



FICHE NAVETTE: DOCTORANTS IDEX

SECTOR: Higher Education Institution

LOCATION: France, Grenoble

RESEARCH FIELD: Knowledge representation and Semantic Web

RESEARCHER PROFILE:

□ *First stage researcher,*

INSTITUTION: Univ. Grenoble Alpes, University of Innovation

One of the major research-intensive French universities, Univ. Grenoble Alpes¹ enjoys an international reputation in many scientific fields, as confirmed by international rankings. It benefits from the implementation of major European instruments (ESRF, ILL, EMBL, IRAM, EMFL²). The vibrant ecosystem, grounded on a close interaction between research, education and companies, has earned Grenoble to be ranked as the 5th most innovative city in the world. Surrounded by mountains, the campus benefits from a natural environment and a high quality of life and work environment. With 7000 foreign students and the annual visit of more than 8000 researchers from all over the world, Univ. Grenoble Alpes is an internationally engaged university.

A personalized Welcome Center for international students, PhDs and researchers facilitates your arrival and installation.

In 2016, Univ. Grenoble Alpes was labeled «Initiative of Excellence ». This label aims at the emergence of around ten French world class research universities. By joining Univ. Grenoble Alpes, you have the opportunity to conduct world-class research, and to contribute to the social and economic challenges of the 21st century ("sustainable planet and society", "health, well-being and technology", "understanding and supporting innovation: culture, technology, organizations" "Digital technology").

Key figures:

- + 50,000 students including 7,000 international students
- 3,700 PhD students, 45% international
- 5,500 faculty members
- 180 different nationalities
- 1st city in France where it feels good to study and 5th city where it feels good to work
- ISSO: International Students & Scholars Office affiliated to EURAXESS

MANDATORY REFERENCES:

CDP TITLE: Patrimalp

SUBJECT TITLE: Conceptual modeling of cultural heritage artifacts: description, transformation

¹ Univ. Grenoble Alpes

² ESRF (European Synchrotron Radiation Facility), ILL (Institut Laue-Langevin), IRAM (International Institute for Radio Astronomy), EMBL (European Molecular Biology Laboratory), EMFL (European Magnetic Field Laboratory)

and creation processes.

Scientific department (laboratory's name): LIG & EDYTEM

Doctoral Schools: Mathématiques, Sciences et technologies de l'information, Informatique (MSTII)

Supporters' names: *D. Ziebelin (LIG), E. Chalmin (EDYTEM)*

SUBJECT DESCRIPTION:

The Patrimalp project aims at an interdisciplinary approach to the tangible, intangible and virtual heritage of the French Alps. Scientists from different disciplines (history of art, archaeology, physics, chemistry, geology, informatics, geography, etc.) are cooperating to develop the scientific tools necessary for the description and analysis of heritage objects (Mohen 1999, E-HRSI).

There are various challenges to overcome before obtaining an interdisciplinary study platform for these heritage objects. These challenges concern data interoperability and the sharing of know-how in both of which the processes are particularly complex.

The processes of the construction and the degradation of the art objects are analysed by the different disciplines (chemical analysis, spectrometric analysis, materials analysis, etc) . These analyses follow the experience gained by experts in their previous analyses with the help of software services such as spectral analysis, pigment recognition or the recognition of drawn symbols, etc.

Explicit semantics must be applied to describe the related work processes so that researchers can exchange and complete their analyses and thus produce a coherent and community-based interpretation. The objective is to explain the semantics of know-how to facilitate the exchange of interactions between researchers and to expand the sharing of new knowledge with a broad-based community. The idea is to make the knowledge shareable and reusable by the community using an ontology and indexation based approach. This work represents a milestone in our development of the architecture of interpretation and analysis systems. And will help researchers to build and execute their engineering workflows concerning the interpretation and analysis of art objects.

The objective of this thesis is to create a model describing the heritage objects - and every element of them - and their manufacture and transformation. This model, shared by several disciplines, will allow information and know-how to be shared. The model, composed of several multidisciplinary elements, will include:

- Description of the heritage object with its motifs and ornaments
- Techniques and know-how needed to create the object
- Cultural and natural environment: description of the context
- Material and equipment: raw materials, processed materials, altered materials, equipment and tools
- Analysis techniques (diffraction, spectroscopy, image analysis, radiation etc).
- ...

The interoperability of the models and processes described above remains a scientific challenge in the conceptualization and implementation for these highly heterogeneous distributed systems. Concerning semantic interoperability , the web of data provides answers through the use of domain standards and ontology . Nevertheless, examining the semantic interoperability between models requires the development of a knowledge representation language reflecting generic and specific links, components and compounds, both partial and total, as well as the similarities between the concepts and the know-how. Concerning the interoperability of practices and know-how, this model should also be able to describe the process used to create the heritage object as well as its change over time.

The objective of this thesis is thus to explain the semantics of know-how in order to facilitate interactions between researchers (archaeologists, historians, chemists, physicists, curators) and to increase the sharing of new knowledge with their community. The work analysis processes are composed of scientific tasks of analysis (sampling, chemical

analysis, spectrometric analysis etc.) and software tasks aimed at increasing the digital information related to the work. We will only focus on the latter in “semanticising” flows and information workflow.

To compare and represent our needs, we will consult with established models such as SHS Europeana (Europeana Data Model) [SHS 2017] - which provides an organization to publish its data, making them semantically interoperable. However, our proposed schema deals with object building and restoration process descriptions that are not present in EDM, since EDM is dedicated to the "life of cultural objects". This schema can express descriptions "centered on cultural objects" or "event-oriented". Depending on the use that is made of the cultural object, the description of a series of events such as, for example, the creation, purchase, classification and restoration of the cultural object can be shown. The EDM model is a consensual model to describe both library data and museum and archive data. It can take into account the diversity of local models of different institutions, describe the specific needs of a domain, avoid the loss of local data and maintain the levels of detail contained in the original local data. The requirements (of EDM) explain the need to distinguish cultural objects from their digital representations and metadata and to allow multiple models for the same object (which can potentially lead to conflicting information). Cultural objects must also be compatible with the objects that compose them, with contextual resources and the possible use of local vocabulary.

In summary, the model developed during the thesis must be compatible with the EDM and ISO 21127 standards on cultural objects. It will focus on the contexts, the components, the environmental and cultural processes and the changes and evolution in time and space of these objects.

Deliverables

Step 1 using existing technologies: Technical proposition: The three models and ontologies will be implemented in a tool using knowledge representation technology (SKOS, OWL and RDF graph) [W3C 2006], to ensure interoperability of this model with open and linked data models. These techniques allow the publication of information in the web of data.

- From a semantic point of view, the heritage object model must take into account: its numerical representation of the concepts with the different academic domains related to its study; its contextual information (history, museums, heritage ...)
- From an implementation point of view, the model will cover notions of abstraction, composition, disciplinary vocabulary, and temporality.
- From a deduction and inference point of view, the model will propose deduction rules and inference mechanisms to allow information retrieval and inference between different disciplines by taking into account the know-how process of construction and degradation of the art object.

Step2 providing new models and tools: This multi-domain ontology will be built and used to index the resources and data sets in different sites (as linked data architecture); the model will include transformation process medialization and transformation rules.

Step 3 implementing of the multipoint of view model in the Patrimalp integrated patrimonial platform.

5 references to support the work

Mohen, JP. 1999. Les Sciences du patrimoine : Identifier, Conserver, Restaurer. Odile Jacob, Sciences et art. 385p.

E-RHIS : institution européenne de recherche pour les sciences du patrimoine, <http://www.erihs.fr>

[EDM 2017] <http://pro.europeana.eu/share-your-data/data-guidelines/edm-documentation>

[W3C 2006] <https://www.w3.org/RDF/>

SKOS: <https://www.w3.org/2004/02/skos/>

OWL : <https://www.w3.org/TR/owl-features/>

<https://www.w3.org/2006/07/SWD/SKOS/skos-and-owl/master.html>

ELIGIBILITY CRITERIA

Applicants:

- must hold a Master's degree (or be about to earn one) or have a university degree equivalent to a European Master's (5-year duration), with multidisciplinary interest.

The ideal candidate holds an MS degree in computer science or a related field and is able to consider both theoretical and practical implementation aspects in her/his work. Fluent English communication and interest for

developing software solutions. The candidate should have experience and commitment to work on one of the following fields:

- * semantic web technologies, linked data and data integration
- * knowledge representations and ontology engineering
- * spatial and temporal knowledge representation and reasoning

Applicants will have to complete online an application form and send their cv, last diploma, and a short presentation of their scientific project (2 to 3 pages max) via email to BOTH supervisors : Danielle.Ziebelin@imag.fr AND emilie.chalmin-aljanabi@univ-smb.fr

Letters of recommendation are welcome.

Selection process

Application deadline: **10/06/2019** (June 10th) at 17:00 (CET)

Applications will be evaluated through a three-step process:

1. Eligibility check of applications in 12/06/2018 (June 12th)
2. 1st round of selection: a Review Board will evaluate the applications June 14th. Results will be given in 17/06/2019.
3. 2nd round of selection: shortlisted candidates will be invited for an interview session, on June 24th – 28th of June 2019 weeks.

TYPE of CONTRACT: temporary-3 years of doctoral contract

JOB STATUS (Full time or part time): Full time

Hours per week: 35

Offer starting date: 01/09/2019

Application deadline: 10/06/2019 at 17:00 (CET)

Salary: between 1769 € and 1989.80€ brut per month (depending on complementary activity or not)