Workshop Summary

While reading through the papers this year, one topic appeared more often than others—*navigation*. Navigation in the physical world is a complex cognitive process; finding one's way in a digital environment can be even more challenging, and has its own peculiarities. Navigating an information space is indispensable for understanding its content and structure, it is an activity accompanying higher-level tasks. Acquiring information about the environment—obtaining an overview, identifying objects and anchors or landmarks as well as relationships between them—is often the first step in an unfamiliar setting. This leads to devising an internal structure, storing and integrating our prior and new knowledge in order to plan and execute a task at hand by interacting with the environment. To facilitate this pursuit, we employ general-purpose visual representations and interaction techniques or tailor them to a specific information space or application. Visualizations are targeted to varying user groups, since individuals possess diverse backgrounds and differ in navigational strategies and abilities; they seek to fulfill different information needs and tasks. Visualizing semantic data introduces an extra tint to the picture—it provides advanced means to explore an information space but may increase visualization and interaction complexity.

The workshop program includes a mixture of general and application-tailored works, most of them implicitly touching the issue of navigation in an information space. They target user groups with different expertise—lay users, technically-fluent users and users possessing domain expertise. The first session—*Visualization of Domain Ontologies and Data*—takes us through several examples of how semantic techniques facilitate the exploration of domain-specific datasets. In the ontology realm, extensive navigation is often in demand to support high-level tasks—developing, modifying, consistency checking, etc. These topics together with ontology visualization are part of the second session—*Visualization in Ontology Engineering*. The next session—*Visualization of SPARQL Queries and Endpoints*—focuses on extracting and visualizing schema information using SPARQL, and visually navigating and exploring Linked Data endpoints, while the last session—*Visualization in Semantic Annotation*—is composed of two talks presenting approaches for semantic annotation in order to improve navigation and exploration.

Session I: Visualization of Domain Ontologies and Data

The first session opens the workshop by presenting several application-tailored visualizations supporting the navigation in domain-specific datasets and ontologies. The first two talks—*VIZ–VIVO: Towards Visualizations-driven Linked Data Navigation* and *PrEVIEw: Clustering and Visualizing PubmEd using Visual Interface*—take us through a topic familiar to the research community—exploration of scholarly data—, and both employ concept maps as a representation of choice. While the latter work centers around the biomedical domain and addresses PubMed data, the former makes use of

a community-driven ontology and it is not limited to a particular domain. Visually exploring geographical data from multiple heterogeneous sources is the focus of the third talk—*A Linked Data Driven Visual Interface for the Multi-Perspective Exploration of Data Across Repositories*. Staying in the realm of geo data and making a preamble to the second session, the last talk—*Exploring Visualization of Geospatial Ontologies using Cesium*—uses the globe to visualize instances from geospatial ontologies.

Session II: Visualization in Ontology Engineering

The second session is dedicated to the different stages of an ontology life cycle. The first talk—*Starting Ontology Development by Visually Modeling an Example Situation - A User Study*—compares a common approach for ontology development using the Protégé editor to an alternative workflow—visually developing an ontological background model of an example situation. The second work—*Advanced UML Style Visualization of OWL Ontologies*—brings us back to the familiar topic of ontology visualization, while the third—*Extending Ontology Visualization with Interactive Contextual Verbalization*—extends visual notations with on-demand verbal descriptions to facilitate domain experts' understanding of selected graphical elements. Developing (large) ontologies increasingly involves a number of people with different roles and development styles. The fourth talk—*Visualizing User Editing Behavior in Collaborative Ontology-Engineering Projects*—provides means to facilitate the analysis of users' editing behavior in a collaborative setting. Consequently, ontologies are changing, and tools to explore the modifications are in demand; the last talk—*Visualization for Ontology Evolution*—surveys existing ontology evolution tools and catalogues their functionalities.

Session III: Visualization of SPARQL Queries and Endpoints

A common step when navigating an information space is acquiring an overview of its content. By knowing the schema of an endpoint, the users can pose queries to fulfil varying information needs. This topic is tackled during the third session. The first talk—*A Visual Aide for Understanding Endpoint Data*—establishes three requirements necessary for providing a visual overview of an endpoint's schema. The tool that has been implemented is suitable for SPARQL-fluent users. The next work—*LD-VOWL: Extracting and Visualizing Schema Information for Linked Data Endpoints*—adapts the VOWL notation, suitable for casual users, to present an endpoint's schema extracted through a dynamic stepwise approach. While the aforementioned two works employ node-link diagrams as a representation of the graph metaphor, the third talk—*ViziQuer: Notation and Tool for Data Analysis SPARQL Queries*—adapts UML class diagrams for defining data aggregation queries. These are general approaches which facilitate the understanding of an endpoint's structure. Unlike them, the last talk—*SQuaRE: a Visual Support for OBDA Approach*—focuses on a particular scenario and provides visual support for developing mappings between relational databases and ontologies.

Session IV: Visualization in Semantic Annotation

The last session comprises two works which depict the benefits from semantic annotations to the navigation task. The first work—*Semantic Annotation and Information Visualization for Blogposts with refer*—helps content authors (lay-users) to annotate textual content in order to facilitate content consumers in discovering background information and exploring relationships between entities. The second work—*Visual Development & Analysis of Coreference Resolution Systems with CORVIDAE*—employs radial diagrams to support NLP developers in discovering errors in coreference annotation during information extraction.

Conclusion

The workshop program is a mixture of works navigating different domains, targeting diverse user groups and combining various visual metaphors. Some of the authors have conducted user evaluations to uncover the strengths and weaknesses of their approaches. More user evaluations are, however, needed to get a better understanding of which (set of) visual metaphors and representations meet best the requirements of particular user groups, domains and goals and are thus essential in this area.

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Workshop Program

Session I: Visualization of Domain Ontologies and Data

– VIZ-VIVO: Towards visualizations-driven linked data navigation, *Muhammad Javed, Sandy Payette, Jim Blake and Tim Worrall*
– PrEVIEw: Clustering and Visualizing PubmEd using Visual Interface, *Syeda Sana E Zainab, Qaiser Mehmood, Durre Zehra, Dietrich Rebholz-Schuhmann and Ali Hasnain*
– A Linked Data Driven Visual Interface for the Multi-Perspective Exploration of Data Across Repositories, *Gengchen Mai, Krzysztof Janowicz, Yingjie Hu and Grant McKenzie*
– Exploring Visualization of Geospatial Ontologies using Cesium, *Abhishek Potnis and Surya Durbha*

Session II: Visualization in Ontology Engineering

– Starting Ontology Development by Visually Modeling an Example Situation - A User Study, *Marek Dudáš, Vojtěch Svátek, Miroslav Vacura and Ondřej Zamazal*
– Advanced UML Style Visualization of OWL Ontologies, *Jūlija Ovčiņņikova and Kārlis Čerāns*
– Extending Ontology Visualization with Interactive Contextual Verbalization, *Uldis Bojārs, Renārs Liepiņš, Normunds Grūzītis, Kārlis Čerāns and Edgars Celms*
– Visualizing User Editing Behavior in Collaborative Ontology-Engineering Projects, *Simon Walk, Tania Tudorache and Mark Musen*
– Visualization for Ontology Evolution, *Patrick Lambrix, Zlatan Dragisic, Valentina Ivanova and Craig Anslow*

Session III: Visualization of SPARQL Queries and Endpoints

– A Visual Aide for Understanding Endpoint Data, *Fernando Florenzano, Denis Parra, Juan L. Reutter and Freddie Venegas*
– LD-VOWL: Extracting and Visualizing Schema Information for Linked Data Endpoints, *Marc Weise, Steffen Lohmann and Florian Haag*
– ViziQuer: Notation and Tool for Data Analysis SPARQL Queries, *Kārlis Čerāns and Jūlija Ovčiņņikova*
– SQuaRE: a Visual Support for OBDA Approach, *Michał Blinkiewicz and Jarosław Bąk*

Session IV: Visualization in Semantic Annotation

– Semantic Annotation and Information Visualization for Blogposts with refer, *Tabea Tietz, Joscha Jäger, Jörg Waitelonis and Harald Sack*
– Visual Development & Analysis of Coreference Resolution Systems with CORVI-DAE, *Nico Möller and Gunther Heidemann*