informatics **mathematics**

Ínría

IN PARTNERSHIP WITH:
Université de Grenoble Alpes

Activity Report 2018

Project-Team MOEX

Evolving Knowledge

IN COLLABORATION WITH: Laboratoire d'Informatique de Grenoble (LIG)

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Project-Team MOEX

Creation of the Team: 2017 January 01, updated into Project-Team: 2017 November 01

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Computer Science and Digital Science:

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A3.2.4. - Semantic Web
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A9.1. - Knowledge

Other Research Topics and Application Domains:

B9. - Society and Knowledge
B9.8. - Reproducibility

1. Team, visitors, external collaborators

Research Scientist
Jérôme Euzenat [Team leader, Inria, Senior Researcher, HDR]

Faculty Members
Manuel Atencia Arcas [Univ Grenoble Alpes, Associate Professor]
Jérôme David [Univ Grenoble Alpes, Associate Professor]

PhD Students
Khadija Jradeh [Univ Grenoble Alpes, from Oct 2018]
Line Van Den Berg [Univ Grenoble Alpes, from Oct 2018]

Interns
Marie Dumaz [Univ Grenoble Alpes, from May 2018 until Jun 2018]
Khadija Jradeh [Univ Grenoble Alpes, from Feb 2018 until Jun 2018]
Bilal Lahmami [Univ Grenoble Alpes, from May 2018 until Jun 2018]
Iris Lohja [Inria, from Feb 2018 until Jun 2018]

Administrative Assistant
Alexandra Fitzgerald [Inria]

2. Overall Objectives

2.1. Overall Objectives

Human beings are apparently able to communicate knowledge. However, it is impossible for us to know if we share the same representation of knowledge.

mOeX addresses the evolution of knowledge representations in individuals and populations. We deal with software agents and formal knowledge representation. The ambition of the mOeX project is to answer, in particular, the following questions:

- How do agent populations *adapt* their knowledge representation to their environment and to other populations?
- How must this knowledge *evolve* when the environment changes and new populations are encountered?
- How can agents preserve knowledge *diversity* and is this diversity beneficial?

We study them chiefly in a well-controlled computer science context.

For that purpose, we combine knowledge representation and cultural evolution methods. The former provides formal models of knowledge; the latter provides a well-defined framework for studying situated evolution.

We consider knowledge as a culture and study the global properties of local adaptation operators applied by populations of agents by jointly:

- *experimentally* testing the properties of adaptation operators in various situations using experimental cultural evolution, and
- *theoretically* determining such properties by modelling how operators shape knowledge representation.

We aim at acquiring a precise understanding of knowledge evolution through the consideration of a wide range of situations, representations and adaptation operators.

In addition, we still investigate RDF data interlinking with link keys, a way to link entities in different data sets.

3. Research Program

3.1. Knowledge representation semantics

We work with semantically defined knowledge representation languages (like description logics, conceptual graphs and object-based languages). Their semantics is usually defined within model theory initially developed for logics.

We consider a language L as a set of syntactically defined expressions (often inductively defined by applying constructors over other expressions). A representation ($o \subseteq L$) is a set of such expressions. It may also be called an ontology. An interpretation function (I) is inductively defined over the structure of the language to a structure called the domain of interpretation (D). This expresses the construction of the "meaning" of an expression in function of its components. A formula is satisfied by an interpretation if it fulfills a condition (in general being interpreted over a particular subset of the domain). A model of a set of expressions is an interpretation satisfying all the expressions. A set of expressions is said consistent if it has at least one model, inconsistent otherwise. An expression (δ) is then a consequence of a set of expressions (o) if it is satisfied by all of their models (noted $o \models \delta$).

The languages dedicated to the semantic web (RDF and OWL) follow that approach. RDF is a knowledge representation language dedicated to the description of resources; OWL is designed for expressing ontologies: it describes concepts and relations that can be used within RDF.

A computer must determine if a particular expression (taken as a query, for instance) is the consequence of a set of axioms (a knowledge base). For that purpose, it uses programs, called provers, that can be based on the processing of a set of inference rules, on the construction of models or on procedural programming. These programs are able to deduce theorems (noted $o \vdash \delta$). They are said to be sound if they only find theorems which are indeed consequences and to be complete if they find all the consequences as theorems.

3.2. Data interlinking with link keys

Vast amounts of RDF data are made available on the web by various institutions providing overlapping information. To be fully exploited, different representations of the same object across various data sets, often using different ontologies, have to be identified. When different vocabularies are used for describing data, it is necessary to identify the concepts they define. This task is called ontology matching and its result is an alignment A, i.e., a set of correspondences $\langle e, r, e' \rangle$ relating entities e and e' of two different ontologies by a particular relation r (which may be equivalence, subsumption, disjointness, etc.) [3].

At the data level, data interlinking is the process of generating links identifying the same resource described in two data sets. Parallel to ontology matching, from two datasets (d and d') it generates a link set, L made of pairs of resource identifier.

We have introduced link keys [3], [1] which extend database keys in a way which is more adapted to RDF and deals with two data sets instead of a single relation. More precisely, a link key is a structure $\langle K^{eq}, K^{in}, C \rangle$ such that:

- K^{eq} and K^{in} are sets of pairs of property expressions;
- C is a pair of class expressions (or a correspondence).

Such a link key holds if and only if for any pair of resources belonging to the classes in correspondence such that the values of their property in K^{eq} are pairwise equal and the values of those in K^{in} pairwise intersect, the resources are the same. Link keys can then be used for finding equal individuals across two data sets and generating the corresponding owl:sameAs links. Link keys take into account the non functionality of RDF data and have to deal with non literal values. In particular, they may use arbitrary properties and class expressions. This renders their discovery and use difficult.

3.3. Experimental cultural knowledge evolution

Cultural evolution applies an idealised version of the theory of evolution to culture. Cultural evolution experiments are performed through multi-agent simulation: a society of agents adapts its culture through a precisely defined protocol [15]: agents perform repeatedly and randomly a specific task, called game, and their evolution is monitored. This aims at discovering experimentally the states that agents reach and the properties of these states.

Experimental cultural evolution has been successfully and convincingly applied to the evolution of natural languages [14], [16]. Agents play *language games* and adjust their vocabulary and grammar as soon as they are not able to communicate properly, i.e., they misuse a term or they do not behave in the expected way. It showed its capacity to model various such games in a systematic framework and to provide convincing explanations of linguistic phenomena. Such experiments have shown how agents can agree on a colour coding system or a grammatical case system.

We adapt this experimental strategy to knowledge representation [2]. Agents use their, shared or private, knowledge to play games and, in case of failure, they use adaptation operators to modify this knowledge. We monitor the evolution of agent knowledge with respect to its ability to perform the game (success rate) and with respect to the properties satisfied by the resulting knowledge itself. Such properties may, for instance, be:

- Agents converge to a common knowledge representation (a convergence property).
- Agents converge towards different but compatible (logically consistent) knowledge (a logical epistemic property), or towards closer knowledge (a metric epistemic property).
- That under the threat of a changing environment, agents which have operators that preserve diverse knowledge recover faster from the changes than those which have operators that converge towards a single representation (a differential property under environment change).

Our goal is to determine which operators are suitable for achieving desired properties in the context of a particular game.

4. New Software and Platforms

4.1. Lazylav

Lazy lavender

KEYWORDS: Reproducibility - Multi-agent - Simulation

SCIENTIFIC DESCRIPTION: Lazy lavender aims at supporting mOeX's research on simulating knowledge evolution. It is not a general purpose simulator. However, it features some methodological innovations in term of facilitating publication, recording, and replaying of experiments.

FUNCTIONAL DESCRIPTION: Lazy Lavender is a simulation environment for "cultural knowledge evolultion", i.e., experimenting with several agents evolving their own knowledge through interacting.

NEWS OF THE YEAR: In 2018, we automated the generation of experiment specification and reports. In particular, we added (docker) container generation allowing to replay the experiment or to run it again on updated software. We also implemented agent improvement (strengthening) and fixed various bugs (see the logs).

- Participant: Jérôme Euzenat
- Contact: Jérôme Euzenat
- Publications: Crafting ontology alignments from scratch through agent communication - Interaction-based ontology alignment repair with expansion and relaxation - First experiments in cultural alignment repair (extended version)
- URL: http://lazylav.gforge.inria.fr

4.2. Alignment API

KEYWORDS: Ontologies - Alignment - Ontology engineering - Knowledge representation

SCIENTIFIC DESCRIPTION: The api itself is a Java description of tools for accessing the common format. It defines five main interfaces (OntologyNetwork, Alignment, Cell, Relation and Evaluator).

We provide an implementation for this api which can be used for producing transformations, rules or bridge axioms independently from the algorithm which produced the alignment. The proposed implementation features:

a base implementation of the interfaces with all useful facilities,

a library of sample matchers,

a library of renderers (xslt , rdf , skos , swrl , owl , c-owl , sparql),

a library of evaluators (various generalisation of precision/recall, precision/recall graphs),

a flexible test generation framework which allows for generating evaluation datasets,

a library of wrappers for several ontology api ,

a parser for the format.

To instanciate the api , it is sufficient to refine the base implementation by implementing the align() method. Doing so, the new implementation will benefit from all the services already implemented in the base implementation.

FUNCTIONAL DESCRIPTION: Using ontologies is the privileged way to achieve interoperability among heterogeneous systems within the Semantic web. However, as the ontologies underlying two systems are not necessarily compatible, they may in turn need to be reconciled. Ontology reconciliation requires most of the time to find the correspondences between entities (e.g., classes, objects, properties) occurring in the ontologies. We call a set of such correspondences an alignment. We have designed a format for expressing alignments in a uniform way. The goal of this format is to be able to share on the web the available alignments. The format is expressed in RDF, so it is freely extensible.

RELEASE FUNCTIONAL DESCRIPTION: See http://alignapi.gforge.inria.fr/relnotes.html
NEWS OF THE YEAR: Support for the EDOAL language has been improved in 2018 (better documentation, better error reporting)

- Participants: Armen Inants, Chan Le Duc, Jérôme David, Jérôme Euzenat, Jérôme Pierson, Luz Maria Priego-Roche and Nicolas Guillouet
- Contact: Jérôme Euzenat
- Publications: An API for ontology alignment - The Alignment API 4.0
- URL: http://alignapi.gforge.inria.fr/

5. New Results

5.1. Cultural knowledge evolution

Our cultural knowledge evolution work currently focusses on alignment evolution.

Agents may use ontology alignments to communicate when they represent knowledge with different ontologies: alignments help reclassifying objects from one ontology to the other. Such alignments may be provided by dedicated algorithms [7], but their accuracy is far from satisfying. Yet agents have to proceed. They can take advantage of their experience in order to evolve alignments: upon communication failure, they will adapt the alignments to avoid reproducing the same mistake.

We performed such repair experiments [2] and revealed that, by playing simple interaction games, agents can effectively repair random networks of ontologies or even create new alignments.

5.1.1. *Strengthening modality for cultural alignment repair*
Participants: Jérôme Euzenat [Correspondent], Iris Lohja.

Our previous work on cultural alignment repair achieved 100% precision for all adaptation operators, i.e., all the correspondences in the alignments were correct, but were still missing some correspondences, and did not achieve 100% recall. We had conjectured that this was due to a phenomenon called reverse shadowing [2], avoiding to find specific correspondences.

This year we introduced a new adaptation modality, strengthening, to test this hypothesis. The strengthening modality replaces a successful correspondence by one of its subsumed correspondences covering the current instance. This modality is different from those developed so far, because it leads agents to adapt their alignment when the game played has been a success (previously, it was always when a failure occurred). We defined three alternative definitions of this modality depending on if the agent chooses the most general, most specific or a random such correspondence.

The strengthening modality has been implemented in our *Lazy lavender* software. We experimentally showed that it was not interferring with the other modalities as soon as the *add* operator was used. This means that all properties of the previous adaptation operators are preserved. Moreover, as expected, recall was greatly increased, to the point that some operators achieve 99% F-measure. However, the agents still do not reach 100% recall.

5.1.2. *Experiment reproducibility through container technology*
Participants: Jérôme Euzenat [Correspondent], Bilal Lahmami.

Performing experiments and reporting them requires care in order for others to be able to repeat them.

We experimented with container technology in order to embed our experiments and offer to others to run them easily. To that extent, we developed scripts associated to the *Lazy lavender* software to specify, run, and analyse experiments. In particular, these scripts are able to generate a Docker container specification that can perform experiments in the same conditions or with updated software. The documentation of the experiments on our Wiki platform (https://gforge.inria.fr/plugins/mediawiki/wiki/lazylav/index.php/Lazy_Lavender) is also eased by this process.

5.2. Link keys

Link keys (§3.2) are explored following two directions:
- Extracting link keys;
- Reasoning with link keys.

5.2.1. *Link key extraction with relational concept analysis*

Participants: Manuel Atencia, Jérôme David [Correspondent], Jérôme Euzenat.

We have further investigated link key extraction using relational concept analysis and the associated prototype implementation [8]. In particular, we showed that that link keys extracted by formal concept analysis are equivalent to an extension of those which were extracted by our former algorithm [1]

5.2.2. *Link key extraction under ontological constraints*

Participants: Jérôme David [Correspondent], Jérôme Euzenat, Khadija Jradeh.

We investigated the use of link keys taking advantage of ontologies. This can be carried out in two different directions: exploiting the ontologies under which data sets are published, and extracting link keys using ontology constructors for combining attribute and class names.

Following the first approach, we extended our existing algorithms to extract link keys involving inverse ($^{-1}$), union ($\sqcup$), intersection ($\sqcap$) and paths ($\circ$) of properties. This helps providing link keys when it is not possible otherwise (without inverse, there is no possible correspondence if one data set is using parents and the other is using children). We showed how the paths could be normalised to reduce the search space. Extracting link keys under these conditions required to introduce better indexing techniques to avoid unnecessary link key generation and even looping.

We implemented this method and evaluated it by running experiments on two real data sets, this resulted in finding the correct link keys that were not found without them.

5.2.3. *Tableau method for $\mathcal{ALC}+$Link key reasoning*

Participants: Manuel Atencia [Correspondent], Jérôme Euzenat, Khadija Jradeh.

Link keys can also be thought of as axioms in a description logic. We further worked on the tableau method designed for the $\mathcal{ALC}$ description logic to support reasoning with link keys.

5.3. Semantic web queries

5.3.1. *Evaluation of query transformations without data*

Participants: Jérôme David, Jérôme Euzenat [Correspondent].

Query transformations are ubiquitous in semantic web query processing. For any situation in which transformations are not proved correct by construction, the quality of these transformations has to be evaluated. Usual evaluation measures are either overly syntactic and not very informative —the result being: correct or incorrect— or dependent from the evaluation sources. Moreover, both approaches do not necessarily yield the same result. We proposed to ground the evaluation on query containment [4]. This allows for a data-independent evaluation that is more informative than the usual syntactic evaluation. In addition, such evaluation modalities may take into account ontologies, alignments or different query languages as soon as they are relevant to query evaluation [6].

6. Partnerships and Cooperations

6.1. National Initiatives

6.1.1. ANR Elker

Program: ANR-PRC

Project acronym: ELKER

Project title: Extending link keys: extraction and reasoning

Duration: October 2017 - September 2021

Coordinator: LIG/Manuel Atencia

Participants: Manuel Atencia Arcas, Jérôme David, Jérôme Euzenat

Other partners: Inria Lorraine, Université de Vincennes

Abstract: The goal of ELKER is to extend the foundations and algorithms of link keys (see §3.2) in two complementary ways: extracting link keys automatically from datasets and reasoning with link keys.

6.1.2. Framework agreement Ministère de la culture et de la communication

Program: Framework agreement Inria-Ministère de la culture et de la communication

Project acronym: GINCO V3

Project title: Outil d'aide à l'alignement pour l'élaboration du graphe culture

Duration: November 2017 - December 2018

Coordinator: Jérôme David

Participants: Jérôme David, Jérôme Euzenat, Manuel Atencia Arcas

Abstract: The GINCO V3 project aims at extending the GINCO tool with ontology alignment capabilities.

Program: Framework agreement Inria-Ministère de la culture et de la communication

Project acronym: FNE

Project title: Algorithmes d'aide à la définition de clés de liage et d'alignement d'autorités

Duration: November 2017 - December 2018

Coordinator: Jérôme David

Participants: Jérôme David, Manuel Atencia Arcas, Jérôme Euzenat

Other partners: Bibliothèque nationale de France

Abstract: The goal of the FNE cooperation is to evaluate the suitability of link key extraction algorithms to matching authorities from BnF, ABES and the ministry of Culture and to improve such algorithms if necessary.

7. Dissemination

7.1. Promoting Scientific Activities

7.1.1. Scientific Events Organisation

7.1.1.1. Member of the Organizing Committees

- Jérôme David had been organiser of the workshop Symbolic methods for data-interlinking of the 21st EKAW, Nancy (FR), 2018 (with Miguel Couceiro)
- Jérôme Euzenat had been organiser of the 13th Ontology matching workshop of the 18th ISWC, Monterey (CA US), 2018 (with Pavel Shvaiko, Ernesto Jiménez Ruiz, Michele Cheatham and Oktie Hassanzadeh)

7.1.2. Scientific Events Selection

7.1.2.1. Chair of Conference Program Committees

- Jérôme Euzenat had been program chairman of the "French national artificial intelligence conference (CNIA)" [10], Nancy (FR), 2018.
- Manuel Atencia had been workshop and tutorial chairman (with Marieke van Erp) of the 21st EKAW, Nancy (FR), 2018.

7.1.2.2. Member of the Conference Program Committees

- Jérôme David and Jérôme Euzenat had been programme committee members of the "International joint conference on artificial intelligence (IJCAI)" 2018
- Jérôme David and Jérôme Euzenat had been programme committee member of the "National conference on artificial intelligence (AAAI)" 2018
- Manuel Atencia and Jérôme Euzenat had been programme committee members of the "International semantic web conference (ISWC)" 2018
- Jérôme David and Jérôme Euzenat had been programme committee members of the "European Semantic Web Conference (ESWC)" 2017
- Manuel Atencia, Jérôme David and Jérôme Euzenat had been programme committee member of the "Web Conference (WWW)" 2018
- Jérôme David had been programme committee member of the "Pacific Rim Knowledge Acquisition Workshop (PKAW)" 2018
- Jérôme Euzenat had been programme committee member of the "International Conference on Semantic Systems (Semantics)" 2018
- Jérôme Euzenat had been programme committee member of the "International conference on knowledge engineering and knowledge management (EKAW)" 2018
- Jérôme David had been programme committee member of the "French national artificial intelligence conference (CNIA)" 2018.
- Jérôme Euzenat had been programme committee member of the "French fundamental artificial intelligence days (JAIF)" 2018
- Manuel Atencia and Jérôme David had been programme committee members of the ISWC "Ontology matching" workshop (OM) 2018
- Manuel Atencia and Jérôme David had been programme committee members of the "French Extraction and gestion des connaissances conference (EGC)" 2018
- Jérôme David had been programme committee member of the "29es Journées francophones d'ingénierie des connaissances (IC)" 2018

7.1.3. Journal

7.1.3.1. Member of the Editorial Boards

- Jérôme Euzenat is member of the editorial board of *Journal of web semantics* (area editor), *Journal on data semantics* and the *Semantic web journal*.
- Jérôme Euzenat had been guest editor of a special issue of *Semantic web journal* on "semantic technologies and interoperability in the build environment" (with Álvaro Sicilia, Pieter Pauwels, Leandro Madrazo, and María Poveda-Villalón).

7.1.3.2. Reviewer - Reviewing Activities

- Manuel Atencia had been reviewer for *Journal of web semantics* and *Applied ontology*.
- Jérôme David had been reviewer for *Information system journal* and *Ingénierie des systèmes d'information* (special issue on "Impact des Open et/ou Linked Data dans les systèmes d'information").
- Jérôme Euzenat had been reviewer for *ACM transactions on the web*, and *International journal on metadata, semantics and ontologies*.

7.1.4. Invited Talks

- "Towards cultural knowledge evolution: experiments with alignments repair", Seminar LIP6, Paris (FR), 2018-10-15 (Jérôme Euzenat)
- "Enhancing Link Keys: Extraction and Reasoning", BNF workshop on "Données liées et données à lier: quels outils pour quels alignements?", Paris (FR), 2018-07-10 (Manuel Atencia)
- "Link key extraction with a variation of relational concept analysis", EKAW workshop on symbolic methods for data interlinking, Nancy (FR), 2018-11-12 (Jérôme Euzenat)

7.1.5. Leadership within the Scientific Community

- Jérôme Euzenat is member of the scientific council of the CNRS GDR "Intelligence artificielle".

7.1.6. Scientific Expertise

- Manuel Atencia had been evaluator for CAPES-COFECUB projects (BR)
- Jérôme Euzenat had been member of the scientific evaluation committee "CE23: Data, knowledge, big data, multimedia content – artificial intelligence" of the French national research agency (ANR)
- Manuel Atencia had been evaluator for the French national research agency (ANR)

7.2. Teaching - Supervision - Juries

7.2.1. Teaching

- Jérôme David is coordinator of the Master "Mathematiques et informatiques appliquées aux sciences humaines et sociales" (Univ. Grenoble Alpes)
- Manuel Atencia is co-responsible of the Master 2nd year "Mathematiques et informatiques appliquées aux sciences humaines et sociales" (Univ. Grenoble Alpes)
- Jérôme Euzenat had been, with Danielle Ziébelin, coordinator of the "AI and the web" option of the M2R in computer science and applied mathematics (Univ. Grenoble Alpes)

7.2.1.1. Lectures

Licence: Jérôme David, Algorithmique et programmation par objets, 70h, L2 MIASHS, UGA, France

Licence: Jérôme David, Introduction à Python, Licence ESSIG, 24h, UGA, France

Licence: Jérôme David, Système, L3 MIASHS, 18h, UGA, France

Licence: Manuel Atencia, Technologies du web, LP ESSIG, 18h, UGA, France

Licence: Manuel Atencia, Introduction aux technologies du Web, 60h, L3 MIASHS, UGA, France

Master: Jérôme David, Programmation Java 2, 30h, M1 MIASHS, UGA, France

Master: Jérôme David, JavaEE, 30h, M2 MIASHS, UGA, France

Master: Jérôme David, Développement Web Mobile, 30h, M2 MIASHS, UGA, France

Master: Jérôme David, Web sémantique, 3h, M2 MIASHS, UGA, France

Master: Manuel Atencia, Formats de données du web, 15h, M1 MIASHS, UGA, France

Master: Manuel Atencia, Introduction à la programmation web, 30h, M1 MIASHS, UGA, France

Master: Manuel Atencia, Intelligence artificielle, 7.5h, M1 MIASHS, UGA, France

Master: Manuel Atencia, Web sémantique, 27h, M2 MIASHS, UGA, France

Master: Manuel Atencia, Semantic web: from XML to OWL, 22.5h, M2R MoSIG, UGA, France

Master: Jérôme David, Stage de programmation, 10h, M2 MIASHS, UGA, France

7.2.2. Supervision

- PhD in progress : Nacira Abbas, "Link key extraction and relational concept analysis", 2018-10-01 (Jérôme David and Amedeo Napoli)

- PhD in progress : Khadija Jradeh, "Reasoning with link keys", 2018-10-01 (Manuel Atencia and Chan Le Duc)

- PhD in progress : Line van den Berg, "Knowledge Evolution in Agent Populations", 2018-10-01 (Manuel Atencia and Jérôme Euzenat)

- MSc: Iris Lohja, "Improving semantic recall of ontology alignments in cultural knowledge evolution", M2R Informatics, Univ. Grenoble Alpes, June 2018 (Manuel Atencia and Jérôme Euzenat)

- MSc: Khadija Jradeh, "Link key extraction under ontological constraints", M2R Informatics, Univ. Grenoble Alpes, June 2018 (Jérôme David and Jérôme Euzenat)

7.2.3. PhD panels

- Jérôme David had been panel member of the computer science PhD of Valentina Beratta (IMT Mines Alès) "Évaluation de la véracité des données: améliorer la découverte de la vérité en utilisant des connaissances a priori" supervised by Sylvie Ranwez and Isabelle Mougenot

- Jérôme Euzenat had been panel member of the computer science PhD of Paula Chocrón (Universitat Autònoma de Barcelona) "A pragmatic approach to translation: vocabulary alignment through multiagent interaction and observation" supervised by Marco Schorlemmer

- Jérôme Euzenat had been panel chair of the computer science PhD of Louis Jachiet (Université Grenoble-Alpes) "On the foundations for the compilation of web data queries: optimization and distributed evaluation of SPARQL" supervised by Nabil Layaïda and Pierre Genevès

- Jérôme Euzenat had been reviewer of the computer science habilitation of Chan Le Duc (Université Paris 8) "Raisonnement et révision pour des ontologies en logique de description"

- Jérôme Euzenat is member of the PhD supervision committee of Élodie Thiéblin (Université de Toulouse 2-Jean Jaurès) supervised by Ollivier Haemmerlé and Cássia Trojahn dos Santos

7.3. Popularization

7.3.1. Interventions

- Jérôme Euzenat gave a talk on "Artificial intelligence: a broad view" to BEST Spring course, Grenoble (FR), 2018-04-16

- Jérôme Euzenat gave a talk on "mOeX: évolution de la connaissance" Inria "Mon projet en 180 secondes", Grenoble (FR), 2018-05-29

- Jérôme Euzenat gave a talk on "Evolving knowledge: different facets of Artificial Intelligence" to the French-American Doctoral Exchange (FADEx) seminar, Grenoble (FR), 2018-06-27

8. Bibliography

Major publications by the team in recent years

[1] M. ATENCIA, J. DAVID, J. EUZENAT. *Data interlinking through robust linkkey extraction*, in "Proc. 21st european conference on artificial intelligence (ECAI), Praha (CZ)", Amsterdam (NL), T. SCHAUB, G. FRIEDRICH, B. O'SULLIVAN (editors), IOS press, 2014, pp. 15-20, ftp://ftp.inrialpes.fr/pub/exmo/publications/atencia2014b.pdf

[2] J. EUZENAT. *Interaction-based ontology alignment repair with expansion and relaxation*, in "Proc. 26th International Joint Conference on Artificial Intelligence (IJCAI), Melbourne (VIC AU)", 2017, pp. 185–191

[3] J. EUZENAT, P. SHVAIKO. *Ontology matching*, 2nd, Springer-Verlag, Heidelberg (DE), 2013, http://book.ontologymatching.org

Publications of the year

Articles in International Peer-Reviewed Journals

[4] M. CHEKOL, J. EUZENAT, P. GENEVÈS, N. LAYAÏDA. *SPARQL Query Containment under Schema*, in "Journal on Data Semantics", April 2018, vol. 7, n⁰ 3, pp. 133-154 [*DOI :* 10.1007/s13740-018-0087-1], https://hal.inria.fr/hal-01767887

Articles in Non Peer-Reviewed Journals

[5] J. EUZENAT. *De la langue à la connaissance: approche expérimentale de l'évolution culturelle*, in "Bulletin de l'Association Française pour l'Intelligence Artificielle", April 2018, vol. 100, pp. 9-12, https://hal.inria.fr/hal-01953227

International Conferences with Proceedings

[6] J. DAVID, J. EUZENAT, P. GENEVÈS, N. LAYAÏDA. *Evaluation of Query Transformations without Data*, in "WWW 2018 - Companion of The Web Conference", Lyon, France, ACM Press, April 2018, pp. 1599-1602 [*DOI :* 10.1145/3184558.3191617], https://hal.inria.fr/hal-01891182

[7] J. DA SILVA, K. REVOREDO, F. ARAUJO BAIÃO, J. EUZENAT. *Interactive ontology matching: using expert feedback to select attribute mappings*, in "13th ISWC workshop on ontology matching (OM)", Monterey, United States, No commercial editor., October 2018, pp. 25-36, https://hal.archives-ouvertes.fr/hal-01964686

National Conferences with Proceedings

[8] J. DAVID, J. EUZENAT, J. VIZZINI. *Linkky: Extraction de clés de liage par une adaptation de l'analyse relationnelle de concepts*, in "IC 2018 - 29es Journées Francophones d'Ingénierie des Connaissances", Nancy, France, S. RANWEZ (editor), AFIA, July 2018, pp. 271-274, https://hal.archives-ouvertes.fr/hal-01839642

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