

A VISUAL ANALYTICS APPROACH FOR ANALYZING TECHNOLOGICAL TRENDS IN TECHNOLOGY AND INNOVATION MANAGEMENT

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MOTIVATION

Visual Analytics provides with a combination of automated techniques and interactive visualizations huge analysis possibilities in technology and innovation management. Thereby not only the use of machine learning and data mining methods plays an important role. Due to the high interaction capabilities, it provides a more user-centered approach, where users are able to manipulate the entire analysis process and get the most valuable information. Existing Visual Analytics systems for Trend Analytics and technology and innovation management do not really make use of this unique feature and almost neglect the human in the analysis process.

TREND ANALYSIS FOUNDATIONS

Identifying and analyzing trends refer mainly to these questions:

1. *When* have technologies or topics emerged and when established?
2. *Where* are the key-players and key-locations?
3. *Who* are the key-players?
4. *What* are the core-topics?
5. *How* will the technologies or topics evolve?
6. *Which* technologies or topics are relevant for an enterprise?

To answer these questions, the data should own the following properties: type of publication, publication year, extracted topics, authors, countries, affiliations.

INTERACTION APPROACH

- Approach for investigating the entire analysis process for visual trend analytics covers four main steps: Overview, Search, Visualization and Tasks.

1. Overview

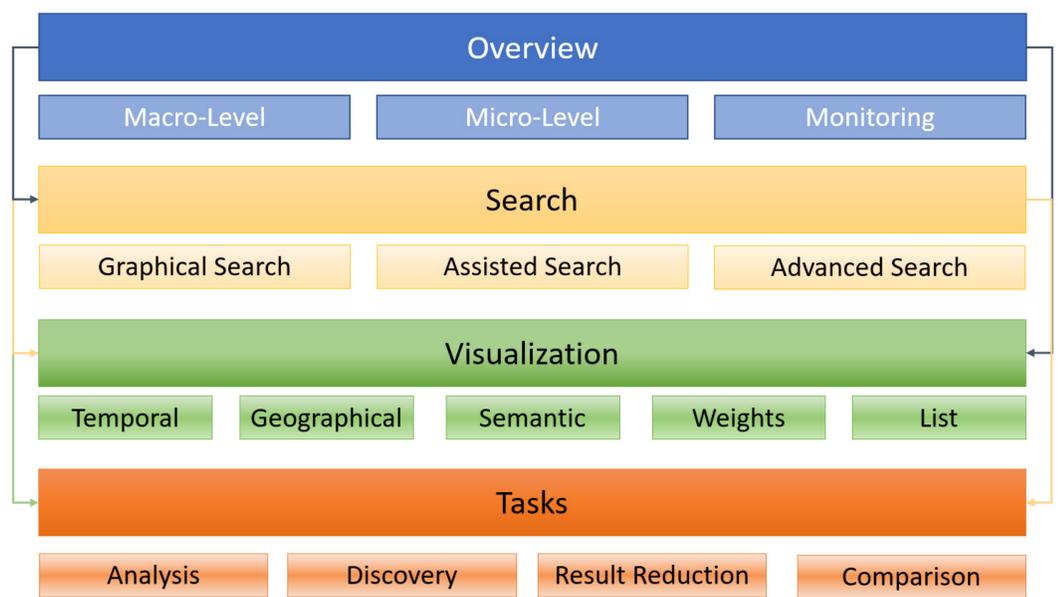
- *Macro-Level* should give an initial overview of emerging trends out of the entire data base
- *Micro-Level* gives an overview of all related topics in a temporal manner and insights of the main technologies and approaches for a certain key-term that is either searched or selected from the macro-level overview
- *Monitoring* provides a personalized word cloud that illustrates the most search or selected terms for a single person → a simple user model with a bag-of-words approach is implemented and enables the user to select the terms that wants to monitor.

2. Search

- *Graphical Search* allows a visual search in search where terms/POIs are shown as circle and can be dragged & dropped on others
- *Assisted Search* extends the search functionalities beside traditional linguistic methods with a topic-based approach
- *Advanced Search* is detecting automatically all data rows in the database and provides dedicated search in those tables

3. Visualization

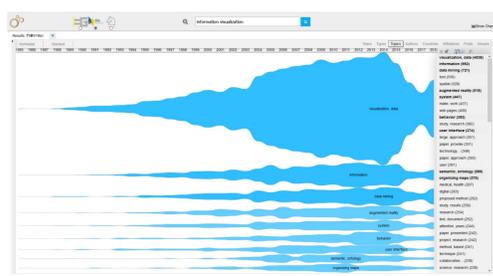
- a set of different visualizations that are based on different data models that are the foundation of the underlying visual structures



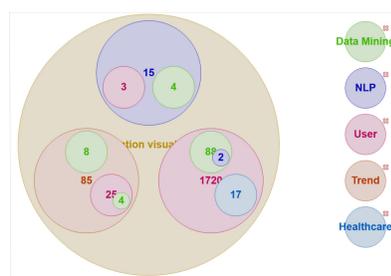
4. Tasks

- *Analysis* tasks incorporates solving a complex analytical task with a specific goal in order to strengthen the potentials of an enterprise or other institution
- *Discovery* tasks aims at detecting unexpected patterns, topics, technologies or correlations in data
- *Result Reduction* is essential for every research task, e.g. researching for related technologies or competitors
- *Comparison* task can be performed on two different levels: Comparison on data-subset with two same visual layouts or comparison of different databases

DESIGN & IMPLEMENTATION



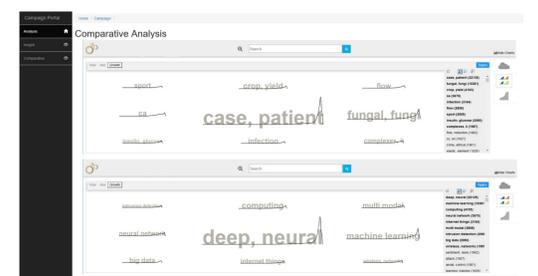
➤ Overview on Micro-Level: temporal spread of related topics for a single key-term (in this example for information visualization).



➤ Graphical Search: the initial search-term is represented as a circle, users can define further search terms and drag them into the initial search-term to get a nested number of combined search.



➤ Visualization: examples of integrated temporal, geographical, semantic, weight and list visualizations.



➤ Comparison Task on macro-level by using macro-level overview visual layouts.

CONCLUSION

- Proposed an approach for Visual Trend Analytics that included the economic tasks in a human-centered way
- We applied and illustrated each step of our approach with a Visual Analytics system for technology and innovation management

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