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The AIXPLORATORIUM: A Vision for AI and the Web

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Abstract

The web is making fundamental changes to the field of artificial intelligence (AI), ranging from how we teach AI to how we conduct research. The rich assortment of media available—including applets, sound, video, down-loads, and text—can be exploited to make AI come alive. This article discusses an all-encompassing vision to create a web-site—an exploratorium for artificial intelligence—that is informative, useful, up-to-date, and, most important, fun.

1 Introduction

Artificial Intelligence is an exciting research area, with fundamental advances still occurring at a brisk pace. We *artificial intelligentsia* can watch as the science advances, as major challenges are addressed and conquered. We can watch ideas migrate out of the research labs, and into successful real-world applications. We can appreciate the splendor of the mathematics and the formalisms, the clever algorithms, and the solid empirical results. And more important, we can understand the basic ideas, and use them, with their associated theorems and algorithms, in addressing and solving our problems.

While we can appreciate and apply these results, many of our colleagues cannot. Why? Unfortunately, many of these ideas are non-trivial, and the learning process required to get up to speed can require a big commitment of time and energy.

Our field is challenged to find ways to better communicate our results, as well as our excitement, to our peers (both others within AI and in other fields), as well as our students and the lay-public. Fortunately, there are now a number of first-rate textbooks. While these do help, no static textbook can bring alive the many subtle AI ideas — especially as much of AI is inherently about algorithms, and hence is *dynamic*. It is better to, instead, have *animated* systems, like web applets.

Of course, many people—professors teaching AI at universities, authors writing textbooks, companies trying to sell AI-based technologies, students writing projects—have already realized this, and produced a number of web-based applets, each designed to motivate and illustrate some particular AI idea. Unfortunately, these sites are scattered throughout the web. Moreover, these web-sites also have learning curves, especially as each has its unique terminology, notation, look-and-feel, etc. Even worse, there is tremendous variation in the quality of these web-sites, ranging from simple projects done by undergraduates, through professional jobs, with well-designed GUIs and comprehensive descriptions of the ideas. Unfortunately, it is not always clear which web sites are accurately portraying their topic.

The AAAI organization has begun to address some of these issues, in producing its "AI-TOPICS" web-site (neé "PathFinder", [AIT]). This site, designed to provide answers to the questions people pose about AI in general, is very impressive and professionally done, and contains a vast repository of material that is well organized, easily searchable, and presented in an engaging way. The AI-TOPICS is an excellent first step to bringing order to the chaos that is the web. But, if we are to marshal the web's resources into a coherent placard for artificial intelligence, then considerably more work needs to be done. This article presents a vision for the creation of a an exploratorium for artificial intelligence on the web—the AIXPLORATORIUM.[1]

2 Our Vision

A vision is insight and imagination; it does not have to be grounded in reality. As a vision, the AIXPLORATORIUM would cater to a diverse collection of interest groups:

Researchers. A repository for the latest up-to-date research papers, results, data sets, etc.

Educators and students. Material for teaching artificial intelligence, including web applets, tutorials, code, etc. Make learning AI fun!

Funding agencies. Material to introduce each subfield, coupled with both previous success stories and caveats.

News media. We should highlight AI success stories and advances in the field.

[1]The term "Exploratorium" is trade-marked and unavailabe, hence the merged name.

J.Q. Public. Well-designed content would allow the casual reader to be able to visit the site and learn something about AI (and return for another visit).

The site would offer something for everyone—a very ambitious goal. The reality, of course, would be something less, since realizing this vision would take many years and many millions of dollars. Nevertheless, we want to promote the idea of having a single definitive site for all AI topics; the one place that everyone should go to learn more about our exciting and changing field.

Based on our experience in designing and developing the AIXPLORATORIUM web-site [AIx], we would like to suggest several ways that the current AI-TOPICS website can be enhanced. The vision is a resource that is fun, informative, useful, and up-to-date:

Fun: Most articles will include multimedia material, including animation, video clips, games, exercises, ..., to illustrate the ideas. Many will also include interactive demos, which lead the user through the complexities of the task and/or algorithm by presenting small pieces that successively build on the previous information. Most of these will include a "My turn" facility, which allows the user to try out her/his own ideas, to see whether s/he can produce solutions that are more effective than the received approach.

That is, we want to make this web-site a place where people *want to go*, rather than just be a site that people go to when they have to.

Informative: These interactive articles, "interArticles", will be written by the experts in the areas, then rigorously reviewed and edited, and augmented with appropriate multimedia components, as well as relevant cross-links.

Useful: In addition to reading/playing with the interArticles, the user will be able to down-load various algorithms and datasets, as well as possible exercises. S/he can also follow cross-links to other material, both within the web-site and elsewhere. Moreover, all this should all be available for *free*!

Up-to-date: After the articles are written, the staff associated with this effort will work to maintain the information—by scanning the literature for new results, and then deciding whether to include the relevant new material as an addendum (to both text and perhaps applet), to re-write the relevant portion of the article/applet, or to add a new interArticles, updating the pointers as appropriate. In addition to this "bottom-up" process, the editorial staff will periodically scan the material in a top-down fashion, seeking out-of-date material to excise, or at least de-emphasize. Finally, we will implement mechanisms that allow readers to respond to the authors—offering new insights, suggesting possible corrections, etc., which may then lead to updates.

3 Issues and Suggestions

Our AIXPLORATORIUM system [AIx] is still in its formative stages. Still we have had to address (or at least side-step) a number of issues, many of which are relevant to a more ambitious web-based presence. We list several below.

Audience: The first and most important consideration is the intended audience. As mentioned above, there are many possible target audiences, each have different content requirements (*e.g.*, research results versus teaching tools), presentation methods (*e.g.*, reference guide versus "AI for dummies"), learning (*e.g.*, do-it-yourself versus step-by-step guide), etc. Clearly different material needs to be presented in different ways for different classes of user. Does an AIXPLORATORIUM cater to one audience? Some? All?

Usage: A related issue is the intended use of the system. Should it be like an encyclopedia, with a body of useful archival information chunked into bite-size, independent articles? Another option is the text-book or tutorial model, with a single coherent framework and notation, and perhaps a common set of examples throughout. Here the reader would expect a progression of ideas, in the sense that the material in Section 5 can assume the reader has already read and understood the material in Sections 1 through 4. It might also include exercises.

Applet design: Applets play a key role in providing an engaging web site. In the design of applets, it was a major challenge just to decide what an applet should display. Based on the two applets we designed, we converged on showing three types of information (which we implemented as three panels on the display): the dataset, the algorithm, and the "data structure" (*e.g.*, decision tree). We also noted that the applet alone was not sufficient—it is much better to have a story that goes with it, to slowly introduce the ideas, notation and control.

As a design constraint, we also tried to include a facility for users to try out their own tweaks, using their specific modification to the algorithm, datasets, or starting configurations, as we found this was much more satisfying than simply having canned demos. We were pleased to note that authors of other applets, for other packages, had independently made similar decisions.

Learning methods: Within the context of a tutorial model (either for the entire web-site, or some subtopic) there are other issues, depending on the model of the user. Some users prefer being spoonfed, with a step-by-step tutorial. Others prefer "discovery learning": just explore on their own, with a large collection of tools to play with, but only a minimal amount of guidance. In some situations, (some) users will want the full details, with all of the mathematical formulas and details; while in other situations, casual popular writing is more appropriate.

Standards: Standards are essential to make this all work. It is difficult to write software that runs under all browsers, on all operating systems, and compatible with all versions of Java. There will have to be trade-offs, but these decisions need to be made early in the development process.

Note the AI-Topics web-site is more like an encyclopedia, due perhaps to its approach of assembling existing articles from various locations, authors and contexts. While there is perhaps some notion of a progression of ideas within a subtopic, there is little connection between subtopics.

The vision is a single site that is "everything for everyone"—which will serve all of these functions. This goal is grandiose, and perhaps unobtainable for material assembled into a static, ordered book. It remains to be seen whether this is possible using an active, richly-structured web-site, with pointers, cgi-scripts, etc.

4 Requirements

We need several things to make this vision a reality:

Researchers who understand the underlying ideas, can design the basic frameworks, write down the core ideas, and monitor the literature to see what else is needed.

Programmers to implement these ideas, producing a system that works flawlessly, across a number of host machines, browsers and versions of the software.

Graphics designers and **web gurus** to make sure the web pages are effective and esthetically pleasing.

Editorial support and **proof-readers** to verify the text is similarly correct.

Money (and lots of it) to pay for the people mentioned above, as well as the server and software in general.

5 Who Should be Involved?

No single group can make this happen. For a (partial) AIxploratorium vision to become a reality, numerous people need to be involved, including:

AAAI must show leadership to help popularize AI and enhance the resources available to people working in this area.

Researchers are needed to design, develop, supervise, and referee content. One can consider doing this in such a way that researchers can earn academic credit for their efforts.

Publishers must recognize that the world is changing; static words on paper cannot compete with the dynamics of the web. Don't get left behind! One approach is to have AIxploratorium development go hand-in-hand with the development of a major AI textbook.

Funding agencies need to recognize that development of web sites like the AIxploratorium is a valid e-learning project. There are lots of research opportunities that can explore pedagogical issues, standards, assessing quality, etc.

Companies can get involved by sponsoring web pages.

6 Conclusions

The AIxploratorium is not completely original—one need only look at other disciplines to see that they are moving rapidly to have a major web presence. The AI-Topics effort is an excellent start, and we commend AAAI for the initiative. We want to see this effort accelerated.

Yes, the AIxploratorium vision is too grandiose—at least right now. But it is essential to have a long-range vision, so that short-term decisions made today do not adversely affect where AI wants to go.

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References

[AIT] `http://aaai.org/Pathfinder/pathfinder.html`.

[AIx] `http://www.cs.ualberta.ca/~aixplore`.