

Introduction to Artificial  
Intelligence  
CSCI 3202  
Fall 2007  
Greg Grudic

# Admin Stuff 1

Location:	TR 12:30-1:45 ECCR 105
Instructor:	Greg Grudic
Office:	ECOT 525
Office Hours:	Wednesdays 10:00 to 11:00. Thursdays 2:00 to 3:00. <b>And By Appointment.</b>
Phone:	303-492-4419
Email:	grudic@cs.colorado.edu
Course URL:	<a href="http://www.cs.colorado.edu/~grudic/teaching/CSCI3202_2007">http://www.cs.colorado.edu/~grudic/teaching/CSCI3202_2007</a> (under construction...)

# Admin Stuff 2

- Course Textbook: There isn't one, but good *reference* books are:
  - The Elements of Statistical Learning, by Hastie, Tibshirani, Friedman
  - S. Russell and P. Norvig *Artificial Intelligence: A Modern Approach* Prentice Hall, 2003, Second Edition
- Grading:
  - Group Project: 60%
  - Homework: 30%
  - Class participation: 10%
- Course workload outside of class?
  - About 3-4 hours per week

# Admin Stuff 3

- Homework Assignments
  - There will be many small ones and one “bigger” one.
  - Goal: Test knowledge of basic concepts
- Class Project
  - Students work in teams of 4 or 5....
- Class Participation
  - There will be many in class quizzes
  - You are expected to give your “best answer” to the quiz questions
  - If you give your “best answer” you will be given credit for the quiz. If not, (or you don’t hand it in), you will NOT be given a credit.
  - Mark calculated:
    - $10\% * (\text{number of quiz credits}) / (\text{total number of quizzes})$ .
  - If you can’t make it to a class email me.

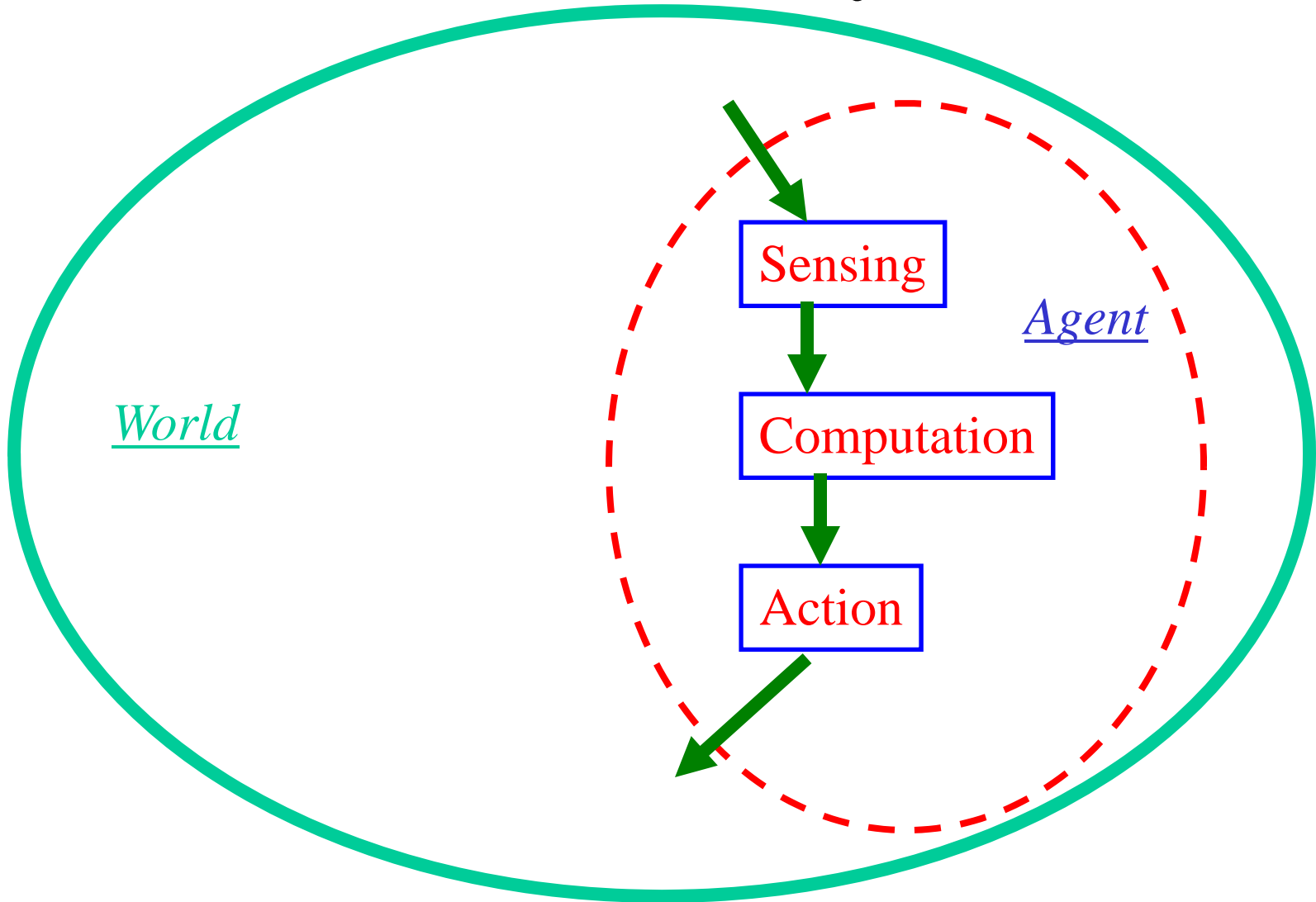
# Admin Stuff 4

- Sending Me Email: Start all subject descriptions with:
  - CSCI 3202:
- I will post most slides **AFTER** Class
  - So take notes during class and ask questions!

# Goal of the Course

- A fundamental understanding of the basic concepts behind Artificial Intelligence
  - What does it mean for a machine to exhibit AI?
- A practical understanding of how to apply AI to real world problems
- **PLEASE ASK QUESTIONS!!!**

# What is an AI System?



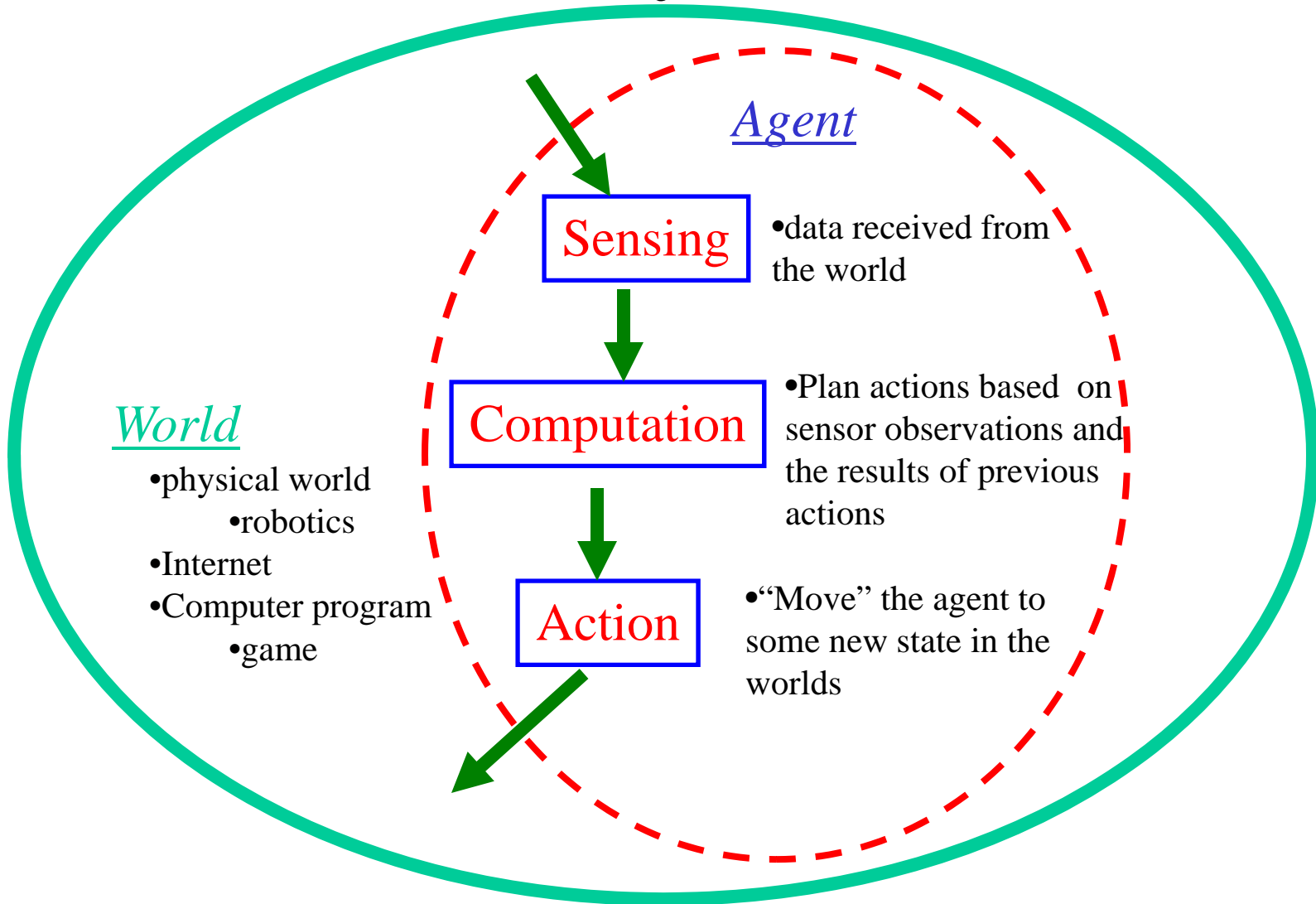
# Components of an AI System

- **World**
  - This is where the AI agent lives
- **Agent**
  - Sensing: Takes information from the world
  - Computation: Makes computations based on what it has sensed (perhaps using a time history of sensor readings)
  - Action: Acts in the world to change the state of the agent within it (towards some **purpose**).

# What are some common uses (successes) of AI Systems?

- Web search: google, ask, yahoo....
- Loan Applications
- Marketing
- Economic Analysis
  - Stocks to buy....
  - Products to produce...
  - Prices to charge....
  - Federal economic policies...
- Computer Games
- Criminology

# AI System



# Some AI Systems that are Better Than Humans (1)

- Checkers
  - Chinook was the first computer program to win a checkers world championship (using heuristics)
    - <http://www.cs.ualberta.ca/~chinook/>
  - Checkers is now solved
    - [http://www.cs.ualberta.ca/~chinook/publications/solving\\_checkers.html](http://www.cs.ualberta.ca/~chinook/publications/solving_checkers.html)
    - There is a proof that nothing can now beat this program (no more heuristics)

# Some AI Systems that are Better Than Humans (2)

- Chess
  - DEEP BLUE was the first computer program to beat the world chess champion (using powerful computers and a bunch of very good heuristics)
    - [http://en.wikipedia.org/wiki/IBM\\_Deep\\_Blue](http://en.wikipedia.org/wiki/IBM_Deep_Blue)
  - Not yet solved...

# Some AI Systems that are Better Than Humans (3)

- Backgammon
  - TD gammon was the first program to beat the worlds best players (Gerald Tesauro)
    - <http://researchweb.watson.ibm.com/massive/tdl.html>

# Some AI Systems that are Better Than Humans (4)

- Robotics for manufacturing in structured factories
  - Many products (cars, computers, etc..) are made using robots

# Some Failures of AI

- The game GO
  - Simple rules but very large search space...
- Expert systems (in general)
  - These attempted to encode an experts knowledge into an autonomous reasoning systems
- Robotics in unstructured environments. A robot **cannot**
  - Clean my house
  - Cook when I don't want to
  - Wash my clothes
  - Cut my grass
  - Fix my car (or take it to be fixed)
  - i.e. do the things that I don't feel like doing...

# Robotics

- Robotics is AI in the physical world
- It is the hardest subfield of AI because robots must sense and act in the physical world
- *The computer revolution has changed the world....*
- ***However, the robotics revolution, when it happens, will make the computer revolution pale in comparison***

# A Open Problem in AI/Robotics?

- “Vision-based autonomous navigation in unstructured outdoor environments”
  - This is the main research focus of the DARPA LAGR program. Includes 8 teams
    - GaTech, Netscale (NYU), SRI, NIST, API, JPL, UPenn, CU
- **The problem of navigating between 2 GPS waypoints (more than a few hundred metres apart) in unstructured outdoor environments is unsolved!**

# How is it Currently Done?



Crusher and, more recently, PerceptTOR

# What About the DARPA Grand Challenge?

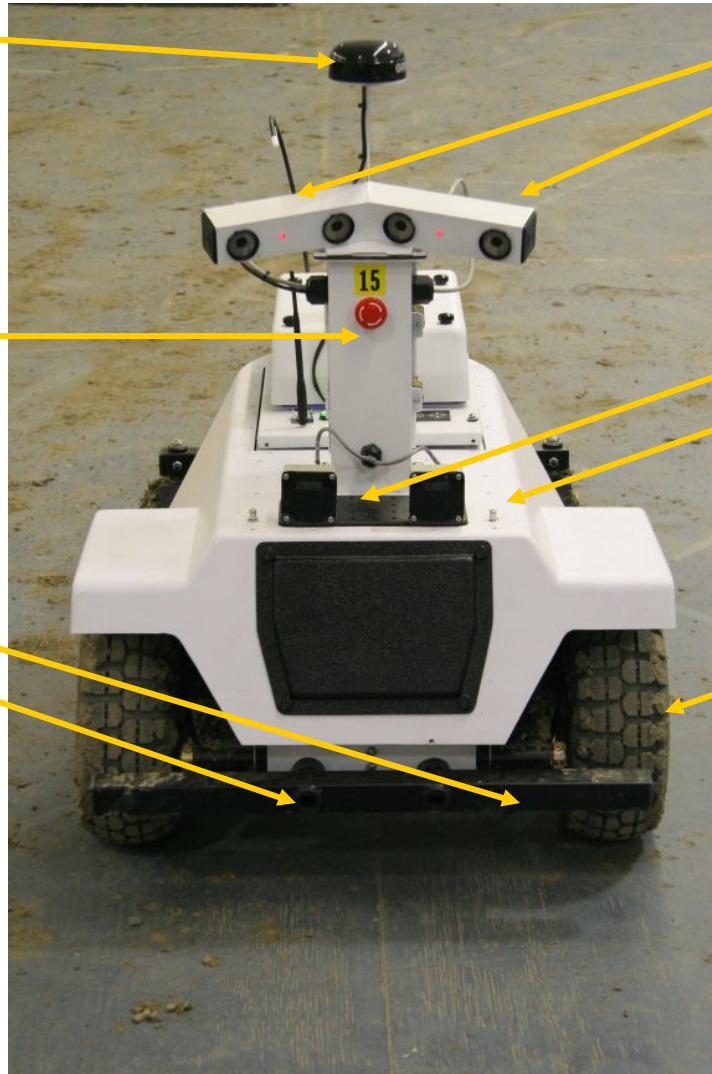
- Autonomous Navigation in the Desert over a 132 mile course.
- 5 Teams succeeded!
  - <http://www.darpa.mil/grandchallenge05/gcorg/index.html>
- This was a monumental achievement in autonomous robotics
- **HOWEVER: This was not an unstructured environment!**
  - GPS waypoints were carefully chosen, sometimes less than a meter apart.

# Environments that DARPA Grand Challenge winners would find challenging:



# Our Main Platform (LAGR)

**WAAS GPS  
mounted on  
a collapsible  
mount  
E-Stop**



**Dual stereo cameras**

**IR Rangefinder**

**Bumper with  
dual switches**

**Differential drive**



# Our LAGR Robot



# Next Class

- 5 minute quiz at the start of class
  - Hint: think about what differentiates the successes and failures of AI.
  - Remember – quizzes only counts towards class participation!
- Robot demo outside
- Introduce the group project
- Questions?