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A knowledge push technology based on applicable probability matching and multidimensional context driving

Key words: Product design; Knowledge push; Applicable probability matching; Multidimensional context; Personalization

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Motivation

1. Knowledge push is one of the key technologies in intelligent product design, which is the future direction of manufacturing (Xu et al., 2013).

2. A knowledge push technology usually includes matching of related knowledge and proper pushing of matching results.

3. Knowledge matching methods commonly use similarity calculation to set the filtering threshold according to experiments and manual intervention, which is insufficient.

4. Pushing of matching results is less personalized. Some advanced methods, such as design intent capture and interest acquisition, are in the early stages of research and not mature.

Main idea

1. Combining design content with the knowledge center, including the design knowledge base and design case library, the applicable probability matching method serves knowledge matching using probability theory.

2. The method of personalized knowledge push is driven by multidimensional contexts, which include design knowledge, design context, design content, and the designer. The highly demanded knowledge can be ranked first in the push queue to the designers.

Method

1. Knowledge matching is performed via the method of applicable probability matching, which is inspired by the Naive Bayes classifier.
2. The hierarchical design content models are built to filter the knowledge in push results.
3. The multidimensional contexts decide the final sorting rules for personalized push results from the four dimensions, including design knowledge, design context, design content, and the designer.

Major results

Applicable probability matching method can match the correct design knowledge and avoid manual setting of the filter threshold.

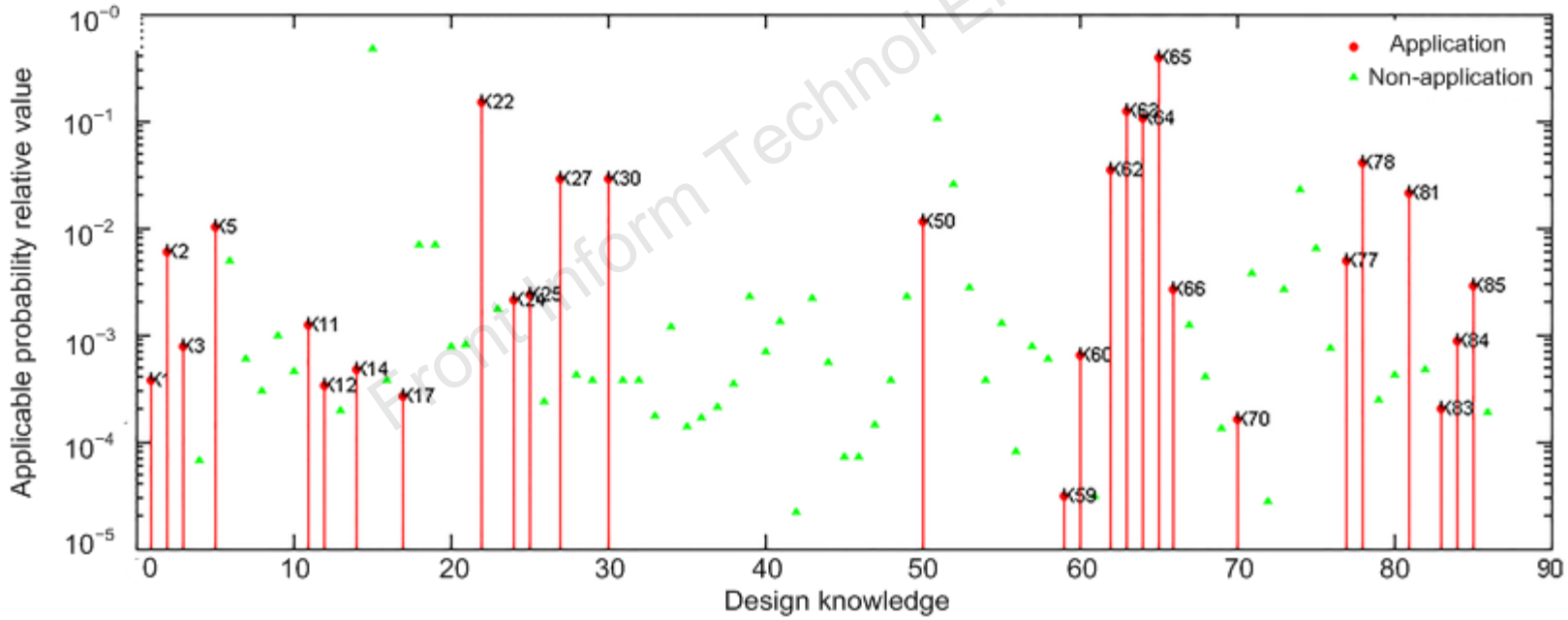

Fig. 6 Results for design knowledge matching (References to color refer to the online version of this figure)

Major results (Cont'd)

The hierarchical design content models and multidimensional context-driven sorting rules serve the personalized knowledge push for different designers.

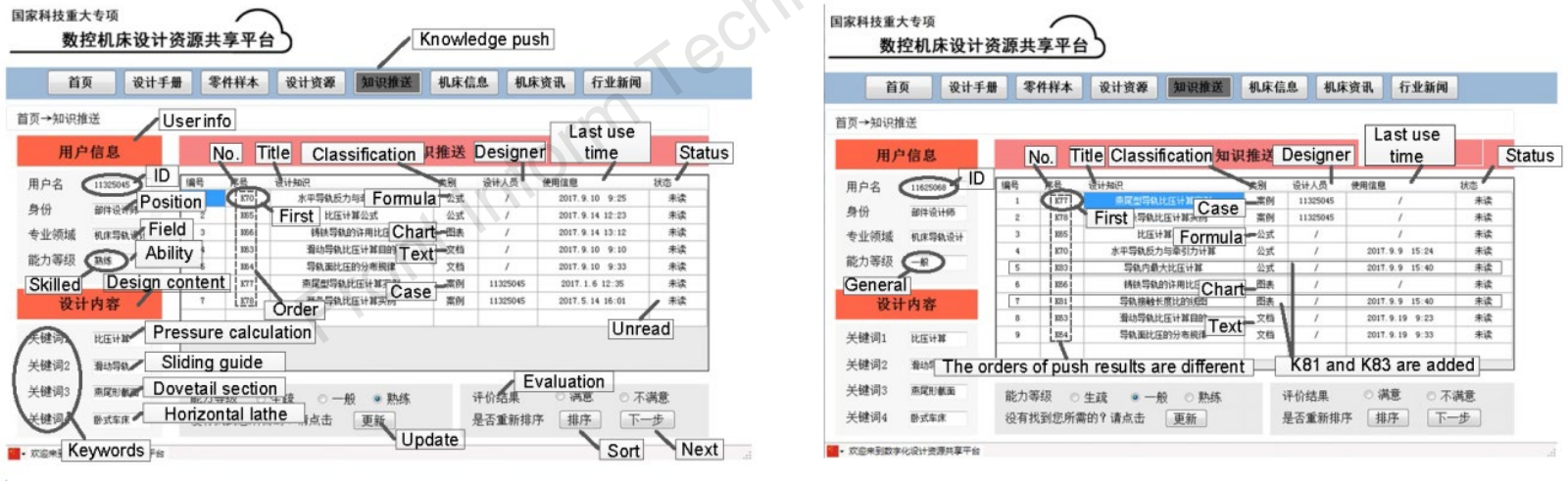

Fig. 10 Push results for two different designers

Conclusions

1. The applicable probability matching method in knowledge matching can set the filtering threshold automatically compared with traditional knowledge matching methods.

2. The hierarchical design content models overcame the difficulty that a traditional model cannot meet different designers' requirements. The multidimensional context driven sorting of push results ensures that designers can find the highly demanded knowledge as soon as possible.

3. We developed a knowledge push system based on intellectualized design of CNC machine tools and completed an illustrative example on the design of horizontal lathe guides. Experimental results showed that the push results were accurate, and that the system can provide a personalized knowledge push service.