

Using FindSampo Linked Open Data Service and Portal for Spatio-temporal Data Analysis of Archaeological Finds in Digital Humanities

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Abstract. This paper presents and demonstrates how FINDSAMPO, a Linked Open Data (LOD) service and semantic portal, can be used for Digital Humanities research, based on Finnish Citizen Science archaeological data integrated with GIS services. The system has been in public use since May 2021.

Keywords: Data Analysis · Semantic Web · Digital Humanities · Archaeology

1 FindSampo Framework for Archaeological Finds

Recreational metal detecting has already a quite long-lasting tradition in Europe but during the last decade this popular hobby has spread even more and grown rapidly in many countries such as in Finland. At the same time, several countries have started to develop digital reporting services to collect, analyze, and study archaeological data [3]: 1) Portable Antiquities Scheme (PAS)⁵ records archaeological discoveries found by the public in England and Wales since 1997 [1]; 2) Digital Metal Finds (DIME)⁶ is an online platform for reporting metal detecting finds in Denmark [11]; 3) Portable Antiquities of the Nether-

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⁵ PAS: <https://finds.org.uk/database>. Some 1.4 million finds have been reported in PAS by more than 14,000 citizens by now.

⁶ DIME: <https://www.metaldetektorfund.dk>

lands (PAN)⁷ is an online portal in use in the Netherlands [10]; 4) MEDEA⁸ is an online portal developed in Flanders for metal detectorists [2,11].

FINDSAMPO [6] is a new framework⁹ aiming to improve the reporting process and analysis of archaeological finds based on collaborations between the public, academic researchers, archaeologists, and heritage managers [8]. This paper demonstrates, how the FINDSAMPO PORTAL¹⁰, opened for public use on May 17, 2021, can be used for data exploration, analysis, and visualizations. The portal is based on a LOD service¹¹ that can also be accessed directly. The service currently contains data about archaeological finds made by the public in Finland that have been cataloged to the collections of the Finnish Heritage Agency (FHA) between 2015 and 2020. In contrast to the aforementioned related works, FINDSAMPO makes use of semantic web technologies and is integrated with tools for Digital Humanities (DH) research. Based on the “Sampo” model [5], the FINDSAMPO PORTAL is yet another member in the Sampo series¹² of LOD services and semantic portals that utilize the national Semantic Web DH infrastructure LODI4DH¹³.

2 Using FindSampo for Spatial and Temporal Analysis

The FINDSAMPO DATA SERVICE includes currently over 3000 archaeological finds made by the public. The FINDSAMPO PORTAL queries this data service with SPARQL, and offers search, exploration, and analysis tools for DH researchers and hobbyists. The finds can be filtered using faceted search [9] with hierarchical facets based on ontologies, and then visualized using maps with external layers from the GIS services¹⁴ of the FHA, various types of charts, and a timeline.

Faceted search can be used to get the information of some specific find, and it can also be used to analyze and compare groups of finds. The individual finds are presented as a table as the default option on wider screens, or as a more mobile friendly list with mobile devices. The various charts and timelines can be used to visualize the relative distributions of selected groups of finds. For example, pie charts can be used to compare the distributions of provinces for Iron Age and medieval finds, by making the appropriate selections from the period facet.

The map visualizations can be used to show finds made by the public and the registered archaeological sites of FHA. As an example, Fig. 1 shows finds (green markers, one of which is opened) and protected archaeological sites (red areas) along the Aura River in Turku, the former capital of Finland. A buffer

⁷ PAN: <https://portable-antiquities.nl>

⁸ Metaaldetectie en Archeologie (MEDEA): <https://vondsten.be>

⁹ More information and publications can be found on the project homepages at <https://seco.cs.aalto.fi/projects/sualt/> and <https://blogs.helsinki.fi/sualt-project>.

¹⁰ The portal is available at <https://findsampo.fi>.

¹¹ The LOD service is available at: <https://www.ldf.fi/dataset/findsampo>.

¹² The Sampo portals are described at <https://seco.cs.aalto.fi/applications/sampo/>.

¹³ <https://seco.cs.aalto.fi/projects/lodi4dh/>

¹⁴ <https://kartta.museoverkko.fi/?lang=en>

zone of 200 meters where metal detecting is not recommended is automatically calculated and shown around the sites with a dashed line. The finds can be visualized using different base maps and map layers (selected in the box on the top right) including, e.g., street maps, satellite images, and a lidar-based elevation model. The maps can be used by researchers for analysis, and by hobbyists to get information on promising places to practice metal detecting as well as on protected sites where detecting should be avoided.

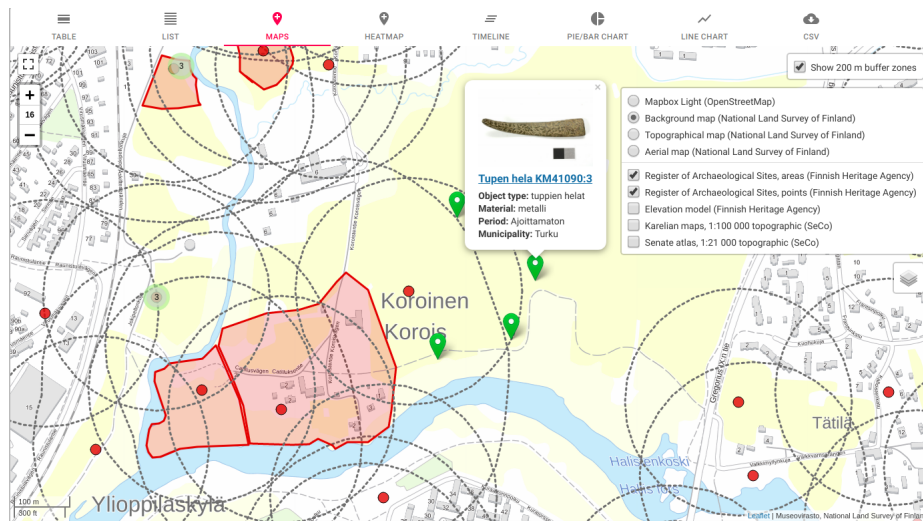


Fig. 1. Archaeological finds and protected sites along the Aura River in the City of Turku as shown in the FINDSAMPO portal.

As an example of temporal data-analysis, Fig. 2 shows a timeline visualization where all weapon finds have been filtered out using the object type facet. The timeline view of the finds groups them by province in which they were found (y-axis) and by period (x-axis). The start and end years for the periods are retrieved from the period ontology developed with domain experts, and the periods are indicated by the colors listed on the top. The user can observe that there are Stone Age and Bronze Age weapons found in only a few provinces, but there are Iron Age weapon finds from every province. Interestingly, not every province has medieval or later weapon finds.

Each individual object find has its own “home page” that contains detailed information about the find. The object types and periods have their own pages in the same way.

The FINDSAMPO DATA SERVICE can also be used directly for research by querying the data with SPARQL and then by creating analyses of the results with, for example, Python or R libraries. As the data service is open, it can also be used to create new web services such as the FINDSAMPO PORTAL by anyone.

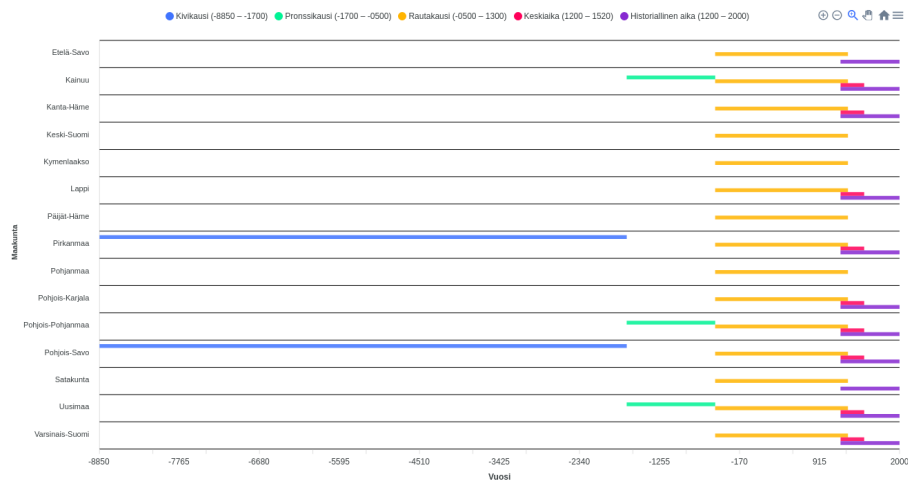


Fig. 2. The portal’s timeline visualization of all weapon finds.

The user interface of the portal is implemented with the Sampo-UI framework [7], and the source code is available on GitHub¹⁵ with an open license. The LOD service is run on the Linked Data Finland platform¹⁶ [4], which is powered by a combination of the Fuseki SPARQL server¹⁷ and a Varnish Cache web application accelerator¹⁸ for routing URIs, content negotiation, and caching.

3 Discussion and Future Work

FINDSAMPO takes the current state of the art of archaeological find databases a step further by providing a framework for utilizing Linked Data. To test and demonstrate the LOD approach, a prototype portal was presented that can be used to easily access and analyze data. Currently the public demonstrator is only for the Finnish data but the framework can be applied as well to international archaeological finds data in the future. We have already done preliminary tests on adapting the framework to the Portable Antiquities Scheme data¹⁹ of the British Museum.

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¹⁵ <https://github.com/SemanticComputing/findsampo-web-app>

¹⁶ <https://ldf.fi>

¹⁷ <https://jena.apache.org/documentation/fuseki2/>

¹⁸ <https://varnish-cache.org>

¹⁹ <https://finds.org.uk>

²⁰ Decision numbers 310854, 310859, and 310860

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