

Fédération de recherche NormaSTIC

Rapport et Projet Scientifique 2017-2021

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Chapter 1

Executive Summary

1.1 English version

The federation NormaSTIC (FR 3638) has been funded the 1 january of 2014. Its convention finishes at the end of the five-year convention of the site. i.e the 31 december 2016. The federation associates two public research laboratories. The GREYC (UMR CNRS 6072) is the only laboratory performing fundamental research in information science in the Lower Normandy region. The LITIS (EA 4108) is also the only laboratory performing fundamental research in Computer science in Upper Normandy. NormaSTIC concentrates thus the whole potential of research in information and computer science in Normandy. Note that both Lower and Upper Normandies regions will merge by 1st january 2016 in a single region hence enforcing the need for a single representative of this research field in the newly created region. Besides, our federation will also constitute the only research structure in information sciences of the newly created COMUE Normandie Université.

Despite its youthfulness, NormaSTIC has been active during its first year of existence. We can thus make a first evaluation of its actions and have a reflexion on the future activities to run.

This report present first the federation, its organization, scientific axis and missions together with the main motivations which have lead to the creation of the federation (Section 2.1). Then we present in Section 2.3 a first conclusion about the activities of the federation.

1.2 Version Française

La fédération NormaSTIC (FR 3638) a été créée le 1 janvier 2014. La convention de la fédération se termine à la fin de la convention quinquennale du site, i.e. le 31 décembre 2016. La fédération regroupe deux laboratoires publics: Le laboratoire GREYC (UMR CNRS 6072) est le seul laboratoire effectuant une recherche fondamentale en STIC en Basse Normandie. Le LITIS (EA 4108) est également le seul laboratoire effectuant une recherche fondamentale en STIC en haute Normandie. NormaSTIC concentre donc l'ensemble des recherches STIC de Normandie. Notons que les régions de Basse et Haute Normandie doivent fusionner en une seule région dans un futur proche ce qui doit renforcer le besoins d'une structure unifiée représentant cette thématique de recherche dans la nouvelle région. De plus, notre fédération constituera la seule unité de recherche STIC de la COMUE Normandie Université nouvellement créee.

Malgré sa jeunesse, NormaSTIC a été actif durant sa première année d'existence. On peut donc effectuer un premier bilan de ses actions et avoir une réflexion sur les futures activités à mener.

Ce rapport présente tout d'abord la fédération, son organisation, ses axes scientifiques et ses missions ainsi que les principales motivations qui ont conduit à la création de la fédération (Section 2.1). On présente ensuite en Section 2.3 nos premières conclusions concernant les activités de la fédération.

Chapter 2

Scientific report

2.1 Presentation of the federation

2.1.1 Introduction

Research and innovation are quickly mutating in France and in the whole Europe and most of the changes are still to come. Considering this mutation of our environment the Normand's research laboratories working in sciences and technologies of information and communication (STIC) : GREYC (Groupe de Recherche en Informatique, Image, Automatique et Instrumentation de Caen, UMR 6072) and LITIS (Laboratoire d'Informatique, de Traitement de l'Information et des Systèmes, EA 4108) decided to join their skills in the federation NormaSTIC. The aims of the federation are the following: promote scientific synergies between the research activities of the two laboratories, structure research activities in information technologies in Normandy, enhance the visibility of this research field in Normandy and finally become the privileged interlocutor of different regional, national or international organizations having to deal with research on information technologies on our territory.

The federation is mainly localized on three sites:

- 1. The Campus Côte de Nacre in Caen,
- 2. The technopôle of the Madrillet in Rouen,
- 3. and the Havre (Figure 2.1)

Let us note that the members of the federation have already a good experience of collaborative works between different sites thanks to several common projects and co tutorships. Moreover, members of the federation localized in Rouen and le Havre already belong to a same laboratory (the LITIS). Finally, let us note that the distance between any two locations is about one hour by car.



Figure 2.1: Location of the three main sites of NormaSTIC together with their environmement.

Research in Normandy has been recently structured around large domains and/or by research federations. We can cite the Labex SynOrg for chemistry, the Labex EMC3 and the project Archade for physics. Among the scientific research federations in Normandy we can cite: Normandie-Mathematics for mathematics, the Normand institute of molecular medicinal and macro-molecular chemistry (INC3M) for chemistry and finally the institute of energy, propulsion and environment (IEPE) for energy. This scientific structuration of the Normady has been a strong argument for the creation of NormaSTIC.

2.1.2 Partners of the federation

This structuration of research in information technologies in Normandy is coherent with several industrial fields closely related to information technologies and structured through different clusters of competitiveness. We can cite:

- The secured electronic transactions (TES) cluster created in 2005. TES Pole is a vast ecosystem of more than 120 players, including major corporations, SMEs, the research laboratories and local authorities and other organizations. The core of TES activities concerns all electronic, computer and telematic techniques for performing information exchange, secure and confident, in areas of very varied applications.
- The Mov'eo cluster funded in 2006 is an automotive and public transport R&D competitiveness cluster composed of 370 members. The Mov'eo Cluster is one of the largest French communities of innovation activity for products and services in the field of mobility.
- The Nov@log cluster aims especially in developing the services and logistics systems of tomorrow. The themes engaged in by the pole are traceability, intermodality, processes and flows of industrial logistics, the maritime and terrestrial interface, urban and logistics movements, environment and security.

The federation has also established regular relationships with different professional associations such as:

- The Club TIC groups 70 institutional and industrial members involved with information technologies.
- The Association NovImage composed of 20 members has been created in 2009 and is mainly located in Lower Normandy but is quickly growing and includes now also High Normandy's compagnies. This association federate industrial companies and institutions with a special focus on numerical images and 3D data. This association manages a set of materials (3D scanners, gesture acquisition systems, one 3D printing system,...) which is rent to local compagnies, provides information about calls for industrial projects and organizes common answers of its members to some of the calls.

The federation maintains close relationships with its institutional partners (The concils of Lower and Upper Normandy). Moreover, the federation has strong links with the newly created COMUE of Normandy which by its status should be the main interlocutor of the different federations located in Normandy. This comue joins the five higer educational institutions on which depends the federation: Universities of Caen, Rouen, le Havre, INSA of Rouen, ENSICAEN.

Let us finally note, that the federation has established close links with the federation Normandy-Mathematics.

A detailed description of the action of the federation concerning these different partners is provided in Section 2.2.

2.1.3 Laboratories composing the federation

We provide here a brief description of each laboratory composing the federation. A description of the staff and of the main financial ressources of both laboratories from contracts are provided in Tables 2.1 and 2.2. Further details are provides in Annexes.

The GREYC Laboratory

The Laboratory GREYC is a UMR research unit placed under the joint responsibility of CNRS/University of Caen Basse-Normandie and ENSICAEN.

It is a laboratory of over 220 membres which covers all research and academic skills in the field of computer science, electronic and electrical engineering in Basse-Normandie.

The research themes developed in the laboratory focus on both fundamental and methodological aspects - models, new concepts – as well as practical achievements: application development and software platforms, design and production of electronic devices, etc.

The areas of expertise of the GREYC are: modeling and analysis of algorithms, information security, decision support and data mining, image and signal processing and analysis, human language and document technologies, identification and control, microelectronics, instrumentation and sensors.

The GREYC develops its research with the permanent concern of technology transfer and research training of junior researchers. Many collaborations, often multidisciplinary (mathematics, human language, geography, psychology, medicine, chemistry, physics), at the regional, national (CNRS, CEA, INRIA, IRD, etc.), international (DARPA, European programs: ITEA, EUREKA & FP7 NoE), and industrial levels (Orange Labs, NXP, Thales, EADS, SNECMA, GE Healthcare, Gemalto, etc.) illustrate the exceptional dynamism of the laboratory.

Most of the members of the Laboratory GREYC are principal investigators or members of several national and international projects and grants (ANR especially), and are also involved in several industrial partnerships. The GREYC also participates in several competitiveness clusters (TES, Mov'eo, Equine, Cap Digital, Systematic). The economic impact of the scientific activity of the GREYC is illustrated by a growing number of patents, supervision of PhD students (26 during 2011 and currently 7 CIFRE funding) and spin offs (six created by members of GREYC since 2007).

The LITIS laboratory

The computer science, information processing and systems laboratory (LITIS) is the public information technology research unit in the "Haute Normandy" council combining the three main institutions of higher education in the region: University of Rouen, Le Havre University and the National Institute of Applied Sciences (INSA) of Rouen. LITIS 's scientific project is structured around seven research teams that invest three major areas of application.

The access to unstructured information raises fundamental questions in pattern recognition, machine learning, information retrieval, theoretical computer science, distributed computing, knowledge and user modeling, security. Many of these issues are addressed by the teams Document and Learning (DocApp) Information processing in Biology and Health (TIBS), Multi-agent interaction Decision (MIND) and Combinatorics and algorithms (C & A). Platform for Regional Indexing (Plair) allows to synergize contributions teams.

Biomedical information processing is one of LITIS specificities due to its strong multidisciplinary inking combining IT and biomedicine. The Information Processing team in Biology Health (TIBS) brings together computer scientists, biologists and physicians to address problems of indexing and information retrieval in clinomique data (clinical and omics) on one hand and in biological data mainly from high-throughput sequencers. The team Functional Imaging Quantification (QUANTIF) brings together doctors and image processing specialists around the issue of medical imaging and imaging platform of the Centre Henri Becquerel (Anti Cancer Center). These two teams are involved in the Institute of Biomedical Research and Innovation (IRIB) gathering biology and medicine laboratories.

	Professors	Assistant	CR CNRS	ITA/BIATSS
		professors		
		(HDR)		
NormaSTIC (FR 3638)	57	123(16)	5	27,5
GREYC (UMR 6072)	26	64(11)	5	20
LITIS (EA 4108)	31	59(5)	0	7,5

Table 2.1: Types of members of the federation.

	GREYC	LITIS	NormaSTIC
	$(UMR \ 6072)$	(EA 4108)	(FR 3638)
ANR	4 256 253€	2 507 307€	6 763 560€
CPER	1 295 449€	642 890€	1 938 339€
Region	1 633 101€	133 500€	1 766 601€
Compagnies	1 655 343€	1 269 269€	2 924 612€
public institutions	1 383 782€	1 427 000€	2 810 752€

Table 2.2: Resources from contracts.

Ambient Intelligence is the historical application domain invested by the team Intelligent Transportation Systems (ITS) which focus its research on intelligent vehicle communications. It now turns its attention to the entire vehicle communicating with a multidisciplinary vision involving specialists in embedded vision and computer that address issues related to real-time information systems for mobility. The team of Interaction Networks and Collective Intelligence (RI2C) addresses the complementary issues of mobility and territorial intelligence in terms of complex systems. It turns its attention to risk management, modeling of interactions and the study of urban dynamics.

These application areas interact strongly with clusters Mov'éo, Nov@log, and IRIB.

2.1.4 Human and Scientific potential

Human potential

The set of human resources belonging to the laboratories composing NormaSTIC is important any may decomposed in the following way (Table 2.1):

- 180 Professors and assistant professor,
- 5 full researchers belonging to the CNRS,
- A staff of 27,5 technical and administrative employees,
- 143 PhD and non permanent position (PhD, Post docs, invited professors,...)

We obtain thus a total of 199 permanent position and 407 permanent and non permanent positons. We may add to this number about 50 master students performing an internship in one of the laboratory of the federation each year.

Most of researchers belong to the sector "mathématiques, physique, nano-sciences, sciences et technologies de l'information et de la communication" (S.S.R.I A3) from the Directorate General for Research and Innovation of the Ministry of Higher Education and Research.

The activities of the federation take also place within the institute "sciences de l'information et de leurs interactions" (INS2I) and "sciences de l'ingénierie et des systèmes" (INSIS) of the CNRS.

Finally researchers mainly depend of sections 6, 7(information technologies) and 8 (electronics) of the CNRS.

Concerning the CNU, the associated section are mainly the 27, 61 and 63.

Scientific Potential

The scientific potential of NormaSTIC comes from the one of the different research team of the laboratories composing the federation.

The federation allows to combine complementary and multi disciplinary research skill with researchers sharing their different point fo views on the research fields composing the research axis of the federation (Section 2.1.6).

The list of the research skills of the laboratories associated within NormaSTIC may be resumed by the following short list of keywords:

- Algorithmic,
- Security,
- Complex systems and multi-agent,
- Image processing and analysis,
- machine learning and pattern recognition,
- data mining,
- document processing,
- automatic,
- mobility,
- electronics.

2.1.5 Objectives of the federation

As mentioned in Section 2.1.1, the federation NormaSTIC evolves in a changing environmement where research fields tend to be structured on a bi regional basis (Upper and Lower Normandy) and where institutions such as the COMUE or both regional concils are invited to define their priorities and fields of excellence.

Based on this situation, the federation NormaSTIC follows since its creation two complementary objectives:

A first objective consists in supporting and structuring the research on information technologies performed in Normandy. This objective aims to enhance the quality, the visibility, the readability and the attractiveness of the main Normand's research domains in numerical sciences.

A second objective of the federation is to become a privileged interlocutor for the various institutions structured on a regional basis (Section 2.1.2) and to promote among them the excellence of the research performed on information technologies in Normandy.

Based on these two general objectives the federation has set up a serie of operational objectives:

• support the emergence of common research projects through different inscitations.

- enforce the national and international visibility of the research teams of the federation by supporting them when they apply to international projects.
- Enforce the promotion of the research skills of the federation through different supports (Web site¹, set up of different communication support, participation to exhibitions...)
- Promote teaching activities in information technologies developed within the federation

2.1.6 Scientific Axis

The definition of the scientific axis of NormaSTIC is of course based on the scientific skills of the research teams of the laboratories composing the federation (Section 2.1.4). Considering also the research potential located around the Normandy (Saclay, Lille, Rennes), we decided to adopt a niche strategy in order to affirm a few set of domains of excellence correponding to the scientific identity of information technologies in Normandy.

We thus decided to organize the research activities of the federation into 4 main axis described in the following:

Algorithmic and combinatorics

The members of the AlgoComb Axis study some mathematical aspects of computer science, as for examples models of computation, algorithmics, cryptography, and formal genomics. The Axis assembles almost all the scientists of NormaSTIC working in the domain « Informatique Mathématique » (IM), as defined by the eponym french national research group². It is composed of about 30 permanent members, 10 PhD students, and non permanent members, located in 3 different geographical areas (Caen-Le Havre-Rouen), and belonging, for almost all of them, to one of the three following research teams: AmacC (GREYC laboratory), CA (LITIS laboratory) and TIBS (LITIS laboratory). The members of the Axis share the same scientific culture, relying on various domains of IM and approaches: combinatorics (algebraic, analytic, dynamic, combinatorics of words), information theory and text algorithmics, arithmetic, formal computation, encoding and cryptography, complexity and logic, etc.

The scientific skills of the axis are mainly divided into 3 domains:

- Algorithms and complexity: those skills are developed with the complementary approaches of models of computation and random structures. The skills on models of computation are the study of the notion of algorithmic complexity in the worst case, using computational complexity classes. Random structures are studied in a probabilistic framework. In particular, those skills are applied to Information Protection, especially in Encoding and Cryptography, with an upstream algorithmic activity in Information Theory and Arithmetics, were algorithms and analysis are conceived. Complementary researches are developed in « non-exact » algorithmics with a probabilistic approach, often completed by approximations.
- Fundamental aspects of computation: we focus here on structures modeling information, as words and free monoids, and structures modeling computation, as automata and formal series, especially in their algebraic approaches.
- *Text algorithmics*: we develop methods and structures for indexation and extraction of informations in biological datas (such as genome, for example). We aim at improving the

¹http://www.normastic.fr ²http://www.gdr-im.fr

compacity, speed, and dynamicity of data structures used in text algorithmics, especially regarding the suffix tree and its variants, suffix vectors and suffix arrays.

The existing domains of synergy in the Axis are divided into three groups:

- Combinatorics of words, text algorithmics and information theory: some problems in word combinatorics or automata theory can be generalized when symbols are not independent or equiprobable. The probabilistic properties of the source of the symbols play an important role in the analysis of these problems. There are two complementary activities in text algorithmics: on the creation of new data structures, and on the probabilistic analysis of the properties of those structures.
- Arithmetics, formal computation, encoding and cryptography: the scientists of the Axis share an interest and culture on algorithms working on mathematical structures, algebraic (polynoms) or arithmetic (integers or euclidian networks), with a skill on probabilistic analysis of these algorithms. They also meet on the domain of encoding and cryptography, and especially in cryptanalysis, with two complementary approaches: one uses mainly arithmetics (with euclidian networks, for example), the other formal computation (polynomial systems). These synergies on cryptanalysis also appear in the transverse Axis « Security »(Section 2.1.7).
- Analytic and algebraic combinatorics: the formal series are used in two complementary approaches for the extension of the models commonly used in the definition of algorithms, and their analysis. The first one focus on the probabilistic analysis of random structures and algorithms. We develop a realistic framework for the modeling of those algorithms, where they are viewed as dynamic systems. The second approach focus on the generalization of formal series to other structures, as for example non-commutative structures. We study in particular symmetric functions, Hopf algebras and operades.

Some other synergies between the Axis and the Normand Federation of Mathematics are being developed: the dynamic systems are a common subject of interest and research. They are studied with links to the theory of codes or to cellular automata. Dynamic systems can also be an intersection with the Axis « Complex Systems » of NormaSTIC.

Complex systems

Complex systems group of Normastic federation gathers together a number of researchers from GREYC and LITIS Labs where they develop formal methods and algorithms of developing, modeling and designing complex systems and targeting some real-word applications. The research in this group is focused on using formal theoretic tools based on decision-theoretic approaches, cellular automata, bio-inspired models to design and simulate dynamic real-word systems such as natural phenomena, traffic networks, crowded and populated environments and territorials, autonomous systems, intelligent vehicles. Such application domains lead to develop analytical tools or diagnosis, simulation, decision making and decision support. This study completes the full chain from theoretical and fundamental study to applications domains.

Complex systems group aims at overcoming some fundamental and scientific challenges concerning the interactive systems under different hypothesis: (1) local/global observability, (2) heterogeneous/homogenous systems, (3) the human in the loop and interaction models, (4) topdown and bottom-up interaction-based model analysis and (5) uncertainty allowing us to analyze a complex system from local behavior of entities to the global behavior of the system or from the global desired behavior deriving the local behaviors considering. This research program is organized into three directions: Modeling direction, the research developed revolve around modeling algorithm and sources (in the sense of information theory) by dynamic systems, complex networks and the study of cellular automata. Formalization direction, refers to artificial intelligence approaches, specifically, distributed multi-agent systems or bio-inspired approaches for self-organization in social insects. Solving problem direction, the work carried out concerning the conceptual development of methodologies and innovative algorithms on the detection of organizations, their multi-scale representation and decision-making in an uncertain environment in organizational systems. This research finds applications in the spatial simulation for geographic systems , robotics courses in smart vehicle logistics or risk management.

Many researchers are involved in this program. From LITIS Lab, we find researchers from MIU, RI2C and TSI and from GREYC Lab we find researchers from MAD, AMACC, CODAG and Automatic. These groups cover the necessary competences required by complex systems topics and in a complementary way.

ImageS

The axis welcomes researchers from the Image team of GREYC lab and from Quantif, Docapp and STI teams of LITIS lab. GREYC Image team has been developing a strong background in the development of generic methodological methods for image processing. These methods are based on various mathematical models for image description and characterization (geometrical, statistical, topological) and take benefit of different optimization schemes (convex optimization, shape optimization and active contours, variational approaches and PDEs, discrete optimization based on graph theory). Besides, LITIS owns a recognized expertise in many different fields such as document analysis and pattern spotting, medical imaging, analysis of multimodal images using original fusion algorithms, shape prior-based image segmentation and image characterization and classification, but also innovative vision systems for intelligent vehicles.

The main target of this research axis is then to bring out new methodologies and innovative algorithms to take up scientific challenges concerning image and data analysis and processing, with a focus on complex and unusual data characteristics (e.g. multimodal images, 2D or 3D medical images, old manuscripts, 3D incomplete data of cultural patrimony, multiple sensors images). This research is based on the complementary skills developed by the two involved labs, and is concerned with practical applications, especially in the following fields: medical imaging, intelligent vehicle and patrimony preservation and enhancement.

Inside this axis, three themes will be considered :

• Restoration, segmentation, attributes extraction.

This first theme classically gathers the three main categories of process involved in image analysis :

- 1. Restoration as an important tool to remove noise, artifacts in old manuscripts and to increase the image quality in order to facilitate further treatments.
- 2. Segmentation to allow the delineation of complex regions and objects inside the images for further quantification and analysis steps.
- 3. Extraction of region attributes which are essential for any classification or categorization step, but also useful for object matching, tracking and recognition.

Practical applications essentially concern patrimony preservation and old manuscripts enhancement (where the restoration step is particularly important and text segmentation remains challenging), mobility, and medical imaging that always offers complex structures to delineate and quantify. • Image characterization for region matching

Images of medieval manuscript document exhibit particularly rich illuminations and colors, and require the development of dedicated image processing techniques. In particular, pattern spotting, which facilitates indexing and information retrieval in these relatively complex medieval databases, must rely on, on the one hand, color descriptors and sparse representations of a dictionary of visual words, and on the other hand, on the integration of mechanisms to preserve and represent the spatial organization of colors. This theme also finds applications in mobile systems for guidance and localization.

• Information fusion.

The fusion of information plays an important role in many areas. Multi-modality and multi-sources of information are exploited to make a decision. These issues are found both in medical imaging (3D anatomical (CT, MRI) and functional (PET and single photon (SPECT)), which are important sources for the decision, and also in mobile systems or multiple sensors (GPS, LIDAR, camera), that provide relevant information on the status and / or position of the cameras.

Data, knowledge and machine learning

DAC scientific axis gathers a number of researchers from 4 research teams of GREYC lab (CoDaG, Hultech, Image and « Monétique & Biométrie ») and from 4 research teams of LITIS lab (DocApp, MIND, C&A and TIBS). Researchers within this axis develop theoretical and applied research activities on machine learning, optimization, statistical modeling, graph theory, data and trace mining, information extraction and information retrieval. Their skills are complementary in those topics: in particular GREYC lab has a strong expertise in unsupervised machine learning and data mining, graph kernels, image and video retrieval whereas LITIS lab has a strong expertise in statistical machine learning, kernel machines, HMM, CRF, classifier ensembles and document image analysis. Moreover, both labs are interested in the extraction and coding of descriptors (from images for GREYC lab, and from document images and documents for LITIS lab) and learning from data (sequential data for GREYC lab and multidimensional data for LITIS lab).

The research in this axis is focused on the processing of huge amounts of heterogeneous data (texts, images, videos, sequences, chemical structures...) for which extracting relevant information is becoming a critical issue for decision making. We thus aim at conceiving new models, new methodologies and new algorithms to make optimized and real-time decisions in the context of Big Data. The scientific activities of DAC axis are organized around four topics:

- Optimization and machine learning: optimization is everywhere and is of crucial importance for designing efficient machine learning algorithms that will be able to deal with Big Data. We aim here at studying the combination between advanced descriptors (graph kernels, hierarchical bags of words...) and recent machine learning techniques (collaborative, incremental, active...) for tackling the challenging issue of machine learning from complex data that are not necessarily multidimensional.
- Graphs: graph-based data are now daily collected in a lot of applications and the scientific community still needs sophisticated algorithms and methods for analyzing/processing these data. We are interested here in studying graph kernels, propagation of partial differential equations on graphs, wavelets on graphs for resolving inverse problems in image processing and machine learning, but also machine learning on graphs based on 1D or 2D Conditional Random Fields, or similarity between graphs based on graph isomorphism.

- Indexing: there is no efficient information extraction nor retrieval without a good description of the documents or the images. In this topic, we study the descriptors used to characterize natural images, document images and textual documents in order to take benefit from their complementarity. We also investigate the use of new compact descriptors instead of classical bag-of-visual-words descriptors for scalable image retrieval systems.
- Information extraction and data mining: we aim at setting methodological links between supervised and unsupervised machine learning techniques for extracting queried information from data or discovering new knowledge as recurrent patterns for example. In particular, we investigate how to make cooperate global models and local patterns in data and trace mining.

2.1.7 Transversal axis

The federation has defined three main application fields of its scientific axis. These application fields, also named transverse axis correspond to:

- 1. Security systems,
- 2. Document Analysis,
- 3. Mobiblity systems.

These transverse axis correspond to strong application fields of both laboratories in close collaboration with the cluster secured electronic transaction, the departements of human sciences in the university of Caen and Rouen and clusters Mov'eo and Nov@log (Section 2.1.2).

2.1.8 Organization of the federation

Decision processes of NormaSTIC are conducted through different concils defined in its convention. However, due to the recent creation of the federation (one year) and the fact that the CNRS's convention of the federation has not yet been approved by the five higher education institutions on which depend the federation only the direction and the Governing board of the federation are currently active. Note however that the scientific animation of NormaSTIC is conducted conjointly by the direction, the governing board and the heads of the four scientic axis composing the federation (Section 2.1.6).

Head of the federation

The head of the federation is insured by a director and an assistant director. The director implements the federation policy and ensures the use of the funds of the federation. His role also includes the scientific animation of the federation and the access to the information. The director and assistant director are nominated for four years. Their position may be renewed twice with the agreement of all tutorship institutions.

For this mandate the director is Luc Brun and the assistant director is Stéphane Canu.

Governing Board

The governing board consists of the director of the federation (Luc Brun), his assistant director (Stéphane Canu) and the directors of the laboratories or their representatives. The governing board met at the director initiative.

The governing board is consulted on any important decision of the federation.

Federation concil

The federation consil is composed of:

- The governing board,
- Four elected members of the concils of the laboratories of each entity including one representative of ITA/IATOS and one representative of PhD/Post doctorates,
- Two nominated members.

This concil is consulted on the current state of the federation, the orientation of its researches, the funds to be requested by the federation and how this funds are used.

Scientific Concil

The scientific concil consits of:

- One member of the federation,
- One representative of the main CNRS institute of the federation,
- Five persons external to both laboratories and nominated by the director. At least, one of this person should be non French.

The scientific concils should provide an external point of view on the scientific policy of the federation and its main orientations.

2.2 Past activities of the federation (2014-2015)

In its first year of existence, the federation has initiated collaborations between both laboratories through its scientific axis. In parallel, the governing board of the federation has conducted an active policy of communication towards its main institutional interlocutors in both regions.

2.2.1 Global animation of the federation

Implication in the design of the RIS3

The concil of lower normandy has invited Luc Brun, as head of the federation NormaSTIC, to participate to the debates concerning the design of the research and innovation strategies for smart specialisation (RIS3) of Lower Normandy. This simple fact shows the expectation of the insitutions of Normandy concerning a structuration of information technology in Normandy. The Lower Normandy defined 5 axis of smart specialization:

1. Sustainable and intelligent materials,

- 2. Science and biomedical technologies,
- 3. Information technologies and Society,
- 4. Energy Transition,
- 5. Environment and resources for sure, healthy and sustainable food.

NormaSTIC is of course mainly concerned with item 3 with however strong connections with item 2 and 5 through image analysis, bioinformatics and chemoinformatics fields.

After several meetings, and many exchanges of documents, organized by the miriade (public organism for valorisation of Lower Normandy) the priority axis defined within the information technology and Society axis include:

- Secure electronic transactions,
- Virtual reality,
- smart digitization of Documents.

The secure electronic transactions includes skills in Algorithmics and cryptography which concern the Algorithmic axis of NormaSTIC. Moreover, secure electronic transactions also corresponds to one cluster of competitivity of the region Lower Normandy.

Virtual Reality concerns few skills of the federation. However, this axis is supported by a technical team of the university of Caen which works since 2006 on the virtual reconstruction of the ancient city of Rome. The axis also strongly interest the association Novimage (Section 2.1.2).

The last axis (smart digitization of document) includes strong skills of the Axis "Data, Knowledge and machine learning". This axis develop both new methods of text indexation and pattern recognition and machine learning methods to analyse images of Documents. Such an axis also induces a strong connection with the "Maison des ressources en sciences humaines" (MRSH, USR3486) which provide an expertise on the content of the documents.

Moreover, the axis "Science and biomedical technologies" is divided into three sub-axis corresponding to:

- 1. Application of nuclear technologies to health,
- 2. Horse health and performance,
- 3. Silver economy and e-health.

Axis 1 and 3 explicitly include the problematic of image analysis and hence are strongly related to the Image axis of NormaSTIC. Moreover, axis 2 also includes genomic problems which corresponds to skills developed in the axis Data, Knowledge and machine learning. The problematic raised by e-health applications may also imply the axis algorithmic (for secure transactions) and complex systems.

The situation is not as favorable for our federation in Upper Normandy, where the information technology area is not specifically identified as a proper area of expertise. However, the transverse strategic axes of course contribute to the development of innovative digital projects and creation of activities and jobs in the field of Web usage by example and NormaSTIC have to play an important role in it. Four domains of smart specialization have been defined in Upper Normandy together with two emerging ones:

- mature domains:
 - 1. materials ageing and performance,
 - 2. reliability of systems and components in embedded systems,
 - 3. energy efficiency propulsion systems,
 - 4. new technologies in chemistry and biology applied to health and wellness,
- emerging axes:

- 5. wind power,
- 6. multimodality and logistics performance.

NormaSTIC, through its activities in "complex systems", is clearly leader in the domain of "multimodality and logistics performance". The domain "New technoloogies in chemistry and biology for health and wellness" also implies the axis "Data, Knowledge and machine learning" through medical imaging, bio and chemoinformatics fields.

In conclusion, NormaSTIC is clearly better involved in Lower Normandy than in Upper, since the skills of three axis of NormaSTIC over four are strongly represented in the smart specialisation defined by the region Lower Normandy. However, the now announced reunification of Normandies brings some opportunities that NormaSTIC could benefit. Indeed, the competitiveness and innovation of the future Normandy goes through an evolution and elevation of skills in companies and increased use of IT.

Implication in the design of the PIA2 of the COMUE

After the design of the smart strategy of both Normandies we learnt that the COMUE of Normandy-University wanted to apply to the second call of the National Project of Investment for the future (PIA2) called NORMAND'I-SITE. Independently of its failure, and from an internal point of view this project may have a strong influence on the structure of research in Normandy.

The preliminary sketch of this project was only considering information technology as a transverse axis in support of other scientific disciplines. Based on the work already done for the setting of the federation and during the design of the RIS3, the governing board of NormaSTIC has written a proposal for an information technology axis and has submitted it to the president of the COMUE and to the vice presidents in charge of the research in the different higher educational institutions of the COMUE.

Based on this report and after several discussions, the COMUE decided to set a working group mixing representatives of Information technologies, mathematics and human sciences. Note that both directors of the federations NormaSTIC and Normandy-Mathematics have been nominated as representatives as well as Thierry Paquet, director of the LITIS laboratory and in charge of the animation of the Higher Normandy research Network 'Logistic, Mobility, Digital'. After a work of about one trimester of the different working groups, the COMUE selected the following three main research axis:

- 1. Energy, propulsion materials,
- 2. Innovation, diagnostics and therapeutics,
- 3. Digital and Information technologies, culture, memory, heritage.

Which include thus the one in which NormaSTIC is mainly implied (third axis). Note that NormaSTIC is also implied in the second axis through image processing/analyzing and bio/chemo informatics fields.

One of the main project retained in the third axis selected by the COMUE comes from intensive discussions between the governing boards of NormaSTIC and Normandy-Mathematics. Both federations propose in this joint project to perform conjoint calls and common meetings in order to promote conjoint works between mathematics and information technologies and to produce a common scientific culture between both federations. The main objective of this project is to create an informal research entity whose scientific excellence would be comparable the LabeX (Laboratories of Excellence) Milyon (Lyon) or CIMI (Toulouse). This ambition of both federations is reinforced by the project of a joint doctoral school combining information technologies and mathematics (next section).

Implication in the creation of a new doctoral school

Close collaborations between Mathematicians and researchers in the fields of information technology and system engineering in Normandy lead to the creation of a new doctoral school ("école doctorale"), an educational structure similar in focus to a graduate school but restricted to PhD level. This Doctoral school called MIIS (Mathématiques, Informatique, Ingénérie des Systèmes) relies upon a dense network of laboratories in Normandy highlighted by the federative structure in mathematics and information science. It is all is backed up with the specialties (master's degrees) of 6 research laboratories in order to supply the doctoral candidates with favorable conditions to carry out their dissertation and to integrate working world. It brings together 141 PhD student, corresponding to an average flow of 40 doctoral student per year.

Our Doctoral School has a coordinating role, ensuring the scientific consistency of the candidate's research project. It is responsible for training and preparing PhD students for their occupational integration. It is also strongly linked to the institutional and economic regional environment. The connections with the economic environment are settled thanks to research projects carried out within competitive clusters such as TES, Moveo and Nov@log thanks to the presence of doctoral students within companies.

After they have been awarded their PhD, the young doctors in the IT domain are not faced with integration problems, neither in the academic environment nor in the private sector.

2.2.2 Scientific Animation

NormaSTIC Colloquium

May, 28 2014 NormaSTIC organized its first colloquium with two invited speakers: Christian Jutten³ (Professor at University Joseph Fourier) and Gilles Schaeffer⁴ (Professor at École Polytechnique). The Colloquium has been opened by the vice president of Caen's University in charge of research activities. This colloquium has been a good oportunity for intensive scientific exchanges with one talk provided by each scientific axis and three focuses on transverse applications: Numerical documents, mobility and Security.

Algorithmic and combinatorics

Research Meetings of the axis Before the creation of the federation, we have met several times in order to get a better mutual understanding and knowledge of the two laboratories and research themes. Four one-day meetings have been organised.

- January 30, 2012 in Caen: Presentation of the Rouen Combinatorics team Four talks from Rouen researchers.
- March 30, 2012 in Rouen: Text algorithmics Three talks from Rouen researchers, four talks from Caen researchers.
- December 14, 2012 in Rouen: Analytic combinatorics and analysis of algorithms One talk by a Rouen researcher and three by Caen researchers.

³http://www.gipsa-lab.grenoble-inp.fr/~christian.jutten/
⁴http://www.lix.polytechnique.fr/Labo/Gilles.Schaeffer/

• October 21, 2014 in Caen. Presentation of Rouen activities: five talks by Rouen researchers, one talk by a Caen researcher.

Detailed information on the meetings: January 30, 2012 (Caen)

- Magali Bardet: Complexité de résolution de systèmes quadratiques booléens.
- Pascal Caron: Langages rationnels 1-non ambigus et extensions.
- Jean-Gabriel Luque: Théorème de Polya et fonctions "mots" symétriques.
- Carla Selmi: Mots infinis, stratégies et probabilités.

March 30, 2012 (Rouen)

- Arnaud Lefebvre: Calcul de périodes abéliennes.
- Tayeb Merabti: Alignements de terminologies médicales.
- Thierry Lecroq: Correction orthographique de requêtes.
- Gaël Dias et Antoine Doucet: Autour de l'algorithmique du texte.
- Julien Clément: Statistiques de motifs dans un texte aléatoire.
- Brigitte Vallée: Modélisation de sources générales.

December 14, 2012 (Rouen)

- Brigitte Vallée: Analyse de l'arbre digital de recherche (dst).
- Arnaud Lefebvre: Sur la complexité du calcul d'un conjugué sans bord.
- Loïck Lhote: Analyse du calcul de pgcd de plusieurs entiers ou polynômes.
- Julien Clément: Analyse réaliste des algorithmes de tri et de recherche.

October 21, 2014 (Caen)

- Nicolas Bacquey: Leader election on two-dimensional periodic cellular automata.
- Vlad Dragoï: Polynomial structures in code-based cryptography.
- Nadia Ben Nsira, Mourad Elloumi, Thierry Lecroq: Recherches de mots dans des séquences similaires.
- Carla Selmi: Transducteurs pour décodage bi-directionnel.
- Jean-Gabriel Luque: Le Genji et les bosons.
- Bastien Cazaux, Thierry Lecroq, Eric Rivals: Construction d'un graphe de de Bruijn compact à partir d'un arbre des suffixes.

Exchanges The Normastic federation is funding a master student (Dimitry Darthenay) for 6 months under the supervision of Julien Clément and Loïck Lhote in Caen, and Magali Bardet and Ayoub Otmani on the Rouen counterpart. The subject is « Models and analyses of algorithms generalising the Euclide algorithm in higher dimension » with two main applicative fields which are discrete geometry and cryptography. The student will mainly stay in Caen and make visits to the Rouen laboratory.

Brigitte Vallée and Kanal Hun have visited in Rouen to work with Jean-Gabriel Luque on combinatorial interpretations of constants arising in the study of digital search trees. Laura Giambruno was a postdoc in the GREYC lab in 2012-2013. She participated to the meetings and finished during her stay a journal article with colleagues from the LITIS lab (Carla Selmi, Jean Néraud) and Sabrina Mantaci (from Palermo). The article "A generalization of Girod's bidirectional decoding method to codes with a finite deciphering delay" is actually under submission.

Conferences Some members of the GREYC lab are organising a conference entitled *First International Symposium on Web AlGorithms* (ISWAG 2015), 2–4 June 2014, Deauville. This is a new symposium that covers research in the areas of algorithms for solving web related problems. Some financial support is provided by the Normastic federation.

http://iswag-symposium.org/

Organizers: Sylvain Peyronnet (GREYC, Université de Caen, on leave), Jérôme Darbon (CNRS, Ecole Normale Supérieure de Cachan), Thomas Largillier et Gaétan Richard (Université de Caen).

Projects The federation is also supporting the MIDI (Mathématiques, Informatique et structures DIscrètes) project, who aims at facilitating collaborations between some researchers of the AlgoComb team (LITIS, University of Rouen) and some researchers of the LMRS (Laboratory of Mathematics Raphaël Salem, University of Rouen). The project mainly belongs to the Axis "Logique, Mobilité, Numérique" of the GRR of High-Normandy, and basically consists in the organisation of about ten one-hour seminars during 2014–15, and a three-days national meeting in September 2015. Among the main topics of the MIDI project, let us cite formal machines, quantum information, combinatorial physics, cryptography, or discrete geometric structures.

Complex systems

The animation of the group have started with many meetings where many talks have been given to present different works developped in diffrent research groups and to define the topics on which the complex systems team will focus. A plenary session has garthered all researchers to define a roadmap of meetings, topics, research directions and cooperation of our team. In the following, we present all the meetings and their objectives.

- January 31th 2012, Caen : at this meeting all the groups of both Labs GREYC and LITIS have been present by giving different talks on their research related to complex systems. After different presentations, a discussion has been open where topics for next meetings have been decided and some specific actions have been defined for common projects and research programs. A roadmap has been defined for all these actions and potential national program submission.
- March 29th 2012, Caen : this meeting has been dedicated to presentations and works on models of interaction. Researches on Cellular Automata, Decentralized POMDP, dynamic graphs and dialogue interactions have been presented. After these presentations, a discussion on common research directions has been developed.
- July 11th 2014, Rouen : this meeting has been dedicated to graphs and dynamic networks with some perspectives around these topics. Another point that has been discussed is to nominate some leaders of work groups on different topics of complex systems.
- February 3rd 2015, Caen : this meeting has been dedicated to human behavior understanding and Human-agent interaction.

Normastic has supported many actions of the complex systems group such as a funding of 2 masters in 2014 and 2015 involving a cooperation between the two labs and supporting some national and european projects such as COACHES european project.

Members of complex system group of Normanstic collaborate in many national projects such as PEPS and ANR. For example we can mention the ANR project NARECA where members of MIU and of CODAG are partners. Also, researchers of complex system group involved in national and international researcher networks like RNSC (French national network on complex systems) or CSS (international Complex System Society) but also in the CS-DC Unesco UniTwin as co-coordinator of this international network composed of more than 100 universities around the world.

Finally, Normastic research group members have been co-chairs of one of the major international conference on complex systems in France : ICCSA 2014, helded at university of Le Havre, June 23-26, 2014, was an important international meeting in dynamical systems and complex systems with some famous researchers in these topics.

ImageS

- In 2013, teams of both LITIS and GREYC laboratories worked together to develop a segmentation method based on graph through the post-doc of Pierre Buyssens who prepared his PhD at the GREYC lab and was recruited for a post-doctoral fellowship at the LITIS lab. This collaboration has given rise to a publication: Pierre Buyssens, Isabelle Gardin, Su Ruan, Abderrahim Elmoataz, "Eikonal-based region growing for efficient clustering", Elsevier, Image and Vision Computing, Vol. 32 (12), Pages 1045–1054, December 2014.
- 2. In March 2013, Abderrahim Elmoataz and Thierry Paquet organized in Caen a day of conferences dedicated to the study of images in numerical documents. It took place as as seminary of the NUMNIE (digital Normandy) group. There were three national guests : Jean-Yves Ramel (University of Tours), Franck Lebourgeois (INSA Lyon), Alamin Mansouri (University of Bourgogne). This day also included presentations of SHS or STIC researchers from the MRSH of Caen, the LITIS and the GREYC.
- 3. In 2014, members of the ImageS axis (Rouen and Caen) applied to CNRS-funded PIC projects through the NormaStic federation. The project, entitled "Fusion of multimodal medical image to help cancer therapy" aimed to develop new methods for image segmentation and data fusion to automatically segment tumors (brain, prostate and lung) and follow them during therapeutic treatment. Unfortunately the project was not selected. However one of the members was invited by the Chinese partner university to discuss collaboration project in the future.
- 4. The image axis participated in the organization of the "Image Processing Day" via the M2NUM project, approved by the Grand Project Network Haute Normandie (Grand Réseau de Recherche Haute Normandie), which was held on 04.09.2015 at INSA Rouen. Two scientists from Paris and Rennes gave interesting talks. The colleagues of Rouen and Caen also presented their work.
- 5. Su Ruan (LITIS) and Olivier Lezoray (GREYC) participated in organizing a Workshop "Processing, Analysis, Life imaging Indexing" in Paris, to be held 23-25 June 2015. This workshop addresses the image processing community in relationship with health. A physician of the QUANTIF team of LITIS (S. Thureau) is invited to give a presentation on the role of functional imaging in thoracic radiotherapy.

Data, knowledge and machine learning

Before the official start of the federation, we organized several meetings to get a better mutual understanding of the research activities carried out within the labs. Presentations of the teams were given during plenary meetings and a one-day workshop on July 2nd, 2012 focuses on analysis and the multiple uses on trace data (6 talks, around 20 participants).

Meetings In 2014, we organized two one-day workshops. The goal of these workshops were to provide an opportunity for the DAC axis to favor scientific exchanges and to strengthen collaborations between LITIS and GREYC teams. At each meeting, we save time to debate on the scientific life within the axis and the federation (roadmap of research directions, actions to be taken to improve cross-fertilization between researchers). Here are the title on the talks (more information on the NormaSTIC web site).

April 18th, 2014: after an introduction to the scope and the scientific goal of the axis, 9 talks were given. Around 40 people attended the meeting.

- "Optimisation multi-objectif pour l'apprentissage en environnement incertain" (Simon Bernard, LITIS)

- "Les EDPs sur graphes pour le traitement et la classification de données" (Mathieu Toutain, GREYC)
- "Extraction et partitionnements de motifs dialogiques (projet ANR Nareca)"et Introduction à Nareca

(Zacharie Alès, Alexandre Pauchet et François Rioult, LITIS et GREYC)

- "Groupe Nouveaux Usages" (Pierre Beust, Stéphane Ferrari, Mayvonne Holzem et Fabrice Maurel, GREYC et LITIS)

- "Programmer en nombres entiers pour apparier des graphes : des formulations à la librairie gem++" (Julien Lerouge, LITIS)

- "Factorisation matricielle pour la recommandation dans un contexte" (Julien Delporte, LITIS)

- "Extraction de connaissances du jeu de test Ames : Sous-graphes, graph patterns, et graph patterns stables" (Bertrand Cuissart et Jean-Philippe Métivier, GREYC)

- "Les noyaux sur graphes : applications à la chémoinformatique et extensions" (Luc Brun et Benoîst Gaüzère, GREYC)

- "Recherche d'information sémantique dans un dossier du patient informatisé" (Stefan Darmoni, LITIS)

November 27th, 2014: around 30 people attended the meeting which included an invited talk and 6 presentations.

- Invited talk : "Unsupervised Dimensionality Reduction: from Principal Component Analysis to Modern Nonlinear Techniques" (John Aldo Lee, Université catholique de Louvain).

- "Étude et réalisation d'oralisation de tag clouds pour non-voyants" (Alexandre Beudin, Pierre Beust, Stéphane Ferrari, Fabrice Maurel, GREYC)

- "Complétion de valeurs manquantes à l'aide d'un surfeur aléatoire" (Saad Ouadrim, François Rioult, Alexandre Pauchet, GREYC et LITIS)

- "Méthodes structurelles pour la reconnaissance de formes" (Équipe DocApp, Pierre Héroux, LITIS)

- "Fonctions p-harmonieuses : de certains jeux stochastiques à l'analyse d'images et de données sur graphes" (Abderrahim Elmoataz, GREYC)

- "Graphes et chimie : découverte automatique de structures d'alerte pour la toxicologie prédictive" (Bertrand Cuissart, GREYC)

- "Présentation de GraphStream : fonctionnement de la plate-forme et quelques exemples d'utilisation" (Antoine Dutot, LITIS)

Other meetings:

- *May 28th, 2014:* for the official kick-off meeting of NormaSTIC on May 28th, 2014, the DAC axis has presented its research activities with a focus on pattern spotting in historical documents. - the next one-day workshop is planned on May 19th, 2015.

Invited talks On November 27th, 2014, John Aldo Lee (Université catholique de Louvain, Belgium) gave an invited talk entitled "Unsupervised Dimensionality Reduction: from Principal Component Analysis to Modern Nonlinear Techniques". On May 19th, 2015, Guozhu Dong (Wright State University, US) will present an invited talk entitled "Pattern Aided Regression Modeling".

Exchanges and joint projects

- some members of DAC axis collaborate or have collaborated within formal projects:
 - ANR ASAP (2009-2012) "Deep architecture in Machine Learning" (leader: Alain Rakotomamonjy, LITIS)

- PEPS INS2I-INSHS Acamodia (2012-2013) "Plate-form on dialogic interactions analysis involving children" (leader: François Rioult, GREYC)

- ANR Nareca (2013-2016) "Narrative Embodied Conversational Agent" (leader: Alexandre Pauchet, LITIS) which is a follow-up of the Acamodia project.

• two joint master students were funded in 2014 by NormaSTIC:

- Saad Ouadrim under the supervision of François Rioult and Alexandre Pauchet. Subject: Imputing Missing Values Using a Random Surfer.

- Alexandre Beudin under the supervision of Pierre Beust, Stéphane Ferrari, Fabrice Maurel. Subject: speech of tag clouds for blind people.

- joint PhD student: the PhD thesis of Sovann En, co-supervised by L. Heutte (LITIS) and F. Jurie (GREYC), is one of the major collaboration action of DAC axis. In this context, Sovann En has spent one week in September 2014 for scientific collaboration with GREYC on his PhD subject dealing with pattern spotting in historical document images.
- several members of the axis actively take part on joint research activities for the e-Tourism project which will be submitted to the InterReg 2015 call for proposals.

Working groups

- the group "Nouveaux usages" works from several years on document contents and their accesses with an interdisciplinary approach. The group organized a one day workshop on December 4th, 2014.
- two members of DAC axis, P. Héroux and B. Cuissart, have initiated a transversal working group on "Graphs" which is a hot topic jointly shared by other scientific axies of NormaSTIC. A special session was devoted to this topic during the one-day workshop on November 2014.

2.2.3 Connection with socio-economic partners

Federation NormaSTIC has close relationships with the association NovImage and the club TIC (Section 2.1.2). Indeed, Luc Brun, Head of NormaSTIC also belongs to the governing board of NovImage (as a representative of the ENSICAEN school). Recently to the initiative of NormaSTIC, the association NovImage has decided to support the PIA2 project of Normandy University through a free disposal of its material during several years. The amount of this support represent about 100 k \in .

The federation NormaSTIC has participated in 2014 to Normandy Digital: a professional show which concerns all computer science companies working in Normandy (Both Low and High). NormaSTIC provided during this show a scientific talk and has hold a booth.

Finally NormaSTIC is involved in the creation of an Interreg project about e-tourism. The consortium groups several Normand's and English companies, several tourism offices and local authorities. The project is managed by Caen's aglomeration council.

2.2.4 Connections with other federated structures

Since the creation of the COMUE Normandy University we observe a quick structuring of research fields in Normandy. Considering this point, both federations NormaSTIC and Normandie mathématiques have decided to enforce the links between their respective research fields. From a concrete point of view, both federations support since 2015 common works between laboratories of mathematics and computer science through a joint call for projects. The main idea is to promote a common scientific background between the two communities so as to enable, if needed, a stronger structuring between them. Note that this initiative from the federations is supported by the heads of the laboratories of both federations. This initiative is also in synergy with the creation of new doctoral school regrouping all the laboratories in mathematics and computer science (i.e. all the laboratories of both federations).

2.2.5 Financial results over 2014

Indiquer les modes de répartition.

Income CNRS: 10 k€

Outcomes:

- Seminar axis Algorithmic and combinatorics (October, 21 2014) 475€
- NormaSTIC seminar: 2,469 k€
- Missions Caen/Rouen: 2,053k€
- Participation to the show of the club TIC : $250 \in$
- Support to RFIA 2014: 500€
- Mission in UK within the participation to interreg project framework: 170€
- Algorithmic and combinatorics seminar (October, 21, 2014): 783€
- Laptop: 920€
- INS2I meeting: 71€
- Posters: 70€

Income Caen's University: 4k€

Outcomes

- Internship 1 of the axis Data, knowledge and machine learning: $2180 \in$
- Internship 2 of the axis Data, knowledge and machine learning: 2180€

Income Rouen's University: 8 k€

Outcomes

- Design of a web site and supports for communication : $5050 \in$
- Workshop axis Data, knowledge and machine learning 27/11 : 493€
- 11 Roll up : 1848€

Income Le Havre's University: 3k€

Outcomes:

- Transfer of 2616,3 \in to the University of Caen to pay an internship
- Missions : 383,7 €

Income ENSICAEN: 4k€

Outcomes:

• Transferred to the CNRS.

Income Rouen's INSA: 2,5k€

Outcomes:

- Internship of the axis Complex systems: 2180€
- INS2I meeting : 50€
- Mission for a CNRS training stage : $270 \in$

2.3 Conclusion

The active communication policy of the federation and its insertion in several working groups has provided a new visibility to the main scientific axis of the federation in Normandy. We can cite, the interesting results obtained on the definition of the RIS3 and the ones obtained on the scientific axis defined within the PIA2 framework. Although, the Normand's application to PIA2 has not been successful, we expect that the main scientific axis defined for this application will be used by the newly created COMUE.

One other interesting result of this first year of existence of the federation concerns the closer relationships established between STIC and Mathematics Normand's communities. The governing boards of both federations NormaSTIC and Normandie Mathématiques are convinced of the scientific and politic interest of a close collaboration. The creation of a new doctoral school grouping Normand's mathematicians and computer scientists constitutes an opportunity to enforce the collaborations between both communities.

Scientific axis are now entering in their second year of existence. Several workshops organized by each axis has allowed members of each laboratory to discover more deeply the thematics conducted in the other laboratory. Several master internships paid by NormaSTIC have also allowed deeper point to point collaborations between both laboratories. We expect that each axis should now give rise to several smaller working groups centered on a specific scientific question. These smaller working groups supported by their mother axis, should be the place where a long term collaborative work between both laboratories occurs.

Chapter 3

Projet scientifique pour la période 2017-2021

Le projet scientifique et ses effets structurants seront explicités. Seront également précisés :

- l'organigramme de la structure fédérative;
- le fonctionnement et la composition de l'instance de pilotage;
- les principaux éléments de la convention de fonctionnement entre les unités de recherche fédérées;
- le rôle et la fonction des participants à la structure fédérative et, le cas échéant, des personnels administratifs ou des personnels de recherche employés par la structure (en dehors de ceux qui appartiennent aux unités associées);
- les achats de gros équipements et les financements et cofinancements envisagés.

3.1 Organization of the federation

Federation NormaSTIC has been funded the 1th January 2014 with the organization described in Section 2.1.8 and placed under the administrative umbrella of the CNRS, the ENSICAEN, the Universities of Caen, Rouen, le Havre and the INSA of Rouen. After the creation of the COMUE 'Normandie Université' in December 2014, the convention of NormaSTIC has been modified in order to include Normandie Université as an additional administrative umbrella. The corresponding organization chart is displayed in Figure 3.1. Note that this corrected version of our convention is not yet formally approved by the CNRS.

As mentioned in Section 2.1.8, the governing board of NormaSTIC is composed of :

Its director : Luc Brun

Its assistant director : Stéphane Canu,

The director of the GREYC laboratory : Fréderic Jurie for the next term (the current director is Mohammed M'Saad).



Figure 3.1: Organization chart of the federation with its 7 administrative umbrella including the COMUE. The description of each research² team is provided in annexes. Number between braquets indicate the number of person of each team implied in the axis.

The director of the LITIS laboratory : Thierry Paquet (he remains at the head of the LITIS for two consecutive terms).

The governing board is supported by Agnès Zannier (CNRS) who manages all administrative affairs and the funds provided by the CNRS. Except, Agnès Zannier the federation has no specific staff support. However, the governing board manages the funds allocated by each of the other institutions thanks to the support of the administrative staffs of the GREYC and the LITIS attached to each institution.

A large part of the scientific animation is conducted by the heads of the scientific axis (Sections 2.1.6, 2.2.2 and 3.3) whose names are displayed in Figure 3.1. More precisely, the heads of each scientific axis are in charge of the scientific animation of the research fields covered by their axis. On the other hand, the governing board, arbitrate between the different requests of the scientific animation of the axis is mainly performed through a call for project launch at the beginning of each year (with a deadline usually at the end of February). The applications to this call should be addressed to the heads of each axis who collect the applications and rank them if the total amount of the applications exceeds the funds of the federation. The final decision is performed by the governing board based on the ranking performed by each axis.

Until the formal approval by the CNRS of the new NormaSTIC's convention including the COMUE, the federation council mentioned in Section 2.1.8 will be composed of the governing board and the heads of the different scientific axis.

The convention of the federation specifies that the federation aims at promoting collaborations between the members of both laboratories, to promote the insertion of its members into national or international projects and to increase the visibility of its research fields on a regional and national basis. According to this convention all the funds allocated to NormaSTIC should be managed by a single institution. However, some institutions may manage the funds that they allocate to the federation. Since the CNRS do not belong to the COMUE, we plan for the next terms to ask to gather all the funds provided by our institutions but the CNRS in the COMUE. From a financial point of view we will thus have two main contacts: The CNRS and the COMUE.

3.2 Scientific context

The year 2014 has been quite rich in events since we have seen the birth of the COMUE and its application to a National Project of Investment for the future (PIA2, Section 2.2.1). Unfortunately, this application called Nomand'I-SITE has not been successful. Nevertheless, this application has provided to the COMUE and to all our institutions a clear inventory of the main scientific strengths in Normandy. Such an inventory will certainly serve as a baseline to elaborate the future scientific policies of the COMUE and our institutions.

We thus decided to clearly state and enforce the skills of NormaSTIC regarding the Normand's scientific strengths.

The federation NormaSTIC is strongly concerned with two of the three programs of this application:

1. Innovation, diagnostics and therapeutics with three axis of Excellence:

- (a) chemistry for health,
- (b) nuclear technologies for health,
- (c) genomics.

- 2. Numerical and Information technologies, culture, memory, heritage with three axis of excellence:
 - (a) numerical sciences,
 - (b) support infrastructure to numerical technologies,
 - (c) smart scanning.

Concerning the first program, the federation is already involved in the three identified research fields through researches in chemoinformatics and genomics in the axis Data, Knowledge and machine learning and research in medical image analysis in the axis ImageS. We plan to promote this research skills by enforcing collaborations with the main Normand's actors of this program (Hospitals, Center Cyceron, Baclesse, laboratories of chemistry working in this field).

Concerning the second program, the item 2a created at the initiative of the two federations NormaSTIC and Normandie Mathematics is mainly concerned with the enforcement of collaborations between computer sciences and mathematics fields. The federation NormaSTIC in close collaboration with Normandie Mathematics wants to promote collaborative works between both federations through common call for projects and the conjoint organization of events. The aim of both federations consists to promote the birth of a common scientific culture between both federations. Note that this aim will be supported by the creation of a new doctoral school including all Normand's laboratories in computer science and mathematics.

Item 2c is mainly concerned with the acquisition of a scanning platform which may become a national reference and in parallel with the development of pattern recognition, indexation and new OCR methods in order to analyze the scanned documents. The scanned documents will be mainly patrimonial ones hence involving a strong collaboration between human and computer sciences. The federation NormaSTIC is already involved in the analysis of the scan of old documents through, for example the project DocExplore¹ and PLAIR project (PLateforme d'Indexation Régionale)². The scientific axis of NormaSTIC mainly involved in this research field is the axis Data, Knowledge and machine learning. Note however, that some other axis may also be implied. The federation NormaSTIC wants to promote this research field through an active collaboration with laboratories of human science implied in this projects and a participation to national or international projects such as the current interreg project about e-tourism partially coordinated by NormaSTIC (Section 3.4.1).

3.3 Scientific Animation

3.3.1 Algorithmic and combinatorial

The scientific collaborations inside the Axis will be pursued by organising the ongoing meetings between researchers from all the federation sites.

The exchanges should also be strengthened by the co-supervision of students (Master and eventually PhD Thesis).

The MIDI project was build in the context of the rapprochement of the federation of Mathematics and of NormaSTIC, and should be continued. The meetings between computer scientists and mathematicians organised inside the project were the occasion to invite national and international researchers for a common seminar between the LITIS and the LMRS. It will also be the case for the three-days session planned in September. The project was mainly funded by

¹http://www.docexplore.eu/?lang=fr

²http://www.plair.org

the regional GRR LMN (Grand Réseau de Recherche – Logistique, Mobilité, Numérique), with additional support by NormaSTIC, for the year 2014–15. The funding by the GRR LMN has not been obtained for 2015–16, but the exchanges between the two federations should be maintained. The following tracks are to be followed:

- make the MIDI three-days session a recurrent event, with a biennial regularity at first;
- extend the themes including e.g. statistics and text algorithmics;
- include in theses financing on cross-cutting issues.

3.3.2 Complex systems

The project of complex systems group is a continuum of the previous works by a better focus on some topics. Indeed, the previous workshops of the group allowed us to make clear the interests of the group on topics such as: interaction, dynamic networks and systems, heterogeneous systems. To this end, in the next quinquennium, we will focus the animation of the group around the interaction in dynamic systems from systems with simple reasoning and decision making entities and complex interaction such as cellular automata or bio-inspired multi-agent systems to systems with complex reasoning and decision-making and simple/complex interaction such as decentralized partially observable decision-making or stochastic games in multi-agent systems.

The first class of systems is highly scalable and allow us to deal with a high number of entities while the second class faces the problem of scalability but lead to more sophisticated reasoning and decision-making techniques. Algorithmic problems are thus met and approximate or exact sophisticated algorithms should be developed to scale up well using heuristics, optimisation and structural problems.

In the next quinquennium, the group will be animated by series of focused workshops, particularly on the interaction models, dynamic networks, multi-agent reasoning and decision-making, heterogeneous and dynamic systems. Targeted applications will be also presented in some workshops particularly, intelligent vehicles, robotics, assistant systems. For this latter, the group is involved in an interreg project around intelligent systems for assistance in touristic sites.

3.3.3 ImageS

Main thematics of the axis will be broadened on the following subjects: restoration, segmentation, extraction and selection of attributes, image analysis, information fusion. The different workshops and meetings that already occurred during this first year, and the orientation taken by the regional RIS3 project, confirmed the interest for the two laboratories to work on three main different applications: medical and biomedical imaging, patrimony preservation, and intelligent transport. These applications will then represent a common opportunity to share the methodological and theoretical expertise developed by each lab (e.g. PDEs on graphs, sparse image processing, shape optimization for segmentation, information fusion). We will then continue to encourage both applicative and theoretical workshops. Moreover, some tutorials and technical presentations of the different libraries and platforms developed by each Lab (e.g. GMIC, Pandore, DocExplore) could be valuable and may help us working on the same basis and sharing some methodological aspects. We will also strengthen the collaboration between the LITIS and GREYC teams through the following projects:

1. Participation in the FHU university hospital federation of 3 universities and 3 CHU: Amiens, Rouen and Caen. Our work will focus on bio and medical image processing for computer-aided diagnosis.

- 2. Co-supervision of PhD thesis and master as for example in image processing by machine learning methods.
- 3. Joint organization of both applicative and theoretical scientific meetings.
- 4. Development of collaborations with the other Normastic axes and notably the DAC scientific axis. Indeed, the image data often need to be prepared before applying the high level treatments proposed in this axis such as machine learning methods, indexation, information retrieval.
- 5. Development of collaborations with the MRSH of Caen for the preservation and enhancement of old manuscripts.

Beside these aspects, we also propose to put a "blog" on operation that will be dedicated to the ImageS axis in order to give an "everyday life" to this axis by relaying some information on PhD presentations in each Lab, seminaries, summaries of subjects of interest for the axis, scientific awards or other information that will encourage interaction between lab teams.

Concerning overall organization, Stéphanie Jehan-Besson (GREYC) will replace Abderrahim Elmoataz to be the co-animator with Su Ruan (LITIS) of the ImageS axis.

3.3.4 Data, knowledge and machine learning

In order to strengthen scientific collaborations between LITIS and GREYC team, we want to reinforce the scientific exchanges within the DAC axis by pursuing on going actions such as:

• organization of 2 or 3 workshop days per year around dedicated topics such as discrete optimization, graph kernels, compact descriptors for indexing, similarity between structured contents (trees, graphs, texts), trace data, how to put optimization in data mining, topics from data science with a joint interest from the labs.

We plan to invite international people in the fields to provide a forum for discussion and exchanges of information.

- encourage joint supervised PhD theses and master theses
- support responses to regional, ANR, Interreg and international project calls for proposals

Other actions should be initiated such as:

- organisation of tutorials (like Master courses) on subjects of common interest
- organisation of joint workshop days with the Mathematics Federation
- encourage the creation of specific working groups within the axis

3.4 Connection with socio-economic partners

3.4.1 International partenership

In close collaboration with the management school of Normandy, the federation NormaSTIC is implied in an application to an interreg project with the south of England. The topic of this interreg is the e-tourism and NormaSTIC is in charge of the coordination of the tasks devoted to innovative solutions for a new tourism. Currently we designed four tasks:

- promotion of 2D and 3D cultural heritage
- analysis of the numerical traces of tourists
- smart connected agents for tourist assistance
- recommendation engine.

These four tasks combine skills of NormaSTIC The submission of the application is planed on May 11, 2015.

3.4.2 Regional partenership

The role of NormaSTIC is also to promote innovation through scientific research to help the structuration of the regional IT domain industry. To this end, NormaSTIC is actively involved in the Normandie French Tech project. The French Tech label, awarded by the Ministry of Economy, aims to support the development and internationalization of the most dynamic areas in the digital economy. The idea here is to get closer to the normand IT industries and startups to enhance their development through innovation and help to create new clusters in the IT domain all over Normandy. NormaSTIC will also reinforce its participation in local IT structures or initiatives such as Seine Innopolis or the Normandy Data Lab project that aims at enhancing digital excellence of local economy, particularly through active management and prospective data, to give points for competitiveness and differentiation to create jobs.

The creation of the new region Normandy unifying both lower and higher Normandies rises the question of the scientific policy of the newly created region. More precisely, if the new region keeps the organization of the higher Normandy, the research (from a regional point of view) will be divided into several large networks of research. Each network will concentrates all the supports for its associated research fields. In this case, the federation NormaSTIC, in close collaboration with the federation Normandie Mathematique will support the creation of a large research network focused on the research fields of both federations. The creation of this network will be coherent with the newly created doctoral school(Section 2.2.1) and the will of a stronger collaboration shared by the two federations.

3.5 Conclusion

We conclude this report by a SWOT analysis of the federation:

- **Strength**: NormaSTIC has been quite active during its first year of existence and it appears as the natural representative of the STIC community at a Normand's scale.
- Weaknesses: Despite excellent scientific results, the STIC scientific community does not yet appears as a major interlocutor for its different institutions. This last point may be explained partially by the late structuring of this community which did not allowed it to be implied in Labex or Exquipex projects.
- **Opportunities:** The recent creation of a doctoral school (Section 2.2.1) devoted to mathematics and STIC together with the will of closer collaborations expressed by the governing boards of both federations open the way to the creation of an informal entity whose level of excellence would be comparable to a Labex and which should becomes an important actor of the scientific community in Normandy.

As mentioned in Section 3.4.2, the creation of the new region Normandy may provide an additional tool to structure collaborations between both disciplines in Normandy and a better understanding of the importance of IT and innovation.

Threats: During this first year the different scientific axis have organized several workshops in order to allow each laboratory to understand more deeply the scientific problems attacked by the other laboratory. However, these workshops have covered a wide range of scientific problems in each axis. In order to avoid a lack of interest from the members of each laboratory due to the repetition of such general workshops, each axis should identify more restricted scientific problems and create working groups devoted to each problem. Such working groups should give rise to collaborative works with common publications. The federation will support such initiatives using grants for travels and for hosting members of the federation during their stays in Caen, Rouen or Le Havre.

In order to encourage such collaborative works the call for projects of the federation will be advanced to the end of November with a deadline in February. The governing board of the federation together with the head of the scientific axis will also perform a work of animation in order to apply to National or European projects such as the interreg project mentioned in Section 3.4.1.

Chapter 4

Annexes

4.1 GREYC Organization chart



4.2 LITIS Organization chart

Table 1.3 – Organigramme.			
Equipe de direction			
Directeur	T. Paquet (UR)		
Co-directeurs	A. Bensrhair (INSA), D. Olivier(ULH), T. Lecroq (UR)		
Support administratif			
Secrétariat de direction	F. Bocquet (50 % UR)		
Gestion administrative et financière	F. Bocquet (50 % UR), C. Lemaistre (50 % UR)		
	B. Diarra (50 % INSA), S. Hague (INSA)		
	C. Roussin (50% ULH)		
Support technique			
	P. Tranouez (IR UR), A. Citerin (ASI, 50% UR),		
	F. Hertel (ASI, 50% UR), E. Planterose (IE, 50% INSA),		
	J-F. Brulard (IE, 50% INSA), J. Baudry (IR, ULH)		
Les équipes de recherche			
	F. Guinand (RI2C, ULH)		
	L. Heutte (DocApp, UR)		
	J-G. Luque (C&A, UR)		
	T. Lecroq (TIBS, UR)		
	L. Vercouter (MIND, INSA)		
	P. Vasseur (STI, UR)		
	S. Ruan, P. Vera (QuantIF, UR)		

Le conseil de laboratoire

4.3 GREYC's research teams

4.3.1 AMACC

Two generic concepts, algorithm and complexity are the backbone underlying all the activities of The AMACC team (*Algorithmique, Modèles de calcul, Aléa, Cryptographie, Complexité*). Several complementary points views are developed. The fist one studies computational models or the notion of complexity, n the worst case via complexity classes. The second is concerned with a probabilistic framework with random models.

The AMACC team has also has algorithmic specialities: upstream of the security of information, including coding and cryptography, the team relies on its expertise in information theory and arithmetic. The team has broadened its interests to other themes related to security (Internet of Things or secure embedded environment) or web algorithmics.

The team involves 9 permanent members (1 professor, 7 associate professors and 1 CNRS researcher) and 2 PhD students. The team has also 5 non-permanents collaborators.

4.3.2 Automatique

The control team's research covers the areas of control, signal processing and their applications. The team aims at conducting researches from theoretical developments to experimental implementation and is particularly sensitive to the transfer of the know-how. Its fundamental fields include the identification, observation and control of nonlinear systems. It also conducts methodological researches with view to develop experimental approaches. Many fields of applications have been considered such as the monitoring of biochemical processes, the observation and control of electromechanical systems and the identification and equalization of telecommunication canals.

4.3.3 CoDaG

The "Constraints, Data Mining, Graph" team (CoDaG) performs research activities in the scope of artificial intelligence and data science. Within this area, the team focuses on the three core fields of constraints, data mining and graph and has the originality to seek for links and develop transversal activities between these fields. This scientific context allows the CoDaG team to lead research activities on emergent and promising areas such as cross-fertilization between data mining and constraint programming or sub-polynomial problems in constraint programming. The team is currently involved in several pluridisciplinary research projects in chemoinformatics and hybridization between text mining and Natural Language Processing.

The team is composed of 9 faculty members (4 professors, 5 associate professors), 2 PhD students and 3 non-permanents collaborators.

4.3.4 Electronics

The electronics team (formerly known as the instrumentation team) activities are based on a long term experience of low noise measurements and developments. Our research is centred around the conception/design and device/sensor instrumentation mostly in the fields of bolometry and magnetometry. Our work aim both at the improvement of the device intrinsic performances and at the development of a fully optimized instrumentation around the device, in both cases in order to enhance sensitivity or dynamics of fully integrated sensors.

The team has expertize in micro-technologies and physical characterization that allow us to conduct projects from materials deposition to sensor instrumentation and optimization.

4.3.5 E-payment & Biometrics

The "E-payment & Biometrics" team in the GREYC lab works on research activities in computer security following 2 research topics with a continuity from theoretical to applied research aspects, both of them gaining from the other. Two research topics are considered: trust and biometrics. The "E-payment & Biometrics" team is the academic referent of the E-Secure Transactions cluster. The team involves 11 permanent members (3 professors, 5 associate professors and 3 engineers) and 12 PhD students.

4.3.6 Image

The Image team is composed of 5 Professors, 11 Associate professors, 2 CNRS researchers and 14 PhD students. The objective of this team is the development of new methods in image analysis but also image data processing and pattern recognition. The domains covered by this team can then be decomposed in two main thematics. The first theme is composed of 8 permanent members

and concerns the modelisation aspect and characterization of images (e.g. variational methods, PDEs on graphs, statistical methods, inverse problems, restoration, deformables models, shape and convex optimization). The second theme, composed of 10 permanent members, concerns recognition and information extraction in images and videos (e.g. graphs matching, features description, object recognition, indexing, classification, semi-supervised learning, knowledge engineering for the design and evaluation of applications in image processing...). The assignment of the different members of the Image team is made naturally between the two axis Images and DAC of the Federation according to the main research domain of each member.

4.3.7 MAD

The "Models, Agents, Decision" group (MAD) involves 9 permanent members and around 10 PhD students. Its interests are in Artificial Intelligence problems, in the context of autonomous agents. Its activities can be summarized as follows: "study and propose methods for enabling a group of adaptive, real-time, and resource-constrained agents, evolving in a dynamic environment, to take rational decisions for achieving a mission".

This activities are structured around three axes: Models, Agents, and Decision.

In the "Models" axis, we study models, algorithms, and the complexity of reasoning, in particular reasoning in logic and reasoning about time, space, and preferences, and knowledge compilation problems. In the "Agents" axis, we study multiagent systems, reputation systems, coalition formation, and modelling and formally verifying behaviours. In the "Decision" axis, we study models and algorithms for decision-making, in particular Markov Decision Processes (MDPs), possibly partially observable (POMDPs), decentralized (DEC-MDPs), etc.

The three axes are far from disjoint from each other. Among transversal themes, we study man-robot interaction, integrating knowledge and reasoning with decision-making, heterogenous and open systems, etc. We address all these questions in an integrated perspective, from modelling and theory to implementation, benchmarking, and applications (e.g., multi-robot exploration of unknown zones).

4.4 LITIS' research teams

4.4.1 CA

The CA (Combinatorics & Algorithms) team is composed of 5 Professors and 13 Associate professors, dispatched in 2 geographical sites: among its 18 members, 16 are located at the University of Rouen, 2 at the University of Le Havre. All the members of the CA team are included into the AlgoComb Axis of NormaSTIC.

The Combinatorics and Algorithms team studies the fundamental aspects of computation. Works in the CA team are developed around the combinatorial and algorithmic studies of algebraic models used for information processing (words, free monoids, automata, generating series, polynomial systems), with applications eg. to cryptography. The studies follow two complementary approaches that strongly communicate upstream: the structural approach seeks to classify the different models to compare their expressive powers, but also to enumerate what can be expressed. In the structural frameworks thus defined, algorithmic approach focuses on the effective handling of information. The team is centered around three themes:

- language theory;
- algebraic and enumerative combinatorics;

• cryptography.

4.4.2 DocApp

The "Document and Learning" research team (DocApp for "Document et Apprentissage) is composed of 17 faculty members (7 full professors, 2 associate professors and 8 assistant professors) from University and INSA of Rouen and around 20 PhD students. The team focuses its research on fondamental and applied machine learning and pattern recognition methods for interpreting various data (signal, image, text) that may be diverse from nature, dimensionality, stationarity or coming from heterogeneous contexts.

An important part of our research is devoted to the development of theoretical and algorithmic methods, such as kernel machines (SVM, Kernel PCA, multiple kernel learning), markovian models (multi-stream HMM, random fields, CRF), classification from graphs (graph matching, sub-graph isomorphism, graph classification, graph mining) and model selection (risk estimation, learning with evolutive and unknown costs, hyper-parameter tuning in classifier ensembles). This fondamental research is applied mainly to handwriting and document image analysis (handwriting recognition, word, symbol and pattern spotting, information extraction from handwritten document images or historical manuscripts), signal processing (diagnostic, supervision, brain computer interfaces) and medical image processing (image classification, segmentation).

4.4.3 MIND

The MIND (Multiagent, INteraction, Decision) group develops a research activity in the field of Autonomous Agents and MultiAgent Systems, especially focused on interaction and decision processes involving both human users and software agents. Automatic and semi-automatic decision processes are proposed using reasoning mechanisms from the fields of Artificial Intelligence and Semantic Web in order to cover knowledge representation, cognitive reasoning and trust management issues. Human-Agent interaction is tackled by the definition of interaction patterns that are extracted from traces analysis of real human dialogue. These patterns are used to drive the communicative behavior of artificial conversational agents and to recognize human intentions. The favored applicative domains of our researches are social networks involving human users and software services, e-learning and e-teaching and ambient intelligence. The MIND group is composed by 12 permanent researchers and 4 PhD students

4.4.4 RI2C

RI2C team (Interconnection Networks and Collective Intelligence) aims at studying interactions between entities composing Complex Systems and flows going through these systems. Complex Systems are common in Nature and in Human Societies. They are today at the heart of observations and scientific development of many and various fields like Biology, Physics, Health, Human and Social Sciences, etc. Mathematics and Computer Sciences, that can be considered as Modeling Sciences, pay a special attention to Complex Systems, not only for their application component but also and mainly for their conceptual contents. Their intrinsic characteristics confer to these systems, robustness, adaptability and self-organization properties.

An important part of our researches focuses on the study of these exceptional properties and on the conception of methods and approaches for reproducing and controlling them. A Complex System may present some emergent properties, that may be specific adaptation capabilities or, for instance, a hierarchical organizational structuration on several description scales. A large number of entities interacting locally, a non linear evolution and a strong dynamics are also elements that characterize Complex Systems. Dynamics can be endogenous, but when it is exogenous, it often results from the flows that go through the system leading to a continuous reconfiguration of the system itself and of its internal structures and organizations. We study these systems using a constructive approach by the conception of sets of interacting entities at different scale levels, allowing the representation of entities and their interactions at the micro level while the properties of the whole system are observed at the macro level. The understanding of these different scale levels and their simulation are crucial for the observation and the study of emergence and immergence (feedback) phenomena. When the physical or the topological space plays a role in the processes of interaction, morpho-dynamics reflects the properties of the system. The team builds some models based on dynamic graphs and interaction networks and proposes approaches and algorithms for emergent organization detection, for following the evolution of the system and for the study of flows going through these systems. The team has conceived an API for dynamic graph modeling and processing: GraphStream, an open source software available at http://graphstream-project.org

4.4.5 Quantif

Quantif is one of 7 member teams of LITIS, with 5 professors, 3 associate professors, 5 PhD students and 8 associate members (physicians or computer engineer appointed by the CHB). It is a mixed research team: medicine and image processing. Four professors of the team are University Professor - Hospital Physicians (PU-PH). The research activity is dedicated to the quantification and the characterization of normal / pathological tissues in humans and small animals using in vivo multimodality imaging (MRI, PET/CT, SPECT, CT). The team has a special interest in multimodality / multi-tracer imaging to assist radiotherapy planning and evaluation. The main research topics in image processing field concern image segmentation, data fusion and image classification.

4.4.6 STI

Intelligent Transportation Systems team is composed of 13 faculty members located on the three sites of LITIS laboratory. The main purpose of the ITS team is to explore the various scientific issues related to intelligent transportation systems. In these systems, we deal specifically with two complementary aspects that are respectively systems of vision and perception for static and dynamic scenes and the problematic associated with geo-located data, mobility and real-time constraints.

The first topic deals with the development of theoretical and methodological frameworks for the design of scene analysis systems. Our aim consists in building and updating from sensor measurements (camera, multi-cameras, Lidar, multi-modal cameras, ...) a world modeling allowing a simplified decision process. We then propose methods for 3D reconstruction, mapping, localization, object detection,... From an application point of view, we are particularly interested in help driving systems in order to improve road safety where the goal is to secure the vehicle equipped with sensors that can perceive its nearest environment and to detect possible collisions.

Our second main topic deals with databases that can be embedded in vehicles or located in a fixed infrastructure where two main kinds of data can exist: classical data for which the time is useless and real-time data that can evolve more or less quickly. Our main researches consist in the structuration of the data, their access, their exchange, their consistency, ...

These research topics are driven by many different projects such as FUI PUMAS, EMOTIVE and CODRIVE, but also ANR DrAACaR, Interreg Savemore and some regional projects.

4.4.7 TIBS

The "Information Processing in Biology and Health" (TIBS for Traitement de l'Information en Biologie Santé) is a multidisciplinary research team composed of 12 faculty members and around ten PhD students. The team focuses its research on (i) the indexing and retrieval of multi-terminology, multi-domain and inter-language information in health, especially for clinical and *omics data; and (ii) indexing and information retrieval in biological data coming in particular from high-throughput sequencing.

The proposed solutions are multidisciplinary by making interact computer scientists, medical specialists, biologists, statisticians and professionals in information science. Among the team skills, one can cite for example string matching algorithms, bioinformatics, genomic, statistics, automatic indexing and retrieval of multi-terminology information, terminology intra and inter interoperability and bibliometrics.