



Activity Report 2013

Project-Team AXIS

Usage-centred Design, Analysis and
Improvement of Information Systems

RESEARCH CENTERS
Sophia Antipolis - Méditerranée
Paris - Rocquencourt

THEME

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Project-Team AXIS

Keywords: Data Mining, Interaction, Experimentation, Big Data, Human Assistance, Knowledge, User Experience

AxIS is an interdisciplinary team bi-located at Sophia Antipolis and Rocquencourt.

During 12 years, AxIS provided new tools and methods for usage analysis of Web-based information systems and for user experience analysis in the whole ICT innovation process. Our main research results were in the following scientific communities - Knowledge Discovery from Databases (KDD), Human Computer Interaction (HCI) and Information Retrieval (IR) - and applied in Living lab and Smart city ICT-based projects. A special thought to our colleague Marc Csernel who past away suddenly this summer.

Creation of the Project-Team: 2003 July 01, end of the Project-Team: 2013 December 31.

1. Members

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2. Overall Objectives

2.1. Presentation

AxIS is carrying out research in the area of Information and Knowledge Systems (ISs) with a special interest in evolving large ISs such as Web-based Information Systems. Our **core goal** is to provide knowledge, methods and tools to support better design, evaluation and usage in the digital world, i.e. to improve the overall quality of ISs, to ensure ease of use to end users and also to contribute to user-driven open innovation as a way to foster innovation,

Our researches are organized to support the disruptive process of continuous innovation in which design is never ended and relies on very short test-adapt-test cycles. According to the constant evolution of actual and future ISs, to reach this goal, it is necessary to involve the users in the design process and to empower them, so that they can become codesigners as co-creators of value. This is a new way to anticipate the usage and its analysis and also to consider maintenance very early in the design process.

To achieve such a research, we have set up in July 2003 a multidisciplinary team that involves people from different computer sciences domains (Data Mining & Analysis, Software Engineering) and from cognitive sciences domains (Ergonomics, Artificial Intelligence), all of them focusing on information systems. Our goal is of course to improve **efficiency of data mining methods** but also to improve the **quality of results** for knowledge discovery in information systems. The originality of AxIS project-team is to adopt a cognitive and inter-disciplinary approach for the whole KDD¹ process and for each step (preprocessing, data mining, interpretation).

To address this challenge, relying on our scientific foundations (see our 2007 activity report, Section Scientific Foundations), we had a first 4 years step dedicated to the design of methodological and technical building blocks for IS mining (usage, content and structure) mainly in Web mining. The next four years were dedicated to provide original methods in mining data streams and evolutive data in the context of Web but also in sensor based applications. The last third period, we are putting our main efforts in the sub-objective 3 related to methods and tools for designing and evaluating user experience and supporting user-oriented innovation. In this period a great effort concerns the dissemination of our methods and tools inside the FocusLab experimental platform whose goal is to support the analysis of individual and collective user experience.

2.2. Highlights of the Year

- Y. Lechevallier gave an **invited talk** "Partitioning Methods On Dissimilarity Matrices Set" related to this publication [20] (cf. Section 6.2.8) at the First European Conference on Data Analysis (ECDA 2013) (with around 300 participants) jointly hosted by the two Classification Societies (GkKI in Germany and SFC in France) in July at Luxembourg.
- **BIOVISION 2013**, the World Life Sciences Forum: B. Trousse was invited as **panellist** in the prospective session "eHealth: a coming medical revolution?" at the major event BIOVISION 2013, held March 24-26, 2013 in Lyon, France. With over 3,000 participants, 200 high-level speakers and more than 30,000 Internet followers, BIOVISION is the most-attended multi-stakeholder meeting for all life sciences' players. B. Trousse illustrated the notion of living lab with three concrete e-health experiences from three French living labs (Autonom'lab - Limousin, e-care - Lyon, Living Lab High Alps Living Lab -05) and argued on the importance for the public authorities to appropriate this type of instruments which are living labs;
- **2030 Prospective (ADEME)**: B. Trousse was invited by ADEME and Chronos firm among relevant interdisciplinary experts for analysing the ICT & Building challenges at 2030 horizon and for participating at one 2-days seminar at ADEME (Sophia Antipolis);

¹KDD: Knowledge Discovery From Databases.

- **MyGreenServices - Good Practice Prize** (Category: Project proposals, initiatives, methodologies and studies) by the **International Design for All Foundation** for Awards 2014 which will be at Paris in February 2014; AxIS managed a complete deployment of a Living Lab Experiential Design process involving more than 50 active citizen and 13 citizen pollution fixed and mobile sensors. The impact in terms of behaviour change using MyGreenServices was very promising;
- **FocusLab Platform (CPER Telius 2010-2013)**: we completed a first web-based application allowing the reservation of hardware, software or books (cf. Section 6.6);
- **Signature of a Memorandum of Understanding (MoU)** between B. Trousse, President of **France Living Labs** as Inria representative of ICT Usage Lab and Jarmo Eskelinen, Chair of **ENoLL the European Network of Living Labs**;
- D. Robache is member of the Department of Research Team Assistants of Inria Sophia Antipolis which receives the Research Support Department Inria Award in 2013.

3. Research Program

3.1. Research Program

In the context described in Section 2.2, our team focused its effort on the technical and methodological environment needed to extract meaning from the huge amount of data issued from large and distributed information systems. Our ultimate goal is fed by research contributions from the three sub-objectives below:

- **Sub-objective 1 - Mining for Knowledge Discovery in Information Systems :**
Concerning Data Mining the specificity of our research is in two areas: methods and data. In traditional applications, a data mining process assumes that data to be mined is stored in a database with seldom (non frequent) updates. The extraction might take days, weeks, or even months, but due to the static nature of data, knowledge extraction can easily be deployed. When dealing with data streams, one only gets one look at data, which it changes over time. Due to the growing number of such emerging applications, the advanced analysis and mining of data streams is becoming more and more important, and it receives a great deal of attention. Mining data streams remains very challenging, because traditional data mining operations are impossible on data streams. Since data streams are continuous, high speed and unbounded, it is impossible to use traditional algorithms that require multiple scans.
In traditional Data Mining applications the representation of the data is a vector of R_p where p is the number of descriptors. In Web Mining the navigation must be represented by a ordered list of R_p vectors and it is not easy to reduce this representation by one vector. At the start of AxIS the main challenge was to study different representations of the objects with the objective that the complex representation is closed to the initial representation. We proposed different non vectorial representations, called complex data. The main subject matters in sub-objective 1 are data stream mining, complex data clustering, semantic data mining.
- **Sub-objective 2 - Information and Social Networks Mining for supporting Information Retrieval :**
Related to information retrieval, we managed three main problems in the past: case-based recommender systems for supporting information search, expert finding whose goal is to identify persons with relevant experience from a given domain and entity extraction. Concerning social networks mining, our main subject matters are clustering methods for identifying communities inside social networks, expert finding and entity retrieval in Wikipedia. At the end of the nineties and in the early new millennium, many clustering methods have been adapted to the context of relational data sets (k -means approach and SOM by Hathaway, Davenport and Bezdek (1982, 2005), a divisive clustering by Girvan and Newman (2002), EM and Bayesian approaches by Handcock, M.S., Raftery, A.E. and Tantrum, J. (2007). The units are connected by a link structure representing specific relationships or statistical dependencies, the clustering task becomes a means for identifying communities within networks. Graphs are intuitive representations of networks.
- **Sub-objective 3 - Interdisciplinary Research For supporting user oriented innovation :**

With the last Web 2.0 technology developments of cloud computing, the improvement of web usability and web interactivity through rich interface, Ajax, RSS and semantic web, the concept of CAI² 2.0 is currently a major topic. In addition, HCI design and evaluation focus is no longer placed on usability but on the whole user experience. Experimentations take place out of labs with large number of heterogeneous people instead of carefully controlled panels of users. These deep changes require to adapt existing methodologies and to design new ones. So, to address these new requirements, we identified the following research :

- Conceptual studies: state-of-the-art investigations covering the Living Lab landscape [9], the future internet domain landscape, the future user-open innovation for Smart Cities, user experience. These studies provide insight on methodological aspects for needs analyses, data gathering, evaluation, design, innovation methods.
- Improvement of existing methods or elaboration of new methods and tools for usage analysis of CAI 2.0 tools. Let us cite the following methods and tools:
 - a) Methods and tools for idea generation processes;
 - b) Usability methods and tools: coupling usability design methods with data mining techniques, evaluation methods;
 - c) User Experience design and evaluation methods and tools:
- FocusLab Experimental Platform (CPER Telius) (cf. section for the software part) is our delivery mechanism providing access to AxIS methodology and software for the scientific community.

All our research work (data and methods) is mainly applied in the context of Living Labs. For more scientific foundations on topics of sub-objectives 1 and 2, see our [2007 AxIS activity report](#).

4. Application Domains

4.1. Panorama: Living Labs, Smart Cities

AxIS addresses any applicative field which has the following features:

a) requiring usage/data storage, preprocessing and analysis tools

- for designing, evaluating and improving huge evolving hypermedia information systems (mainly Web-based ISs), for which end-users are of primary concern,
- for a better understanding of the usage of a service/product via data mining techniques and knowledge management,
- for social network analysis (for example in Web 2.0 applications, Business Intelligence, Sustainable Development, etc.).

b) requiring user-driven innovation methods.

Even if our know-how, methods and algorithms have a cross domain applicability, our team chooses to focus on **Living Lab projects** (and mainly related to **Sustainable Development for Smart Cities**) [13], [12] which imply user involvement for the generation of future services/products. Indeed, following the Rio Conference (1992) and the Agenda for the 21st Century, local territories are now directly concerned with the set up of actions for a sustainable development. In this frame, ICT tools are supposed to be very efficient to re-engage people in the democratic process and to make decision-making more transparent, inclusive and accessible. So, sustainable development is closely associated with citizen participation. The emerging research field of e-democracy (so called Digital Democracy or eParticipation), concerned with the use of communications technologies such as the Internet to enhance the democratic processes is now a very active field. Though still in its infancy, a lot of literature is already available (see for instance: <http://itc.napier.ac.uk/ITC/publications.asp> for a global view of work in Europe) and numerous different topics are addressed in the field.

²CAI: Computer Based Innovation

Our experience particularly stressed on the following applicative domains:

- Transportation systems & Mobility (cf. Section 4.2),
- Tourism (cf. Section 4.3),
- User Involvement in Silver Economy, Environment, Energy and e-government (cf. Section 4.4).

4.2. Transportation Systems & Mobility

Major recent evolutions in Intelligent Transportation Systems (ITS) are linked to rapid changes in communication technologies, such as ubiquitous computing, semantic web, contextual design. A strong emphasis is now put on mobility improvements. In addition to development of sustainable transportation systems (better ecological vehicles' performance, reduction of impacts on town planning etc.) these improvements concern also mobility management, that is specific measures to encourage people to adopt new mobility behaviour such as public transportation services rather than their personal car. These prompting measures concern for instance the quality of traveller's information systems for trip planning, the ability to provide real time recommendations for changing transportation means according to traffic information, and the quality of embedded services in vehicles to provide enhanced navigation aids with contextualised and personalised information.

Since 2004, AxIS has been concerned with mobility projects :

- PREDIT (2004-2007): The MobiVIP project has been an opportunity to collaborate with local Institutions ("Communauté d'Agglomération de Sophia Antipolis - CASA") and SMEs (VU Log) and to apply AxIS' know-how in data and web mining to the field of transportation systems.
- Traveller's information systems and recommender systems have been studied with the evaluation of two CASA web sites : the "Envibus" web site which provides information about a bus network and the "Otto&co" web site support car-sharing.
- Advanced transportation systems has been studied in PREDIT TIC TAC (2010-2012): this project aimed at optimizing travel time by providing in an area with weak transportation services, a just in time on demand shuttle based on real time information. It was for AxIS the opportunity to experiment user implication in the design of a new travel information system called MOBILTIC.
- User Experience: in the ELLIOT project (2011-2013), the Mobility scenario is addressed in relation to information on air quality and noise and the use of Internet of Things (IoT).

4.3. Tourism

As tourism is a highly competitive domain, local tourism authorities have developed Web sites in order to offer of services to tourists. Unfortunately, the way information is organised does not necessarily meet Internet users expectations and numerous improvements are necessary to enhance their understanding of visited sites. Thus, even if only for economical reasons, the quality and the diversity of tourism packages have to be improved, for example by highlighting cultural heritage.

Again to illustrate our role in such a domain, Let us cite some past projects where AxIS is involved related mainly to **Semantic Web Mining**³. In our case, a) we exploit ontologies and semantic data for improving usage analysis, personalised services, the quality of results of search engines and for checking the content of an IS and also b) we exploit usage data for updating ontologies.) and Information Retrieval.

- Research has been carried out using log files from the city of Metz. This city was chosen because its Web site is in constant development and has been awarded several times, notably in 2003, 2004 and 2005 in the context of the Internet City label. The objective was to extract information about tourists behaviours from this site log files and to identify possible benefits in designing or updating a tourism ontology.

³By Semantic Web Mining, we mean the mutual benefits between two communities Semantic Web and Web Mining

- Providing Tourism Information linked to Transportation information: AxIS has already studied recommender systems in order to provide users with personalised transportation information while looking for tourism information such as cultural information, leisure etc. (cf. our recommender Be-TRIP (2006) based on CBR*Tools).
- In the context of HOTEL-REF-PACA project, we aimed to better refer the web sites of hotels/campings from the region of TOURVAL in PACA (mainly Vésubie territory), with an approach based on a better understanding of usage from the internauts. To address this, we proposed and adopted a multidisciplinary approach combining various AxIS know-how: knowledge engineering (ontology in tourism), data mining (analysis of Google logs, hotel web site logs and user queries, visual behaviours from eye tracker), Ergonomics (clustering of hotel web sites based on their ergonomical quality).
- Several contacts (PACA, France Living Labs, Island of the Reunion) have been done related to projects in tourism and eco-tourism.

4.4. User Involvement in Silver Economy, Environment, Energy and E-gouvernement

Below are some topics where AxIS was or is involved in:

- **Preprocessing and analysing collective usage data and social networks** from group discussions related to design process: see ANR Intermed (2009) and FP7 Elliot where citizen generate ideas in terms of specific environmental sensors based services according to their needs.
- **Methods and tools for supporting open innovation based on open data:** a first work was made in 2010 with the CDISOD Color action related Public Data in collaboration with Fing (Marseille) and ADEME (Sophia Antipolis). We pursue such a study in the context of FP7 Elliot by providing to citizen environmental data (air quality and noise) issued from citizen and/or territories sensors.

All AxIS topics are relevant for these domains. Let us cite: social network analysis, personalization and information retrieval, recommender systems, expert search, design and evaluation of methods and tools for open innovation and user co-creation in the context of Living Labs, usage mining, mining data streams.

We have addressed specific works:

- **Silver Economy - Health & Well Being:** Axis contributed in 2010-2011 to a Living Lab characterisation in Health domain, study conducted by R. Picard (CGIET⁴ via the participation of a working group (M. Pallot) and the visit of several European Living Labs, which operate in the domain of Health and Autonomy. B. Trousse as Inria representative of ICT usage lab involved in Health and Autonomy was also interviewed. This year Axis team managed the Green Services use case in the context of the achieved FP7 ELLIOT project involving pollution citizen sensors and in relation to health and Well being (targeted users with respiratory problems). interviews. This use case has been evaluated as "Good practice" by the international *Design for All* foundation (Awards 2014). Two ANR proposals involving France Living Labs and/or our living lab have been deposit with "Cité du Design" and University of Lorraine (cf. Sections 7.2.5 and 7.2.4). Let us note that France Living Labs is involved in the Silver Economy contract (cf. Section 7.2.6).
- **Energy:** the main AxIS topic here was usage analysis in the context of an energy challenge in an enterprise (E-COFFICES) taking into account the complex and real situation (installation for more than 400 sensors, differences between the three concerned teams, differences between the offices). Such an analysis aims to correlate team/office energy consuming, team/office eco-responsible behaviours and team/office profile. In 2012, our team was involved in a second project E-COFAMILIES aiming to co-design with families user interfaces for energy monitoring.
- **E-government:** The future Internet will bring a growing number of networked applications (services), devices and individual data (including private ones) to end-users. The important challenges are the organization of their access, and the guarantee of trust and privacy. The objectives of the PIMI⁵ project (cf. section 7.2.1) are the definition of a design environment and a deployment platform for

⁴CGIET: "Conseil Général de l'Economie, de l'Industrie, de l'Énergie et des Technologies"

Personal Information Management system (PIM). The future PIM must provide the end-user personal data access with services that are relevant to his needs. In order to take mobility into account, the PIM will be accessed both by mobile devices (smart-phones) and Personal Computers. With the increasing number of services and associated data being accessible through Internet, the number and complexity of PIM will augment dramatically in the near future. This will require strong research investment in a number of topics, all contributing to the expected usability and accessibility of Individual Information Spaces for the end-user.

5. Software and Platforms

5.1. Introduction

From its creation, AxIS has proposed new methods and software validated experimentally on various applications: Data Mining, Web Usage Mining, Information Retrieval, Activity Modeling. See Sections from 5.3 until 5.6 and our 2013 results.

In the context of the CPER Télius contract (2010-2013), AxIS has proposed to provide a Focus platform (renamed FocusLab) aiming the community of Living Labs or any researcher/actor involving in experimental project with users.

5.2. FocusLab Platform

Participant: Brigitte Trousse [co-correspondent].

Between 2010-2012 in the context of CPER Télius (cf. Section 7.1.1), we bought various hardware (eye-trackers, physiologic sensors, equilibrium platform, tablets, Arduino components, etc.) and software (Sphinx for questionnaires, Story Board for usage scenarios, Interface prototyping tools such as JustInMind, etc.) in order to observe and analyse user behaviours in supporting the design and evaluation of ICT-based services or products within a living lab approach and also to mine data. FocusLab hardware and software (under licences) were used since 2011 by Inria teams and external collaborators with success, supporting experiments or training.

Our goal was also to provide a web-based application for reserving FocusLab material (hardware, software and documentation) and to prepare the access/download of some software issued from Inria research. We started with AxIS software as a first step of the mutualised software part of the platform.

The development process of the web-based FocusLab platform started slowly in 2011, after finding some ways to fund human resources. We started by transforming some AxIS KDD methods into web services. Such a work was pursued this year (cf. Section 6.6) linked to Elliot purposes. This platform (<http://focuslab.inria.fr>) is based on a Service oriented Architecture.

5.3. Data Mining

5.3.1. Classification and Clustering Methods

Participants: Marc Csernel, Yves Lechevallier [co-correspondent], Brigitte Trousse [co-correspondent].

We developed and maintained a collection of clustering and classification software, written in C++ and /or Java:

⁵Personal Information Management through Internet

Supervised methods

- a Java library (Somlib) that provides efficient implementations of several SOM(Self-Organizing Map) variants [44], [43], [69], [68], [73], especially those that can handle dissimilarity data (available on Inria's Gforge server (public access) [Somlib](#), developed by AxIS Rocquencourt and Briec Conan-Guez from Université de Metz).
- a functional Multi-Layer Perceptron library, called FNET, that implements in C++ supervised classification of functional data [64], [67], [66], [65] (developed by AxIS Rocquencourt).

Unsupervised methods : partitioning methods

- Two partitioning clustering methods on the dissimilarity tables issued from a collaboration between AxIS Rocquencourt team and Recife University, Brazil: CDis and CCClust [77]. Both are written in C++ and use the "Symbolic Object Language" (SOL) developed for SODAS. And one partitioning method on interval data (Div).
- Two standalone versions improved from SODAS modules, SCluster and DIVCLUS-T [41] (AxIS Rocquencourt).

Unsupervised methods : agglomerative methods

- a Java implementation of the 2-3 AHC (developed by AxIS Sophia Antipolis). The software is available as a Java applet which runs the hierarchies visualization toolbox called HCT for Hierarchical Clustering Toolbox (see [3] and [42]).

A Web interface developed in C++ and running on our Apache internal Web server .is available for the following methods: SCluster, Div, Cdis, CCClust.

Previous versions of the above software have been integrated in the SODAS 2 Software [61] which was the result of the european project ASSO⁶ (2001-2004). SODAS 2 supports the analysis of multidimensional complex data (numerical and non numerical) coming from databases mainly in statistical offices and administration using Symbolic Data Analysis [39]. This software is registered at APP (Agence de la Protection des Programmes). For the latest version of the SODAS 2 software, see [60], [79].

In 2013, a new release of MND (Dynamic Clustering Method for Mixed Data) algorithm has been done based on [80] (cf. section 6.2.5) and used on clustering the user profiles and analysing user behaviour change (cf. Section 6.5.4).

5.3.2. Extracting Sequential Patterns with Low Support

Participant: Brigitte Trousse [correspondent].

Two methods for extracting sequential patterns with low support have been developed by D. Tanasa in his thesis (see Chapter 3 in [72] for more details) in collaboration with F. Masegla and B. Trousse :

- **Cluster & Divide**,
- and **Divide & Discover** [8].

These methods have been successfully applied from 2005 on various Web logs.

5.3.3. Mining Data Streams

Participant: Brigitte Trousse [correspondent].

In Marascu's thesis (2009) [57], a collection of software have been developed for knowledge discovery and security in data streams. Three **clustering methods for mining sequential patterns (Java) in data streams** method have been developed in Java:

- SMDS compares the sequences to each others with a complexity of $_O(n^2)$.
- SCDS is an improvement of SMDS, where the complexity is enhanced from $O(n^2)$ to $O(n.m)$ with n the number of navigations and m the number of clusters.
- ICDS is a modification of SCDS. The principle is to keep the clusters' centroids from one batch to another.

⁶ASSO: Analysis System of Symbolic Official data.

Such methods take batches of data in the format "Client-Date-Item" and provide clusters of sequences and their centroids in the form of an approximate sequential pattern calculated with an alignment technique.

In 2010 the Java code of one method called SCDS has been integrated in the MIDAS demonstrator and a C++ version has been implemented by F. Masegla for the CRE contract with Orange Labs with the deliverability of a licence) with a visualisation module (in Java).

It has been tested on the following data:

- Orange mobile portal logs (100 million records, 3 months) in the context of Midas project (Java version) and the CRE (Orange C++ version)
- Inria Sophia Antipolis Web logs (4 million records, 1 year, Java version)
- Vehicle trajectories ([Brinkhoff generator](#)) in the context of MIDAS project (Java version).

In 2012 within the context of the ELLIOT contract, SCDS has been integrated as a Web service (Java version) in the first version of FOCUSLAB platform: a demonstration was made on San Raffaele Hospital media use case at the first ELLIOT review at Brussels. We applied SCDS web service on data issued from two other use cases in Logistics (BIBA) and Green Services (Inria) [38].

The three C++ codes done for the CRE (Orange Labs) have been deposit at APP. The java code will be deposit in 2014 at APP.

5.4. Web Usage Mining

5.4.1. AWLH for Pre-processing Web Logs

Participants: Yves Lechevallier [co-correspondent], Brigitte Trousse [co-correspondent].

AWLH (AxIS Web Log House) for Web Usage Mining (WUM) is issued from AxISLogMiner software which implements the multi-site log preprocessing methodology and extraction of sequential pattern with low support developed by D. Tanasa in his thesis [72], [15] for Web Usage Mining (WUM). In the context of the Eiffel project (2008-2009), we isolated and redesigned the core of AxISlogMiner preprocessing tool (we called it AWLH) composed of a set of tools for pre-processing web log files. The web log files are cleaned before to be used by data mining methods, as they contain many noisy entries (for example, robots requests). The data are stored within a database whose model has been improved.

So AWLH offers:

- Processing of several log files from several servers,
- Support of several input formats (CLF, ECLF, IIS, custom, etc.),
- Incremental pre-processing,
- Java API to help integration of AWLH in external application.

5.4.2. ATWUEDA for Analysing Evolving Web Usage Data

Participants: Yves Lechevallier [co-correspondent], Brigitte Trousse [co-correspondent].

ATWUEDA for Web Usage Evolving Data Analysis [52] [4] was developed by A. Da Silva in her thesis [52] under the supervision of Y. Lechevallier. This tool was developed in Java and uses the JRI library in order to allow the application of R which is a programming language and software environment for statistical computing functions in the Java environment.

ATWUEDA is able to read data from a cross table in a MySQL database. It splits the data according to the user specifications (in logical or temporal windows) and then applies the approach proposed in the Da Silva's thesis in order to detect changes in dynamic environment. The proposed approach characterizes the changes undergone by the usage groups (e.g. appearance, disappearance, fusion and split) at each time-stamp. Graphics are generated for each analysed window, exhibiting statistics that characterizes changing points over time.

Version 2. of ATWUEDA (September 2009) is available at Inria's gforge website.

The efficiency of ATWUEDA [46] has been demonstrated by applying it on real case studies such as on condition monitoring data streams of an electric power plant provided by EDF.

ATWUEDA is used by Telecom Paris Tech and EDF [4].

5.5. Information Retrieval

5.5.1. *CBR*Tools for Managing and Reusing Past Experiences based on Historical Data*

Participant: Brigitte Trousse [correspondent].

CBR*Tools [53], [54] is an object-oriented framework [55], [50] for Case-Based Reasoning which is specified with the UMT notation (Rational Rose) and written in Java. It offers a set of abstract classes to model the main concepts necessary to develop applications integrating case-based reasoning techniques: case, case base, index, measurements of similarity, reasoning control. It also offers a set of concrete classes which implements many traditional methods (closest neighbours indexing, Kd-tree indexing, neuronal approach based indexing, standards similarities measurements). CBR*Tools currently contains more than 240 classes divided in two main categories: the core package for basic functionality and the time package for the specific management of the behavioural situations. The programming of a new application is done by specialization of existing classes, objects aggregation or by using the parameters of the existing classes.

CBR*Tools addresses application fields where the re-use of cases indexed by behavioural situations is required. The CBR*Tools framework was evaluated via the design and the implementation of several applications such as Broadway-Web, Educaid, BeCKB, Broadway-Predict, e-behaviour and Be-TRIP.

CBR*Tools is concerned by two past contracts: EPIA and MobiVIP.

CBR*Tools is available on demand for research, teaching and academic purpose via the FocusLab platform. The user manual can be downloaded at the URL: <http://www-sop.inria.fr/axis/cbrtools/manual/>.

See also the web page <http://www-sop.inria.fr/axis/cbrtools/manual/>.

5.5.2. *Broadway*Tools for Building Recommender Systems on the Web*

Participant: Brigitte Trousse [correspondent].

Broadway*Tools is a toolbox supporting the creation of adaptive recommendation systems on the Web or in a Internet/Intranet information system. The toolbox offers different servers, including a server that computes recommendations based on the observation of the user sessions and on the re-use of user groups' former sessions. A recommender system created with Broadway*tools observes navigations of various users and gather evaluations and annotations, to draw up a list of relevant recommendations (Web documents, keywords, etc).

Based on Jaczynski's thesis [53], different recommender systems have been developed for supporting Web browsing, but also browsing inside a Web-based information system or for query formulation in the context of a meta search engine.

5.6. Activity Modeling

5.6.1. *K-MADe for Describing Human Operator or User Activities*

Participant: Dominique Scapin [correspondent].

K-MADe tool (Kernel of Model for Human Activity Description Environment). The K-MADe is intended for people wishing to describe, analyze and formalize the activities of human operators, of users, in environments (computerized or not), in real or simulated situation, in the field, or in the laboratory. Although all kinds of profiles of people are possible, this environment is particularly intended for ergonomics and HCI (Human Computer Interaction) specialists. It has been developed through collaboration between ENSMA (LISI XSLaboratory) and Inria.

This year we participated in the AFIHM Working Group on Task Models (<http://www.gt-mdt.fr/fr/>) "Groupe de Travail de l'AFIHM sur les Modèles de Tâches". Since the early work on MAD, domain modeling task is the subject of much research (particularly in the French-speaking community), in particular the definition of formalisms and tool construction, three of which are now operational and maintained: K-MADE, eCOMM and hAMSTERS, posing an alternative to CTT. Many teams use these formalisms in a variety of goals and task models occupy a place in the field of Model Driven Engineering, and support the teaching of HCI. The WG goals are to serve as a forum between research approaches, development teams and potential users, especially for non-IT users; fostering collaboration to validate approaches; encourage feedback in teaching task models; provide the French-speaking community and eventually the international community a set of centralized, shared resources about the notion of modeling tasks.

6. New Results

6.1. Introduction

Our new results are split into our three sub-objectives as described in Section 3.1:

- **Sub-Objective 1: Mining for Knowledge Discovery in Information Systems:**

This year we obtained ten main results (cf. Section 6.2): five on Clustering methods, four on how to apply these clustering methods on real data and finally one related to the use of ontology for Multi-View KDD process.

Let us note that two 2011 results have been published this year as book chapters [34], [31].

Chongsheng Zhang published also his work conducted during his Explore program at UCLA (USA) when, as AxIS PhD student, he was visiting the WIS team of Prof. Carlo Zaniolo at UCLA in 2010 [26].

- **Sub-Objective 2: Information and Social Networks Mining for Supporting Information Retrieval:**

This year, we pursued our two main works on this topic (cf. Section 6.3):

- the detection of communities in a social network (detection of graphs extracted from relational data) (cf. Section 6.3.1),
- the multi view clustering of relational data (cf. Section 6.3.2).

- **Sub-Objective 3: Interdisciplinary Research For Supporting User Oriented Innovation:**

With the expansion of the innovation community beyond the firm's boundaries (the so-called "open innovation") a lot of changes have been introduced in design and evaluation processes: the users can become co-designers, HCI design and evaluation focus is no longer placed on usability only but also on the whole user experience [70] [11], experimentations take place out of labs with large numbers of heterogeneous people instead of carefully controlled panels of users etc.

All these deep changes required improvements of existing practices, methods and tools for the design/evaluation of information systems as well as for usage analysis. This evolution called also for a structured user-centred methodology (methods and ICT tools) to deal with open innovation. Various different disciplines and trends are dedicated in understanding user behaviour on Internet and with Digital Technologies, notably Human Computer Interaction community (HCI), Computer Supported Cooperative Work (CSCW), Workplace Studies, Service Design, Distributed Cognition and Data Mining.

Our contribution to open innovation research related to ICT-based services or products keeps its focus on usage analysis and user experience measurement for design, evaluation and maintenance of information systems and our activities from 2011 have been conducted both breadth wise and in depth with two main objectives :

- Improving design and evaluation support tools and methods for user driven driven innovation,
- Development of the FocusLab platform

This year, our research was conducted along three focus:

- Extension of usability methods and models (cf. Section 6.4). First we pursued our work on User Evaluation and Tailoring of Personal Information in the context of the ANR project PIMI. Second a paper related to our strategy and heuristics for rural tourist web sites benchmarking elaborated in the context of the Pacalabs project HOTEL-REF-PACA is written for submission in 2014;
- Designing and evaluating user experience in the context of a living lab: this year five results came from ELLIOT project (cf. Section 6.5) such as an environmental data platform based on citizen sensing, low-cost sensor, user experience measurement, user behaviour change analysis, studies of persuasive technologies and gamification in Energy economy and green services.
- FocusLab Platform (cf. Section 6.6).

6.2. Mining for Knowledge Discovery in Information Systems

6.2.1. Fuzzy Clustering on Multiple Dissimilarity Matrices

Participants: Yves Lechevallier, Francisco de Carvalho.

During 2013 we introduce fuzzy clustering algorithms [18] and [27] that can partition objects taking into account simultaneously their relational descriptions given by multiple dissimilarity matrices. The aim is to obtain a collaborative role of the different dissimilarity matrices to get a final consensus partition. These matrices can be obtained using different sets of variables and dissimilarity functions. These algorithms are designed to furnish a partition and a prototype for each fuzzy cluster as well as to learn a relevance weight for each dissimilarity matrix by optimizing an adequacy criterion that measures the fit between the fuzzy clusters and their representatives. These relevance weights change at each algorithm iteration and can either be the same for all fuzzy clusters or different from one fuzzy cluster to another.

A new algorithm [19] based on a non-linear aggregation criterion, weighted Tchebycheff distances, more appropriate than linear combinations (such as weighted averages) for the construction of compromise solutions is proposed.

Experiments with real-valued data sets from the UCI Machine Learning Repository (<http://archive.ics.uci.edu/ml/>) as well as with interval-valued and histogram-valued data sets show the usefulness of the proposed fuzzy clustering algorithms.

6.2.2. Clustering of Functional Boxplots for Multiple Streaming Time Series

Participant: Yves Lechevallier.

We introduced a micro-clustering strategy for Functional Boxplots [30]. The aim is to summarize a set of streaming time series split in non overlapping windows. It is a two step strategy which performs at first, an on-line summarization by means of functional data structures, named Functional Boxplot micro-clusters; then it reveals the final summarization by processing, off-line, the functional data structures. Our main contribution consists in providing a new definition of micro-cluster based on Functional Boxplots and, in defining a proximity measure which allows us to compare and update them. This allows us to get a finer graphical summarization of the streaming time series by five functional basic statistics of data. The obtained synthesis will be able to keep track of the dynamic evolution of the multiple streams.

This work is done in collaboration with the laboratory of Political Science "Jean Monnet", Second University of Naples, Caserta, Italy.

6.2.3. Web Page Clustering based on a Community Detection Algorithm

Participant: Yves Lechevallier.

Extracting knowledge from Web user's access data in Web Usage Mining (WUM) process is a challenging task that is continuing to gain importance as the size of the Web and its user-base increase. That is why meaningful methods have been proposed in the literature in order to understand the behaviour of the user in the Web and improve the access modes to information.

During 2013 we pursued our previous work on our approach for extracting data based on the modularity function. This approach discovers the existing communities by modeling the data obtained in the pre-processing operation as a weighted graph. The method discriminates the communities through their subject of interest and extract relevant knowledge.

This work is done in collaboration with Yacine Slimani from the LRIA laboratory at the Ferhat Abbas University, Setif, Algeria and will be submitted to an international journal.

6.2.4. Normalizing Constrained Symbolic Data for Clustering

Participants: Marc Csernel, Francisco de Carvalho.

Clustering is one of the most common operation in data analysis while constrained is not so common. During 2013 we presented a clustering method [31] in the framework of Symbolic Data Analysis (S.D.A) which allows us to cluster Symbolic Data. Such data can be constrained relations between the variables, expressed by rules which express the domain knowledge. But such rules can induce a combinatorial increase of the computation time according to the number of rules. The algorithm presented a way to cluster such data in polynomial time. This method is based first on the decomposition of the data according to the rules, then we can apply to the data a clustering algorithm based on dissimilarities.

6.2.5. Dynamic Clustering Method for Mixed Data

Participants: Yves Lechevallier, Marc Csernel, Brigitte Trousse.

For ELLIOT project purposes (cf. Section 7.3.1), a new version of MND method (Dynamic Clustering Method for Mixed Data) has been elaborated. It determines iteratively a series of partitions which improves at each step the underlying clustering criterion. All the proposed distance functions for p variables are determined by sums of dissimilarities corresponding to the univariate component descriptors Y_j . The most appropriate dissimilarities have been suggested above according to the type of variables.

In practice, however, data to be clustered are typically described by different types of variables. An overall dissimilarity measure is obtained by a linear combination of the dissimilarity measures computed with respect to the different kinds of variables.

A new release of MND algorithm based on past work [80] has been developed for ELLIOT purposes, providing some default configuration parameters for non experts.

In this version two types of distances are proposed:

- **Quantitative distance:** the choice is type L1 distance or Euclidean distances when the types of variables are quantitative or continuous.
- **Boolean distance:** the choice is Khi2, type L1 distance or Euclidean distances when the type of variables is categorical or discrete.

This algorithm has been applied to cluster answers at questionnaires issued from a diary tool within the ELLIOT Green Services use case (cf. Section 6.5.4).

6.2.6. Applying a K-means clustering method for districts clustering according to Pollution

Participants: Brigitte Trousse, Yves Lechevallier, Guillaume Pilot, Caroline Tiffon.

Our motivation was to provide citizen a comparative analysis at the district level related to pollution data from Azimut stations (ozone O3 and nitrogen dioxide NO2). To achieve this, the Nice Côte d'Azur territory was discretized into small areas. IoT Data are preprocessed for each district and period of time before applying clustering. The temporal and spatial units were clustered into 5 and then into 6 clusters. The partition into 5 clusters was selected, then the temporal units for each area were counted. For the partition in 5 clusters, for each area the percent of each cluster was counted. Around 30 areas with more than 10 temporal units were found. We improved this to classify different districts of the city based on their IoT data (Azimut data O3-NO2) for each hour/day in order to provide a new functionality in the second version of MyGreenServices.

This work is partially funded by ELLIOT project (see Section 7.3.1).

6.2.7. *Summarizing Dust Station IoT Data with REGLO, a FocusLab web service*

Participants: Yves Lechevallier, Brigitte Trousse, Guillaume Pilot, Xavier Augros.

Within ELLIOT, we applied the GEAR (or REGLO in French) method [57], [58], [59] on the evolution of dust data issued from one citizen sensor.

Our motivation was to summarize IoT data in order to have a pollution context for each user. Such IoT summaries constitute interesting individual contextual data for supporting the living lab manager to better interpret the user behavior and finally the user experience.

REGLO summarised IoT data with isolated points and line segments.

The goal now is to carry out an analysis of these summaries to automatically determine the characteristics of the curve.

We selected only segments. For each segment we calculated four variables that characterize it:

- The slope of the segment,
- The midpoint of the segment (average of this segment),
- The length of the segment,
- The duration of the segment (the time interval between the start time and the end time of the segment).

From these four values we can achieve an interpretation of the previous curve, taking into account only two variables and constructing a 2D representation.

This work is partially funded by ELLIOT project (see Section 7.3.1).

6.2.8. *Clustering of Solar Irradiance*

Participants: Thierry Despeyroux, Francisco de Carvalho, Yves Lechevallier, Thien Phuc Hoang Nguyen.

The development of grid-connected photovoltaic power systems leads to new challenges. The short or medium term prediction of the solar irradiance is definitively a solution to reduce the storage capacities and, as a result, authorizes to increase the penetration of the photovoltaic units on the power grid. We present the first results of an interdisciplinary research project which involves researchers in energy, meteorology and data mining, addressing this real-world problem. The objective here is to show interest and disadvantages of two approaches for classifying curves.

In Reunion Island from December 2008 to March 2012, solar radiation measurements has been collected, every minutes, using calibrated instruments. Prior to prediction modelling, two clustering strategies has been applied for analysis the data base of 951 days.

During 2013 we continued our research and obtained many results [28].

Our methodology is based on two clustering approaches. The objective here is to show interest and disadvantages of two approaches for classifying curves.

The first approach combines the following proven data-mining methods. Principal Component Analysis was used as a pre-process for reduction and de-noising and the Ward Hierarchical and K-means methods to find a partition with a good number of classes.

The second approach [78],[20] uses a clustering method that operates on a set of dissimilarity matrices. Each cluster is represented by an element or a subset of the set of objects to be classified. The five meaningfully clusters found by the two clustering approaches are compared.

6.2.9. *Understanding of Cooking User's Recipes by Extracting Intrinsic Knowledge*

Participants: Damien Leprovost, Thierry Despeyroux, Yves Lechevallier.

On community web sites, users share knowledge, being both authors and readers. We present a method to build our own understanding of the semantics of the community, without the use of any external knowledge base. We perform this understanding by knowledge extraction from analysed user contributions. We propose an evaluation of the trust attributable to that deduced understanding to assess the quality of user content, on cooking recipes provided by users on sharing web sites. This work is partially funded by FIORA project (see Section 7.2.2). Two articles have been accepted in early 2014 [25], [29].

6.2.10. *Knowledge Modeling for Multi-View KDD Process*

Participant: Brigitte Trousse.

We pursued our supervision (with our colleagues H. Behja and A. Marzark from Morocco) of E.L. Moukhtar Zemmouri's PhD thesis (Morocco) on a Viewpoint Model in the context of a KDD process, topic we initiated during Behja's PhD thesis [40]). E. Zemmouri defended his thesis at the end of this year [75]. Below is the summary of his PhD thesis.

Knowledge Discovery in Databases (KDD) is a highly complex, iterative and interactive process aimed at the extraction of previously unknown, potentially useful, and ultimately understandable patterns from data. In practice, a KDD process involves several actors (domain experts, data analysts, KDD experts etc.) each with a particular viewpoint. We define a multi-view analysis as a KDD process held by several experts who analyze the same data with different viewpoints. We propose to support users of multi-view analysis through the development of a set of semantic models to manage knowledge involved during such analysis. Our objective is to enhance both the reusability of the process and coordination between users. To do so, we propose first a formalization of Viewpoint in KDD and a Knowledge Model that is a specification of the information and knowledge structures and functions involved during a multi-view analysis. Our formalization, using OWL ontologies, of viewpoint notion is based on CRISP-DM standard through the identification of a set of generic criteria that characterize a viewpoint in KDD. Once instantiated, these criteria define an analyst viewpoint. This viewpoint will guide the execution of the KDD process, and then keep trace of reasoning and major decisions made by the analyst. Then, to formalize interaction and interdependence between various analyses according to different viewpoints, we propose a set of semantic relations between viewpoints based on goal-driven analysis. We have defined equivalence, inclusion, conflict, and requirement relations. These relations allow us to enhance coordination, knowledge sharing and mutual understanding between different actors of a multi-view analysis, and re-usability in terms of viewpoint of successful data mining experiences within an organization. An article selected from the international conference NGNS 2012 [74] will be published in the on-line *Journal of Mobile Multimedia*, Volume 9 No.3 &4 March 1, 2014.

6.3. Information and Social Networks Mining for Supporting Information Retrieval

6.3.1. *Clustering of Relational Data and Social Networks Data: Graph Aggregation*

Participant: Yves Lechevallier.

The automatic detection of communities in a social network can provide a kind of graph aggregation. The objective of graph aggregations is to produce small and understandable summaries and it can highlight communities in the network, which greatly facilitates the interpretation.

Social networks allow having a global view of the different actors and different interactions between them, thus facilitating the analysis and information retrieval.

In the enterprise context, a considerable amount of information is stored in relational databases. Therefore, relational database can be a rich source to extract social network.

During this year we updated the program developed by Louati Amine in 2011. A book chapter [34] proposes a new aggregation criteria.

This work is done by Louati Amine (AxIS) in collaboration with Marie-Aude Aufaure, head of the Business Intelligence Team, "Ecole Centrale de Paris", MAS Laboratory.

6.3.2. Multi-View Clustering of Relational Data

Participants: Thierry Despeyroux, Francisco de Carvalho, Yves Lechevallier.

In the work reported in [47] in collaboration with Francisco de A.T. de Carvalho, we introduce an improvement of a clustering algorithm described in [78] that is able to partition objects taking into account simultaneously their relational descriptions given by multiple dissimilarity matrices. In this version of the prototype clusters depend on the variables of the representation space. These matrices could have been generated using different sets of variables and dissimilarity functions. This method, which is based on the dynamic clustering algorithm for relational data, is designed to provide a partition and a vector of prototypes for each cluster as well as to learn a relevance weight for each dissimilarity matrix by optimizing an adequacy criterion that measures the fit between clusters and their representatives. These relevance weights change at each algorithm iteration and are different from one cluster to another. Moreover, various tools for the partition and cluster interpretation furnished by this new algorithm are also presented.

Two experiments demonstrate the usefulness of this clustering method and the merit of the partition and cluster interpretation tools. The first one use a data set from UCI machine learning repository concerning handwritten numbers (digitalized pictures). The second uses a set of reports for which we have an expert classification given a priori. This work has been published this year as a chapter in "Advances in Knowledge Discovery and Management" [32].

6.4. Extension of Usability Methods and Tools

6.4.1. User Evaluation and Tailoring of Personal Information

Participants: Claudia Detraux, Dominique Scapin.

In the context of the ANR project PIMI (Personal Information Management through Internet) an ergonomic evaluation was conducted on the initial prototype, in its PC version [49] and its mobile version [48]. In addition, an experiment was conducted on the usability of the new improved PIMI prototype. The goals were to evaluate its usability, and to assess user tailoring as an evaluation technique. Thirty users participated to the study: a first part consisted in a standard user test (SUT) and a second part was a usability test with tailoring (UTT). Overall, a total of 51 usability problems were diagnosed. Among those, 32 resulted from SUT, and 19 from UTT. Part of the latter (11) are additional to the ones identified during SUT, and to those diagnosed previously by usability inspection (UI with Ergonomic Criteria). The active involvement of users through customization scenarios appear to provide additional cues for usability assessment, and for design, with new generic usability recommendations [23],[22].

6.5. Designing and Evaluating User Experience and Methods for Open Innovation

6.5.1. MyGreenServices: a Pollution Collective-Awareness Platform based on Citizen Sensing

Participants: Brigitte Trousse, Guillaume Pilot, Xavier Augros, Florian Bonacina, Caroline Tiffon, Anne-Laure Negri, Bernard Senach.

Adopting a living lab approach and following an experiential design process [63], we co-created with users and implemented a Pollution Collective-Awareness platform based on Citizen Sensing called "MyGreenServices" [38]. This deployment was very rich in terms of a better understanding of research problems to be addressed in this context in order to lead to user behaviour changes: citizen sensing, environmental crowdsourcing platform and user experience in the context of IoT.

MyGreenServices (<http://mygreenservices.inria.fr>) which was very robust offers various green services such as the visualization of environmental data collected by citizen, the alert services, the ability to download data, the forum for sharing ideas and best practices in terms of eco-responsible behaviors. MyGreenServices provides access to citizen measures (stations and electric vehicles) for any registered user. Moreover, citizens who host a station can trace the time history of the data sensed. The priority was to provide to users all the IoT data by them. Two ways to represent data have been chosen as shown in Figure 1:

- The use of maps with measures coming from environmental sensors and based on a colour scale indication;
- The pollution curves that support the cartography and allow the access to the detailed data for the user.

A pollution alert service has been created considering two points of view:

- The first consists of localising a person (with his agreement) and indicating via email or text message the passage through a polluted area;
- The second allow the user to define an area to follow and the user will be advised of pollution alerts for the area by email or text message.

An important effort has been done in designing, testing and improving user interfaces based on pre-test with the usability testing software named Morae and experiments in real situations.

Two experiments have been carried out in February and in June 2013, with the aim to test the platform MyGreenServices by two user profiles (consumers and producers of data) and to measure User experience. The aim of the experiments is to assess the user experience and experiential learning related to MyGreenServices; this includes experience related to the IoT devices, to the measures and services as well as air quality awareness and behaviour changes monitoring. See Section 6.5.3) for more details on the used model and measurement methodology.

For supporting Citizen Sensing, we elaborated IoT installation guides for our three Pollution stations (based on user feedbacks): Pollux station for dust from CKAB ⁷, Azimut stations for Ozone and Nitrogen dioxide from Azimut Monitoring ⁸ and AxISbox stations for dust (Inria Cf. Section 6.5.2).

In order to ensure a proper data analysis, log and usage analytics were structured and gathered in an admin tool designed by the AxIS team at Inria. This tool is a component of the MyGreenServices portal.

6.5.2. AxISbox, a Prototype of a Low-Cost Dust Arduino-based Station

Participant: Guillaume Pilot.

In order to provide more citizen sensors during our Elliot experiments, we developed a first prototype of a new low cost dust (PM10) station (with Rasburry and Arduino) called AxISbox (cf. Figure 2) which we tested for research purposes. This prototype was validated during the second ELLIOT experiment in June.

6.5.3. Modelling and Measuring User Experience for Green IoT-based Services

Participants: Brigitte Trousse, Anne-Laure Negri, Caroline Tiffon, Xavier Augros, Guillaume Pilot.

⁷CKAB URL: <http://ckab.com/polluxnz-city>

⁸Azimut Monitoring URL: <http://www.azimut-monitoring.com/>

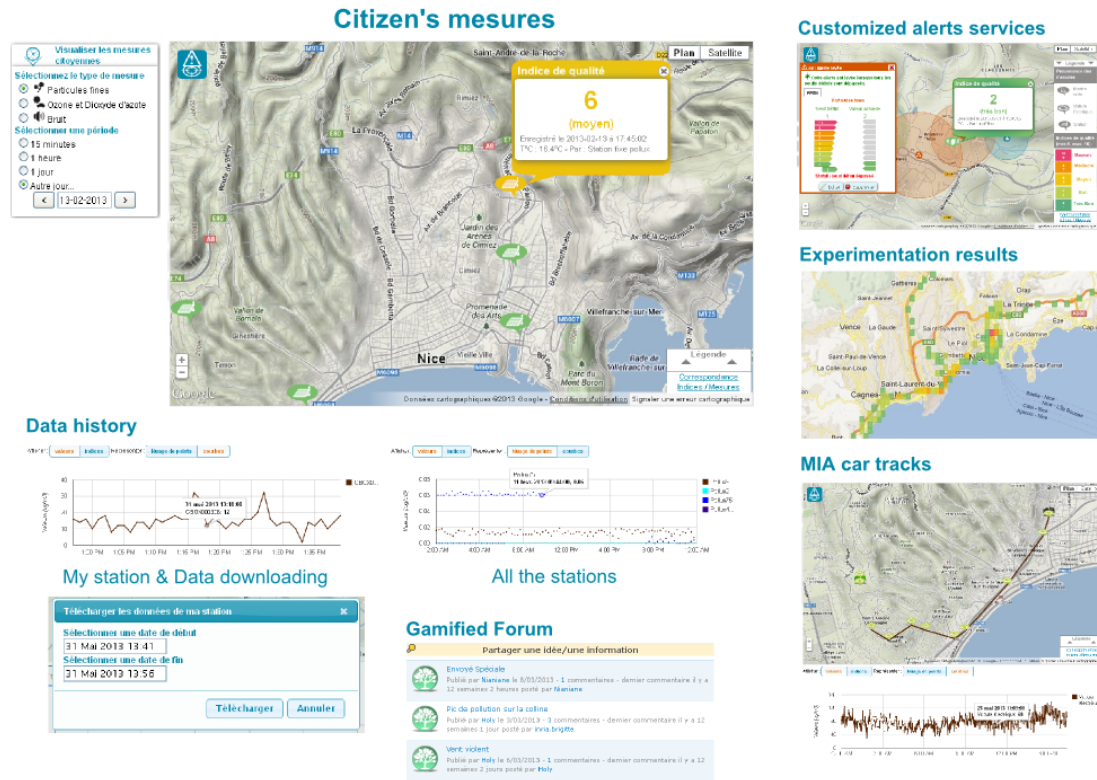


Figure 1. MyGreenServices Platform



Figure 2. Citizen sensors: Pollux station, AxISbox and Azimut mobile station

In accordance with the overall objective of MyGreenServices, we provided an UX modelling and measurement methodology for Green IoT-based services we applied on MyGreenServices. In our ELLIoT context, we focused on the level of awareness/experiential learning raised after usage of MyGreenServices (awareness pollution, awareness of citizen dissemination and change of behaviors), the ease of use and diffusion aspects (as being a tool provided to the citizen). Two objects of the learning were considered: IoT via myGreenServices portal and Air quality. We used a differential between a pre-profile and post-profile. Our UX methodology in the context of ELLIOT project is lying on the five steps we applied on the two versions of MyGreenServices:

- Instantiation of the holistic UX model elaborated within ELLIOT [63] (cf. the first three columns in Figure 3),
- Choice of types of UX momentary, episodic, cumulative) depending on the moment of the measurement (cf. Figure 4),
- Identification of relevant data to be collected and UX indicators (cf. the last two columns in Figure 3),
- Definition of UX metrics for indicators and rules (see Section 6.5.4 for the example of the Usefulness property),
- and finally data pre-processing and UX indicators/properties computation (via for some properties FocusLab 6.6).

| UX Elements | ID | UX Properties | Input | Indicators |
|----------------------|------|---------------------------------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Knoweldge | | | | |
| Perceptual | K2.2 | Sensing and attunement of affordances | Questionnaires | Air quality knowledge |
| Cognitive | K3.2 | Cognitive artefact | Questionnaire, Log, Interview | Environment evaluation, Change in activity, IoT Data comparison |
| Social | | | | |
| Social Ties | S1.1 | Social Networking and openness | Questionnaire, Log | Level of activity, Frequency of connections, Forum statistics |
| Interaction | S2.1 | Communication | Interview | Number of MGS demonstrations |
| Emotional Connection | S5.1 | Attractiveness | Questionnaire, Log | Number of intended recommendations, Number of effective recommendations, Frequency of connections after experiments |
| Business | | | | |
| Performance | B2.1 | Reliability | Questionnaire, Log | Perceived data reliability, Frequency of connections |
| Friendliness | B3.1 | Ergonomic quality | Questionnaires, Log | General findability Forum findability, Opinion alert service, Intuitivity of alert service |
| | B4.1 | Usefulness | Questionnaire, Log, Interview | Alert programmation, Change in habits, Alert logs |
| Satisfaction | B4.2 | Hedonic quality | Questionnaires | Opinion MGS, Reaction to alert service, Opinion forum |
| | B4.5 | Loyalty | Questionnaires, Log | Intention of use, Frequence of connections (perceived)+ data logs connections and users sessions |
| Ownership | B6.1 | User ideas | Interview, Log | Number of new services, Forum statistics |
| Privacy | B7.1 | Data protection | Questionnaire | Data protection (perceived) |

Figure 3. MyGreenServices UX Model

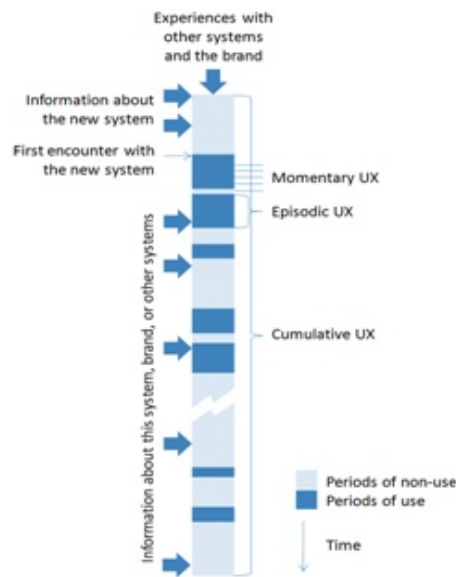


Figure 4. UX Types extracted from [70]

The two experiments clearly indicate both good results in terms of user experience with better result for the second experiment due to the improvement of MyGreenServices (v2) and better community management. A comparative analysis has been made for our two experiments, showing better quantitative value of UX indicators for the second version which was based on User feedback.

6.5.4. Evaluating User Behaviour Changes For MyGreenServices Usefulness Measurement

Participants: Brigitte Trousse, Yves Lechevallier, Xavier Augros, Caroline Tiffon.

The Usefulness UX property of our UX model [38] is calculated by aggregating the analysis of two questions related to a change of behaviours during (4 times) and/or after the experiment in terms of: transportation, aeration, outgoing, sport, aeration or others. We used the web service MNDClustering_Sequence (based on our MND clustering method [45]) to classify the answers to these questions and to provide a sequence of clusters by each user. See Section 6.6.2 related to this new web service.

A data table was built with all the answers for each (user, timestamp) and is analyzed to generate a partition in 3 clusters for the experiment by calling the Focuslab MND webservice (cf. Section 6.2.5) which has been improved this year. The Output via MNDClusterSequence web service is a csv data file with for each user the sequence of 5 clusters obtained during the experiment.

Then we identified the users having changed their behaviour. We use the following UX rules to conclude on this property:

- If % users declaring a change of behaviour $> 5\%$ then high
- If % users declaring a change of behaviour $< 5\%$ and $> 1\%$ then medium
- If % users declaring a change of behaviour $< 1\%$ then low

The result is "high" related to our two experiments. Note that other questions related to the usefulness of some MyGreenServices functionalities (alerts, forum, data synthesis, etc.) could be integrated in a more global rule for Usefulness.

6.5.5. *Persuasive Technologies in Energy Economy*

Participants: Bernard Senach, Anne-Laure Negri.

The ECOFFICES project [51] was for AxIS project team our first step towards eco-behaviour study. This research was complemented in 2012 with a literature review aiming at a deeper understanding of breaks and levers to eco behavior adoption. The work in this topic lead to a presentation ⁹in the mobility context during the GreenCode Forum (see the video on YouTube) and to an internal seminar for Axis members. A draft of an Inria research report on this topic has been started.

The two research lines "Energy Economy" and "Persuasive Technology" have been merged and an analysis of the Ecoffices challenge has been engaged in the light of works in the fields of Persuasive Technologies and Game Design. In this analysis, the Ecoffices Energy challenge is considered as an hybrid system combining gamification and persuasive principles. Using available models of each field, the experimental device used in the Ecoffices project is deconstructed and evaluated. The persuasive quality analysis relies on the Persuasive System Design model [62]. Concerning the gaming quality of Ecoffices, a first model (Octalysis <http://www.yukaichou.com/gamification-examples/octalysis-complete-gamification-framework/>) was discarded and we are now using the gamification principles from the literature for the analysis [76].

At the end of 2012, we joined the work group PISTIL (Persuasive Interaction for SustainableLity) and engaged several actions within this group and two papers are planned for the JIPS 2014 Special Issues on Persuasive Technologies ¹⁰: one on an analysis of the ECOFFICES challenge (under writing) and another on the design and evaluation of persuasive systems.

6.5.6. *Persuasive Technologies in Green Services*

Participants: Brigitte Trousse, Anne-Laure Negri, Mylène Leitzelman, Florian Bonacina, Caroline Tiffon.

The ELLIOT project was for AxIS project team our second step towards eco-behaviour study. It provided us a very rich context to study behaviour changes related to pollution awareness. Our experimental results showed a very promising tendency in terms of user behaviour changes and the impact of MyGreenServices on leading user eco-behaviours [38].

Persuasive technologies and gamification were used in the context of green Services use case. A specific focus was on gamification for the two customised Ideastream-based tools we developed for the co-creation step and mainly for the one used inside MyGreenServices platform (see Figure 5).

6.6. FocusLab Platform

6.6.1. *New Graphical Charter and New Functionalities*

Participants: Xavier Augros, Florian Bonacina, Brigitte Trousse.

This year we implemented a new version of the Focuslab platform (v1.3) (<http://focuslab.inria.fr>) with a new graphical charter, the addition of the documentation part (books, articles, thesis, reports, etc.) and new functionalities such as cross references between the hardware/software parts with the documentation part, the opportunity of reserving hardware, hardware+software or documentation and a new administration interface. This new version has been tested internally in the team at the end of the year.

6.6.2. *FocusLab Generic Web Service: MNDCluster_Sequence*

Participants: Xavier Augros, Yves Lechevallier, Brigitte Trousse.

This year for Elliot purposes, we built a new FocusLab generic Web Service called MNDCluster-Sequence. This web service uses the new release of MND clustering method [80] (cf. Section 6.2.5) which computes the best partition based on all data for each (user, timestamp). Then it builds for each user the sequence of 5 clusters taking into account the five user time stamp in our case. The resulting sequences are then added for each user as new qualified data in the dataset of Green Services.

⁹URL: http://www-sop.inria.fr/axis/papers/2012/GreenCode_2012

¹⁰On-line journal : Journal d' Interaction Personne-Système, Journal of "Association Francophone d'Interaction Homme-Machine".

MyGreenServices
Portail citoyen de l'air azuréen

Accueil Mesures citoyennes Expérimentation Forum F.A.Q.

Bienvenue dans l'espace communautaire de MyGreenServices.
Témoignez de vos usages des données et gagnez des points!

Forum

Passer une question
Partager une idée
Nous encourager
Relever un problème

Vieille santé/bien-être

inria.nice

- Mes votes
- Mes points
- Mes activités sur le forum
- Administrer
- Idea Analytics

Bonjour [nom] Déconnexion

Chercher dans le forum

Rechercher

Top des participants

| | |
|---------|------------|
| Naniane | 949 points |
| Holy | 756 points |
| aDebut | 205 points |

Voir tous les membres

Statistiques

46 membres
105 messages
134 commentaires

Activité récente Classement par vote Toutes les réactions

Partager une idée/une information

Alerte sms
Publié par Naniane le 20/06/2013 - 0 commentaires - dernier commentaire il y a 3 jours 13 heures posté par Naniane

Capteur mobile canin
Publié par fauraudy@hnm... le 14/06/2013 - 2 commentaires - dernier commentaire il y a 1 semaine 20 min posté par Naniane

Poser une question

Nice installe 200 capteurs
Publié par Naniane le 18/06/2013 - 0 commentaires - dernier commentaire il y a 5 jours 23 heures posté par Naniane

difficultés de connexion
Publié par fauraudy@hnm... le 14/06/2013 - 0 commentaires - dernier commentaire il y a 1 semaine 2 jours posté par fauraudy@hnm...

Utilisation des services d'alertes de MGS
Publié par inria.norian le 14/06/2013 - 0 commentaires - dernier commentaire il y a 15 semaines 3 jours posté par inria.norian

Relever un problème

déplacement du capteur
Publié par fauraudy@hnm... le 15/06/2013 - 1 commentaires - dernier commentaire il y a 6 jours 22 heures posté par inria.np

problème resolu
Publié par fauraudy@hnm... le 15/06/2013 - 0 commentaires - dernier commentaire il y a 1 semaine 1 jour posté par fauraudy@hnm...

connexion de la pelux 6
Publié par fauraudy@hnm... le 14/06/2013 - 0 commentaires - dernier commentaire il y a 1 semaine 2 jours posté par fauraudy@hnm...

Problème sur la collecte des données des capteurs mobiles (Rabok)
Publié par inria.np le 14/06/2013 - 0 commentaires - dernier commentaire il y a 1 semaine 2 jours posté par inria.np

POLLUX
Publié par Naniane le 14/06/2013 - 2 commentaires - dernier commentaire il y a 1 semaine 2 jours posté par inria.np

1 2 3 4 5 6 7 8 9 ... suivant > dernier >

Figure 5. "Gamified Forum" page (including AxISbox)

This web service is added to those already integrated in FocusLab (See for more details our 2012 activity report <http://raweb.inria.fr/rappportsactivite/RA2012/axis/uid116.html>)

7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. CPER Telius - FocusLab Platform (2010 - 2013)

Participant: Brigitte Trousse [correspondent].

This grant, funded by Regional and European support, covers several areas. AxIS is being funded through the experimental platform on the usage of information systems called Focus (and renamed FocusLab). Our goal is to support the observation and analysis of user behaviors within ICT-based experimental projects adopting a user driven approach. Hardware, software and documentation are proposed within this platform (<http://focuslab.inria.fr>).

Let us cite AxIS projects which used FocusLab platform: TIC TAC, ECOFFICES, ECOFAMILIES and ELLIOT. In addition to AxIS, others Inria teams (WIMMICS,REVES,MAESTRO,PLANETE) and external organisations or teams (I3M laboratory from University of Nice Sophia Antipolis, CSTB Sophia Antipolis, the Ergonauts Association, two Elliot partners) have used elements of FocusLab.

7.1.2. Labex UCN@Sophia

Participant: Brigitte Trousse [correspondent].

Title: User-Centered Network

URL: <http://www.ucnlab.eu/node/5>

Instrument: Labex

Coordinator: University of Nice - Sophia Antipolis

Others partners: I3S (UNS / CNRS), LEAT (UNS / CNRS), Inria, EURECOM

Abstract: The Labex UCN@Sophia proposes a research program for researchers of the ICT Campus at Sophia Antipolis, program motivated by a vision which positions the user at the centre of the network. Five scientific and strategic directions are proposed: a) Data Centric Networking, b) Distributed and Ubiquitous Computing, c) Security, privacy and network neutrality, d) Infrastructures: Heterogeneity and Efficiency and e) Energy Efficiency. Two application domains have been selected: Homecare services for persons with reduced autonomy and Intelligent Transport Systems.

See : <http://www.ucnlab.eu/>

AxIS research aimed mainly several of the addressed domains and research of user-centred design and co-creation with users (cf. Sections 4.2 and 4.4).

7.1.3. ICT Usage Lab: collaboration with University of Nice Sophia Antipolis

Participants: Brigitte Trousse [correspondent], Céline Lacroix.

In 2013 we had many activities.

First ICT Usage Lab started its involvement in **EIT KIC Labs** via three funded tasks (see Sections 7.3.3, 7.3.5 and 7.3.4). We describe the Experience & living labs facilities and services offered by EIT partners of ICT Usage Lab based on the EIT ICT Labs template elaborated by E&LL research catalyst (cf. Section 7.3.3).

This year was the occasion for Inria to collaborate for **the first time in the context of EIT KIC Labs** with researchers from **University of Nice - Sophia Antipolis**:

- **I3S laboratory** - University of Nice Sophia Antipolis: F. Baude (EIT contact) from OASIS research-team project on one KIC ICT Labs task (cf. Section 7.3.4),
- **I3M laboratory** - University of Nice Sophia Antipolis: C. Lacroix (ICT Usage lab contact), F. Debos and P. Rasse (leader) related to two KIC ICT labs Call 2013 submissions: TravelDashboard2 led by Thales including Arles Inria research-team and CityCrowdSource2 led by Loria (Madynes Inria research team-project) following the 2013 activity we have supported (cf. Section ell).

Secondly as supporting partner of the European IDEALL project, we prepared a presentation of Ecofamilies and ELLIoT projects for a France Living Labs talk at the last IDEALL meeting (Barcelona) in January 2014.

Inria and ICT Usage Lab are official partners of the Innovative City Convention event from 2012 (Nice Côte d'Azur): <http://www.innovative-city.fr/partenaires/partners/>. In this context we invited three speakers: in 2012 Michael Nilsson (CDT, Lulea, Finland) and Khaldoun El Agha (ICT Labs - EIT, Paris) and in 2013 Jarmo Eskelinen (Forium Virium Helsinki, ENoLL).

Thirdly the ELLIoT project via Green Services Use case (2011-2013) was rich in a lot of new assets for ICT Usage Lab (cf. Section 7.3.1):

- IoT: Constitution of a pollution IoT database from ICT Usage Lab citizen mobile and fixed sensors with around 4 millions of pollution measures,
- IoT: Interesting ideas (issued from co-creation workshops) of new smart objects (mainly for asthmatic people) and user feedback on the green watch,
- IoT: Acquisition of four types of pollution stations,
- IoT: Three improved IoT user guides of our ICT Usage Lab stations,
- IoT: A first validation of our prototype of a new low cost dust (PM10) station (with Rasburry and Arduino),
- Citizen Sensing: MyGreenServices platform (cf. Section 6.5.1),
- User production: Qualitative database based on User productions,
- User production: Usage database issued from logs of MyGreenServices portal,
- Knowledge: Improved know-how in modeling and measuring user experience of an IoT-based service based on KSB UX model and FocusLab advanced data analysis methods (cf. Section 6.5.3),
- Knowledge: Development of a new version (v1.3) of Focuslab server (cf. Section 6.6),
- Knowledge: Elaboration and test of two new Ideation methods (Aloha!, GenIoT).

We pursued our informal contacts with Noel Conryut from the living lab "UR.LL.TL" for Teaching and Learning (Island of the Reunion) and with the urban community CINOR related to the deployment of LL projects on this territory.

Finally various tutorials related to Focuslab hardware and software (cf. Section 6.6) have been organised and proposed to Inria members and collaborators (I3S and I3M laboratories from University of Nice Sophia Antipolis, CSTB, CHU Nice). B. Senach took contact with C. Tallec from Utilisacteur in order to plan in the future a workshop about Participative Service Design in Sophia Antipolis.

7.1.4. Collaboration Agorantic-Inria

Participants: Guillaume Pilot, Bernard Senach, Brigitte Trousse.

As the craze for culture and exhibition is increasing, museums have to deal with crowds, stronger expectations about information quality and quantity and requirements for planned personalized visits.

A collaboration began this year between ICT and HSS teams from Agorantic and Inria Sophia Antipolis, including AxIS, Maestro and Wimmics, conducting interdisciplinary ICT-HSS research. This initial collaboration resulted in setting up a ANR proposal of a project for analyzing, designing, and evaluating a recommendation system helping visitors (or groups of visitors) to follow through a museum a tailored path within an exhibition, according to their specific profile. In this ANR proposal called SyReMuse ("Système de recommandation pour la visite des musées et des expositions"), AxIS researchers were involved in the modelling of the visitors (or group of visitors)' cultural experience which will support the design and evaluation of the recommender system and in specifying recommendation computation. A preliminary study of the logs from the Web site of Grenoble Museum (France) providing recommendations according to types of user profiles (families, professionals, students, scholars and groups) has been made in order to better evaluate the research problem to be addressed.

A Inria collaborative project (named "Color") proposal for 2014 is under preparation as a first step of our collaboration.

7.1.5. Involvement in Regions

PACA Region

- B. Trousse was invited at the strategical orientation committee of the PACALABS instrument (PACA Region, Marseille, June 12th) about the evaluation of the 4 past years of Pacalabs and to prepare the programme of the next PACALABS
- B. Trousse for ICT Usage lab has increased contacts with University of Nice Sophia Antipolis (mainly the laboratories I3M via Céline Lacroix and Paul Rasse et I3S via Françoise Baude) disseminating the living lab approach and involving them as ICTUL partners for two KIC ICT Labs 2013 Call submissions (TravelDashboard2, CityCrowdSource2).
- Green Services use case from the European Elliot project was deployed in Nice Côte d'Azur with several experiments
- Participation in the organisation of invited talks of the Innovative City Convention (Nice, 2012).

Midi Pyrénées Region

- AxIS (C. Detraux and D. L. Scapin) are involved in ANR-PIMI project (cf. Sections 7.2.1 and 6.4.1) where the Midi-Pyrénées region and IUT Tarbes are pilot-partners.

7.2. National Initiatives

7.2.1. ANR PIMI (2010 - 2013)

Participants: Claudia Detraux, Dominique Scapin [correspondent].

Title: PIMI

Type: ANR

Defi: Personal Information Space

Instrument: Verso 2010

Duration: 2010 - 2013

Coordinator: Genigraph

Others partners: LRI, IRIT, Institut Telecom, Montimage, The Grand Duchy of Luxembourg

Abstract: PIMI Project aims at the definition of a design environment and a deployment platform for Personal Information Management system (PIM). The future PIM must provide the end-user personal data access with services that are relevant to his needs. In order to take mobility into account, the PIM will be accessed both by mobile devices (smartphone) and personal computers.

The main contributions this year are described in Section 6.4.1.

7.2.2. *FIU FIORA (2012-2015)*

Participants: Yves Lechevallier [correspondent], Thierry Despeyroux.

Program: FIU (14th call)

Project acronym: FIORA

Project title: Moteur d'inférences pour la personnalisation

Duration: 2012-2015

Coordinator: Michel Manago (SME KIOLIS)

Other partners: Editions SOLAR, Mondeca, Inria (AxIS), ISEP, UNiversity of Paris XIII

Abstract: This project aims the design and the development of FIORA an engine offering personalised content. Personalisation will be based on context parameters related to the user and available semantic information. The main result will be to develop an engine merging case-based reasoning technics, recommandation technics based on collaborative filtering and data mining. The proof concept will be experimented in two domains: a) Nutrition and b) tourism and Health (use of the cohort Nutrinet with more than 200 users) and b) e-tourism.

This project starts at the end of 2012. See our work in Section 6.2.9.

7.2.3. *LIMOS, University of Clermont-Ferrand*

A collaboration has been initiated during 2013 with the LIMOS laboratory managed by Enjelbert Mephu Nguifo and Olivier Raynaud in the context of the supervision committee of Dia Diyé 's PhD thesis on the topics security/trust, usage mining and recommender systems. B. Trousse participated in two PhD Thesis meetings: September 27 (working meeting) and October 9th (annual PhD thesis supervision committee meeting).

7.2.4. *Lorraine Smart Cities Living Lab and ERPI - University of Lorraine Living*

B. Trousse as President of France Living Labs and Inria representative of ICT Usage lab had various collaborations this year with the ERPI laboratory of the University of Lorraine:

- Common Work with Laurent Dupont on a template describing a living Lab;
- Workshop on Co-creation with Users at Innovative City Convention (Nice, June): Claudine Guidat and Laure Morel both Professors at ERPI lab gave a talk on the Lorraine Smart Cities Living Lab;
- Study of an interdisciplinary approach of the Accelerated Citizen Co-Creation in the context of Living Labs : from usage scenarios to 3D representations (including PhD thesis subjects).

7.2.5. *Living Lab of Cité du Design - St Etienne*

B. Trousse as President of France Living Labs had various collaborations this year with "Cité du Design"

- Participation as supporting partner of the European project called IDeALL managed by Isabelle Verihlac from "the Cité du Design". Preparation of a **presentation** related to the French supporting partners as Living labs at the last meeting of the project (January 2014, Barcelona);
- F2L Support of an ANR proposal related to silver economy called DECMA: this proposal is on "the design in the context of the day life of Alzheimer patients and help people" (leader Cité du design St Etienne) - "Sociétés innovantes, intégrant et adaptatives. Axe : Innovations".

7.2.6. *France Living Labs*

URL: <http://www.france-livinglabs.fr/>

In 2013 our activities were multiple.

First ENoLL and France Living Labs signed a formal cooperation agreement (MoU - Memorandum of Understanding) on February 24th in order to have closer communication and cooperation in their activities and initiatives through meetings, exchanging of information, knowledge, experiences and best practice. See the video on <http://www.youtube.com/watch?v=EJNXQ2VUtFU>.

Secondly three working groups started:

- Design & Living labs with more than 13 living labs (cf. our presentation at the last IDeALL project [Slides](#))
- Living Labs for Silver Economy and
- Cartography and evaluation of living lab projects inside F2L members on two aspects (co-creation methods and territory role).

Thirdly France Living Labs supported two proposal submissions of the 2013 ANR Call: one with University of Lorraine and "Cité du Design" and another proposal with "Cité du design".

Finally some F2L members were involved various working groups in order to make proposals for the contract "Economy Silver". This contract was signed on December 12th and France Living Labs is mentioned at the page 86 as a key actor for the action 6.2 (Support to the development of living labs in Silver Economy both at the national and international levels). See the contract [here](#)

7.3. European Initiatives

7.3.1. FP7 ICT ELLIOT project (2010-2013)

Participants: Xavier Augros, Florian Bonacina, Mylène Leitzelman, Anne-Laure Negri, Guillaume Pilot, Bernard Senach, Caroline Tiffon, Brigitte Trousse [correspondent].

Type: COOPERATION

Challenge: Internet of Things (IoT) and enterprise environments

Instrument: Specific Targeted Research Project

Objective: Internet of Things and Enterprise environments

Duration: September 2010 - June 2013

Coordinator: TXT Polymemia (Italy)

Partners: University of Nottingham (UK), University of Readings (UK), BIBA (Germany), Hospital San Rafael (Italy), CENG (Italy), Fing (France), Vulog SME(France)

Inria contact: Brigitte Trousse

See also: <http://www.elliott-project.eu/>

Abstract: The ELLIOT project (Experiential Living Labs for the Internet of Things) aims at developing an IoT experiential platform where users/citizen are directly involved in co-creating, exploring and experimenting new ideas, concepts and technological artifacts related to IOT applications and services. Based on a three levels experiential model issued from previous European projects, the study will capitalize on existing practices of co-creation in IoT contexts. It will allow the exploration of the potential impact of IOT and of the Future Internet in the context of the Open User Centered Innovation paradigm followed in the Living Lab approach.

This year we conducted various tasks related to the Green Services Use case:

- Implementation of MyGreenServices application which collects IoT data from electric cars and citizens sensors. stored usage data for sending to the ELLIOT platform (cf. Section [6.5.1](#))
- Specification of the methodology for user experience measurement for Green Services Use case (cf. Section [6.5.3](#)).
- Two experiments of MyGreenServices (February and June).
- Dissemination at Innovative City Convention with Special ELLIOT Citizen Awards.

Inria hosted two ELLIOT meetings on user experience measurement (KSB model and use cases) as well as general meetings. We contributed in the various deliverables including the two public ones [[38](#)] and [[37](#)]. See also our results in Section [6.5](#).

Finally the Elliot project (2011-2013) was very rich in terms of new assets for Inria and for ICT Usage Lab (cf. 7.1.3).

MyGreenServices was evaluated as Good Practice by the international Design for All foundation (for the 2014 awards).

7.3.2. *COST TwinTide (2010-2013)*

Participant: Dominique Scapin [correspondent].

Program: COST IC0904

Project acronym: TwinTide

Project title: Towards the Integration of Transectorial IT Design and Evaluation

Duration: 2010 - 2013

Coordinator: Effie Lai-Chong Law - Swiss Federal Institute of Technology (ETH Zürich), Switzerland (CH) / University of Leicester, UK

Other partners: see <http://www.irit.fr/recherches/ICS/projects/twintide>

Abstract: Towards the Integration of Transectorial IT Design and Evaluation is a usability and user experience research community running under the auspices of COST (<http://www.cost.esf.org/>). The main objective is to harmonize research and practice on design and evaluation methodologies for computing artefacts, across sectors and disciplines, bringing together researchers and D&E professionals.

7.3.3. *EIT KIC ICT Labs (2013) : Experience & Living Labs Research Catalyst*

Participants: Brigitte Trousse [correspondent], Caroline Tiffon, Florian Bonacina.

Program: EIT ICT Labs

Project acronym: Activity E&LL Catalyst Coordination activity from Research Catalysts, included for 2014 in Technology Experimentation Catalyst.

Project title: E&LL Catalyst Coordination Activity

Duration: 2013

Coordinator: F. Pianiesi (Trento Rise, Italy)

Other partners: Inria, (Hungary), TUBerlin, U. Bologna, Telecom Italia, Siemens/VMZ (Germany), DFKI (Germany)

Abstract: The Catalyst Coordination Activity will boost the usage of the E&LLs Catalyst by means of a set of service provision programs. Tasks and Activities from the Action Lines represent the customers of the Catalyst Coordination Activity. The catalyst involves a Team of Experts and leverage assets from available "Open E&LLs", as a set of accessible facilities. "Open E&LLs" function as a one-stop-shop for user-centered research services, as well as hosts of experimentation activities by customers.

This year, we were involved in various works:

- Support to Loria (mainly Madynes research-project team - Thomas Siverston and Abdelkader Lahmadi) related to the CityCrowdSource activity and within the context of the *crowdout* application (with targeted users such city administrators and citizen). Our support relied mainly on the improvement of the ergonomics aspects of the application and pre-tests with users of the first prototype. Redaction of deliverable (17 pages);
- Dissemination of E&LL research catalyst to the Management Committee of the French EIT node and to the Smart Cities action line;
- Support to EIT partners during EIT 2013 Call event (April, Paris), mainly those interested by the two action lines , Smart Cities and Cloud Computing, which are lead by the french EIT KIC labs node;
- Contribution to the elaboration of a Service Provisioning template for Open Living Labs.
- Collectinf data from EIT E&LL facilities from the French EIT node in order to make them visible on an internal EIT Web site (developed by ELL catalyst - Trento);

7.3.4. EIT KIC ICT Labs (2013) : CityCrowdSource Activity - Urban Life and Mobility

Participants: Brigitte Trousse [correspondent], Guillaume Pilot.

Program: EIT ICTLabs

Project acronym: Activity 13 052 from Intelligent Mobility and Transportation Systems action line - Allocation 7396 (IMS), renamed Future Urban Life and Mobility (ULM) mid 2013

Project title: Multimodal Mobility

Duration: 2013, from June to December

Coordinator: F. Baude (OASIS Inria-UNS) and B. Kwella (Fraunhofer Gesellschaft)

Other partners: Inria, BME (Hungary), TUBerlin, U. Bologna, Telecom Italia, Siemens/VMZ (Germany), DFKI (Germany)

Abstract: The activity seeks to specify the building blocks, a platform and a prototype for the provision of multimodal mobility. The main motivation is to facilitate the use of ICT to support the efficient organization of Accessible Mobility (support for people with special needs, economical optimization of mobility and transportation, trip planning, information on available transport modes, etc). It therefore provides the basis for sustainable future mobility.

Axis was involved in the implementation of a Play-based demonstrator and implements, in collaboration with OASIS Inria research-project an interface between MyGreenServices platform and the PLAY platform for elaborating a use case based on our environmental sensors.

7.3.5. EIT KIC ICT Labs (2013) : Q&A - Doctoral School

Participants: Brigitte Trousse [correspondent], Caroline Tiffon.

Program: EIT ICT Labs

Project acronym: DSL

Project title: Activit  DSL 13108-Support Evaluation

Duration: 2013, from March to December

Coordinator: C. Queinnec (UMPC, Paris, France)

Other partners: Inria, University of Turku, etc.

Abstract: EIT Doctortal School

Inria (ICT Usage lab) for its expertise in usage analysis was requested by the DSL leader to support the University of Turku to managae the Q/A tasks for the doctoral school. We made some recommendation for improving questionnaires and anticipating future analysis in terms of data coding. We analysed (with Sphinx IQ) students questionnaires from EIT Doctoral school, and reported results in an internal EIT KIC Labs document. A preliminary study on how to measure the main I&E outcomes of I&E courses based on Bloom'experiential learning [56] has been started.

7.4. International Initiatives

7.4.1. Participation in other International Programs

7.4.1.1. FACEPE CM2ID, Brazil 2003-2013

Participants: Yves Lechevallier, Marc Csernel.

During 2013 we continued a collaboration on social network data analysis with F.A.T. De Carvalho from Federal University of Pernambuco (Recife) and Orpailleur (Inria Nancy Grand Es -LORIA).

A scientific project **Combining Numerical and Symbolical Methods for the Classification of Multi-valued and Interval Data (CM2ID)** submitted by Francisco de Carvalho and A. Napoli has been accepted for 2013 by FACEPE and Inria. The project started on January and will end on 12/2013. Researchers and students are concerned by this project from Orpailleur, Axis and CIn-UFPE side. It aims at developing Numerical and Symbolical methods of clustering on Multi-valued and Interval Data.

This project aims at developing and comparing clustering algorithms for interval and multi-valued data. Two families of algorithms are studied, namely clustering algorithms based on the use of a similarity or a distance for comparing the objects, and classification algorithms in Formal Concept Analysis (FCA) based on attribute sharing between objects. The objectives here are to combine the facilities of both families of algorithms for improving the potential of each family in dealing with more complex and voluminous datasets, in order to push the complexity barrier farther in the mining of complex data. Biological data, namely gene expression data, are used for test and evaluation of the combination of algorithms. The project involves three teams, one Brazilian team and two French Inria teams (AxIS and Orpailleur), including specialists of clustering and classification methods. Thus the complementarity of the teams is ensured and, in addition, close contacts exist with experts of the domain of data for carrying on a complete evaluation of the results obtained by the combined algorithms expected to be designed during the project.

7.4.2. Informal International Partners

B. Trousse maintained collaborations with Morocco (cf. Section 6.2.10):

- ENSAM - Meknès (E.L. Moukthar Zemmouri [75]),
- National High School of Electrical and Mechanical engineering (ENSEM)Casablanca (H. Behja).

7.4.3. Participation to Standards in Ergonomics

Participant: Dominique Scapin [correspondent].

Standardization in ergonomics is increasingly important due to the application of the European directives about the introduction of measures to encourage improvements in the safety and health of workers (e.g., 2006/42CE on security of machinery); as well as taking into consideration national and international legislation, including accessibility. Standardization in ergonomics covers many issues. The contributions from AxIS (D. L. Scapin) at Inria concern mainly software ergonomics, in the context of AFNOR X35A, X35E, as well as ISO mirror groups:

- National: AFNOR X35A ("Ergonomie") (expert); AFNOR X35E ("Ergonomie des Logiciels Interactifs"), AFNOR groupe de travail "Normes de processus ergonomiques" (chair) [71].
- International: ISO/TC 159/SC4/WG5 (Software ergonomics and human-computer dialogues) (expert); ISO/TC 159/SC4/WG6 (Human-centred design processes for interactive systems) (expert); ISO/TC 159/SC4/WG9 (Tactile and Haptic Interactions) (expert); ISO/TC 159/SC4/WG28 (System and software product Quality Requirements and Evaluation - Common industry Format) (expert); ISO/TC 159/SC1/WG1 (Ergonomic principles) (expert).

7.5. International Research Visitors

7.5.1. Visits of International Scientists

AxIS Rocquencourt welcomed various international scientists from Brazil:

- Francisco de Carvalho (UFPE, Brazil) [20],
- Sergio Queiroz (UFPE, Brazil) [19],

8. Dissemination

8.1. Scientific Animation

8.1.1. Organization of Workshops and Conferences

Participation to Innovative City Convention Organisation (June 18th): this event ICC 2013 has attracted more than 2500 people from enterprises and territories.

- B. Trousse organised one workshop Inria-France Living Labs at Innovative City Convention on "Co-create with Users digital services of the territories of tomorrow" with around 100 attendants. At Innovative city convention 2013 (2500 attendants, June 18th, Nice), Inria and Fing has awarded several participants for their user involvement (idea production, viral marketing, questionnaires, sensor management). Two special winners being involved in many experiments received as awards one tablet offered by FING. The awarded citizen have expressed during this workshop their satisfaction related to MyGreenServices in producing IoT data, in being informed about the pollution where they live or when they move or in exchanging with others.

See the article on Atelier.net (the disruptive innovation BNP Paribas journal) ([here](#))

- Co-redaction of a flyer (English version) related to the PACALABS ECOFFICES project for the ICC conference in Nice distributed by "Chambre de Commerce et industrie" (Enterprise/Environment/Energy Department) ISGAN - CCI.

8.1.2. Editorial Boards and Reviewing

Axis members participate in the **editorial boards** of various journals:

Yves Lechevallier

- MODULAD (electronic journal) as co-editor
- BIT (Behaviour & Information Technology)
- ADAC (Advances in Data Analysis and Classification)

Dominique Scapin

- BIT (Behaviour & Information Technology) (Associate Editor)
- UAIS -International Journal of Universal Access in the Information Society)
- IJHCS - International Journal of Human-Computer Studies
- IWC - Interacting with Computers
- IJPOP - International Journal of People-Oriented Programming
- International Journal On Advances in Intelligent Systems
- JMUI - Journal of Mutimodal User Interfaces
- JIPS - "Journal d'Interaction Personne-Système"

Brigitte Trousse

- Journal of Symbolic Data Analysis
- IJDST - International Journal of Design Sciences & Technology (Europa Productions)
- Co-Design, International Journal of CoCreation in Design and the Arts Journal (Taylor Francis online)

Axis members are very regularly **reviewers** for various major journals: ADAC "Advances in Data Analysis and Classification", BIT (Behavior and Information Technology), ADAC "Advances in Data Analysis and Classification", IJHCS (International Journal of Human-Computer Studies), JMUI (Journal of Multimodal User Interfaces), "Le Travail Humain", UAIS, IwC in 2012. Thierry Despeyroux was reviewer for a book: Advances in Knowledge Discovery and Management Vol. 4 to be published. B. Senach reviewed a paper for the BIT journal

8.1.3. Conferences - Workshops Scientific Program Committees

Y. Lechevallier and B. Trousse are members of the **supervising committee** of the association EGC (<http://www.egc.asso.fr/>).

Axis permanent members are involved in the following program committees of conferences and workshops:

Thierry Despeyroux

- EGC 2013, January 29th - February 1st 2013, Toulouse, France.
- EGC 2014, 27-31 January 2014, Rennes, France.

Yves Lechevallier

- EGC 2013, January 29th - February 1st 2013, Toulouse, France.
- EGC 2014, 27-31 January 2014, Rennes, France.

Dominique Scapin

- EGC 2013, January 29th - February 1st 2013, Toulouse, France.
- HCII 2013, 21-26 July 2013, Las Vegas, Nevada, USA.
- SETIT 2014, 6th International Conference Sciences of Electronics, Technologies of Information and Telecommunications, 11-13 October 2013, Chongqing, China.
- INTERACT 2013, 2-6 September 2013, Cape Town, South Africa.
- CENTRIC 2013. October 27th - November 1st, 2013, Venice, Italy.
- IHM 2013, 12-15 November 2013, Bordeaux, France.
- ICMI, 5th ACM International Conference on Multimodal Interaction, December 9-13th, 2013, Sydney, Australia.
- PhyCS, 1st. International Conference on Physiological Computing Systems, January 7-9, 2014, Lisbon, Portugal.
- EGC 2014, 27-31 January 2014, Rennes, France.
- ACHI 2014, 23-27 March 2014 - Barcelona, Spain.
- SETIT 2014, 7th International Conference Sciences of Electronics, Technologies of Information and Telecommunications, March 24-28 2014, Kuala Lumpur, Malaysia.
- CHI 2014, April 26 - May 1, Toronto, Canada.
- HCII 2014, 22-27 June 2014, Heraklion, Crete, Greece.
- ErgoIA 2014, 15-17 October 2014, Bidart, France.

Brigitte Trousse

- EGC 2013, January 29th - February 1st 2013, Toulouse, France.
- CSCWD 2013, the 2013 17th IEEE International Conference on Computer Supported Cooperative Work in Design, June 27-29, Whistler, BC, Canada (sponsored by IEEE SMC Society).
- RAPC 2013?, 21th French Workshop on Case-based Reasoning.
- H2PTM 2013, 16-18 October, International Conference "Hypertextes et Hypermedia, Produits, Outils et méthodes, Usages et pratiques numériques", 2013 CNAM - Paris.
- IJCAI 2013, 3-9 August, 23rd International joint Conference on Artificial Intelligence, Beijing, China (reviewer).
- EGC 2014, 27-31 January 2014, Rennes, France.
- CSCWD 2014, 21-24 May 2014, the 2014 IEEE 18th International Conference on Computer Supported Cooperative Work, National Tsing Hua University, Taiwan in Design.
- DCC 2014, 23-25 June 2014, Sixth International Conference on design Computing and Cognition, University College London, London, UK.
- ICC 2014, 25-26 June 2014, Innovative City Convention, Nice, France.
- ICE 2014, 23-25 June 2014, 20th International Conference ICE on Engineering, Technology and Innovation, IEEE TMC Europe Conference, Bergamo, Italy.

8.1.4. Invited talks or participations

Yves Lechevallier

- Conference ECDA 2013: Y. Lechevallier gave an **invited talk** "Partitioning Methods On Dissimilarity Matrices Set" related to this publication [20] at the First European Conference on Data Analysis (ECDA 2013) (with around 300 participants) jointly hosted by the two Classification Societies (GkKI in Germany and SFC in France) in July at Luxembourg.

B. Trousse

- BIOVISION 2013, The World Life Sciences Forum (Lyon, March): B. Trousse as President of France Living Labs was invited to be panelist in the prospective session "eHealth: a coming medical revolution?".
- Conference of Ladies in mobility at Ever Monaco (Monaco, March 29): B. Trousse made an invited talk on "Innovative Services in Mobility (User Experience, Living Lab Approach)".
- 2030 Prospective ADEME workshop (2 days) organised by ADEME and Chronos firm, Sophia Antipolis.

8.1.5. Other actions

Local Dissemination to Citizen within ELLIOT project which has required a huge effort, both in terms of citizen workshop reporting, recruitment for our two 16 days experiments related to MyGreenServices in 2013 (February and June), community management within the forum, maintenance of a Scoop-it page on green services and finally MyGreenServices reporting for large audience. We realized for citizen recruitment a flyer on ELLIOT project and a call for participation for the workshops we published on various web sites: ICT Usage Lab, GreenCode, WebTimeMedias and Local networks such as the local JCI chapter. In addition to the recruitment we have prepared various packages for citizen related to the use of each citizen IoT stations. Finally for ELLIOT experiments we have recruited 48 participants from the idea generation until the experimentation.

Participation to other events:

B. Trousse participated in several events or meetings disseminating AxIS results:

- Workshop "Design & Living Labs: L'apport du design et des SHS dans les démarches d'innovation centrée usagers ?", January 16th, Marseille (France)
- R2DS Conference: "Dispositifs d'activation de l'innovation pour la ville durable: Espace coworking, fablab, living lab et Smart Cities", organised by Fondaterr and the Regional Council of "Ile de France", at Hémicycle - Regional Council Ile de France (Paris 7e),
- International Biennale of Design, Forum Design et Innovation, March, St Etienne (France).
- General Assembly of France Living Labs, March, St Etienne (France),
- Meeting of the Strategical Orientation Committee of Pacalabs (evaluation of the past Pacalabs four years, done by EDATER and PacaLabs Operational Committee) June, Marseille (France)
- Innovative City Convention (ICC 2013), June, Nice (France),
- European Summer School on Living Labs, August, Manchester (UK),
- Final ELLIOT Review at EU, August, Brussels (Belgium),
- LIFT 2013 "Produire autrement!", 15 October, Marseille (France),
- Innovation & Territories - City of Antibes organised by Telecom valley (Innovation Committee), November 14th, Campus SophiaTech.

B. Senach participated in several scientific events:

- International Biennale of Design, Forum Design et Innovation, Saint-Etienne, March, St Etienne (France). Participation in the Workshop : "Passage de l'économie de la propriété à l'économie de l'usage".
- Conférence "L'intégration de la mobilité durable dans les villes intelligentes", Monaco, March, 29.
- Innovative City Convention (ICC 2013), June, Nice (France).

8.2. Teaching - Supervision - Juries

8.2.1. Teaching

8.2.1.1. Teaching Activities

Y. Lechevallier

- Master 2 Recherche *Systèmes intelligents* (resp: S. Pinson), University at Paris IX-Dauphine, France. Yves Lechevallier taught a course on "Du data mining au knowledge mining" (24h).
- ENSG: Yves Lechevallier taught a course on Clustering (12h).

8.2.2. Supervision

B. Trousse is involved in the supervision committee of two PhD in progress:

- **E. L. Moukhtar Zemmouri**, Ontology-based model for Multi-View KDD process, PhD student at ENSAM, Mathematics-Computer Science Departmenté Moulay Ismaël - Ecole Nationale Supérieur d'Arts et Métiers - Meknès (Morocco), supervision committee: H. Behja, A. Marzark, B. Trousse, B. Ouhbi and Y. Benghabrit
- **Dié Diya**, LIMOS, Université de Clermont Ferrand, supervisors Yannick Loiseau, Olivier Raynaud

8.2.3. Juries

AxIS researchers were members of the following Ph.D. committees in 2013:

Yves Lechevallier

- **Djamal Adboul Nasser Seck**, Ph.D, Arbres de décision symboliques, outils de validation et d'aide à l'interprétation, January, Dauphine University
- **Wafia Parr Bouberrima**, Ph.D, Modèles de mélange de Von Mises-Fisher, October, University Paris 5 and Sétif University

Brigitte Trousse

- **Malek Alaoui**, Ph.D., Application d'une démarche Living Lab au développement de services de TV sociale dédiée aux personnes âgées, December, Technology University of Troyes (UTT)
- **E.L. Moukhtar Zemmouri**, Ph.D., "Représentation et gestion des connaissances dans un processus d'Extraction de Connaissances à partir de Données multi-points de vue", December, Université Moulay Ismaël - Ecole Nationale Supérieur d'Arts et Métiers - Meknès (Morocco) [75].

9. Bibliography

Major publications by the team in recent years

- [1] C. BACH, D. L. SCAPIN. *Comparing Inspections and User Testing for the Evaluation of Virtual Environments*, in "International Journal of Human-Computer Interaction", July 2010, vol. 26, n° 8, pp. 786-824 [DOI : 10.1080/10447318.2010.487195], <http://hal.inria.fr/hal-00950036>
- [2] S. CAFFIAU, D. SCAPIN, P. GIRARD, M. BARON, F. JAMBON. *Increasing the expressive power of task analysis: Systematic comparison and empirical assessment of tool-supported task models*, in "Interacting with Computers", November 2010, vol. 22, n° 6, pp. 569-593 [DOI : 10.1016/J.INTCOM.2010.06.003], <http://hal.inria.fr/hal-00950015>
- [3] S. CHELCEA, P. BERTRAND, B. TROUSSE. *Un Nouvel Algorithme de Classification Ascendante 2-3 Hiérarchique*, in "Actes de 14ème Congrès Francophone AFRIF-AFIA de Reconnaissance des Formes et Intelligence Artificielle (RFIA 2004)", Centre de Congrès Pierre BAUDIS, Toulouse, France, 28-30 Janvier 2004, vol. 3, pp. 1471-1480

- [4] A. DA SILVA, Y. LECHEVALLIER, R. SERAOUI. *A Clustering Approach to Monitor System Working*, in "Learning and Data Science", M. GETTLER SUMMA, L. BOTTOU, B. GOLDFARB, F. MURTAGH, C. PARDOUX, M. TOUATI (editors), CRC Computer Science & Data Analysis, Chapman & Hall, 2011, vol. K13059, chap. 10
- [5] G. HÉBRIL, B. HUGUENEY, Y. LECHEVALLIER, F. ROSSI. *Exploratory Analysis of Functional Data via Clustering and Optimal Segmentation*, in "Neurocomputing / EEG Neurocomputing", Mar 2010, vol. 73, n^o 7-9, pp. 1125-1141, <http://hal.inria.fr/hal-00515908/en>
- [6] A. MARASCU, F. MASSEGLIA. *Atypicality Detection in Data Streams: a Self-Adjusting Approach*, in "Intelligent Data Analysis", January 2011, vol. 15, n^o 1, pp. 89-105 [DOI : 10.3233/IDA-2010-0457], <http://hal.inria.fr/hal-00789034>
- [7] F. MASSEGLIA, P. PONCELET, M. TEISSEIRE, A. MARASCU. *Web Usage Mining: Extracting Unexpected Periods from Web Logs*, in "Data Mining and Knowledge Discovery", February 2008, vol. 16, n^o 1, pp. 039-065 [DOI : 10.1007/s10618-007-0080-z], <http://hal.lirmm.ccsd.cnrs.fr/lirmm-00204872>
- [8] F. MASSEGLIA, D. TANASA, B. TROUSSE. *Web Usage Mining: Sequential Pattern Extraction with a Very Low Support*, in "Advanced Web Technologies and Applications: 6th Asia-Pacific Web Conference, APWeb 2004", Hangzhou, Chine, LNCS 3007, Springer Verlag, April 2004, pp. 513–522, <http://hal.inria.fr/hal-00950768>
- [9] M. PALLOT, B. TROUSSE, B. SENACH, D. L. SCAPIN. *Living Lab Research Landscape: From User Centred Design and User Experience towards User Cocreation*, in "First European Summer School "Living Labs"", Paris, France, Inria (ICT Usage Lab), Userlab, EsoceNet, Universcience, August 2010, <http://hal.inria.fr/inria-00612632>
- [10] F. ROSSI, B. CONAN-GUEZ. *Functional Multi-Layer Perceptron: a Nonlinear Tool for Functional Data Analysis*, in "Neural Networks", 2005, vol. 18, n^o 1, pp. 45–60 [DOI : 10.1016/J.NEUNET.2004.07.001], <http://hal.inria.fr/inria-00000599>
- [11] D. L. SCAPIN, B. SENACH, B. TROUSSE, M. PALLOT. *User Experience: Buzzword or New Paradigm?*, in "ACHI 2012, The Fifth International Conference on Advances in Computer-Human Interactions", Valencia, Espagne, 2012, <http://hal.inria.fr/hal-00769619>
- [12] H. SCHAFFERS, N. KOMNINOS, M. PALLOT, M. AGUAS, E. ALMIRALL, T. BAKICI, J. BARROCA, D. CARTER, M. CORRIOU, J. FERNANDEZ, H. HIELKEMA, A. KIVILEHTO, M. NILSSON, A. OLIVEIRA, E. POSIO, A. SÄLLSTRÖM, R. SANTORO, B. SENACH, I. TORRES, P. TSARCHOPOULOS, B. TROUSSE, P. TURKAMA, J. LOPEZ VENTURA. , *FIREBALL white paper on Smart Cities as Innovation Ecosystems sustained by the Future Internet*, 2012, <http://hal.inria.fr/hal-00769635>
- [13] H. SCHAFFERS, N. KOMNINOS, M. PALLOT, B. TROUSSE, M. NILSSON, A. OLIVEIRA. *Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation*, in "Future Internet Assembly", J. DOMINGUE, ET AL. (editors), LNCS 6656, Springer Verlag, May 2011, pp. 431-446 [DOI : 10.1007/978-3-642-20898-0_31], <http://hal.inria.fr/hal-00950770>
- [14] E. SMIRNOVA, K. BALOG. *A user-oriented model for expert finding*, in "Proceedings of the 33rd European conference on Advances in information retrieval", Berlin, Heidelberg, ECIR, Springer-Verlag, 2011, pp. 580–592, Best Research Paper

- [15] D. TANASA, B. TROUSEE. *Advanced Preprocessing for intersites Web Usage Mining*, in "IEEE Intelligent Systems", March 2004, vol. 19, n^o 2, pp. 59-65 [DOI : 10.1109/MIS.2004.1274912], <http://hal.inria.fr/hal-00950763>
- [16] FRANCISCO. DE CARVALHO, Y. LECHEVALLIER, FILIPE M. DE MELO. *Partitioning hard clustering algorithms based on multiple dissimilarity matrices*, in "Pattern Recognition", 2012, vol. 45, n^o 1, pp. 447-464, article-based publishing, article available in 2011
- [17] FRANCISCO. DE CARVALHO, Y. LECHEVALLIER. *Partitional clustering algorithms for symbolic interval data based on single adaptive distances*, in "Pattern Recognition", 2009, vol. 42, n^o 7, pp. 1223-1236

Publications of the year

Articles in International Peer-Reviewed Journals

- [18] Y. LECHEVALLIER, FRANCISCO. DE CARVALHO, F. DE MELO. *Relational partitioning fuzzy clustering algorithms based on multiple dissimilarity matrices*, in "Fuzzy Sets and Systems", April 2013, vol. 215, pp. 1-28, <http://hal.inria.fr/hal-00917494>
- [19] S. QUEIROZ, FRANCISCO. DE CARVALHO, Y. LECHEVALLIER. *Nonlinear multicriteria clustering based on multiple dissimilarity matrices*, in "Pattern Recognition", December 2013, vol. 46, n^o 12, pp. 3383-3394, <http://hal.inria.fr/hal-00917496>

Invited Conferences

- [20] FRANCISCO. DE CARVALHO, Y. LECHEVALLIER. *Partitioning Methods On Dissimilarity Matrices Set*, in "European Conference on Data Analysis", Luxembourg, GfKI and SFC, July 2013, <http://hal.inria.fr/hal-00916906>

International Conferences with Proceedings

- [21] M. BESSAFI, FRANCISCO. DE CARVALHO, P. CHARTON, M. DELSAUT, P. JEANTY, T. DESPEYROUX, J. D. LAN-SUN-LUK, Y. LECHEVALLIER, H. RALAMBONDRAINY, L. TROVALET. *Clustering of Solar Irradiance*, in "European Conference on Data Analysis", Luxembourg, Studies in Classification, Data Analysis, and Knowledge Organization, Springer, July 2013, <http://hal.inria.fr/hal-00944874>
- [22] C. DETRAUX, D. L. SCAPIN. *Utilisabilité d'un Espace Personnel d'Information Modifiable par les Utilisateurs*, in "25ème conférence francophone sur l'Interaction Homme-Machine, IHM'13", Bordeaux, France, ACM, September 2013 [DOI : 10.1145/2534903.2534916], <http://hal.inria.fr/hal-00877290>
- [23] C. DETRAUX, D. SCAPIN. *Personal information systems usability and contents tailoring by users*, in "EEE13 - The 2013 International Conference on e-Learning, e-Business, Enterprise Information Systems, and e-Government", Las Vegas, United States, July 2013, pp. 155-161, <http://hal.inria.fr/hal-00861197>
- [24] R. GUAN, Y. LECHEVALLIER, H. WANG. *Adaptive Dynamic Clustering Algorithm for Interval-valued Data based on Squared-Wasserstein Distance*, in "Extraction et Gestion des Connaissances", Toulouse, France, C. VRAIN, A. PÉNINOU, F. SEDES (editors), Hermann, 2013, vol. RNTI-E-25, pp. 15-30, <http://hal.inria.fr/hal-00917515>

- [25] D. LEPROVOST, T. DESPEYROUX, Y. LECHEVALLIER. *Compréhension de recettes de cuisine utilisateurs par extraction de connaissances intrinsèques*, in "EGC'2014 - 14ème conférence Extraction et Gestion des Connaissances", Rennes, France, RNTI, January 2014, vol. E-26, <http://hal.inria.fr/hal-00945507>
- [26] C. ZHANG, M. MAZURAN, H. MOUSAVI, Y. HAO, C. ZANIOLO, F. MASSEGLIA. *Mining Frequent Itemsets over Tuple-evolving Data Streams*, in "the 28th Annual ACM Symposium on Applied Computing (SAC '13)", Coimbra,, Portugal, ACM, New York, NY, USA, March 2013, pp. 267–274 [DOI : 10.1145/2480362.2480419], <http://hal.inria.fr/hal-00950631>
- [27] FRANCISCO. DE CARVALHO, F. DE MELO, Y. LECHEVALLIER. *A fuzzy c-medoids algorithm based on multiple dissimilarity matrices*, in "BRACIS-2013 - 2nd Brazilian Conference on Intelligent Systems", Fortaleza, Brazil, SBC, June 2013, pp. 1-6, <http://hal.inria.fr/hal-00917502>

National Conferences with Proceedings

- [28] M. BESSAFI, FRANCISCO. DE CARVALHO, P. CHARTRON, M. DELSAUT, T. DESPEYROUX, P. JEANTY, J.-D. LAN SUN LUK, Y. LECHEVALLIER, H. RALAMBONDRAINY, L. TROVALET. *Classification des journées en fonction des radiations solaires sur l'île de la Réunion*, in "45e journées de la Statistique", Toulouse, France, SfDS, May 2013, <http://hal.inria.fr/hal-00916915>
- [29] D. LEPROVOST, T. DESPEYROUX, Y. LECHEVALLIER. *Langage communautaire, confiance et recettes de cuisine*, in "11ème Atelier sur la Fouille de Données Complexes", Rennes, France, January 2014, <http://hal.inria.fr/hal-00945514>

Scientific Books (or Scientific Book chapters)

- [30] A. BALZANELLA, Y. LECHEVALLIER, R. VERDE. *Clustering Data Streams by On-Line Proximity Updating*, in "Classification and Data Mining", A. GIUSTI, G. RITTER, M. VICHI (editors), Studies in Classification, Data Analysis, and Knowledge Organization, Springer, December 2013, pp. 97-104 [DOI : 10.1007/978-3-642-28894-4_12], <http://hal.inria.fr/hal-00917506>
- [31] M. CSERNEI, FRANCISCO. DE CARVALHO. *Normalizing Constrained Symbolic Data for Clustering*, in "Advances in Theory and Applications of High Dimensional and Symbolic Data Analysis", R. GUAN, Y. LECHEVALLIER, G. SAPORTA, H. WANG (editors), Revue des Nouvelles Technologies de l'Information, Hermann, 2013, vol. RNTI-E-25, pp. 58-77, <http://hal.inria.fr/hal-00838658>
- [32] T. DESPEYROUX, FRANCISCO. DE CARVALHO, Y. LECHEVALLIER, F. DE MELO. *Multi-View Clustering on Relational Data*, in "Advances in Knowledge Discovery and management, vol. 4", F. GUILLET, B. PINAUD, G. VENTURINI, D. A. ZIGHED (editors), Studies in Computational Intelligence, Springer International Publishing, June 2013, vol. 527, pp. 37-51 [DOI : 10.1007/978-3-319-02999-3], <http://hal.inria.fr/hal-00904524>
- [33] R. GUAN, Y. LECHEVALLIER, H. WANG. *Adaptive Dynamic Clustering Algorithm for Interval-valued Data based on Squared-Wasserstein Distance*, in "Advances in Theory and Applications of High Dimensional and Symbolic Data Analysis", R. GUAN, Y. LECHEVALLIER, G. SAPORTA, H. WANG (editors), Revue des Nouvelles Technologies de l'Information, Hermann, December 2013, vol. RNTI E.25, <http://hal.inria.fr/hal-00917515>
- [34] A. LOUATI, M.-A. AUFAURE, Y. LECHEVALLIER. *Graph Aggregation: Application to Social Networks*, in "Advances in Theory and Applications of High Dimensional and Symbolic Data Analysis", R. GUAN, Y.

LECHEVALLIER, G. SAPORTA, H. WANG (editors), *Revue des Nouvelles Technologies de l'Information*, Hermann, 2013, vol. RNTI-E-25, pp. 157-177, <http://hal.inria.fr/hal-00838649>

- [35] R. SOUSSI, E. CUVELIER, M.-A. AUFAURE, A. LOUATI, Y. LECHEVALLIER. *DB2SNA : an All-in-one Tool for Extraction and Aggregation of underlying Social Networks from Relational Databases*, in "The influence of technology on social network analysis and Mining", Springer, 2013, pp. 521-546, <http://hal.inria.fr/hal-00830599>

Books or Proceedings Editing

- [36] Y. LECHEVALLIER, G. SAPORTA, H. WANG, R. GUAN. , R. GUAN, Y. LECHEVALLIER, G. SAPORTA, H. WANG (editors), *Advances in Theory and Applications of High Dimensional and Symbolic Data Analysis*, *Revue des Nouvelles Technologies de l'Information*, Hermann, December 2013, vol. RNTI E.25, 197 p. , <http://hal.inria.fr/hal-00917511>

Research Reports

- [37] M. CONTE, G. MONTELEONE, M. MEGLIOLA, B. TROUSSE, C. TIFFON, D. COLOMBO VERGA, S. VICINI, M. KALVERKAMP, M. PALLOT, A. VILMOS, K. FURDIK, R. NIKOLOV. , *ELLIOT Project Presentation #4*, Apr 2013, 44 p. , Deliverable D6.3.4 (M32), <http://hal.inria.fr/hal-00943988>
- [38] M. TIEMANN, A. BADI, M. KALVERKAMP, S. VINCI, B. TROUSSE, C. TIFFON, X. AUGROS, G. PILOT, F. BONACINA, Y. LECHEVALLIER, A.-L. NEGRI. , *Report on IOT Living Labs Continuous Exploration and Evaluation (final)*, 2013, n^o Livrable D4.3.1, Elliot Deliverable D4.3.3, <http://hal.inria.fr/hal-00940078>

References in notes

- [39] H.-H. BOCK, E. DIDAY (editors). , *Analysis of Symbolic Data. Exploratory methods for extracting statistical information from complex data*, Springer Verlag, 2000
- [40] H. BEHJA. , *Plateforme objet d'évaluation orientée point de vue d'un système d'information*, University of Casablanca, Morocco, 2009
- [41] M. CHAVENT, Y. LECHEVALLIER, O. BRIANT. *DIVCLUS-T: A monothetic divisive hierarchical clustering method*, in "Computational Statistics and Data Analysis", 2007, vol. 52, pp. 687-701
- [42] S. CHELCEA. , *Agglomerative 2-3 Hierarchical Classification: Theoretical and Applicative Study*, University of Nice Sophia Antipolis, March 2007, PhD Thesis, <http://tel.archives-ouvertes.fr/tel-00156809/fr/>
- [43] B. CONAN-GUEZ, F. ROSSI. *Speeding Up the Dissimilarity Self-Organizing Maps by Branch and Bound*, in "Proceedings of 9th International Work-Conference on Artificial Neural Networks (IWANN 2007)", San Sebastian (Spain), F. SANDOVAL, A. PRIETO, J. CABESTANY, M. GRANA (editors), Lecture Notes in Computer Science, June 2007, n^o 4507, pp. 203-210
- [44] B. CONAN-GUEZ, F. ROSSI, A. EL GOLLI. *Fast Algorithm and Implementation of Dissimilarity Self-Organizing Maps*, in "Neural Networks", August 2006, vol. 19, n^o 6-7, pp. 855-863, <http://hal.inria.fr/inria-00174196>
- [45] A. DA SILVA, Y. LECHEVALLIER, F. ROSSI, FRANCISCO. DE CARVALHO. *Clustering Dynamic Web Usage Data*, in "CoRR", 2012, vol. abs/1201.0963

- [46] A. DA SILVA, Y. LECHEVALLIER, R. SERAOUI. *A Clustering Approach to Monitor System Working*, in "Learning and Data Science", M. GETTLER SUMMA, L. BOTTOU, B. GOLDFARB, F. MURTAGH, C. PARDOUX, M. TOUATI (editors), CRC Computer Science & Data Analysis, Chapman & Hall, 2011, vol. K13059, chap. 10
- [47] T. DESPEYROUX, Y. LECHEVALLIER, FRANCISCO. DE CARVALHO, F. DE MELO. *Un algorithme de classification automatique pour des données relationnelles multi-vues*, in "EGC 2012 - Extraction et Gestion des Connaissances 2012", Bordeaux, France, Y. LECHEVALLIER, G. MELANÇON, B. PINAUD (editors), Revue des Nouvelles Technologies de l'Information, Hermann, January 2012, vol. E.23, pp. 125-136, <http://hal.inria.fr/hal-00697118>
- [48] C. DETRAUX, D. L. SCAPIN. , *Evaluation Ergonomique Initiale du prototype V0.1 version Mobile*, 2012, n^o Livrable D3.2.1b, <http://hal.inria.fr/hal-00796106>
- [49] C. DETRAUX, D. L. SCAPIN. , *Evaluation Ergonomique Initiale du prototype V0.1 version PC*, 2012, n^o Livrable D3.2.1a, ANR-PIMI, <http://hal.inria.fr/hal-00796115>
- [50] M. E. FAYAD, D. C. SCHMIDT. *Object-Oriented Application Frameworks*, in "Communication of the ACM", 1997, vol. 40, n^o 10, pp. 32-38
- [51] C. GOFFART, B. SENACH, B. TROUSSE. , *Protocole d'expérimentation - version finale*, november 2011, Pacalabs Ecoffices Déliverable 1.3
- [52] A. GOMES DA SILVA. , *Analyse des données évolutives : application aux données d'usage du Web*, Université Paris Dauphine - Paris IX, September 2009, Prix Simon Régnier 2010- SFC association, <http://tel.archives-ouvertes.fr/tel-00445501>
- [53] M. JACZYNSKI. , *Modèle et plate-forme à objets pour l'indexation des cas par situation comportementale: application à l'assistance à la navigation sur le Web*, Université de Nice Sophia-AntipolisSophia-Antipolis, December 1998
- [54] M. JACZYNSKI, B. TROUSSE. *Patrons de conception dans la modélisation d'une plate-forme pour le raisonnement à partir de cas*, in "Revue l'Objet", 1999, vol. 5, n^o 2, Numéro Spécial sur les patterns orientés objets, D. Rieu et J-P. Giraudon (guest editors)
- [55] R. E. JOHNSON, B. FOOTE. *Designing Reusable Classes*, in "Journal of Object-oriented programming", 1988, vol. 1, n^o 2, pp. 22–35
- [56] D. KRATHWOHL, B. BLOOM, B. MASIA. , *Taxonomy of Educational Objectives, the classification of Educational Goals*, 1973, Handbook 2: Affective domain. New York: David McKay Co., Inc
- [57] A. MARASCU. , *Extraction de motifs séquentiels dans les flux de données*, University of Nice Sophia Antipolis, 2009, PhD Thesis, <http://tel.archives-ouvertes.fr/tel-00445894/fr/>
- [58] A. MARASCU, F. MASSEGLIA, Y. LECHEVALLIER. *REGLO : une nouvelle stratégie pour résumer un flux de séries temporelles*, in "EGC", 2010, pp. 217-228

- [59] A. MARASCU, F. MASSEGLIA. *Atypicality detection in data streams: A self-adjusting approach*, in "Intelligent Data Analysis", 2011, vol. 15, n^o 1, pp. 89-105
- [60] M. NOIRHOMME-FRAITURE, E. DIDAY. , *Symbolic Data Analysis and the SODAS Software*, Wiley InterscienceChichester, 2008, 457 p.
- [61] M. NOIRHOMME-FRAITURE. , *User manual for SODAS 2 Software*, FUNDP, Belgique, april 2004, version 1.0
- [62] H. OINAS-KUKKONEN, M. HARJUMAA. *Persuasive Systems Design: Key Issues, Process Model, and System Features*, in "Communications of the Association for Information Systems", 2009, vol. 24
- [63] M. PALLOT, K. PAWAR. *Holistic Model of User Experience for Living Lab Experiential Design*, in ""Proceedings of the 18th International Conference on Engineering, Technology and Innovation, ICE2012 Innovation by Collaboration and Entrepreneurial Partnerships"", Munich, Germany, june 2012
- [64] F. ROSSI, B. CONAN-GUEZ. *Functional Multi-Layer Perceptron: a Nonlinear Tool for Functional Data Analysis*, in "Neural Networks", January 2005, vol. 18, n^o 1, pp. 45–60, <http://hal.inria.fr/inria-00000599>
- [65] F. ROSSI, B. CONAN-GUEZ. *Un modèle neuronal pour la régression et la discrimination sur données fonctionnelles*, in "Revue de Statistique Appliquée", 2005, vol. LIII, n^o 4, pp. 5–30, <http://hal.inria.fr/inria-00001190>
- [66] F. ROSSI, B. CONAN-GUEZ. *Theoretical Properties of Projection Based Multilayer Perceptrons with Functional Inputs*, in "Neural Processing Letters", February 2006, vol. 23, n^o 1, pp. 55–70, <http://hal.inria.fr/inria-00001191>
- [67] F. ROSSI, N. DELANNAY, B. CONAN-GUEZ, M. VERLEYSSEN. *Representation of Functional Data in Neural Networks*, in "Neurocomputing", March 2005, vol. 64, pp. 183–210, <http://hal.inria.fr/inria-00000666>
- [68] F. ROSSI, A. HASENFUSS, B. HAMMER. *Accelerating Relational Clustering Algorithms With Sparse Prototype Representation*, in "Proceedings of the 6th International Workshop on Self-Organizing Maps (WSOM 07)", Bielefeld (Germany), September 2007, ISBN: 978-3-00-022473-7, <http://dx.doi.org/10.2390/biecoll-wsom2007-144>
- [69] F. ROSSI. *Model collisions in the dissimilarity SOM*, in "Proceedings of XVth European Symposium on Artificial Neural Networks (ESANN 2007)", Bruges (Belgium), April 2007, pp. 25–30, <http://apiacoa.org/publications/2007/dsom-collision-esann.pdf>
- [70] V. ROTO, E. LAW, A. VERMEEREN, J. HOONHOUT. , *User Experience White Paper: Bringing clarity to the concept of user experience*, 2011, (Result from Dagstuhl Seminar on Demarcating User Experience, Sept. 15-18, 2010), <http://www.allaboutux.org/uxwhitepaper>
- [71] D. L. SCAPIN. *Préface*, in "Ergonomie des Logiciels. Recueil de Normes Ergonomie des postes et lieux de travail", AFNOR, 2012

- [72] D. TANASA. , *Web Usage Mining: Contributions to Intersites Logs Preprocessing and Sequential Pattern Extraction with Low Support*, University of Nice Sophia Antipolis, june 2005, PhD Thesis, <http://tel.archives-ouvertes.fr/tel-00178870/fr/>
- [73] N. VILLA, F. ROSSI. *A comparison between dissimilarity SOM and kernel SOM for clustering the vertices of a graph*, in "Proceedings of the 6th International Workshop on Self-Organizing Maps (WSOM 07)", Bielefeld (Germany), September 2007, ISBN: 978-3-00-022473-7, <http://dx.doi.org/10.2390/biecoll-wsom2007-139>
- [74] E. M. ZEMMOURI, H. BEHJA, B. OUHBI, B. TROUSSE, A. MARZAK, Y. BENGHABRIT. *Goal-Driven Approach to Model Interaction between Viewpoints of a Multi-View KDD process*, in "4th Conference on next generation networks & Services", 2012
- [75] E. M. ZEMMOURI. , *Représentation et gestion des connaissances dans un processus d'Extraction de Connaissances à partir de Données multi-points de vue*, Ecole Nationale Supérieure d'Arts et Métiers - Meknès, December 2013, <http://tel.archives-ouvertes.fr/tel-00940780>
- [76] G. ZICHERMANN, C. CUNNINGHAM. , *Gamification by design*, O'Reilly, 2011
- [77] FRANCISCO. DE CARVALHO, R.M.C.R. DE SOUZA, M. CHAVENT, Y. LECHEVALLIER. *Adaptive Hausdorff distances and dynamic clustering of symbolic interval data*, in "Pattern Recognition Letters", February 2006, vol. 27, n^o 3, pp. 167–179
- [78] FRANCISCO. DE CARVALHO, Y. LECHEVALLIER, FILIPE M. DE MELO. *Partitioning hard clustering algorithms based on multiple dissimilarity matrices*, in "Pattern Recognition", 2012, vol. 45, n^o 1, pp. 447-464
- [79] FRANCISCO. DE CARVALHO, Y. LECHEVALLIER, R. VERDE. *Clustering methods in symbolic data analysis*, in "Symbolic Data Analysis and the SODAS Software", E. DIDAY, M. NOIRHOMME-FRAITURE (editors), Wiley, 2008, pp. 181-204
- [80] FRANCISCO. DE CARVALHO, Y. LECHEVALLIER, FILIPE M. DE MELO. *Partitioning hard clustering algorithms based on multiple dissimilarity matrices*, in "Pattern Recognition", 2011, vol. 45, n^o 1, pp. 447-464