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# Dissertation Defense

***Doctor of Philosophy in Computer Science***

"**Leveraging Interactive User Feedback for Personalized Data Visualization Recommendation**" by **Xiaozhong Zhang**

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**Abstract:** Data visualization is a powerful tool to communicate information clearly and efficiently, and is widely used in data analysis to support data-driven decision making. To provide data visualization (i.e., view) recommendation, a variety of utility functions have been proposed to estimate the utility of the views, such as usability and usefulness. Different utility functions assess different aspects of a view's utility and can be combined to form a multi-objective utility function. Selecting a good utility function that can generate visualization that is both usable and useful is not a trivial task, because the search space of visualization configurations (e.g., variables to visualize, data transformations, visual encodings) is prohibitively large.

Traditional view recommendation systems typically do not consider user preferences of utility functions or user expectation of view values, leading to further suboptimal recommendation. A predefined utility function is not likely to fit all users' needs at all times. User expectation also plays a role in the utility of a view. For example, if a peculiar pattern is expected by the user, then they will not find it very interesting in a recommended view. In order to support effective view recommendation for a given analysis, in this thesis, we propose a new paradigm, called *Interactive View Recommendation (IVR)*, in which the system iteratively interacts with the user to elicit user preference information and expectations to formulate the most suitable utility function.

IVR has two main objectives: *high recommendation quality* and *low user interaction effort*. However, these two objectives are usually in conflict, making the IVR problem even more challenging than traditional view recommendations. As a proof-of-concept, we propose *ViewSeeker*, an active learning-based IVR framework and prototype system, which intelligently selects informative questions for user feedback to achieve a satisfactory recommendation quality while minimizing user interaction effort. ViewSeeker implements three main functionalities: (1) utility function preference learning, (2) user expectation learning, and (3) external knowledge base utilization. Simulated and real user studies were conducted to evaluate ViewSeeker's effectiveness in leveraging interactive user feedback for personalized view recommendation, showing that with acceptable user effort, ViewSeeker can outperform current non-IVR recommenders.