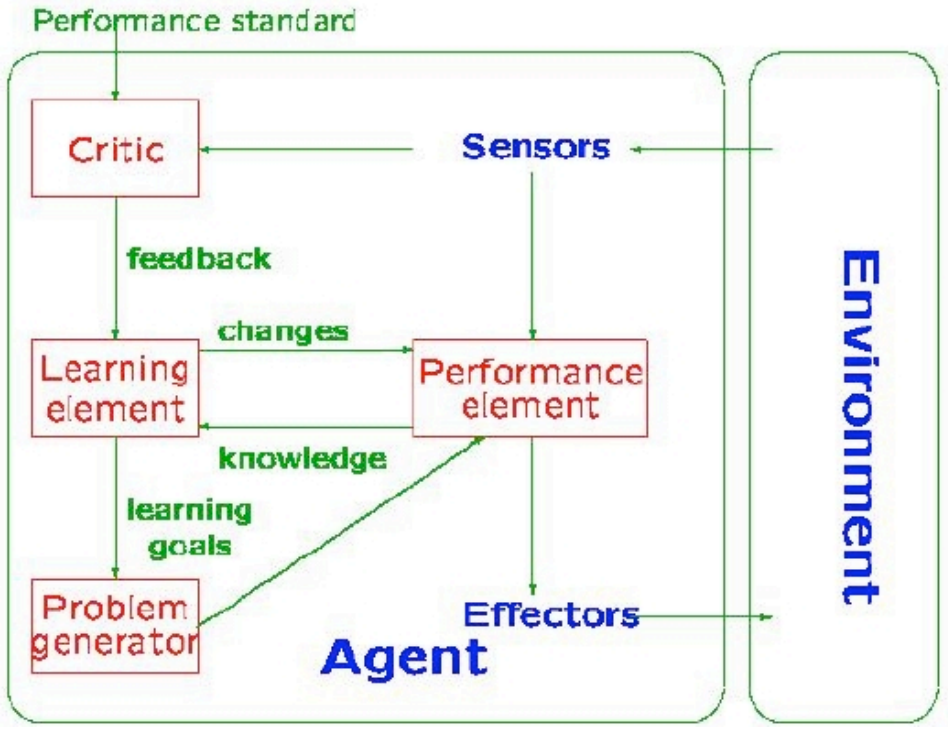
MID-TERM is currently set to be **IN-CLASS on Thursday, March 29th**

FINAL is set for **Thursday, May 24th 10:30 am to 12:30 am**

Projects

- Project 1 will be a Robotics Project (with Lab time)

- Project 2 will be a Learning Agent Software Project.



Russell and Norvig's Learning Agent

Academic Integrity

The work you submit for assessment should be completed ON YOUR OWN.

- You may get help from me, friends.
- You must acknowledge all help given.
- You must not download material from the web and submit it as your own work.
- You must not copy files (work) from others and submit it as your own work.
- If someone asks you to do this, "NO"!
- Google will catch you!

Feedback

- Homework, projects and exams let me know how you are doing.
- In a way, they let me know how I am doing, as a reflection of how you are doing.
- But, I welcome feedback from you in any of these forms:
  - email,
  - anonymous written notes,
  - instant messages,
  - comments during office hours.

What is AI?

• AI is both **science** and **engineering**:

– the *science* of understanding intelligent entities — of developing theories which attempt to explain and predict the nature of such entities;

– the *engineering* of intelligent entities.

• four views of AI

1. AI as *acting humanly*

– as typified by the Turing test

2. AI as *thinking humanly*

– cognitive science.

3. AI as *thinking rationally*

– as typified by logical approaches.

4. AI as *acting rationally*

– the intelligent agent approach.

Acting Humanly

• A problem that has greatly troubled AI researchers: when can we count a machine as being intelligent?

• (1950) Most famous response due to Alan Turing, British mathematician and computing pioneer:

> Human interrogates entity via teletype for 5 minutes. If, after 5 minutes, human cannot tell whether entity is human or machine, then the entity must be counted as intelligent.

Acting Humanly

$100,000!

October 20th, 2007
New York City

No program has yet passed Turing test! (Annual Loebner competition & prize.)

http://www.loebner.net/Prizef/loebner-prize.html

• A program that succeeded would need to be capable of:

– natural language understanding & generation;

– knowledge representation;

– learning;

– automated reasoning.

Note no *visual* or *aural* component to basic Turing test — augmented test involves video & audio feed to entity.

Thinking Humanly

Try to understand how the mind works — how do we think?

• Two possible routes to find answers:

– by *introspection* — we figure it out ourselves!

– by *experiment* — draw upon techniques of psychology to conduct controlled experiments. ("Rat in a box"!)

• The discipline of *cognitive science*: particularly influential in *vision*, *natural language processing*, and *learning*.

Thinking Rationally

- Trying to understand how we *actually* think is one route to AI — but how about how we *should* think.
- Use logic to capture the *laws of rational thought* as *symbols*.
- *Reasoning* involves shifting symbols according to well-defined rules (like algebra).
- Result is *idealised* reasoning.
- Logicist approach theoretically attractive.

Thinking Rationally

• Lots of problems:

– *transduction* — how to map the environment to symbolic representation;

– *representation* — how to represent real world phenomena (time, space, . . .) symbolically;

– *reasoning* — how to do symbolic manipulation tractably — so it can be done by real computers!

• We are still a long way from solving these problems.

• In general logic-based approaches are unpopular in AI at the moment. (GOFAI)

Acting Rationally

Acting rationally = acting to achieve one's goals, given one's beliefs.

• An agent is a system that perceives and acts; intelligent agent is one that acts rationally

w.r.t. the goals we delegate to it.

• Emphasis shifts from designing *theoretically best* decision making procedure to best decision making procedure possible in circumstances.

• Ways of Acting Rationally without Logical Inference (Reflex from a Hot Stove)

• Logic may be used in the service of finding the best action — not an end in itself.

• Achieving perfect rationality — making the best decision theoretically possible — is not usually possible, due to limited resources:

– limited time;

– limited computational power;

– limited memory;

– limited or uncertain information about environment.

• The trick is to d*o the best with what you've got!*

• This is easier than doing perfectly, but still tough.

About Me

- Undergrad and Graduate Studies at University of Michigan in: Electrical Engineering, Computer Science, and Fine Arts
- Previously Taught at University of Michigan and at Pratt Institute
- Research / Teaching Interests:

  - Intersections of Computers in Art, Design, and Architecture
  - Educational Robotics (LEGO Robots)
  - Physical Computing and Design
  - GeoComputation: Spatial Uses of AI (in Geography)

About You

Please take out a piece of paper and write down...

1. Your name.

2. Your email address (*the one you'll check most often*).

3. Your class and major OR if you are a non-matriculating student, categorize yourself.

4. Why you are taking this course?

5. What you hope to get out of this course?

6. What do you think artificial intelligence is?

7. Tell me about one fun thing you did over break.

...and give it to me before you leave.