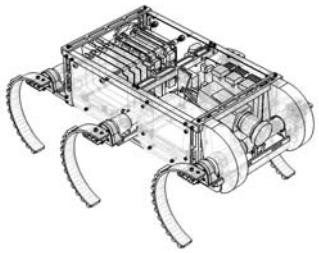
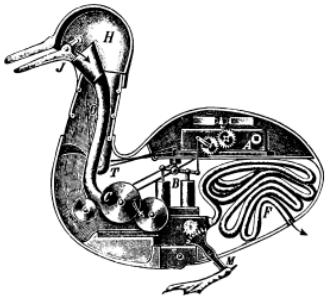


EE 586 Artificial Intelligence
Spring 2012



Instructor:

Assist. Prof. Dr. Afşar SARANLI,
Room: EZ-10; **Phone:** 210-4529; **e-mail:** afsars@metu.edu.tr
Course Web: http://online.metu.edu.tr

Assistants: None

Course Purpose:

The purpose of this course is to teach the fundamentals of intelligent behavior and decision making by machines. By the end of this course, you will have gained an overall view of a fairly diverse range of methods and technologies for automated decision making as well as practical applications of these techniques in commercial, scientific and engineering problems. Hopefully, you will be at a point to use this knowledge to advance your research goals or to find more competitive engineering solutions in your work.

Main Reference Text:

"Artificial Intelligence: A Modern Approach", 2nd Ed. Stuart Russel and Peter Norvig - 2002

Prerequisites:

Good knowledge of data structures and competence in at least one programming language is strongly recommended. Matlab may be usable. Some background in Probability Theory is also recommended.

Course Objectives:

By the end of this course, we will have covered:

- **Rational Agents:** Evolution of AI. Intelligent system as a Rational Agent. Properties of task environments. Agent architectures. (1 week, Ch 1,2)
- **Problem Solving as Search:** Data structures. Uninformed search: Depth first, breath first, progressive deepening. Search with partial information. Informed search, A* search and Heuristic functions. Local search and optimization. (2 weeks, Ch 3,4)
- **Adversarial Search and Games:** Optimal decision in games. Minimax algorithm. Alpha Beta Pruning. Imperfect decisions. Element of chance. (1 week, Ch 6)
- **Logical Agents:** Propositional logic. Reasoning in propositional logic. Resolution. Forward and backward chaining. First order logic. Inference in first order logic. (3 weeks, Ch 7,8,9)
- **Planning:** The planning problem. Planning with state space search. Partial order planning. Planning graphs. GRAPHPLAN algorithm. Planning with propositional logic. Time, schedule and resources, Constraints, Hierarchical task network planning. (2 weeks, Ch 11, 12)
- **Physically Embodied Agents: Robotics:** Robot hardware. Sensors. Effectors. Localization and Mapping. Planning and acting. Moving. (1 week, Ch. 25)

- **Uncertainty (Time permitting):** Handling uncertain knowledge, Probability, Inference using joint distributions. Independence, Bayes' Rule, Bayes Decision Nets and applications. (1 week, Ch 13)

Other References:

- "An Introduction to AI Robotics (Intelligent Robotics and Autonomous Agents)", Robin R. Murphy - 2000
- "Probabilistic Robotics", Sebastian Thrun et al. - 2005
- "Principles of Robot Motion", Howie Choset et al. - 2005
- "Artificial Intelligence - A Knowledge Based Approach", M.W. Firebaugh – 1989
- "Pattern Classification, 2nd Ed.", R.O.Duda, P.E. Hart, D.G.Stork – 2001

COURSE POLICIES AND GUIDELINES

Professional Behavior:

This is a graduate course. I will treat you as professionals and will expect to see ethic and professional behavior in return. Honesty is of great importance for me. Remember: Respect comes mutually.

Class Web Site and Resources:

The class has a web site in METU-ONLINE: **http://online.metu.edu.tr** Registered students will have access to the course content, notices and additional materials. You will have the chance to use the discussion forums to ask general questions or to exchange ideas. Check the web-site to make sure you have access and check periodically so that you do not miss anything. I will try to check the discussion forums periodically to answer your questions. Same professional behavior is expected in these forums as would be expected in-class.

Grading:

The course will involve in-class discussions and group work, a programming mid-term study, projects, and a final examination. The contribution of the course work to grading is given below.

- In-class work and attendance: % 10
- Midterm Assignment % 15
- Term projects – Intermediate % 10
- Term Projects – Final % 30
- Final Exam % 35

In-Class Discussions and Group Work:

There will be in-class discussions and occasional individual work to probe your understanding of the topics. You will work as teams (number to be determined) for some of the in-class work (and projects) and submit one output with all names. You will share the same grade for the work you have produced. You are free to form your small team and all of you will be expected to equally contribute. Team members will alternate in presenting their ideas and results.

Term Projects:

A number of programming intensive (sometimes open ended) projects will be offered. Alternatively, you will have a chance to make a preliminary search, think about your desired area of research and propose your own term project.

The project topics will be reviewed and fixed at a later meeting (**to be announced**) If you find your own project topic of interest, you should bring it to me for a preliminary discussion.

- **Term Projects:** These will require programming effort, reporting and presentation. The implementation language should be either C/C++ or Matlab 7.0.0 (R14). The intermediate reporting is to help you focus your effort and organize your timing. Final report and presentation will present all your work. The following will be expected:
    - ***Intermediate report:*** Definition of the problem/task, Summary of previous efforts (from the web or paper references). Chosen implementation language / framework. An outline of how you will implement it. What the outcome will look like? Work allocation for team members.
    - ***Final report/presentation:*** Both a report will be submitted and a presentation will be given. Definition of the problem, algorithmic details, some level of implementation details. Work breakdown for team members. Demo of the implementation. If the work is open ended and not completed within the course, then a convincing plan of how it will be finalized.

- **Quality of Reports:** You are considered to be engineering professionals. You will be expected to present a well structured, quality report that has an introduction and conclusion as well as all the relevant information in a well organized manner. If you are not familiar with a well written report format, I will post examples from the previous year. The report should contain all the extra details that might be left out of the presentation. As an exercise in publication, the reports will be in the double column IEEE Conference Format but with no strict page limit.

- **Presentations:** You will present the material in a 15 minutes PowerPoint presentation (electronic). There will be an additional 5 minute period for questions. Another 10 minutes will be allocated for term project demonstrations. Both team members will present a section of the presentation and they will answer the questions together. The time and place for the presentations will be announced later in the class web site.

- **Term Project Programs/Demos:** You will be expected to produce a presentable program or model to solve the problem that you have chosen. This will have a concise but functional GUI interface that makes all the relevant points about the task clear. Basic GUI work is possible with reasonable effort in C/C++ and in Matlab. Over-polished interfaces are not necessary and will not be considered as a contribution. You are all intelligent people. If you feel good about it, then the chance is high that it will be of acceptable quality. Source package of your work (in zipped format) as well as all support materials will be submitted electronically in METUONLINE together with your reports.

- **Submissions:** The date for submitting the intermediate term project reports will be announced later at the course web site. Final reports will be submitted some time before the date for the presentations (to

be announced). The reports will be submitted electronically together with all working code and sources. Late submissions are strongly discouraged. They will be graded at most %80 of full value for up-to 2 days late and %50 full value for up-to a week late. Reports later than that will not receive any credits.

Midterm Assignment:

One midterm exam will be in the form of a solo programming assignment. This will involve the implementation of some standard algorithms on a small size toy problem and presenting performance results in the form of a report and a demo program. The assignment will be collected through the course web site.

Policy on Collaboration:

For the projects, you will work in teams and will be expected to contribute equally to the team's performance. Collaboration between teams is possible out-of-class at a level where general ideas and algorithms are discussed. In-class discussions will be a necessary part of the class. Cheating, copying work from each other or from the web will not be tolerated. Remember that I am not that bad in searching the web!

Good wishes note:
This is an exiting field and a good opportunity to learn. I hope you will enjoy it as much as I enjoy teaching it. Good luck and have a nice spring term.