

Non-Traditional Projects in the Undergraduate AI Course

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1. SUMMARY

Projects in the Artificial Intelligence course have evolved over the years. Along the way, they have taken several forms, including small-scale LISP/Prolog projects, larger-scale object-oriented projects in CLOS/C++, projects organized around games, and more recently, projects organized around the concept of agents. All along, educators have attempted to make the projects more appealing and instructive at the same time.

In this panel, we will examine three disparate approaches for making AI projects more instructive and engaging:

- The first approach organizes all the projects around a central theme, in this case, machine learning;
- The second approach uses inexpensive robots as the platform for traditional projects;
- The third approach moves to a software platform that enables working with advanced or simulated robots as well.

All three approaches have been evaluated, and make supplementary materials available for use by interested faculty.

2. MACHINE LEARNING – INGRID RUSSELL

We will present a suite of adaptable hands-on projects that can be closely integrated into a one term AI course. Our work unifies the Artificial Intelligence (AI) course around the theme of machine learning and creates an adaptable framework for presenting core AI concepts around that theme. Machine learning is inherently connected with the AI core topics and provides methodology and technology to enhance real-world applications within many of these topics. Machine learning is now considered as a technology

for both software development (especially suitable for difficult-to-program applications or for customizing software) and building intelligent software (i.e., a tool for AI programming). Our projects emphasize the relationship between AI and computer science in general, and software development in particular and highlight the bridge that machine learning provides between AI technology and modern software engineering. Each project involves the design and development of a learning system which will enhance a particular commonly-deployed application. In an introductory course one wishes to impart a wide variety of topics efficiently, indexing the major areas of the field. A machine learning application can be rapidly prototyped, allowing learning to be grounded in engaging experience without limiting the important breadth of an introductory course. The projects span several applications including Web user profiling, character recognition, the N-Puzzle problem, the jeopardy dice game Pig, Web document classification, and the popular board game Clue.

We will present our projects as well as our experiences using them. Evaluation results indicate that the projects enhanced the student learning experience in the introductory AI course and that students demonstrated a better understanding of fundamental AI concepts such as Knowledge Representation and Search. Students were better motivated to learn the fundamental concepts both of AI and machine learning. The projects also stimulate students' interest in additional AI and machine learning related areas [7,8]. Additional information about our work is available at <http://uhaweb.hartford.edu/compsci/ccli>.

3. LEGO ROBOTS – AMRUTH KUMAR

I have been using LEGO robots as the platform for projects in my Artificial Intelligence course since fall 2000. The objectives of my approach are:

- The robots must be easy to use, hence, LEGO robots which are plug-and-play.
- The projects must emphasize traditional AI topics such as search, expert systems and neural networks (as opposed to say, robotics or robot construction). Adapting these topics to the robot format situates the projects, and can lead to better engagement of students.
- Using robots in AI should entail minimal course-time/laboratory/instructor overhead for the institution, hence, open-lab format for the projects.

I have developed and tested several fully-constrained (as opposed to open-ended) projects that adapt traditional topics to LEGO robots. I will present the design of the projects, robot hardware,

demonstration props, and robot software; share my experience and point out pitfalls in the design and execution of robot projects; and discuss the logistics of using LEGO robots in the AI course.

My experience has been that students find the robot projects more challenging, yet more enjoyable than symbolic projects in AI; and the projects are effective at helping students learn AI concepts [5,6]. Additional information about this project is available at <http://phobos.ramapo.edu/~amruth/grants/robots>.

4. PYRO – DEEPAK KUMAR

We have developed a Python-based programming environment called Pyro (for Python Robotics) that enables uniform and easy access to sophisticated research-level robots. In addition to the software, we have developed extensive courseware that can be used in different ways in various undergraduate and graduate AI curricula. The development of Pyro and associated courseware has the following goals:

- it should be easy for beginning students to use - it should provide a modern object-oriented programming paradigm
- it should run on several platforms
- it should allow exploration of many different robot control paradigms and methodologies
- it should remain useful as users gain expertise
- it should be extendable
- it should allow for the creation of user-defined visualizations
- it should be distributed as open-source
- it should be usable on actual robots, as well as simulated robots to enable schools without robot hardware to use it

The resulting software and courseware are available at www.pyrorobotics.org. The software has been adopted in many different AI courses at several institutions. The available materials allow faculty to tailor the use of robots and control paradigms according to the goals of their individual courses [1,2,3,4].

In the panel, I will represent the position of moving the teaching of AI courses away from LEGO-based robots to more realistic and viable platforms that can also be used for doing advanced AI research. I will present examples of its use and results from various course offerings that use Pyro.

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