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Book Reviews

Bayesian Networks and Decision Graphs, Second Edition by Finn V. Jensen and Thomas D. Nielsen, Springer Verlag, 447 pp., $79.95, ISBN 0-387-68281-3
doi:10.1017/S0269888908000076

Bayesian networks and decision graphs is the second edition of what, in my opinion, was the benchmark textbook on graphical probabilistic models. Unlike many second editions, it is not only an update of the first edition but also greatly expanded, and the magnitude of the change is reflected in the presence of a second author and the addition of nearly 200 pages. Indeed, the change is not just the addition of material, but a complete revision of the way the book is organized.

The first edition divided the material into two parts, first covering the representation of probabilistic influences (or, rather, the absence of independencies) by graphical models and then describing algorithms for carrying out inference in those models. The new edition starts with the basic probability theory, and then is split into two—one part deals with Bayesian networks and the other part deals with decision graphs. In both parts we are first introduced to the models, and then told how to do inference within the models. Given that much of the new material is on decision problems, this rearrangement makes sense. It keeps the discussion of algorithms closely tied to the material on representation, and also makes the book more accessible to anyone who is only interested in either Bayesian networks or decision graphs.

Part of the new material covers Markov decision processes (both fully and partially observable). While one might cavil that they are not really decision graphs, including such a widely used approach is, in my view, an excellent idea, and one that adds a great deal of value to the book. The only problem with this addition is that there is no real discussion of learning in such models. This is a shame since one of the great strengths of these models is their close connection to reinforcement learning, a connection that means that the entire model can be learnt from scratch. However, that is a minor flaw in a very good book, and given the extent of the revisions that they carried out, an understandable omission on the part of the authors. Once again Finn Jensen has delivered a book that should be the standard text on the subject. I look forward to seeing the next edition.

Reviewed by Simon Parsons
Brooklyn College, City University of New York, USA

Augmented Learning: Research and Design of Mobile Educational Games by Eric Klopper, MIT Press, 251 pp., $35.00, ISBN 978-262-11315-1
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As technology has become cheaper, and hence more widespread, there has been increasing interest in bringing it into the classroom. The aim of doing this has been not only to teach about technology but also to make use of technology in teaching. Despite all the money that has been spent, this use of technology does not appear to have been very successful in improving education. There seem to be two reasons for this. First of all, there is the issue of accessibility. Typically computers are not really in the classroom at all, they are in some other space (for perfectly good

reasons like ease of maintenance and ensuring that there are enough computers for every student in a class to use one), and this makes them hard to use in the usual kind of timetable. By the time a class has gathered itself, got to the computer room and started up the machines, there is little time to work before everything has to be shutdown and the students head out to the next class. Second, there is the issue of content. Typical educational software tries to exploit the tremendous appetite for computer games, assuming that since students are happy to spend hours every day playing games that involve chasing and shooting things, then they will be equally engaged in games that involve doing arithmetic and solving word puzzles. Sadly, such games exhibit little of the subtlety—need for lateral thinking, transfer learning, and group interaction—that modern videogames, and those who play them, take for granted.

To deal with these problems, Eric Klopper's group at the MIT Media Lab have been developing educational games on handheld devices, and these games are the subject of *Augmented Learning*. The use of handheld devices solves the accessibility problem since such devices—they concentrate on the Palm and the Pocket PC (sadly ignoring the Nintendo DS, despite its prominent place both on the cover and in the handheld market)—are cheap enough that they can really be housed in every classroom. Despite the hardware and software limitations of such platforms, they can be used to provide much more engaging games than is typical of educational software, and indeed possibly than can be provided for desktop machines.

The key is that handhelds are mobile, and this mobility can be used to stimulate interaction[1]. As an example, consider the game 'Live Long and Prosper' developed by Klopper's group. In this game, students have to grow a long-living organism, breeding individuals by beaming data between different handhelds. To breed, students have to physically move around the classroom, and identifying the desirable traits quickly leads to discussions about the role of different genes, discussions that would be much harder to get started without the mechanism of the game to carry forward student interest. (This shows another key difference between Klopper's games and more traditional ones—the former do not try to teach, instead they support the students in learning from each other.)

Mobility is even more important in the game 'Environmental Detectives', also described in *Augmented Learning*. Here the information provided to students is location-dependent, with location information being provided by GPS. Students have to move to particular locations in order to 'meet' with specific artificial characters, and to take specific actions (like obtaining samples or having the samples analyzed). More complex kinds of interaction are also possible. In 'Outbreak @ the Institute', for example, operations can be carried out on other players, and those operations vary from location to location, so groups of players need to closely coordinate their movements in order to progress in the game.

As yet there is no real evidence that this approach to educational games will be any more successful than the traditional one—there is plenty of anecdotal evidence but Klopper's games have not been used widely enough to gather significant data. However, the approach seems to me to have a lot more going for it than the traditional one. Not only does it bring the notion of educational games up to date in its encouragement of interaction but it also is also a big step towards student-centered learning, providing a structure around which students can seek out information for themselves, discover new ideas, and engage in critical thinking and dialogue. This form of teaching is one that the evidence shows to be more effective than the more usual 'push' techniques, and encourages the development of transferable skills. As a result, I think we will see much more augmented learning in school and university classrooms and hear much more about *Augmented Learning*.

Reviewed by Simon Parsons
Brooklyn College, City University of New York, USA

[1] Interaction is, of course, key to many popular videogames in contrast to the popular view of such games as being solitary and antisocial—indeed there are games, such as World of Warcraft and other multiplayer role-playing games, in which players probably have a greater degree of interaction than they do in real life.