SimBaTex: Similarity-based Text Exploration

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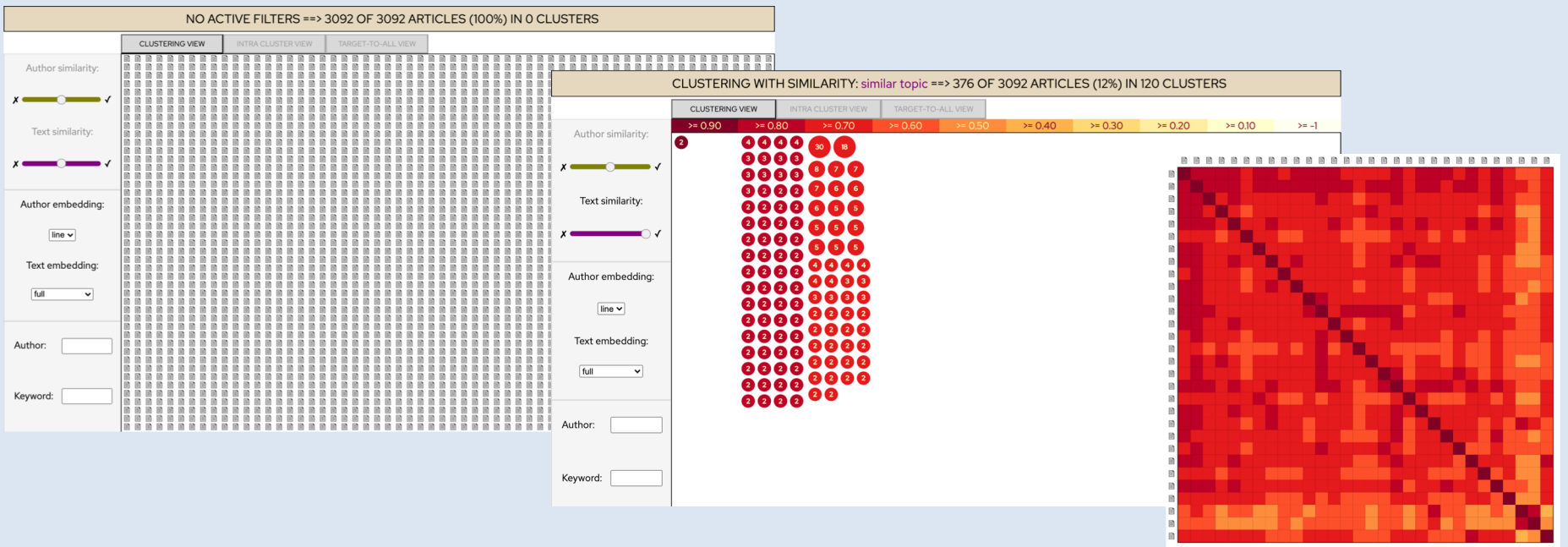
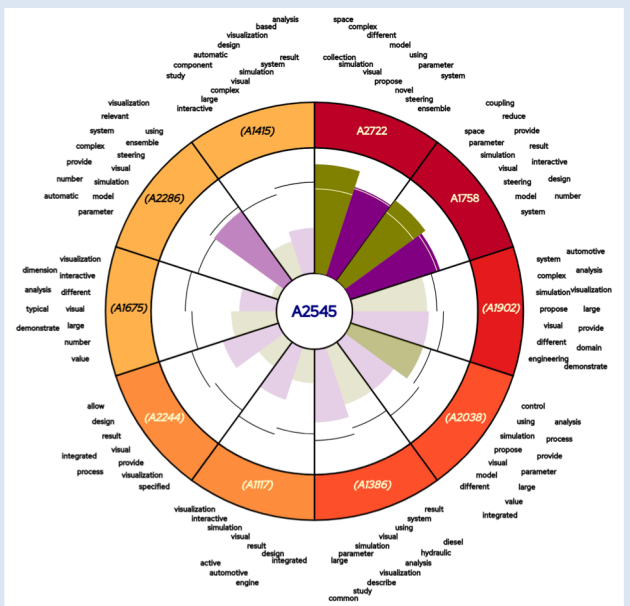
Natural language processing in combination with visualization can provide efficient ways to discover latent patterns of similarity which can be useful for exploring large sets of text documents. In this poster, we present an overview of the interface of a work-in-progress visual analytics application, called SimBaTex, which is based on embedding technology, dynamic specification of similarity criteria, and a novel approach for similarity-based clustering. The goal of SimBaTex is to provide search-and-explore functionality to enable the user to identify items of interest in a large set of text documents by interactive assessment of both high-level similarity patterns and pairwise similarity of chosen texts.



REVEAL HIGH LEVEL SIMILARITY PATTERNS

Enable, disable or invert the specific similarity criteria to cluster each document together with the document that it is most similar to (if any) given the current settings. Assess the homogeneity of the created clusters through heatmap displays.



A2545 Kresimir Matkovic, Denis Gracanin, Rainer Splechtna, Mario Jelovic, Benedikt Stehno, Helwig Hauser, Werner Purgathofer	In this paper we propose a novel approach to hybrid visual steering of simulation ensembles. A simulation ensemble is a collection of simulation runs of the same simulation model using different sets of control parameters. Complex engineering systems have very large parameter spaces so a naïve sampling can result in prohibitively large simulation ensembles. Interactive steering of simulation ensembles provides the means to select relevant points in a multi-dimensional parameter space (design of experiment). Interactive steering efficiently reduces the number of simulation runs needed by coupling simulation and visualization and allowing a user to request new simulations on the fly. As system complexity grows, a pure interactive solution is not always sufficient. The new approach of hybrid steering combines interactive visual steering with automatic optimization. Hybrid steering allows a domain expert to interactively (in a visualization) select data points in an iterative manner, approximate the values in a continuous region of the simulation space (by regression) and automatically find the "best" points in this continuous region based on the specified constraints and objectives (by optimization). We argue that with the full spectrum of optimization options, the steering process can be improved substantially. We describe an integrated system consisting of a simulation, a visualization, and an optimization component. We also describe typical tasks and propose an interactive analysis workflow for complex engineering systems. We demonstrate our approach on a case study from automotive industry, the optimization of a hydraulic circuit in a high pressure common rail Diesel injection system.
A2722 Rainer Splechtna, Kresimir Matkovic, Denis Gracanin, Mario Jelovic, Helwig Hauser	Multi-level simulation models, i.e., models where different components are simulated using sub-models of varying levels of complexity, belong to the current state-of-the-art in simulation. The existing analysis practice for multi-level simulation results is to manually compare results from different levels of complexity, amounting to a very tedious and error-prone, trial-and-error exploration process. In this paper, we introduce hierarchical visual steering, a new approach to the exploration and design of complex systems. Hierarchical visual steering makes it possible to explore and analyze hierarchical simulation ensembles at different levels of complexity. At each level, we deal with a dynamic simulation ensemble - the ensemble grows during the exploration process. There is at least one such ensemble per simulation level, resulting in a collection of dynamic ensembles, analyzed simultaneously. The key challenge is to map the multi-dimensional parameter space of one ensemble to the multi-dimensional parameter space of another ensemble (from another level). In order to support the interactive visual analysis of such complex data we propose a novel approach to interactive and semi-automatic parameter space segmentation and comparison. The approach combines a novel interaction technique and automatic, computational methods - clustering, concave hull computation, and concave polygon overlapping - to support the analysts in the cross-ensemble parameter space mapping. In addition to the novel parameter space segmentation we also deploy coordinated multiple views with standard plots. We describe the abstract analysis tasks, identified during a case study, i.e., the design of a variable valve actuation system of a car engine. The study is conducted in cooperation with experts from the automotive industry. Very positive feedback indicates the usefulness and efficiency of the newly proposed approach.
A2545 Kresimir Matkovic, Denis Gracanin, Rainer Splechtna, Mario Jelovic, Benedikt Stehno, Helwig Hauser, Werner Purgathofer	In this paper we propose a novel approach to hybrid visual steering of simulation ensembles. A simulation ensemble is a collection of simulation runs of the same simulation model using different sets of control parameters. Complex engineering systems have very large parameter spaces so a naïve sampling can result in prohibitively large simulation ensembles. Interactive steering of simulation ensembles provides the means to select relevant points in a multi-dimensional parameter space (design of experiment). Interactive steering efficiently reduces the number of simulation runs needed by coupling simulation and visualization and allowing a user to request new simulations on the fly. As system complexity grows, a pure interactive solution is not always sufficient. The new approach of hybrid steering combines interactive visual steering with automatic optimization. Hybrid steering allows a domain expert to interactively (in a visualization) select data points in an iterative manner, approximate the values in a continuous region of the simulation space (by regression) and automatically find the "best" points in this continuous region based on the specified constraints and objectives (by optimization). We argue that with the full spectrum of optimization options, the steering process can be improved substantially. We describe an integrated system consisting of a simulation, a visualization, and an optimization component. We also describe typical tasks and propose an interactive analysis workflow for complex engineering systems. We demonstrate our approach on a case study from automotive industry, the optimization of a hydraulic circuit in a high pressure common rail Diesel injection system.
A1758 Kresimir Matkovic, Denis Gracanin, Mario Jelovic, Helwig Hauser	Interactive steering with visualization has been a common goal of the visualization research community for twenty years, but it is rarely ever realized in practice. In this paper we describe a successful realization of a tightly coupled steering loop, integrating new simulation technology and interactive visual analysis in a prototyping environment for automotive industry system design. Due to increasing pressure on car manufacturers to meet new emission regulations, to improve efficiency, and to reduce noise, both simulation and visualization are pushed to their limits. Automotive system components, such as the powertrain system or the injection system have an increasing number of parameters, and new design approaches are required. It is no longer possible to optimize such a system solely based on experience or forward optimization. By coupling interactive visualization with the simulation back-end (computational steering), it is now possible to quickly prototype a new system, starting from a non-optimized initial prototype and the corresponding simulation model. The prototyping continues through the refinement of the simulation model, of the simulation parameters and through trial-and-error attempts to an optimized solution. The ability to early see the first results from a multidimensional simulation space - thousands of simulations are run for a multidimensional variety of input parameters - and to quickly go back into the simulation and request more runs in particular parameter regions of interest significantly improves the prototyping process and provides a deeper understanding of the system behavior. The excellent results which we achieved for the common rail injection system strongly suggest that our approach has a great potential of being generalized to other, similar scenarios.

ASSESS DETAILED PAIRWISE SIMILARITY

Select a specific document for target-to-all comparison to reveal the pairwise similarity with the Top 10 best matches, both in compiled form and as highlighted text for close reading.

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