AI EDAM 25th anniversary issue reflections

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Reviewing the research activities of the engineering design community over the past few years (many of which find their home in *AI EDAM*) reveals that the field is on the cusp of a major breakthrough in computer-assisted design research. I believe we are on the edge of making a shift to computer-*directed* design. Consider the following: methods from case-based research or design by analogy are gaining acceptance and need more accessible stores of design knowledge from which to extract analogies. Automated concept generation algorithms exist that are capable of parsing hundreds of thousands of alternatives across a multitude of domains in a matter of seconds. Failure and risk prediction is possible now at the earliest stages of product design with appropriate statistical data on relevant prior designs. Design is more frequently grappling with large, complex systems that go beyond one designer's, team of designers' or single firm's knowledge and ability to predict interactions of the vast number of components. Fully utilizing these findings and solving the remaining integration issues may well advance the field to the next level and era of computer-*directed* design.

My particular interest in this area has been to imbue the engineering design process with artificial intelligence (AI), that is, what I am calling computer-directed design. As a designer, my favorite activity is concept generation. It is exciting to identify the real needs of a customer, to imagine new solutions to a problem, and to consider all of the permutations; but it is also time consuming to complete, impossible to be completely thorough, and difficult to know everything you need to about a particular problem. That is where it has been an absolute joy to be both a contributing party and a spectator of the AI in design community. Over the 15 or so years that I have been involved in this community, I have watched the research move from defining basic units for design computation (e.g., functional, behavior, and component lexicons) to creating more and more advanced ways of generating concepts (e.g., generative grammars, matrix-based synthesis, mining of biological analogies) and now to evaluating concepts (e.g., design preference modeling, uncertainty modeling). All of these activities are moving design computation further into the "front end" of design. We are producing algorithms and techniques that truly are AI and, although not replacing the human designer, can handle the more tedious tasks involved with producing and evaluating concepts.

Although I do not advocate a future where HAL- or Sky-Net-like computers run our lives, the promise of computer-directed design should allow the human designer to innovate further and faster based on the legwork that the AI methods analyze, synthesize, and present back to the designer. For 25 years, *AI EDAM* has been the place where the signature works in the AI in design community are published. As a member of the Editorial Board, I will make sure that remains true and look forward to being a part of and seeing the results of this dynamic community of researchers.

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