LODStories: Learning About Art by Building Multimedia Stories[1]

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Abstract. LODStories is an engaging application where people learn about art while constructing multimedia stories about art. LODStories mines the Linked Open Data cloud to discover interesting connections between artworks, artists, places and ideas. LODStories guides users to construct a storyboard that connects the entities in an interesting way. It then fetches text, images and videos that users can arrange to create a multimedia story, and finally constructs a narrated video that users can edit and then publish to tell their story. The process is fun, and students learn about art and its connection to the world they live in. The paper describes the architecture of the system and the algorithms to make the exploration entertaining and educational.

1 Introduction

The Internet has information about every subject one can imagine. Search engines help us find information about entities, but do little to help us see how the information is connected. Topics that seem disparate are often linked in very interesting ways. Data sources such as Wikipedia show some connections, but pouring through pages of information to explore the links is tedious and uninteresting.

LODStories solves these problems by showing the user connections between various subjects in an innovative and engaging format. It builds on the idea of Everything is Connected [1], which automatically creates multimedia stories from a start and end topics. Everything is Connected finds a path in the Linked Open Data cloud to connect the two topics, searches for relevant images and videos, and automatically constructs a narrated movie with scenes for every link in the path. LODStories takes this idea further by enabling users to choose the paths and to customize the images, videos, and text used for the narration. Most importantly, at every step of the path-

[1] The project is the work of five undergraduates at the University of Southern California supervised by Craig Knoblock, Pedro Szekely, and Miel Vander Sande (one of the creators of Everything is Connected).

construction process, LODStories suggests interesting connections to new entities, exposing users to concepts and relationships they may not know about, and encouraging them to explore in new directions. Users can add a personal touch to the stories by editing the narration, selecting media that depict the topics in ways they find interesting, and can finally share their stories with others.

The main contribution of our work is an application where users learn while having fun. William Shakespeare said, "Things won are done, joy's soul lies in the doing". Linked Open Data enables this as it explicitly represents the connections between millions of topics. Since many connections may be uninteresting, we use algorithms that find the most interesting connections to build a story and an editor that helps users tell these stories through text, images and videos.

LODStories can be used in multiple educational contexts. Teachers and museum curators can use it to create movies that tell interesting stories about art. Students can use it to build their own movies and tell stories from their point of view. However, the uses of LODStories do not just stop in the classroom. The format of LODStories allows users of all ages to themselves explore various topics and see how they can build their own connections.

LODStories is a live educational web application that builds upon Linked Open Data. A live prototype of the system is available at http://goo.gl/XIZhbJ. The software is available on GitHub at https://github.com/InformationIntegrationGroup/LinkedDataEduApp, published using an open source Apache 2 license.

2 System Description

LODStories has four main modules, the Path Finder, the Path Explorer, the Story Editor and the Story Player (Figure 1). A user starts to create a story in the Path Explorer by searching an entity from DBPedia or a Linked Data set containing all artists and artworks from the Smithsonian American Art Museum [2] (Figure 2). Then the system applies a recommendation mechanism in the Path Finder module to retrieve the top five interesting connections to the current node. In Path Explorer, users can choose to explore any existing node until satisfied with the path they explored (Figure 3) and then proceed to the Story Editor. In Story Editor users can pick any number of images or videos, and update the default text description from Wikipedia to customize their stories (Figure 4). Finally, Story Player builds on Everything Is Connected to fetch chosen Google images, YouTube videos and text descriptions and plays the multimedia story that the user created [1].

2.1 Dataset Usage.

Currently, the LODStories system has incorporated the open-source DBpedia dataset as its knowledge base. DBpedia has more than 4 million entities and LODStories focuses on people, artworks, places, organizations, and species. Currently, the system runs live queries on DBpedia to fetch data. We are now in the process of integrating

the data about the artwork from the Smithsonian American Art Museum (SAAM), which we have already mapped into Linked Open Data [2] We plan to merge both the DBpedia and SAAM data into a triplestore for faster access.

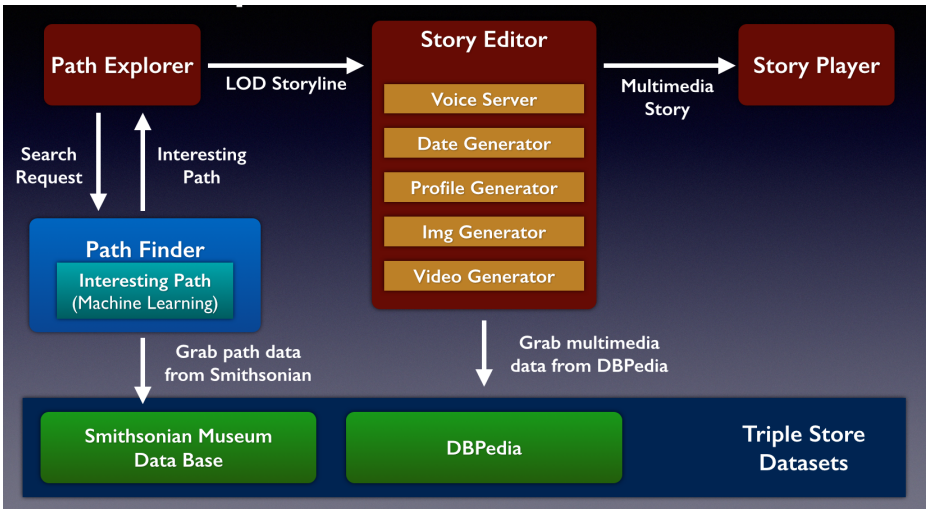

Figure 1. Architecture with components in LODStories

2.2 Implementation.

The system is divided into two main modules: the front-end user interface and the back-end path finder. The whole LODStories system is deployed under one Maven project and each sub-module is added with dependencies. We independently developed the system and we acknowledge the usage of many open-source services. Specifically, the open-source Festival Speech Synthesis System (http://www.cstr.ed.ac.uk /) was incorporated to generate speech from text for creating the sound played in the Story Player. The front-end sends requests to the back-end Path Finder module, which retrieves data from the publicly hosted DBpedia by executing SPARQL queries. Additionally, MongoDB is used to store intermediate results to improve performance.

A general usage flow of LODStories system starts with the user searching for content on the starting page of Path Explorer (Figure 2). The front-end UI module receives the selected resource and creates a parent-children structured JSON object. The communication between front-end and back-end is implemented as a REST service by sending JSON objects back and force to exchange information. Specifically, the front-end Path Explorer will send an information request to the back-end Path Finder when a user clicks to explore any node. Then, the back-end receives the JSON object and fills its content with fetched data from the database, namely adjacent nodes and the top 5 interesting nodes calculated by Path Finder. Then the front-end uses the D3 library (http://d3js.org/) to visualize the JSON objects in a tree-structured graph, with parents and children displayed as nodes (Figure 3).

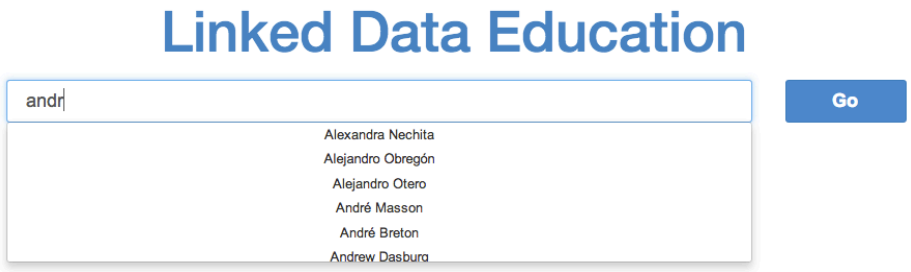

Figure 2. Path Explorer Starting Search page

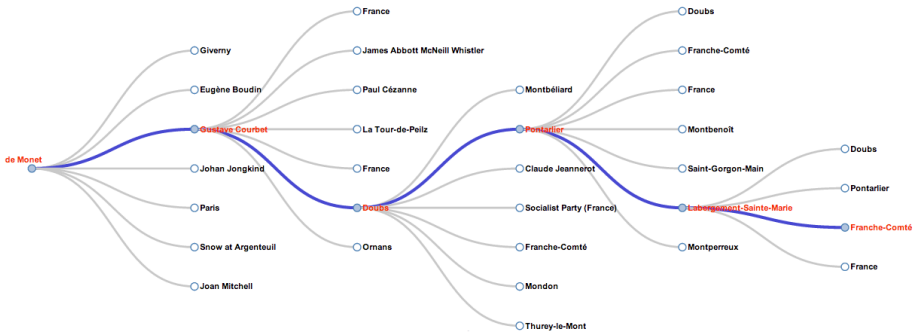

Figure 3: Path Explorer for user to explore connections between data

The node recommendation mechanism in Path Finder applies the open-source SVM machine learning algorithm from Weka (http://www.cs.waikato.ac.nz/ml/weka/) to automatically calculate the interestingness of each connection. The machine learning techniques generate the evaluation of connections. Currently, the system uses four general features:

- The rarity of the subject with the specific predicate
- The rarity of the object with the specific predicate
- The degree of the subject, which is all links to a subject
- The degree of the object, which is all links to an object

All these features are calculated through SPARQL queries and cached into a local MongoDB instance to improve data retrieval performance.

3. Discussion

The goal of LODStories is to act as a fun educational tool. Users are encouraged to explore various topics through the linked data, and the multimedia presentation ensures that the information about those topics will be presented in an interesting way.

Users have fun creating the multimedia presentations, both selecting the topics, and selecting the images, videos, and text used. The movie format encourages users to share their movies with others the way one might share a YouTube video; in this way people other than the initial user will be educated about whatever topics are mentioned.

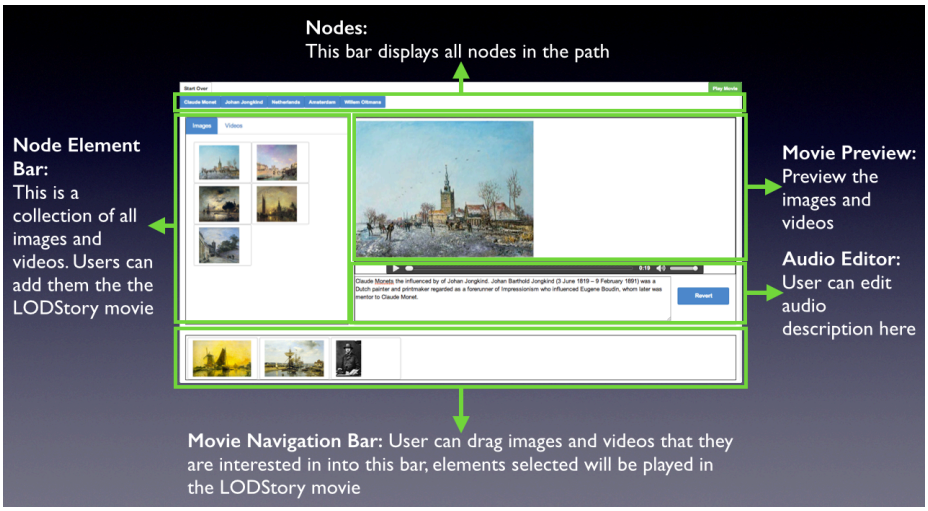

Figure 4: Story Editor for customizing stories

LODStories is based upon the already-existing application found at everythingisconnected.be. Everything Is Connected allows users to choose a start and end point, then automatically generates a path with intermediate nodes and plays back a movie about this path. The video-generation technology is derived from that of the parent application, as is the founding idea of exploring the linked data tree and generating a movie based on the relationships between nodes in DBpedia. The main difference between LODStories and Everything Is Connected is that LODStories allows the user much more freedom, both in choosing their path and in editing the videos. In order to provide interesting paths for the users to choose from, we developed a machine learning approach to rank the interestingness of a given path. And by allowing users more control over the creation process, we aim to provide more interesting end-product movies, since the users were the ones to choose the topics. In addition, the video editing software should help ensure higher quality videos, since there will be a human behind it, as well as allowing for more flexible presentations if the user wants to make sure certain information is conveyed.

Another similar application is the mobile app WikiLinks (http://wikilinks.net/), which also allows users to explore related topics or nodes. Like WikiLinks, LODStories visualizes these connections using a tree of labeled nodes. In the case of WikiLinks, however, the dataset being explored is Wikipedia rather than linked data database(s) such as DBpedia. In addition, while WikiLinks merely brings users to the corresponding Wikipedia pages, LODStories attempts to make the exploration process more interesting by presenting information in the form of a narrated movie.

LODStories is still a work in progress. The algorithm used to determine which nodes are 'interesting' and should be presented to users during the path creation process will improve over time as more input from users is attained. In addition, the video generation and editing technology will be improved in future presentations in order to provide more flexibility in the types of movies being generated as well as the content being included: Currently, users are only able to select from a collection of images/videos to be included in their movie; perhaps this may be changed so that users can manually include any image/video they want.

4. Conclusion

This paper has described the LODStories' usage, implementation details, server-side architecture, and path recommendation mechanism. With this application, users can easily identify interesting connections between artists or artworks, and learn about interesting connections while building customized multimedia stories. An important goal of LODStories is to make the application fun to use, so that students will learn about artwork as a by product of having fun playing with the application.

In terms of future work, we plan to incorporate additional datasets into the system besides DBpedia, which has a lot of data about art. Our next target dataset is the art collections data from Smithsonian American Art Museum (SAAM). With SAAM data, LODStories will have more opportunities for users to explore information about artworks. We also plan to develop a feedback mechanism to collect user input and optimize the path recommendations to guide the users down more interesting paths. The system will learn from user feedback and adjust the machine learning model to better predict which paths will be the most interesting ones to follow.

5. Acknowledgements

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References

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