An AI Repository as a Course Development Resource

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ABSTRACT

This paper presents preliminary results on an on-going project with AAAI (American Association of Artificial Intelligence) to develop a repository of pedagogic resources for the Introduction to Artificial Intelligence course. This repository is intended to assist educators by providing a variety of resources that may be utilized in the classroom to facilitate learning of various aspects and topics in Artificial Intelligence (AI). These resources include syllabi, sample programming assignments, sample written assignments, on-line tutorials on specific AI topics, papers related to AI pedagogy, AI tools and environments, and source code included in popular AI textbooks. This paper also discusses how these resources may be used by AI educators to develop course materials for the Introduction to AI course.

1. INTRODUCTION

Artificial Intelligence is moving rapidly toward the mainstream in the field of computer science[3]. The growth of AI theory and application has contributed to its recognition as a key area of study. AI is now becoming an integral part of the undergraduate curriculum and its coverage there has begun to be addressed. In the past few years, coverage of AI topics in the CS curriculum has been addressed numerous times. For instance, the ACM/IEEE-CS Curricula 1991 makes specific recommendations regarding coverage of AI topics in the curriculum [1,2]. Additionally, a number of papers have appeared discussing the various topics and concepts to be included in undergraduate introductory AI courses and providing pointers to related resources [1,11]. Finally, several papers have identified various delivery methods of presenting such material, ranging from preparing a three-credit course in AI to spreading the material over a number of courses in the curriculum [2,6,11]. However, due to its broad range of coverage, AI is a difficult course to teach.

This paper presents preliminary results on an on-going project with AAAI (American Association of Artificial Intelligence) to develop an AI Educational Repository intended to assist educators teaching the undergraduate Introduction to AI course. The project was announced by the president of AAAI at the AAAI Fall symposium held in New Orleans in November 1994, a symposium motivated by concerns voiced by AI educators regarding difficulties associated w-ith teaching this course.

This paper presents a brief overview of the repository with some sample sections and concentrates on its structure and how it can effectively be used as a tool in facilitating the process of course creation and curriculum development by AI educators.

2. OVERVIEW AND STRUCTURE OF THE REPOSITORY

The repository is a central registry and distribution point for resources and materials related to AI pedagogy. It contains a collection of resources including syllabi, sample programming assignments, sample written assignments, on-line tutorials on specific AI topics, papers related to AI pedagogy, AI tools and environments, and source code included in popular AI textbooks. After examining several available textbooks and course syllabi, the following topics were used to organize the available resources: Expert Systems, Fuzzy Logic, Knowledge Representation, Logic and Reasoning, Natural Language Processing, Neural Networks, Robotics, Search and Game Playing, and Vision.

The repository is structured as follows:
. General resources, which include syllabi, papers, general purpose tools, and available textbook materials.
. Core topics, which include: Search and Game Playing, Logic and Reasoning, and Knowledge Representation.
- Advanced topics, which include: Expert Systems, Fuzzy Logic, Natural Language Processing, Neural Networks, Robotics, Vision, and Other.

More on the structure of the repository can be found in Manaris and Russell[4], and the repository can be accessed at http://www.aaai.org/ Education-Repository/education-repository. html.

3. REPOSITORY AS A COURSE DEVELOPMENT RESOURCE

This section discusses how this repository may be used to develop course materials. Since a common set of core topics is usually covered in the Introduction to AI course, the AI Repository includes a section on each of these. These topics include logic, knowledge representation schemes, and search techniques.

In addition to the core topics, instructors may introduce one or two advanced AI topics to give a broad foundation in these areas and to motivate further study. In addition to helping instructors with the core topics covered in the AI course, the repository will perhaps have more of an impact in helping instructors in the coverage of the more advanced topics. Coverage of such topics in the undergraduate AI textbooks is usually minimal and shallow. Advanced texts in these areas are beyond undergraduate understanding levels and in many cases instructors struggle to compile appropriate material that is at the right level to supplement class lectures. Advanced topics that are commonly included are: neural nets, computer vision, robotics, fuzzy logic, expert systems, and natural language processing. In the remaining sections, we will discuss how the repository can help instructors in the compilation of material that can be used in covering these advanced areas. We will focus our discussion on one specific topic, neural networks, and provide excerpts from the repository's section on neural networks. Similar material also exists in the repository for the other advanced areas covered in the undergraduate AI course.

For each of these advanced topics, the repository will, when complete, have sections on: Module Outline, On-line Tutorial, General Resources, and Tools and Environments. The sections that follow present more details on each one of them and show how each can be used in the course. The discussion will be within the context of neural networks, a topic that has been more prominently covered during the last few years. Figure 1 shows the neural networks entry.

3.1 NEURAL NETWORKS MODULE

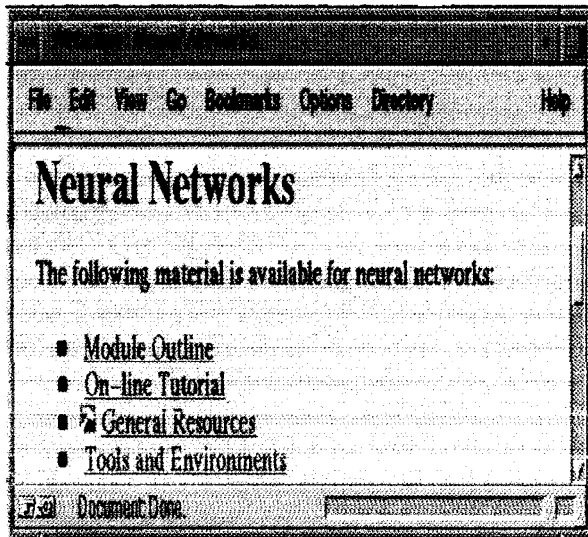This section of the repository presents a classroom tested module that includes an outline of topics to
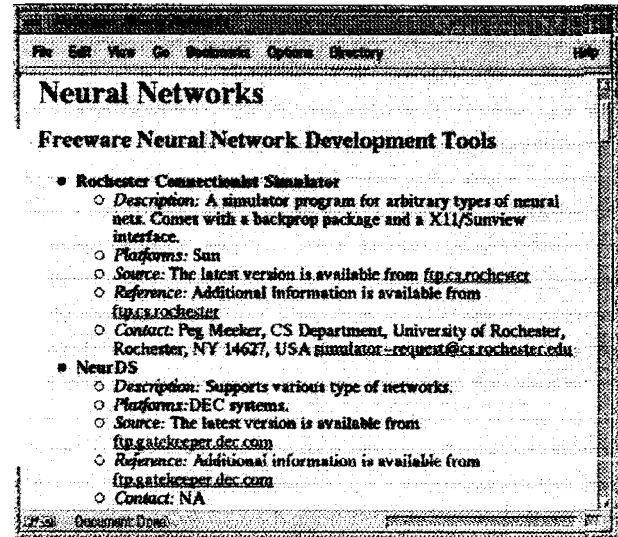
Figure 1. Neural Networks Entry.

Figure 2. Excerpt from the Neural Networks Tools and Environments Entry.

be covered as well as details regarding each section in the outline. The goal is to provide students with an appreciation of the capabilities of neural networks in general and to help them develop some basic understanding of several of these networks and how they can be used in application areas. Such a module provides students with a valuable introduction to the field, points to directions of research and further study, and highlights some of the problem-solving capabilities that these parallel distributed systems possess. Coverage of such advanced topics, even though it is minimal, may encourage students to pursue further courses in these areas. The module consists of the following sections:

. Brief History of Neural Networks
● Definition and Structure of a Neural Network
. Learning Algorithms
. Pattern Associator
● Hebb Rule
. Delta Rule
. Generalized Delta Rule

3.2 ON-LINE TUTORIAL

Since advanced topics are not easy to cover and require considerable knowledge from the instructor and since Introductory AI books have very limited coverage of these topics, it is very valuable to AI instructors to have available on-line tutorials on these topics. Most instructors find themselves having to search for and collect material to supplement the book when covering these topics. Currently, a number of papers are available in the area of neural nets. However, for the most part they are too advanced and at a higher level than desired for an undergraduate course.

The on-line tutorial serves a two-fold purpose, assisting instructors who wish to become familiar in a given advanced topic, and assisting students of the Intro to AI course. Currently, books written in these advanced topics are at a high level. Such a repository will provide tutorials in each of these topics for

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1996 ASEE Annual Conference Proceedings

instructs who are not familiar in that area. The tutorial available in the AI Repository is intended to be an introduction to the field at a level undergraduate students can follow [9]. It is also designed to provide useful exposure to the field of neural networks by introducing simple yet powerful neural network models. Suggestions for further reading provide a more in-depth look into the topic, if desired.

3.3 GENERAL RESOURCES

Another major problem that instructors face when covering these advanced topics is the selection of projects that are at appropriate levels for students in that class. This is very often a challenge not only for the common topics that are covered in the intro course but also for the advanced topic section. What often happens is that students are given a choice of projects, spanning various topics covered in the course. Because of the nature of these projects and the fact that instructors are not experts in these areas, the presence of a sample of these projects in the repository will be valuable to the instructors. Some of these projects cover core topics while others give the student a chance to expand his/her knowledge in one of the advanced topics. The repository includes a sample of projects that ranges from brief descriptions of projects to detailed projects in each of the advanced topics. For neural networks, for example, one sample project presented is to write a program that simulates and tests a given neural network model, such as a pattern associator. Students are asked to study the effects of changing a number of factors including the learning rate and the number of training iterations. They then are asked to determine which combination of the above factors provides reasonable performance. Students are asked to test the network's ability to generalize what it learned about the training patterns to other similar patterns.

3.4 TOOLS AND ENVIRONMENTS

The majority of currently available AI-related resources are geared towards production environments as opposed to educational environments. Since it takes much longer for students (and the instructor) to get acquainted with the former, their adoption may be undesirable for a regular one-semester/quarter Introduction to AI undergraduate course. However, for graduate-level courses where a more advanced and focused approach is desired, it maybe appropriate to concentrate more on the production-oriented systems. Therefore, the repository provides a balanced mix of tools and environments in terms of hardware/software platforms, acquisition cost, system complexity, and specific AI topics.

Based on various parameters and constraints as well as depth and level of coverage, instructors can make the best choice of tool for their own situation. The tools have been grouped into two categories: freeware development tools and commercial development tools. For each tool, we include a brief description, the various platforms that support the tool, FTP information on the latest version, and locations of additional references and information available including the contact person. Figure 2 shows an excerpt from the neural networks tools and environments entry.

4. CONCLUSION

The last few years have seen great advances in AI and have witnessed rapid growth in its practical applications to diverse fields. This growth has in turn created discussion regarding the role of AI in computer science and generated calls for the incorporation of AI into the undergraduate curriculum. This paper presented preliminary work on the development of an AI Educational Repository available on the World Wide Web, whose aim is to provide instructors of the Introductory .41 course with a teaching educational tool that fully explores the potential of the Web in the design and creation of course material. The repository is an on-going project which will grow as more researchers and educators continue to contribute to its development, and which

when complete should have a significant impact on and contribution to the development and design of the Introductory AI course.

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BIOGRAPHICAL SKETCH

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