IN PARTNERSHIP WITH:
Université de Grenoble Alpes

Activity Report 2017

Project-Team MOEX

Evolving knowledge

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

RESEARCH CENTER
Grenoble - Rhône-Alpes

THEME
Data and Knowledge Representation and Processing

Table of contents

Project-Team MOEX

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

Keywords:

Computer Science and Digital Science:

A3.2. - Knowledge
A3.2.1. - Knowledge bases
A3.2.2. - Knowledge extraction, cleaning
A3.2.4. - Semantic Web
A3.2.5. - Ontologies
A6.1.3. - Discrete Modeling (multi-agent, people centered)
A9. - Artificial intelligence
A9.1. - Knowledge

Other Research Topics and Application Domains:

B9. - Society and Knowledge
B9.6. - Reproducibility

1. Personnel

Research Scientist

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

Faculty Members

Manuel Atencia Arcas [Univ Grenoble Alpes, Associate Professor, in secondment at Inria for 6 months]
Jérôme David [Univ Grenoble Alpes, Associate Professor]

Intern

Jérémy Vizzini [Univ Grenoble Alpes, from Feb 2017 until Jun 2017]

Administrative Assistants

Alexandra Fitzgerald [Inria, from 2017-10-01]
Lydie Leon [Inria, until 2017-07-31]

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. 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 properties of 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. Ontology matching and alignments

When different representations are used, it is necessary to identify their correspondences. This task is called ontology matching and its result is an alignment [4]. It can be described as follows: given two ontologies, each describing a set of discrete entities, find the relationships, if any, holding between these entities.

An alignment between two ontologies o and o' is a set of correspondences $\langle e, e', r \rangle$ such that:

- e and e' are the entities between which a relation is asserted by the correspondence, e.g., formulas, terms, classes, properties, individuals;
- r is the relation asserted to hold between e and e'. This relation can be any relation applying to these entities, e.g., equivalence, subsumption, exclusion.

In addition, a correspondence may support various types of metadata, in particular measures of the confidence in a correspondence.

Given the semantics of the two ontologies provided by their consequence relation, we define an interpretation of two aligned ontologies as a pair of interpretations $\langle m, m' \rangle$, one for each ontology. Such a pair of interpretations is a model of the aligned ontologies o and o' if and only if each respective interpretation is a model of the ontology and they satisfy all correspondences of the alignment.

This definition is extended to networks of ontologies: a collection of ontologies and associated alignments. A model of such a network of ontologies is a tuple of local models such that each alignment is valid for the models involved in the tuple. In such a system, alignments play the role of model filters which select the local models that are compatible with all alignments. So, given a network of ontology, it is possible to interpret it.

3.3. Data interlinking

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 have to be identified. Data interlinking is the process of generating links identifying the same resource described in two data sets.

We have introduced link keys [4], [1] which extend database keys in a way which is more adapted to RDF and deal 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.

3.4. 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 [16]: agents perform repeatedly and randomly a specific task, called game, and their evolution is monitored. This aims at discovering experimentally the states that agents may reach and the properties of these states.

Experimental cultural evolution has been successfully and convincingly applied to the evolution of natural language [15], [17]. 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 [3]. 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 Results

4.1. Cultural knowledge 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 [9], 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.

Such repair experiments have been performed [3] and revealed that, by playing simple interaction games, agents can effectively repair random networks of ontologies.

4.1.1. Expansion and relaxation modalities for cultural alignment repair

Participant: Jérôme Euzenat [Correspondent].

We repeated these experiments and, using new measures, showed that the quality of previous results was underestimated. We introduced new adaptation operators that improve those previously considered. We also allowed agents to go beyond the initial operators in two ways [8]: they can generate new correspondences when they discard incorrect ones, and they can provide less precise answers. The combination of these modalities satisfy the following properties: (1) agents still converge to a state in which no mistake occurs, (2) they achieve results far closer to the correct alignments than previously found, (3) they reach again 100% precision and coherent alignments.

4.1.2. Starting with empty alignments in cultural alignment repair

Participant: Jérôme Euzenat [Correspondent].

The results of §4.1.1 suggest that, with the expansion modality, agents could develop alignments from scratch. We explored the use of expanding repair operators for that purpose. When starting from empty alignments, agents fail to create them as they have nothing to repair. Hence, we introduced the capability for agents to risk adding new correspondences when no existing one is useful [7]. We compared and discussed the results provided by this modality and showed that, due to this generative capability, agents reach better results than without it in terms of the accuracy of their alignments. When starting with empty alignments, alignments reach the same quality level as when starting with random alignments, thus providing a reliable way for agents to build alignment from scratch through communication. The evolution curves of both approaches (random and empty alignments), passed a starting phase in which figures correspond to the initial conditions, superimpose nearly exactly. This comfort a posteriori the experiments with random initialisation.

4.2. Link keys

Link keys (§3.3) are explored following two directions:

- Extracting link keys;
- Reasoning with link keys.

4.2.1. Link key extraction with relational concept analysis

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

A first method has been designed to extract and select link keys from two classes which deals with multiple values but not object values [1]. Moreover, the extraction step has been rephrased in formal concept analysis (FCA) allowing to generate link keys across relational tables [2].

We have extended this latter work so that it can deal with multiple object values when the data set is cycle free. This encoding does not necessarily generate the optimal link keys. Hence, we use relational concept analysis (RCA), an extension of FCA taking relations between concepts into account. We show that a new expression of this problem is able to extract the optimal link keys even in the presence of cyclic dependencies. Moreover, the proposed process does not require information about the alignments of the ontologies to find out from which pairs of classes to extract link keys.

We implemented these methods and evaluated them by reproducing the experiments made in previous studies [14]. This shows that the method extracts the expected results as well as (also expected) scalability issues.

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

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

Link keys can also be thought of as axioms in a description logic. As such, they can contribute to infer ABox axioms, such as links, or terminological axioms, and other link keys. We have extended the tableau method designed for the $\mathcal{ALC}$ description logic to support reasoning with link keys in $\mathcal{ALC}$ [5]. This year, we have proven that this method is sound, complete and that it always terminates.

5. Partnerships and Cooperations

5.1. National Initiatives

5.1.1. 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 §3.3) in two complementary ways: extracting link keys automatically from datasets and reasoning with link keys.

5.1.2. 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.

5.2. International Initiatives

5.2.1. Participation in Other International Programs

Jérôme Euzenat has benefited from a special visiting researcher grant from the Brazilian Ciência sem Fronteiras program on "Methodology and algorithms for ontology refinement and matching" (2015-2017). He works with the team of Fernanda Baião and Kate Revoredo at the Universidade Federal do Estado do Rio de Janeiro (UNIRIO). Together, they investigate methods for evolving ontologies and alignments which involve users and agents. The goal of the project is to design methods and algorithms using theory revision to deal with knowledge evolution in a reliable manner and obtaining better quality alignments.

5.3. International Research Visitors

5.3.1. Visits of International Scientists

- Kate Revoredo (UNIRIO) visited mOeX in May 2017.

5.3.2. Visits to International Teams

- Jérôme Euzenat visited the Universidade Federal do Estado do Rio de Janeiro (UNIRIO) for one month in November-December 2017 (see §5.2.1).

6. Dissemination

6.1. Promoting Scientific Activities

6.1.1. Scientific Events Organisation

6.1.1.1. Member of Organizing Committees

- Jérôme Euzenat was organiser of the 12th Ontology matching workshop of the 16th ISWC, Wien (AT), 2017 (with Pavel Shvaiko, Ernesto Jiménez Ruiz, Michele Cheatham and Oktie Hassanzadeh)
- Jérôme Euzenat was organiser of the 1st Workshop on Interaction-Based Knowledge Sharing (WINKS) of the 3rd Joint Ontology Workshop (JOMO), Bozen-Bolzano (IT), 2017 (with Dagmar Gromann and Kemo Adrian)

6.1.2. Scientific Events Selection

6.1.2.1. Member of Conference Program Committees

- Jérôme David and Jérôme Euzenat have been programme committee members of the "International joint conference on artificial intelligence (IJCAI)" 2017
- Manuel Atencia, Jérôme David and Jérôme Euzenat have been programme committee members of the "International semantic web conference (ISWC)" 2017
- Jérôme David and Jérôme Euzenat have been programme committee members of the "European Semantic Web Conference (ESWC)" 2017

- Jérôme Euzenat has been programme committee member of the "International Worldwide web Conference (WWW)" 2017
- Jérôme Euzenat has been programme committee member of the "13th International Conference on Semantic Systems (Semantics)" 2017
- Jérôme Euzenat has been programme committee member of the "International Conference on Web Information Systems and Technologies (WebIST)" 2017
- Manuel Atencia and Jérôme David have been programme committee members of the ISWC "Ontology matching" workshop (OM) 2017
- Jérôme David and Jérôme Euzenat have been programme committee members of the "French Extraction and gestion des connaissances conference (EGC)" 2017
- Jérôme David has been programme committee member of the "28es Journées francophones d'ingénierie des connaissances (IC)" 2017

6.1.2.2. Reviewer

- Jérôme David has been a reviewer for the 31st "AAAI Conference on artificial intelligence (AAAI)", 2017.

6.1.3. Journal

6.1.3.1. Member of 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*.

6.1.3.2. Reviewer - Reviewing Activities

- Manuel Atencia has been reviewer for *Knowledge-based systems* and the *VLDB journal*.
- Jérôme Euzenat has been reviewer for *ACM transactions on the web*, and *Mobile information systems*.

6.1.4. Invited Talks

- "Symbolic methods for RDF data interlinking", Lecture at EGC, Grenoble (FR), 2017-01-23 (Jérôme David)
- "Data interlinking using link keys", Seminar Trinity college, Dublin (IE), 2017-04-13 (Jérôme Euzenat)
- "Cultural knowledge evolution: motivations and experiments", Seminar Trinity college, Dublin (IE), 2017-04-13 (Jérôme Euzenat)
- "Linked data", Tutorial at the 4th Journées du développement logiciel (JDEV) 2017, Marseille (FR), 2017-07-06 (Manuel Atencia)
- "Knowledge diversity under socio-environmental pressure", Invited talk, International Conference on Computational Approaches to Diversity in Interaction and Meaning, Venezia (IT), 2017-10-08 (Jérôme Euzenat)
- "Ontology matching, adaptation and evolution", GDRI in Web science Workshop, PUC-Rio, Rio de Janeiro (BR), 2017-12-04 (Jérôme Euzenat, Fernanda Baião, Kate Revoredo)

6.1.5. Leadership within the Scientific Community

- Jérôme Euzenat is member of the executive committee and the scientific council of the CNRS Pre-GDR "Artificial intelligence".

6.1.6. Research Administration

- Jérôme David is member of the organising committee of the LIG keynote speeches

6.2. Teaching - Supervision - Juries

6.2.1. Teaching

- Jérôme David is coordinator of the Master "Mathematiques et informatiques appliquées aux sciences humaines et sociales" (Univ. Grenoble Alpes)
- Manuel Atencia is responsible of the option "Web, Informatique et Connaissance" of the Master 2nd year "Mathematiques et informatiques appliquées aux sciences humaines et sociales" (Univ. Grenoble Alpes)
- Jérôme Euzenat is, with Sihem Amer-Yahia, coordinator of the "AI and the web" option of the M2R in computer science and applied mathematics (Univ. Grenoble Alpes)

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

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

Master: Jérôme David, Formats de données du web, 15h, M1 MIASHS, UGA, France

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

Master: Jérôme David, Développement Web Mobile, 22h30, 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

6.2.2. Supervision

- MSc: Jérémy Vizzini, Data interlinking with relational concept analysis, M2R Informatics Data science, Univ. Grenoble Alpes, June 2017 (Jérôme David and Jérôme Euzenat)

6.2.3. PhD committees

- Jérôme Euzenat has been committee chair of the computer science PhD of Anthony Hombiat (Université Grenoble Alpes) "OF4OSM: Un méta-modèle pour structurer la folksonomie d'OpenStreetMap en une nouvelle ontologie" supervised by Jérôme Gensel and Marlène Villanova-Oliver, 2017
- Jérôme Euzenat has been reviewer of the computer science PhD of Nguyen Thinh Dong (Université Paris 8 – Vincennes) "Révision d'ontologies fondée sur tableaux" supervised by Myriam Lamolle and Chan Le Duc, 2017
- Jérôme Euzenat has been external examiner of the computer science PhD of Zlatan Dragisic (Linköping university) "Completion of ontologies and ontology networks" supervised by Patrick Lambrix, 2017
- Jérôme Euzenat has been committee chair of the computer science PhD of Jie Sun (Université Clermont-Auvergne) "Intelligent flood adaptive context-aware system" supervised by Kun Mean Hou, Gil de Sousa and Catherine Roussey, 2017
- Jérôme Euzenat has been external examiner of the computer science PhD of Abdelfettah Feliachi (Université Paris-Est) "Interconnexion et visualisation de ressources géoréférencées du Web de données à l'aide d'un référentiel topographique de support" supervised by Bénédicte Bucher, Fayçal Hamdi and Nathalie Abadie, 2017

- Jérôme Euzenat has been committee chair of the computer science PhD of Abdullah Abbas (Université Grenoble-Alpes) “Static analysis of semantic web queries with ShEx schema constraints” supervised by Nabil Layaïda, Pierre Genevès and Cécile Roisin, 2017
- Jérôme Euzenat has been reviewer of the computer science PhD of Quentin Cohen-Solal (Université de Caen-Normandie) “Un cadre algébrique pour le raisonnement qualitatif en présence d’informations hétérogènes: application aux raisonnements multi-échelle et spatio-temporel” supervised by Maroua Bouzid and Alexandre Niveau, 2017

6.3. Popularization

- Jérôme Euzenat gave a talk to the local #FranceIA day “Intelligence artificielle et communication”, Grenoble (FR), 2017-03-02
- Manuel Atencia animated the workshop “Modéliser les ontologies: cas d’application d’une ontologie pour l’annotation de photos” at the 4th Journées du développement logiciel (JDEV), Marseille (FR), 2017-07-06
- Jérôme David animated the workshop “Comment faire une application avec des données liées: annotation de photos en utilisant les technos du web sémantique avec Jena” at the 4th Journées du développement logiciel (JDEV), Marseille (FR), 2017-07-06
- Jérôme Euzenat gave an interview “Dans 50 ans, les ordinateurs écriront des succès littéraires?” for the Inria web site, Montbonnot (FR), 2017-10-24

7. 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

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[3] J. EUZENAT. *First experiments in cultural alignment repair (extended version)*, in "ESWC 2014 satellite events revised selected papers", Heidelberg (DE), V. PRESUTTI, E. BLOMQVIST, R. TRONCY, H. SACK, I. PAPADAKIS, A. TORDAI (editors), Springer Verlag, 2014, pp. 115-130, ftp://ftp.inrialpes.fr/pub/exmo/publications/euzenat2014c.pdf

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[5] M. GMATI, M. ATENCIA, J. EUZENAT. *Tableau extensions for reasoning with link keys*, in "Proc. 11th ISWC workshop on ontology matching (OM), Kobe (JP)", P. SHVAIKO, J. EUZENAT, E. JIMÉNEZ-RUIZ, M. CHEATHAM, O. HASSANZADEH, R. ICHISE (editors), 2016, pp. 37-48, ftp://ftp.inrialpes.fr/pub/exmo/publications/gmati2016a.pdf

Publications of the year

International Conferences with Proceedings

[6] M. ACHICHI, M. CHEATHAM, Z. DRAGISIC, J. EUZENAT, D. FARIA, A. FERRARA, G. FLOURIS, I. FUNDULAKI, I. HARROW, V. IVANOVA, E. JIMÉNEZ-RUIZ, K. KOLTHOFF, E. KUSS, P. LAMBRIX, H. LEOPOLD, H. LI, C. MEILICKE, M. MOHAMMADI, S. MONTANELLI, C. PESQUITA, T. SAVETA, P. SHVAIKO, A. SPLENDIANI, H. STUCKENSCHMIDT, É. THIÉBLIN, K. TODOROV, C. TROJAHN DOS SANTOS, O. ZAMAZAL. *Results of the Ontology Alignment Evaluation Initiative 2017*, in "OM 2017 - 12th ISWC workshop on ontology matching", Wien, Austria, No commercial editor., October 2017, pp. 61-113, achichi2017a, https://hal.archives-ouvertes.fr/hal-01670238

[7] J. EUZENAT. *Crafting ontology alignments from scratch through agent communication*, in "PRIMA 2017: Principles and Practice of Multi-Agent Systems", Nice, France, B. AN, A. BAZZAN, J. LEITE, S. VILLATA, L. VAN DER TORRE (editors), Springer Verlag, October 2017, pp. 245-262, euzenat2017b [*DOI :* 10.1007/978-3-319-69131-2_15], https://hal.inria.fr/hal-01661140

[8] J. EUZENAT. *Interaction-based ontology alignment repair with expansion and relaxation*, in "IJCAI 2017 - 26th International Joint Conference on Artificial Intelligence", Melbourne, Australia, AAAI Press, August 2017, pp. 185-191, euzenat2017a [*DOI :* 10.24963/IJCAI.2017/27], https://hal.inria.fr/hal-01661139

[9] J. DA SILVA, F. ARAUJO BAIÃO, K. REVOREDO, J. EUZENAT. *Semantic interactive ontology matching: synergistic combination of techniques to improve the set of candidate correspondences*, in "OM 2017 - 12th ISWC workshop on ontology matching", Wien, Austria, No commercial editor., October 2017, pp. 13-24, silva2017a, https://hal.archives-ouvertes.fr/hal-01670205

Scientific Books (or Scientific Book chapters)

[10] M.-C. ROUSSET, M. ATENCIA, J. DAVID, F. JOUANOT, O. PALOMBI, F. ULLIANA. *Datalog revisited for reasoning in linked data*, in "Reasoning Web. Semantic Interoperability on the Web. Reasoning Web 2017", G. IANNI, D. LEMBO, L. BERTOSSI, W. FABER, B. GLIMM, G. GOTTLOB, S. STAAB (editors), Reasoning Web International Summer School, Springer Verlag, 2017, vol. LNCS, n^{o} 10370, pp. 121-166, rousset2017a [*DOI :* 10.1007/978-3-319-61033-7_5], https://hal.inria.fr/hal-01661141

Books or Proceedings Editing

[11] M. CHEATHAM, I. CRUZ, J. EUZENAT, C. PESQUITA (editors). *Semantic web journal: Special issue on ontology and linked data matching*, IOS Press, 2017, vol. 8, n^{o} 2, pp. 183–251, cheatham2017a, https://hal.inria.fr/hal-01661137

[12] P. SHVAIKO, J. EUZENAT, E. JIMÉNEZ-RUIZ, M. CHEATHAM, O. HASSANZADEH (editors). *OM-2017: Proceedings of the Twelfth International Workshop on Ontology Matching*, No commercial editor., Wien, Austria, 2017, pp. 1-233, shvaiko2017a, https://hal.archives-ouvertes.fr/hal-01674668

Other Publications

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