Configuration and Recommender Systems: Two Converging Research Fields

By Markus Zanker[1,2] and Juha Tiihonen[1]

Configuration (CS) and recommender systems (RS), two successful applications of AI techniques, have enjoyed wide-spread implementation for more than a decade. In addition to supporting sales-related functions, both have become immensely popular and active research fields in the context of Web-based commerce.

The history of knowledge-based configuration systems dates back to the first rule-based systems for ensuring the technical correctness of customer-defined orders for computer systems [2]. With the application of the Mass Customization paradigm to industries like automobiles, machinery, computers or furniture, configurators have been in widespread use ever since. Mittal and Frayman [4] defined configuration as a special type of design activity, with the key feature that the artifact being designed is assembled from a set of pre-defined components. Consequently, a configurator computes valid configurations, i.e. product instances, that conform to a given generic product structure and comply with a set of restrictions ensuring for instance compatibility, connectivity and customer requirements.

The field has continued to evolve since the late 1980s, exploring various higher-level knowledge representation mechanisms in order to enable shorter system development cycles, provide higher maintainability and more flexible reasoning. With the advent of Web-based commerce, configuration systems have had to satisfy new requirements such as online availability, ease-of-use or personalized interaction modes.

Tailoring the configuration process to the assumed informational needs and technical capabilities of the user or personalizing selection options based on past interaction logs has recently been identified as an avenue for further research in the field. These challenges connect configuration research with the field of recommender systems. RS help users to identify those items that will most probably interest them out of large sets of choices. One of the first application domains for a recommendation technique termed *collaborative filtering* was a personalized online news platform [5]. However, generating personalized recommendations for a user based on the opinions of peers with similar preferences quickly became popular in other online commerce domains such as movies, music or books. For instance, the online superstore *amazon.com* very successfully converts visitors into buyers by supporting their decision making with personalized recommendations. Since then a variety of additional recommendation approaches such as content-based, knowledge-based, utility-based and hybrid variants thereof have been explored [3]. More recent application domains with complex product items such as financial services or travel packages require the merging of knowledge based approaches with statistical learning methods like collaborative filtering. Thus, further interaction between both research fields seems inevitable in the near future.

This conference report will in the following outline the additional contents and discussions of both workshops.

I. ECAI 2008 - Workshop on Configuration Systems

The Workshop on Configuration Systems was the 11th in the series started at the AAAI'96 Fall Symposium (Cambridge, MA) and has continued in association with IJCAI, AAAI, and ECAI conferences since 1999. In addition to researchers from a variety of different fields, the events have attracted a significant number of industrial participants from major configurator vendors like SAP, Oracle, ILOG, and Tacton, as well as from end-users like Siemens, HP, or DaimlerChrysler.

Fig. 1. Rio-Antirrio bridge, a cable-stayed bridge crossing the Gulf of Corinth near Patras

The 2008 Patras workshop was a 1.5 day event that took place from July 21st to 22nd [6]. Its program consisted of nine technical papers and three invited talks. The invited talk of *Markus Stumptner* from University of South Australia titled "Reconfiguration from First Principles - with a fair bit of pragmatism in the mix" addressed the challenging topic of reconfiguration. Reconfiguration is used to modify an existing configuration to satisfy new requirements, usually with the goal of implementing minimal changes to existing individual products. Existing work was reviewed and new ideas were presented, providing practical solutions to existing and new application areas such as web service composition and responding to time-bounded changes in sales quotation processes. Research must continue in the future if languages capable of modeling general reconfiguration problems in commercial environments and inference systems based on general purpose reasoning mechanisms are to become a reality. The industrial invited talk of *Andreas Falkner* from Siemens on "Two Decades' Experience

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[1]Organizer and Chair of the ECAI 2008 Workshop on Configuration Systems

[2]Organizer and Chair of the ECAI 2008 Workshop on Recommender Systems

in Developing Product Configurators" discussed the breadth of configuration problems in a large manufacturing company. For a long time Configurators have played a vital role in Siemens' business processes. Adopting new solutions and satisfying user requirements has in the meantime lead to the introduction of 6th generation of in-house developed configuration systems. A demonstration of the new S'UPREME configurator comprehensively illustrated the current state-of-the-art. Albert Haag from SAP gave the invited talk "What Makes Product Configuration Viable in a Business?". He reflected on the commercial and technical promises of The PLAKON system envisioned in 1985 and concluded that the original commercial expectations have not yet been met. Total cost of ownership, return on investment in configuration systems, technology gaps as well as integration hassles are still impediments for the pervasive deployment of configuration technology. Finally, exemplary business scenarios, commercial obstacles and an outlook on emerging trends were presented.

In addition, the workshop on configuration systems had three sessions, discussing technical papers on the following topics:

- Fundamentals: modeling and constraint based systems (4 papers)
- Personalization and Interactivity (3)
- Process Integration and Long-term management (2)

To summarize, presentations and discussions exhibited emerging trends and continuously active topics. It appears that application domains are being extended beyond traditional products to service industries and software configuration. Personalized interaction modes, long-term management of configurators and their knowledge bases, as well as reconfiguration and integration with other systems is becoming increasingly important.

II. ECAI 2008 - WORKSHOP ON RECOMMENDER SYSTEMS

The workshop continued the series of successful Workshops on Recommender Systems over the past decade, following in the footsteps of a similar one at ECAI 2006 or the Joint Workshop on Intelligent Techniques for Web Personalization and Recommender Systems at AAAI 2007 and 2008 to name only a few.

All submissions underwent a double-blind peer review process by at least three members of the international programme committee. The workshop was also held in conjunction with the 18th European Conference on Artificial Intelligence on July 22nd in Patras, Greece [7].

The workshop started with an invited talk titled "Revealing the Magic of Product Recommendation" by *Thomas Roth-Berghofer* who is Senior Researcher at the German Research Center for Artificial Intelligence (DFKI). He introduced the audience to the case-based recommendation paradigm that on the one hand exploits domain specific knowledge encoded as similarity functions on product items or cases, and on the other hand utilizes community knowledge by evaluating past system interactions. Due to their knowledge on item similarities, such systems are capable of explaining why a specific product was proposed to the user. Despite the fact that explanations for recommendations rarely appear in practical applications, they may help to stimulate users' trust in a system and make its function more transparent.

In addition the workshop consisted of three technical sessions dealing with the following topics:

- Social and Interactivity Aspects of Recommender Systems (4 papers)
- Algorithms and Security (4)
- Recommender Systems and Knowledge Management (3)

Accordingly, the workshop received a wide spectrum of technical contributions ranging from different recommendation scenarios like Web 2.0 or help-desk agents to algorithm improvements or attack strategies. The Netflix competition strongly stimulates research on algorithm improvements for collaborative filtering and subsequently the workshop included two technical papers presenting new strategies in the field. However, discussions at the workshop questioned if the current state-of-practice that evaluates algorithms' accuracy based on few historic datasets really captures their true performance and their effect on the user. As a result, a special issue on "Measuring the impact of personalization and recommendation on user behaviour" by the International Journal on Human-Computer Studies is now calling for contributions addressing this

research question this autumn [1]. As online superstores diversify their product portfolios the potential of cross domain recommendations is an additional item for future research.

REFERENCES

[1] CFP: Measuring the impact of personalization and recommendation on user behaviour. *International Journal on Human-Computer Studies*, 66(10):756, 2008.

[2] Virginia E. Barker, Dennis E. O'Connor, Judith Bachant, and Elliot Soloway. Expert systems for configuration at digital: Xcon and beyond. *Communications of the ACM*, 32(3):298–318, 1989.

[3] Robin Burke. Hybrid recommender systems: Survey and experiments. *User Modeling and User-Adapted Interaction*, 12(4):331–370, 2002.

[4] Sanjay Mittal and Felix Frayman. Toward a generic model of configuration tasks. In 11th *International Joint Conferences on Artificial Intelligence*, pages 1395–1401, Menlo Park, California, 1989.

[5] P. Resnick, N. Iacovou, N. Suchak, P. Bergstrom, and J. Riedl. Grouplens: An open architecture for collaborative filtering of netnews. In *Computer Supported Collaborative Work (CSCW)*, Chapel Hill, NC, 1994.

[6] Juha Tiihonen, Alexander Felfernig, Markus Zanker, and Tomi Maennistoe, editors. *Proceedings of the ECAI 2008 Workshop on Configuration Systems*. ECAI 2008 - University of Patras (ISBN 978-960-6843-01-3), Greece, 2008.

[7] Markus Zanker, Alexander Felfernig, and Robin Burke, editors. *Proceedings of the ECAI 2008 Workshop on Recommender Systems*. ECAI 2008 - University of Patras (ISBN 978-960-6843-06-8), Greece, 2008.

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