

NEWS IN TIME AND SPACE: Global Event Exploration in Virtual Reality

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ABSTRACT

We present NEWS IN TIME AND SPACE (NiTS), a virtual reality application for visualization, filtering and interaction with geo-referenced events based on GDELT. It can be used both via VR glasses and as a desktop solution for shared use by multiple users with UBIQ. The aim of NiTS is to provide overviews of global events and trends in order to create a resource for their monitoring and analysis.

CCS CONCEPTS

• **Information systems** → **Geographic information systems**; Multimedia information systems; Collaborative and social computing systems and tools.

KEYWORDS

virtual reality, virtual hypertext, virtual reality simulation, human data interaction, geographic information systems, spatial computing

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1 MOTIVATION

On a daily basis, countless events occur world wide, which can be assigned to different categories, published in different media and spread over various locations. As a result of the large amount of this information, real-time visualization is challenging in terms of actuality [8, 15], presentation [18] as well as interaction in spatial computing [14]. Earlier work pursued these research issues of visualizing Big Data in *Virtual Reality (VR)* [13], integrating an

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interactive interface between a human and the visual representation of the data [17] and geo-localizing information on virtual globes [6]. In addition, there are applications that visualise information on a globe, such as geographically indexed information on the transmission of infections [3, 9]. However, processing of the interrelationships of information that allow for a more comprehensive understanding of global events and trends over time are still pending. In order to cover this gap, we developed NEWS IN TIME AND SPACE (NiTS): NiTS combines these aspects in a collaborative hypertext environment to map location-based news and events [10] onto a globe in an interactive VR application. NiTS visualises geographically located data on a globe and allows this visualisation to be adjusted through a series of filters depending on the user's current perspective. Applications based on NiTS could address challenges of information overload through geographic information representation that overcomes the limitations of more linear information representations. In this context, various application scenarios are possible, without claiming to be exhaustive: Interaction through VR methods can provide a more hands-on information space than is possible with traditional programs without VR. This could provide a learning environment for students, who are more willing to deal with big data in a more playful way. At the same time, NiTS can also be used as a starting point for tools that emerge from further research on interacting with big data in VR. Furthermore, the incorporation of additional data sources could create applications such as weather forecasts, a Twitter world space, mapping and interaction with geological discoveries around the world, and general location-based data. Equally important are additional time-related information to visualize historical data for events such as migration periods, conflicts between people, mapping of natural disasters in vulnerable regions, as well as increases of air pollution or CO2 levels in the atmosphere in view of climate change. In addition, an integration of further collaborative features like simultaneous interaction with the data could benefit job meetings, scientific discussions and analysis by students in a classroom. Above that, an overload of information often leads to confusion, so NiTS is intended to be used to extract only the most useful information while providing visual embedding.

2 NEWS IN TIME AND SPACE IN A NUTSHELL

NiTS provides the usage of an VR interface using 3D glasses as well as a technologically simpler approach via a desktop application,

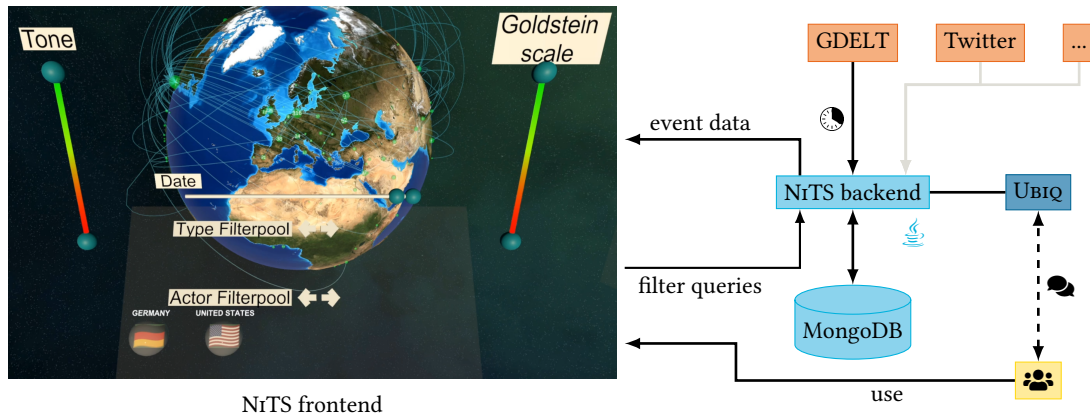


Figure 1: NiTS frontend visualizes events based on filters as well as the position and zoom level of the globe, provided by a backend. The backend periodically retrieves new information from GDELT and imports them into a MongoDB (<https://www.mongodb.com>) and prepares these to be used. Users can communicate with each other through the application using UBIQ.

with both implementations implemented in *Unity* [7]. In addition, UBIQ [4] is integrated to enable a collaborative experience as well as communication between users [1, 11]. In addition, users can control information filters (Figure 1) by moving sliders as well as interacting with a filter pool to select by event types and actors. The filters are based on GDELT [10], which is the current primary data source for NiTS; it includes time, place, actors, event types, networks, sentiment, and Goldstein scale [5]. The sliders filter over a period of time, a sentiment (“Tone”) that indicates whether the event was rated positive, neutral, or negative, and the Goldstein value that indicates the impact of an event on a country’s stability. The more complex filters by actors and event types can be combined or placed separately to map conjugations or disjunctions. Beyond that, the zoom levels and the rotation of the globe represent an implicit filter providing users with aggregations of events which give a broader overview of regions and their relations. As soon as the filter parameters are changed, the frontend requests the backend, which queries and returns the data stored in a MongoDB, which are visualized afterwards. In order to provide the frontend with data as well as to query, prepare and make the collected data available, NiTS-backend is implemented in Java using *Java Spark* [16] as a RESTful web-service; furthermore, an interface with *OpenApi3* [12] was specified. For this purpose, NiTS downloads new events and information published by GDELT each 15 minutes, which are released with a pre-analyzed “global knowledge graph” (*gkg*). After GDELT publishes a new export, it will be retrieved and mapped to the database schema by importing actors, event type, geo-location, the optional reference to a news article, the Goldstein value and the tone into the database. Additional information from *gkg* is used to enrich the events, which may include, e.g., themes from the article or pictures. Due to the extensible data model of NiTS, which is implemented as an interface, additional data sources can be integrated, as long as they contain geo-coordinates, such as Twitter or Instagram. To set up a new data source, only the defined interface needs to be re-implemented to map the data source to the database. As a result, news events are defined and visualized by a location,

the type of event and the involved actors. By grouping events into nodes [2] based on the event location and linking them via the actors involved, events of certain types can be filtered out to build networks [2] of news reports describing these events. This enables the comparison of different reports on the same events based on information provided by GDELT’s Natural Language Processing (NLP). The resulting hypertext networks provide a new perspective [2] on actor participation in global affairs to further understanding of geopolitical relations. By grouping news reports via the geo-location of the event, a user can effectively compare differences in descriptions and biases of different sources with respect to similar topics. Using filters to define a subset of event types and specific actors involved, a user can get an overview and comparison of viewpoints on this selection of events from many news sources around the world. This allows for a much broader view on topics, that typical media and news outlets can not provide, and allows a user to highlight geopolitical or cultural differences in opinions and their development over time. NiTS is freely available via GitHub¹, licensed under AGPL and can be extended and reused. A video demonstration of NiTS can be found on YouTube².

ETHICAL ASPECTS

The results of this paper have been prepared taking into account ethical aspects. Moreover, the development of NEWS IN TIME AND SPACE is based on visualizing events and news on a globe and filtering and interacting with these. Since this prototype makes no distinction between the information given and no ethical filter is inserted, it is conceivable that the individual will have a negative effect as a result of the information presented.

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¹<https://github.com/texttechnologylab/NewsInTimeAndSpace/>

²https://youtu.be/_wnbwupkLzQ

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