



# Activity Report 2019

## Team EXPRESSION

### Expressiveness in Human Centered Data/Media

D6 – Media and Interaction Department





# 1 Team composition

## 1.1 Composition

### Head of the team

Pierre-François Marteau, Professor, Université Bretagne Sud

### Administrative assistants

Sylviane Boisadan, Université Bretagne Sud

Angélique Le Penec, Université de Rennes 1

Joëlle Thépault, Université de Rennes 1

### Permanent members

Nelly Barbot, Associate professor, Université de Rennes 1

Vincent Barraud, Associate professor, Université de Rennes 1

Nicolas Béchet, Associate professor, Université Bretagne Sud

Giuseppe Bério, Professor, Université Bretagne Sud

Jonathan Chevelu, Associate professor, Université de Rennes 1

Arnaud Delhay-Lorrain, Associate professor, Université de Rennes 1

Sylvie Gibet, Professor, Université Bretagne Sud

Caroline Larboulette, Associate professor, Université Bretagne Sud

Gwénolé Lecorvé, Associate professor, Université de Rennes 1

Damien Lolive, Associate professor, Université de Rennes 1

Gildas Ménier, Associate professor, Université Bretagne Sud

Jeanne Villaneau, Associate professor (emeritus), Université Bretagne Sud

### External collaborator

Elisabeth Delais-Roussarie, Senior researcher, CNRS/LLF

⇒ Simon Giddings, Engineer, Université de Rennes 1 (January-July 2019)

Jean-François Kamp, Associate professor, Université Bretagne Sud

Farida Said, Associate professor, Université Bretagne Sud

### Non-permanent members

→ Nazanin Dehghani, Post-doctoral researcher, Université de Rennes 1 (from August 2019)

Quentin Di-Fant, Engineer, Université de Rennes 1 (from November 2018)

⇒ Cédric Fayet, Université de Rennes 1, ATER (from September 2018 to August 2019) and Post-doc (October-December 2019)

→ Hassan Hajipoor, Research Engineer, Université de Rennes 1 (from August 2019)

→ Simon Giddings, Engineer, Université de Rennes 1 (from November 2019)

← Rémy Kessler, Post-doctoral researcher, Université de Bretagne Sud (since December 2016)

← Waseem Safi, Post-doctoral researcher, Université de Rennes 1 (from November 2018 to September 2019)

→ Gaëlle Vidal, Engineer, Université de Rennes 1 (from September 2017)

**PhD students**

- Lucie Naert, Université Bretagne Sud, CDE, final year
- Oussama Ahmia, Université Bretagne Sud, CDE, Thèse CIFRE OctopusMind, 3rd year
- ← Nicolas Bloyet, Université de Bretagne Sud, Thèse CIFRE Seed, 3rd year
- Stefania Pecóre, Université de Bretagne Sud, final year (defended on January 2019)
- Antoine Perquin, Université de Rennes 1, CD INSA, 2nd year
- ← Clément Reverdy, Université Bretagne Sud, CDE+ANR InGredible, defended in December 2019
- Meysam Shamsi, Université de Rennes 1, ARED/CD22, 3rd year
- Aghilas Sini, Université de Rennes 1, LABEX EFL/ANR SynPaFlex, 3rd year
- Ahmad Alaa Eddine, Université Bretagne Sud/Lebanese University, CIOES, 3rd year
- Valentin Durand De Gevigney, Université Bretagne Sud, DGA/CDE, 1st year
- Betty Fabre, Université de Rennes 1, CIFRE Orange Labs, 1st year
- Tiago Brizolara, Université Bretagne Sud, ARED/CD56, 1st year
- Jade Mekki, Université de Rennes 1, ANR TREMoLo, 1st year
- Esso-Ridah Bléza, Université Bretagne Sud, CIFRE, 1st year
- Somaye Jafaritzehjani, Université de Rennes 1, CDE/TU Dublin, 1st year
- Clémence Mertz, Université de Rennes 1, CDE/LTC, 1st year (From December 2019)

**Master students**

- ⇒ Alexis Blandin, Université de Rennes 1, ENSSAT
- ⇒ Aline Étienne, Université de Rennes 1, Université Paris-Nanterre
- ⇒ Clémence Mertz, EFREI
- Olivier Zhang, Université de Rennes 1, INSA/M2R

**1.2 Evolution of the staff**

The permanent staff has been stable during the year. The number of PhD students decreases with 3 PhD defense, against 1 newly hired PhD student: Esso-Ridah Bléza.

The PhD defense of Stefania Pecóre was held on 28th January 2019. Stefania Pecóre holds since February 2019 a postdoc position at MITACS, Ottawa University, Canada. Clément Reverdy's defense was held on the 13th of December 2019. Clément holds an engineering position at La Tour Azur in Malestroit. Nicolas Bloyet's PhD was held the 19th december 2019. Nicolas holds an engineer position at See-d startup in Vannes.

**2 Overall objectives**

Expressivity or expressiveness are terms which are often used in a number of domains. In biology, they relate to genetics and phenotypes, whereas in computer science, expressivity of programming languages refers to the ability to formalize a wide range of concepts. When it comes to human expressivity, we will consider the following reading:

expressivity is the way a human being conveys emotion, style or intention. Considering this definition, the EXPRESSION team focuses on studying human language data conveyed by different media: gesture, speech and text. Such data exhibit an intrinsic complexity characterized by the intrication of multidimensional and sequential features. Furthermore, these features may not belong to the same representation levels - basically, some features may be symbolic (e.g., words, phonemes, etc.) whereas others are digital (e.g., positions, angles, sound samples) - and sequentiality may result from temporality (e.g., signals).

Within this complexity, human language data embed latent structural patterns on which meaning is constructed and from which expressiveness and communication arise. Apprehending this expressiveness, and more generally variability, in multidimensional time series, sequential data and linguistic structures is the main proposed agenda of EXPRESSION. This main purpose comes to study problems for representing and characterizing heterogeneity, variability and expressivity, especially for pattern identification and categorization.

The research project targets the exploration and (re)characterization of data processing models in three mediated contexts:

1. Expressive gesture analysis, synthesis and recognition,
2. Expressive speech analysis and synthesis,
3. Expression in text and language.

## 2.1 Main challenges addressed by the team

Four main challenges will be addressed by the team.

**C1:** The characterization of the expressiveness as defined above in human produced data (gesture, speech, text) is the first of our challenges. This characterization is challenging jointly the extraction, generation, or recognition processes. The aim is to develop models for manipulating or controlling expressiveness inside human or synthetic data utterances.

**C2:** Our second challenge aims at studying to what extent innovative methods, tools and results obtained for a given media or for a given pair of modality can be adapted and made cross-domain. More precisely, building comprehensive bridges between discrete/symbolic levels (meta data, semantic, syntactic, annotations) and mostly continuous levels (physical signals) evolving with time is greatly stimulating and nearly not explored in the different scientific communities.

**C3:** The third challenge is to address the characterization and exploitation of data-driven embeddings<sup>1</sup> (metric or similarity space embeddings) in order to ease post-processing of data, in particular to reduce the algorithmic complexity and meet the real-time or big-data challenges. The characterization of similarity in such

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<sup>1</sup>Given two metric or similarity spaces  $(X, d)$  and  $(X', d')$ , a map  $f : (X, d) \rightarrow (X', d')$  is called an embedding.

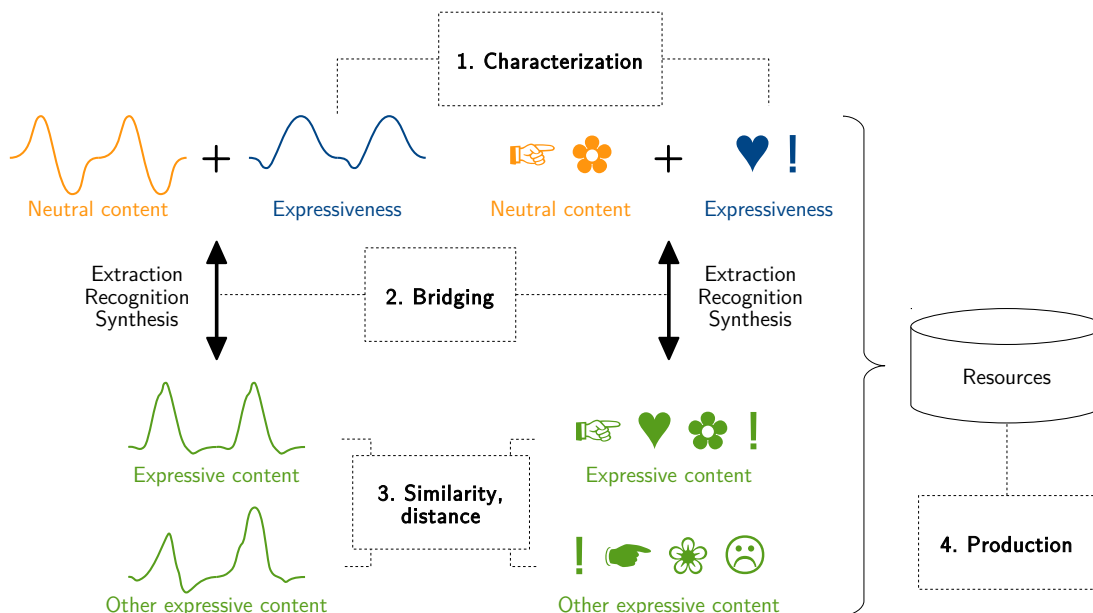


Figure 1: Overview of the main challenges considering both on continuous numerical (left) and discrete symbolic (right) data.

embeddings is a key issue as well as the indexing, retrieval, or extraction of sub-sets of data relevant to user’s defined tasks and needs, in particular the characterization of expressiveness and variability.

**C4:** The fourth challenge is to contribute to the production of resources that are required, in particular to develop, train and evaluate machine learning (statistical or rule-based) models for human language data processing. These resources are mainly corpora (built from speech, text and gesture time series), dictionaries, and semantic structures such as ontologies.

All the addressed challenges are tackled through the development of models, methods, resources and software tools dedicated to represent and manage gesture, speech or textual data. Thus we consider a complete processing chain that includes the creation of resources (corpus, thesaurus, semantic network, ontology, etc.), the labeling, indexing and retrieval, analysis and characterization of phenomena via classification and extraction of patterns (mostly sequential).

These challenges also target multi-level aspects, from digital tokens to semantic patterns, taking into account the complexity, the heterogeneity, the multi-dimensionality, the volume, and the nature of our temporal or sequential data.

We are aiming at addressing these challenges in terms of development and exploitation of machine learning and pattern discovery methods for clustering, classification, interactive control, recognition, and production of content (speech signals, texts or gestures), based on different levels of representation (captured or collected data but also knowledge that is specific to the media or the considered application). Finally, both objective and subjective (perceptive) evaluations of these models are a key issue of the research directions taken by the EXPRESSION team.

## 2.2 Main research focus

Five thematic lines of research are identified to carry out this research.

**RF1: Data acquisition** – Gesture, speech or text data are characterized by high levels of heterogeneity and variability. Studying such media requires high quality data sets appropriate to a well defined and dedicated task. The data acquisition process is thus a crucial step since it will condition the outcomes of the team research, from the characterization of the studied phenomena, to the quality of the data driven models that will be extracted and to the assessment of the developed applications. The production of high quality and focused corpora is thus a main issue for our research communities. This research focus addresses mainly the fourth challenge;

**RF2: Multi-level representations** – We rely on multi-level representations (semantic, phonological, phonetic, signal processing) to organize and apprehend data. The heterogeneity of these representations (from metadata to raw data) prevents us from using standard modeling techniques that rely on homogeneous features. Building new multi-level representations is thus a main research direction. Such representations will provide efficient information access, support for database enrichment through bootstrapping and automatic annotation. This research focus contributes mainly to the second, third and fourth challenges;

**RF3: Knowledge extraction** – This research addresses data processing (indexing, filtering, retrieving, clustering, classification, recognition) through the development of distances or similarity measures, rule-based or pattern-based models, and machine learning methods. The developed methods will tackle symbolic data levels (semantic, lexical, etc.) or time series data levels (extraction of segmental units or patterns from dedicated databases). This research focus contributes mainly to the first and third challenges.

**RF4: Generation** – We are also interested in the automatic generation of high-quality content reproducing human behavior on two modalities (gesture and speech). In particular, to guarantee adequate expressiveness, the variability of the output has to be finely controlled. For gesture, statements and actions can be generated from structural models (composition of gestures in French sign language (LSF) from parameterized linguistic units). For speech, classical approaches are data-driven and rely either on speech segment extraction and combination, or on the use of statistical generation models. In both cases, the methods are based at the same time on data-driven approaches and on cognitive and machine learning control processes (e.g., neuromimetic). This research focus contributes mainly to the first and fourth challenges since generation can be seen also as a bootstrapping method. As parallels can be possibly drawn between expressive speech and expressive movement synthesis, the focus also contributes to the second challenge;

**RF5: Use cases and evaluation** – The objective is to develop intuitive tools and in particular sketch-based interfaces to improve or facilitate data access (using different modes of indexing, access content, development of specific metrics, and graphical interfaces), and to integrate our aforementioned models into these tools.

As such, this focus contributes to the first challenge and has a direct impact on the fourth challenge. Furthermore, whereas many encountered sub-problems are machine learning tasks that can be automatically evaluated, synthesizing human-like data requires final perceptive (i.e., human) evaluations. Such evaluations are costly and developing automatic methodologies to simulate them is a major challenge. In particular, one axis of research directly concerns the development of cross-disciplinary evaluation methodologies. This research focus contributes also to the second challenge;

### 3 Scientific achievements

#### 3.1 New Results by Key Issues

In accordance with the Team Project, the main outcomes for 2019 are listed into the following key issues items defined above for the team:

Knowledge  
extraction

**Anomaly detection in the scope of intrusion detection by mean of a sequence covering similarity [7]:** This work introduces the covering similarity, formally defined for evaluating the similarity between a symbolic sequence and a set of symbolic sequences. A pair-wise similarity can also be directly derived from the covering similarity to compare two symbolic sequences. An efficient implementation to compute the covering similarity has been proposed that uses a suffix tree data-structure, but other implementations, based on suffix array for instance, are possible and possibly necessary for handling large scale problems. We have used this similarity to isolate attack sequences from normal sequences in the scope of Host-based Intrusion Detection. We have assessed the covering similarity on two well-known benchmarks in the field. In view of the results reported on these two datasets for the state of the art methods, and according to the comparative study we have carried out based on three challenging similarity measures commonly used for string processing or in bioinformatics. We have shown that the covering similarity is particularly relevant to address the detection of anomalies in sequences of system calls in a zero day attack setting.

Knowledge  
extraction

**Canonical form of Graphs using Rooted-Trees [3]:** Graphs increasingly stand out as an essential data structure in the field of data sciences. To study graphs, or sub-graphs, that characterize a set of observations, it is necessary to describe them formally, in order to characterize equivalence relations that make sense in the scope of the considered application domain. Hence we seek to define a canonical graph notation, so that two isomorphic (sub) graphs have the same canonical form. Such notation could subsequently be used to index and retrieve graphs or to embed them efficiently in some metric space. Sequential optimized algorithms solving this problem exist, but do not deal with labeled edges, a situation that occurs in important application domains such as chemistry. We present in this article a new algorithm based on graph rewriting that provides a general and complete solution to the graph canonization problem.



Although not reported here, the formal proof of the validity of our algorithm has been established. This claim is clearly supported empirically by our experimentation on synthetic combinatorics as well as natural graphs. Furthermore, our algorithm supports distributed implementations, leading to efficient computing perspectives.

**Sparsification of the Alignment Path Search Space in Dynamic Time Warping [9]:** This work addresses the sparsification of the alignment path search space for Dynamic Time Warping (DTW) like measures, essentially to lower their computational cost without losing on the quality of the measure. As a result of our sparsification approach, two new (dis)similarity measures, namely SP-DTW (Sparsified-Paths search space DTW) and its kernelization SP-K rdtw (Sparsified-Paths search space K rdtw kernel) are proposed for time series comparison. A wide range of public datasets is used to evaluate the efficiency (estimated in term of speed-up ratio and classification accuracy) of the proposed (dis)similarity measures on the 1-Nearest Neighbor (1-NN) and the Support Vector Machine (SVM) classification algorithms. Our experiment shows that our proposed measures provide a significant speed-up without losing on accuracy. Furthermore, at the cost of a slight reduction of the speedup they significantly outperform on the accuracy criteria the old but well known Sakoe-Chiba approach that reduces the DTW path search space using a symmetric corridor.

Knowledge  
extraction

**Times series averaging and denoising from a probabilistic perspective on time-elastic kernels [8]:** In the light of regularized dynamic time warping kernels, this paper re-considers the concept of time elastic centroid for a set of time series. We derive a new algorithm based on a probabilistic interpretation of kernel alignment matrices. This algorithm expresses the averaging process in terms of a stochastic alignment automata. It uses an iterative agglomerative heuristic method for averaging the aligned samples, while also averaging the times of occurrence of the aligned samples. By comparing classification accuracies for 45 heterogeneous time series datasets obtained by first nearest centroid/medoid classifiers we show that: i) centroid-based approaches significantly outperform medoid-based approaches, ii) for the considered datasets, our algorithm that combines averaging in the sample space and along the time axes, emerges as the most significantly robust model for time-elastic averaging with a promising noise reduction capability. This way of averaging set of time series has been successfully applied to the denoising of GPS road segments [6].

Knowledge  
extraction

**Etude lexicographique de sous-graphes pour l'élaboration de modèles structures à activité à cas de la chimie organique [12]:** Structure activity models (QSARs) seek to extract useful information in structural observations, with the aim of associating structural elements with macroscopic activity. A typical example is that of organic chemistry, where certain physical and chemical properties of a molecule are a function of its internal arrangement (conformation). In particular, we extract and analyze characteristic substructures, called functional groups or fragments, that are similar to subgraphs, as well as link structures. We propose a lexicographic analysis of these

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fragments and show that they follow approximately power laws, close to the Zipf laws observed in the context of natural languages. In pursuing this analogy, we develop the notion of "fragmentation" (fragment-embedding). We show the interest of this notion and deduce some perspectives.

Knowledge  
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**Utilité d'un couplage entre Word2Vec et une analyse sémantique latente : expérimentation en catégorisation de données textuelles [10]:** In this work, we review text-based methods in a document classification framework. We study methods based on word (word2vec) or or document (latent semantic analysis, or bag of words associated with various weights) embeddings as well as certain combinations of these methods. To this end, we evaluate these vectorization methods using three classification models (a multilayer perceptron, a linear vector machine, and a naive Bayes multinomial classifier). Our results show that the proposed model dedicated to associate word2vec and LSA methods, which combines two complementary characterizations of the word occurrence context (local for word2vec and global for LSA), makes it possible to produce a robust vectorization, which is generally more discriminating than the other tested approaches.

Knowledge  
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multi-level  
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**Similarité par recouvrement de séquences pour la fouille de données séquentielles et textuelles [16]:** From the notion of sequence covering similarity [7] to estimate the similarity between a sequence and a set of sequences, we derive a discriminant model dedicated to the classification of textual data whose algorithmic complexity does not depend on the size of the learning set, but only on the number of classes and the length of the sequences. The preliminary experimental study presented is based on two benchmarks: the first relates to nucleotide sequences, the second to a classification of texts. The results that are obtained position the proposed method within the state-of-the-art approaches (including deep learning approaches) on the tasks under consideration.

Generation

**Skeletal mesh animation driven by few positional constraints [5]:** A general method for driving kinematics by distances and more specifically for controlling kinematically articulated systems has been developed. Unlike traditional approaches, the problem is addressed in the metric space using distances belonging to points of the skeleton and to the environment. After defining kinematic control through a distance-based formalization, an optimization method for solving classic issues such as motion adaptation and inverse kinematics has been proposed. The originality of the method lies in the possibility to introduce distance constraints with priorities. The approach is validated by a large variety of experiments in the field of motion control of articulated figures, and compared to other approaches by means of stability, convergence and performance issues.

Generation

**Kinematics in the metric space [4]:** A whole animation pipeline for data-driven character animation has been proposed. Considering that the traditional animation pipeline, including skeleton reconstruction from markers, rigging and retargeting, is subject to potential loss of information and precision, the objective is to control in real-time articulated meshes from a low number of positional constraints. The proposed method is based on an efficient deformation technique that integrates into a volumetric control structure the high resolution mesh, the skeleton, as well as relevant marker locations. An iterative optimization method, which preserves both geometric characteristics, segment lengths and joint limits, is applied to this structure. The ability of the system to interactively animate and deform high-resolution models from few positional constraints, while keeping all the details of the movement is showed and demonstrated in several simulation examples, from movement edition, retargeting, to hand animation with corrections in French sign language.

**Phone-Level Embeddings for Unit Selection Speech Synthesis [18]:** Objective evaluation of embeddings for speech synthesis guided by neural networks. The evaluation of embeddings extracted from neural networks is complex. The quality of embeddings is relative to the task it was trained for and the evaluation of this task may be a lengthy and costly process if human annotators are involved. Thus, it may be useful to estimate their quality using fast and reproducible objective measures on auxiliary tasks. In the continuation of work started in 2018, this work introduces a generic method to estimate the quality of an embedding. This method is applied to speech synthesis based on unit selection guided by neural networks and allows to compare two systems.

Generation

**Towards the Automatic Processing of Language Registers: Semi-supervisedly Built Corpus and Classifier for French [15]** Language registers are a strongly perceptible characteristic of texts and speeches. However, they are still poorly studied in natural language processing. In this work, we have developed a semi-supervised approach which jointly builds a corpus of texts labeled in registers and an associated classifier. This approach relies on a small initial seed of expert data. After massively retrieving web pages, it iteratively alternates the training of an intermediate classifier and the annotation of new texts to augment the labeled corpus. The approach is applied to the casual, neutral, and formal registers, leading to a 750M word corpus and a final neural classifier with an acceptable performance.

Data acquisition, multi-level representation

**Prediction of age recommendations for children's access to texts** Understanding a text or a speech is conditioned by the capacities and knowledge of the reader or listener. In the case of a child, it is therefore interesting to determine how the age influences this understanding. Psycholinguistic studies have studied this problem closely in order to establish to what extent a text is, or is not, intended for a child. At the same time, advances in natural language processing open up new possibilities for studying information from texts. Hence, a new research has been opened to investigate

Knowledge extraction, multi-level representation [22, 23]

to determine an age recommendation for a text intended for children. This has resulted in two M.Sc. internships: one about deepening linguistic aspects that may be important, especially regarding the emotions that can be found in texts [23] ; the other about implementing a first machine learning prediction for age recommendation [22]. These activities have led to a new ANR project, shared with University of Paris-Nanterre (MoDyCo lab) and industrial partners. Especially, a PhD will start in January 2020.

Knowledge  
extraction,  
to appear in  
ICDIM/DDP  
2019 [13]

**Extraction of terminology in the field of construction** We describe a corpus analysis method to extract terminology from a collection of technical specifications in the field of construction. Using statistics and word n-grams analysis, we extract the terminology of the domain and then perform pruning steps with linguistic patterns and internet queries to improve the quality of the final terminology. Results are evaluated by using a manual evaluation carried out by 6 experts in the field.

Knowledge  
extraction,  
to appear in  
ICDIM/DDP  
2019 [14]

**A word embedding approach to explore a collection of discussions of people in psychological distress** In order to better adapt to society, an association has developed a web chat application that allows anyone to express and share their concerns and anguishes. Several thousand anonymous conversations have been gathered and form a new corpus of stories about human distress and social violence. We develop a method of corpus analysis combining unsupervised learning and word embedding in order to bring out the themes of this particular collection. We compare this approach with a standard algorithm of the literature on a labeled corpus and obtain excellent results. An interpretation of the obtained clusters collection confirms the interest of the method.

Knowledge  
extraction

**La vulnérabilité dans le dire: de la mise en mots du stigmaté à sa construction sociale [2]** This contribution analyzes devices for staging speech to improve the quality of public aid, devices that emerged in France in the 1990s; we are working on a corpus of 30 conversations in the form of a webchat extracted from a larger corpus of 10 years of archives of an association that fights against suicide. The webchat is a space that allows anyone to express and share with a volunteer listener their concerns, their discomforts and the problematic aspects of their existence. The purpose of this contribution is both to study the putting into words of the status of weak actor, and the dynamics of vulnerability in the course of the exchange. We will approach these conversations through the prism of discourse analysis by focusing on the presentation of self in callers and on the construction of the interlocutor in listeners through enunciative staging and different forms of reformulation by callers. This contribution allows us to show how the ambivalence of the notion of weak actor has an impact on the technodiscursive device of webchat by making vulnerable speech audible but at the same time contributing to the maintenance of the social status of the vulnerable person.

Generation,  
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**Corpus Design using Convolutional Auto-Encoder Embeddings for Audio-Book Synthesis [19, 21, 20]** These works are carried out within the framework of the PhD-thesis of Meysam Shamsi. We propose an approach for script selection in order to design TTS speech corpora. A Deep Convolutional Neural Network (DCNN) is used to project linguistic information to an embedding space. The embedded representation of the corpus is then fed to a selection process to extract a subset of utterances which offers a good linguistic coverage while tending to limit the linguistic unit repetition. We present two selection processes: a clustering approach based on utterance distance and another method that tends to reach a target distribution of linguistic events. We compare the synthetic signal quality of the proposed methods to state of art methods objectively and subjectively. The subjective and objective measures confirm the performance of the proposed methods in order to design speech corpora with better synthetic speech quality. The perceptual test shows that our TTS global cost can be used as an alternative to synthetic overall quality. This first study is carried out using a unit selection TTS system.

Secondly, we consider this reduced voice optimized for a unit selection system using a CNN-based model as a baseline. It is compared to a hybrid TTS system that uses, as its target cost, a linguistic embedding built for the recording script design step. This approach is also compared to a standard hybrid TTS system trained only on the voice and so that does not have information about the corpus design process.

Objective measures and perceptual evaluations show how the integration of the corpus design embedding as target cost outperforms a classical hard-coded target cost. However, the feed-forward DNN acoustic model from the standard hybrid TTS system remains the best. This emphasizes the importance of acoustic information in the TTS target cost, which is not directly available before the voice recording.

**Analogical proportions and analogy between concepts [1, 11, 17]** Reasoning by analogy plays an important role in human thinking, in exploring parallels between situations. It enables us to explain by comparing, to draw plausible conclusions, or to create new devices or concepts by transposing old ones in new contexts. A basic form of analogy, called Analogical Proportion (AP), describes a particular relation between four objects of the same kind, e.g. "A calf is to a bull as a foal is to a stallion". It is only recently that researchers have started to study APs in a formal way (APs are statements of the form " $A$  is to  $B$  as  $C$  is to  $D$ ", where  $A, B, C, D$  are generally items of the same nature) and to use their properties in different tasks of artificial intelligence (AI). In collaboration with Laurent Miclet, former Emeritus Professor at University of Rennes 1, and Henri Prade, CNRS Research Director at IRIT, our works follow this line of research. Specifically, we are interested in giving the definition and some properties of an AP in lattices, a widely used structure in AI. We give general results before focusing on Concept Lattices, with the goal to investigate how analogical reasoning could be introduced in the framework of Formal Concept Analysis (FCA). This leads us to define an AP between formal concepts and to give algorithms to compute them, but also to point to special subcontexts, called analogical complexes. They are themselves organized as a lattice, and we show that they are closely related to APs between concepts, while not needing the complete construction of the lattice. We relate

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extraction

them to another form of analogy, called Relational Proportion, which involves two universes of discourse, e.g. "Carlsen is to chess as Mozart is to music", which leads to the more compact way of saying "Carlsen is the Mozart of chess", which is not anymore a relation between four objects of the same kind, but can be interpreted as well in FCAs framework. Relational proportions are formulated as described as "object  $A$  has the same relationship with attribute  $a$  as object  $B$  with attribute  $b$ " and we derive how relational proportions can be obtained in a formal context from the identification of an analogical complex.

Additionally, in order to extract and qualify such analogies in numerical way in future works, we study in [17] how to associate a distance to a finite partially ordered set, using the tools of FCA. In particular, its application to concept lattices allows us to equip this lattice with a distance depending only on its structure. We also study the links between this distance and the notion of analogical proportion in a concept lattice.

### Summary of the contributions

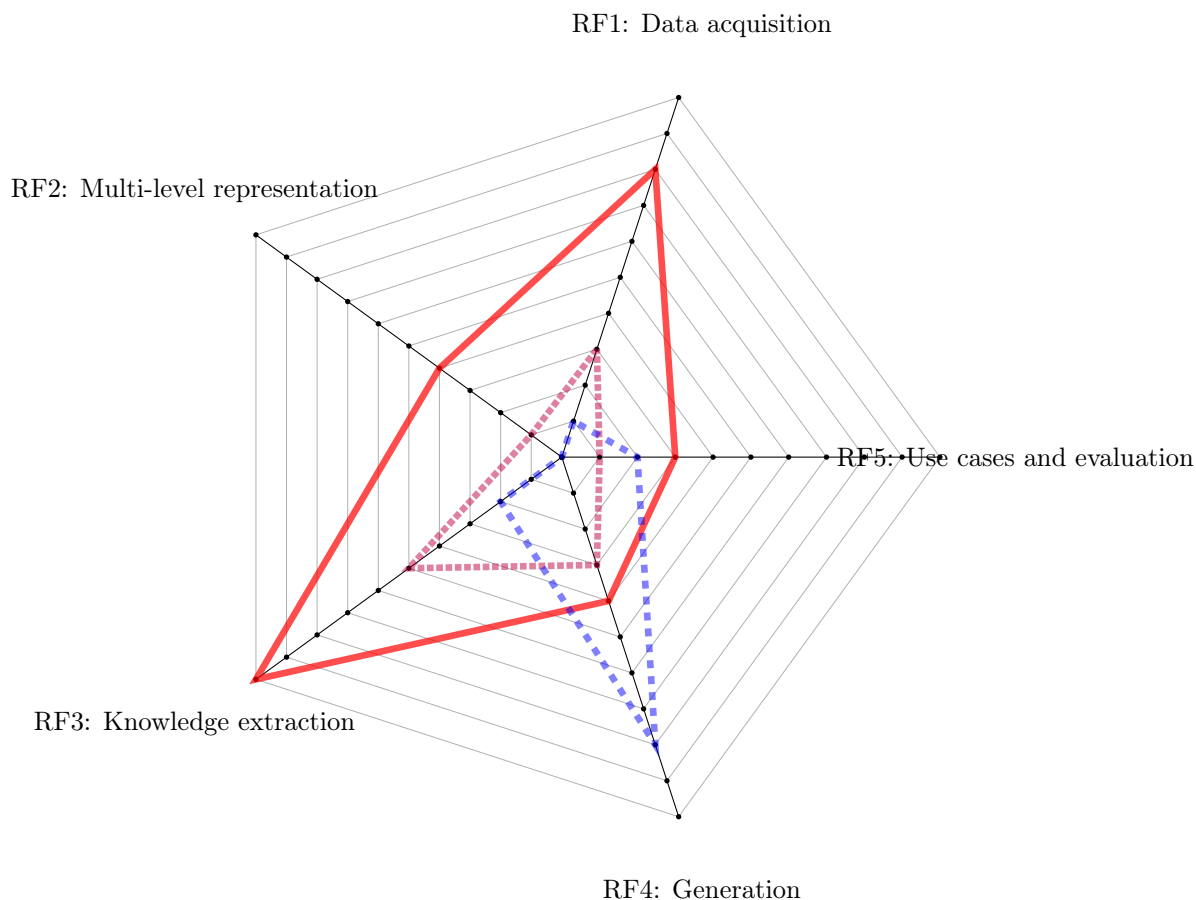


Figure 2: Contributions to each research focus of the team in 2018 (red, solid) compared to 2017 (purple, dotted) and 2016 (blue, dashed)

### 3.2 Defended PhDs and HDRs

- Clément Reverdy defended his PhD on the 13th of December 2019.
- Nicolas Bloyet defended his PhD on the 17th of December 2019.

### 3.3 On going PhDs

1. Oussama Ahmia is finishing his 4th year PhD research program (in the context of a CIFRE grant with the Jurismarchés, renamed OctopusMind, company). His main research contribution this year has been mainly to proposed some efficient hierarchical attention models to categorize (classification and clustering) automatically call for tenders publications. A mixture of Latent Semantic Indexing and Word2vect embedding has been proposed and evaluated with success through Deep Neural Networks (CNN) architecture with attention. These results have been published in EGC 2019 (long paper). The submission of an article a journal papers is being written, as well as Oussma's PhD manuscript. His PhD defense will be held the 6th of March 2020.
2. Nicolas Bloyet has completed his 3rd year of research (in the context of a CIFRE grant with the SEED company). Nicolas Bloyet has finalized his thesis entitled "Characterization and embeddings of colored subgraphs: application to quantitative structure-activity relationship (QSAR) models". Nicolas's thesis addressed the prediction of chemical properties of molecules through graph characterization. More generally speaking, it addresses graph isomorphism, graph canonization, graph fragmentation and graph embedding for fully labelled (or colored) graphs. The application area is indeed quite large although Nicolas focused essentially on QSAR prediction and regression. By means of graph fragmentation, Nicolas adapted methods used in automatic processing of natural languages to achieve this goal. To implement them, more theoretical work was needed, especially on the graph isomorphism problem that lead him to proposed an original algorithm, called SCOTT, to provide a canonical representation of colored graphs, either taking the form of strings or canonical adjacency matrices. The results obtained on classification / regression tasks are at least competitive with the state of the art, and even sometimes better, in particular on restricted data sets, attesting some opportunities for transfer learning in this field.
3. Clément Reverdy has defended his PhD in December 2019. His research addresses the issue of data-driven annotation and synthesis of facial expressions in French sign language (LSF). In LSF, facial expressivity is particularly important since it is the vector of numerous information (e.g., affective, clausal or adjectival). Clément's thesis aims to integrate the facial aspect of LSF into the concatenative synthesis system of the team to edit and synthesize new LSF content with a visualization through an animated virtual character. Thus, a processing pipeline is proposed, from data capture via a MoCap device to facial animation of the avatar from these data and to automatic annotation of the corpus thus constituted. The first contribution of this thesis concerns the employed methodology and the representation by blendshapes, both for the synthesis of facial animations and for

automatic annotation. It enables the analysis/synthesis scheme to be processed at an abstract level, with homogeneous and meaningful descriptors. The second contribution concerns the development of an automatic annotation method based on the recognition of expressive facial expressions using machine learning techniques. The last contribution lies in the synthesis method, which is expressed as a rather traditional optimization problem but in which a Laplacian-based energy quantifying the deformations of a surface has been included as regularization energy. The results of the synthesis system have been evaluated and validated through two perceptual studies.

Keywords: facial expressions, French sign language (LSF), data-driven synthesis, annotation through machine learning, perceptual studies

4. Lucie Naert has completed her third year of PhD. During this year, she augmented her original MoCap corpus, the *LSF-ANIMAL* corpus, with the data of a new signer to add inter-personal variations and grammatical mechanisms of LSF (pointing gestures, size and shape specifiers, proforms...). She designed a perceptual evaluation to test the quality of the data present in the *LSF-ANIMAL* corpus. She collected and processed the answers of 50 participants (deaf, hard of hearing, and hearing people) to validate her corpus. She developed simple methods for the synthesis of new signs from existing data which have not yet been validated. She is currently working on the redaction of her thesis.
5. Stefania Pecore has completed 3rd year of PhD and has defended her PhD the 28th january 2019. The topic of her research is sentiment analysis and, more precisely, detection of opinion from review extracted from French websites. A Movie and Book Annotations corpora in French Language for Aspect Based Sentiment Analysis has been developed and presented at LREC 2018 [?]. Some experiments using classical statistical tools (SVM and Logistic Regression) have suggested directions to follow in order to address the shortcomings of the bag-of-words approach. Some experiment have been conducted around the contribution of the negation in opinion mining and the extraction of words and patterns from manually annotated data to enrich a French opinion lexicon. The PhD defense of Stefania Pecore is scheduled the 28th of January 2019.
6. Ezzo-Ridah Bleza has started his PhD in July 2019. His research focuses on flow and time series analysis applied to homecare assistance: how to make best use of environmental data collected in a minimally intrusive way in the housing of vulnerable people is the primary question that the JANASENSE start-up is seeking to resolve. The first six months have been devoted to collect few sample data to assess a proof of concept for detecting the main activities and their duration in a day period (activity in the bathroom (shower, tooth-brushing, etc.), in the kitchen (cooking, eating) in the living room (reading, watching tv, etc.), or in the room (sleeping, reading, etc.). This activity recognition task is currently covered using classical machine learning approaches.
7. Antoine Perquin has completed his 3rd year of PhD. He has moved in November 2019 to the National Institute of Information (NII, Tokyo, Japan) for a 5-month stay. His research addresses new paradigms of speech synthesis opened by recent advances in neural networks and deep learning. The goal of the PhD is to enable



generating flexible speech samples based on heterogeneous and massive data. A key aspect within this work lies in properly describing and representing speech variability without relying on expert knowledge. This differs from related work where models are usually trained to produce speech signals, not descriptions, and they are always trained on carefully limited data. During his second year, Antoine has experimented different ways to extend state-of-the-art approaches in order to generate synthetic speech signal with new speakers and new accents, without requiring any new training phase. He presented results about the evaluation of embeddings for text-to-speech at the conference TALN [18].

8. Meysam Shamsi started his PhD in June 2017 and replaced Sandy Aoun after her resignation. His research addresses the optimisation of recording scripts for the expressive reading of audiobooks. The originality of this work is that the problem is addressed by trying to find the best subset of the books we want to synthesize, that will be used to build a voice, then used to generate the remaining part of the books. This way, the goal is to find the best compromise between the size of what we need to record and the quality of the audiobooks we generate. In 2018, Meysam worked mainly on the setup of an approach to reduce the size of a recording script. To do so, he worked on state of the art approaches and also proposed the use of deep convolutional neural networks or recurrent networks. Interesting results have been achieved and this work should be submitted in early 2019 to a conference.
9. Aghilas Sini has started his PhD in December 2016. He has completed his first year. His research addresses the characterisation and generation of expressivity in function of speaking styles for audiobook synthesis. This Phd takes places in the context of the ANR project SynPaFlex dealing with prosody modelling and the use of prosodic models in speech synthesis. This thesis is also co-funded by the Labex Empirical Foundations of Linguistics (EFL) and co-directed by Elisabeth Delais-Roussarie (DR, CNRS/LLF). During 2017, he worked on the construction of a large speech corpus containing approximately 80 hours of speech. On this topic, we presented a paper at LREC 2018 [?]. This research required the construction of a tool to annotate discourse genres and has been published to the TALN conference [?]. Finally, he also spent 3 months at CSTR, Edinburgh, Scotland, during an internship under the supervision of Prof. Simon King.
10. Tiago Brizolar has completed his first year of PhD. He has developed and validated an audio synthesis system for application in contemporary music/sound art/performing arts/entertainment, controlled by movement and muscular activity of the arms. His system proposes the instrumentalization of environmental sounds, normally tailored for audio design. Two groups of perceptual experiments were then conducted: first a preliminary evaluation with general public in the form of experimental sessions followed by a questionnaire, assessing ease of use, overall experience and quality of produced sounds, among others. The second group of experiments, in the city of Recife (Brazil) consisted in a similar evaluation with more specialized public (musicians, dancers, actors, human-computer interfaces designers). A task-based evaluation was also achieved, leading to the generation for several subjects of a sound database plus a perceptual rating of each sound in

terms of human movement qualities. Finally a subsequent experiment was conducted to investigate the movements elicited by a limited sub-database (selected by Tiago) of the aforementioned sounds. This last experiment is ongoing. The movements were recorded with inertial sensors, a Microsoft Kinect and a video camera. Sessions of free use with musicians and dancers were also achieved.

11. Valentin Durand De Gevigney has started his PhD in October 2018. His research aims at designing Deep Neural Network models for the multimodal detection of abnormal behaviours or anomalies. Here, anomalies, are defined as behaviours that are unexpected considering the context they occur in. This work is a follow-up of the PhD of Cédric Fayet on the detection of anomalies in discourse defended in December 2018.
12. Betty Fabre has started her PhD in October 2018. This CIFRE PhD work is jointly conducted in Orange Labs and IRISA/Expression in Lannion. Her research aims at reinforcement learning and structured prediction applied to paraphrase generation.
13. Jade Mekki has completed her first year of PhD. She is supervised by Nicolas Béchet, Gwénoél Lecorvé, and Delphine Battistelli (from University of Paris-Nanterre, MoDyCo lab). Jade works on the characterization of language registers using sequential pattern mining. During her first year, she has build two states of the art: one in sequential pattern extraction, the other in linguistics regarding the notion of register. Then, she has experimented pattern extraction techniques on small artificial corpora, and compared their accuracy and complexity in order to forecast their scalability to real massive text corpora. In parallel, she has built a textual corpus labeled in registers [15].
14. Ahmad Alaa Al-Dein started his PhD in January 2016 and is currently enrolled in fourth year. The original subject was on extracting relationships from textual resources for ontology learning. His work is currently much more focused on hypernym/hyponym relationships found in textual resources. However, it is planned to adapted the techniques developed for hypernym/hyponym relationship extraction to general relationships. Concerning hypernym/hyponym relationships a first extraction system based on earlier work, has been submitted to SemEval 2018 competition. A different system has been presented at the KEOD 2018 conference and the paper received the best student award.
15. Clémence Mertz has started her PhD in December 2019. Her research aims at the automatic translation of LSF to French (and vice versa) with neural networks. Considered base material is video input.
16. Somaye Jafaritazehjani has completed her first year of PhD. She is supervised by Damien Lolive, Gwénoél Lecorvé, and John D. Kelleher (from TU Dublin, Ireland). Somaye works style transfer in natural language processing using deep learning, that is the task to shift a text from one style to another. During her first year, she has built a bibliographical review of the domain, and started extending a state-of-the-art approach. By doing so, she has also investigated the issue of objective evaluation for this natural language generation task.

## 4 Software development

**LSF-ANIMAL** The *LSF-ANIMAL* corpus developed in 2018 was augmented with 30 min of MoCap data coming from another signer to add inter personal variations. The new content consists in animal descriptions, various isolated signs, hand configurations and grammatical mechanisms such as pointing gestures and proforms. The *LSF-ANIMAL* corpus was perceptually evaluated and validated by 50 people (deaf and hearing). The data was added to the *SGN library* which has been developed in the team for several years. Motion retrieval methods comes from *SGN* and new interpolation techniques were added in *SGN*.

**Text-To-Speech system** In the frame of several technology transfer projects, developments have been done in 2019 on many pieces of software involved in the team's text-to-speech system to make it usable in industrial environments. This has mainly consisted in shifting some tools from script languages (Python, Perl, shell) to C++, and setting up web services on a production server, compatibility for Android and AMR7 architectures.

This is achieved in the frame of the SPAM project (maturation project funded by the transfer technology service of University of Rennes 1).

## 5 Contracts and collaborations

### 5.1 National Initiatives

#### 5.1.1 SynPaFlex ANR project

**Participants:** Damien Lolive, Gwéno   Lecorv  , Marie Tahon, Ga  lle Vidal, Aghilas Sini.

EXPRESSION is leader of a ANR project named SYNPAFLEX and accepted in July 2015 and started the 1st of December 2015. This project is targeted at the improvement of Text-To-Speech synthesis engines through two main research axes:

- Pronunciation variants modelling and generation
- Context-adapted prosody modelling and generation

The main targeted applications are in the domains of entertainment (audiobook reading, video games), serious games (virtual environments), language learning (dictation, elocution style) or even for vocal aids designed for handicapped people.

This project is mainly supported by IRISA, coordinated by Damien Lolive and involves members from LLF (Laboratoire de Linguistique Formelle) and from ATILF.

Up-to-date information are available at <https://synpaflex.irisa.fr>.

### 5.1.2 TREMoLo ANR project

**Participants:** Gwéno   Lecorv  , Nicolas B  chet, Jonathan Chevelu, Nazanin Dehghani, Jade Mekki, Aline   tienne.

EXPRESSION is leader of the ANR project TREMoLo, which has been accepted in December 2016. The project studies the use of language registers and seeks to develop automatic methods towards the transformation of texts from a register to another. To do so, the project proposes to extract linguistic patterns which discriminate a register from another, and to integrate them into a probabilistic automatic paraphrase generation process. The language under study is French.

This project is mainly supported by IRISA, coordinated by Gw  no   Lecorv   and involves a member of MoDyCo (UMR 7114 Mod  les, Dynamiques, Corpus), Delphine Battistelli.

Up-to-date information are available at <https://tremolo.irisa.fr>.

### 5.1.3 VOCAGEN PME project

**Participants:** Nicolas B  chet, Giuseppe Berio, R  my Kessler.

This project (funded by Pole Images et R  seaux and R  gion Bretagne) is focused on the building of a software in the field of the construction, allowing users to automatically fill forms starting for the output of a speech recognition system. To this end a concept and term taxonomy is required covering the construction domain. Expression Team is focused on the development of techniques for automatically extracting a relevant terminology and a list of hypernym/hyponym relationships between terms.

This project is coordinated by Script&Go compagny based in Rennes and involves TyKomz company based in Lannion.

### 5.1.4 KALIGO Dys

**Participants:** Gw  no   Lecorv  , Damien Lolive, Arnaud Delhay, Quentin Di-Fant.

This project, coordinated by Learn&Go, aims at developing a software usable to detect pupils having dys troubles, like dispraxia, and also focusing on re-mediation. The platform should propose dedicated exercises (work on pressure on the sheet, speed measures, fatigability, etc.). It should also be a practical interface for health specialists enabling the preparation of training sessions, helping to follow and report kids' progress. The second main objective is to develop an ergonomic pen usable for re-education.

### 5.1.5 PI IA Education

**Participants:** Gw  no   Lecorv  , Damien Lolive.

This project, coordinated by Learn&Go, aims at developing a software usable to

learn the French language. Our contribution is on Speech Synthesis and language analysis for education applications. Notably, we have to produce an adapted feedback for children. This project is funded by the ministry of education.

#### 5.1.6 TextToKids ANR Project

**Participants:** Gwéno   Lecorv  , Nicolas B  chet, Jonathan Chevelu, Damien Lolive, Alexis Blandin.

The TextToKids ANR project is the continuation of the homonymous CNRS PEPS project, previously running in 2018. It aims to facilitate the writing and the filtering of texts for children, especially but not only in order to tell them about current events (e.g., presidential elections, Brexit, reception of migrants in France, etc.) in respect of their language skills. The targeted age group is that of young readers, that is, the 7-12 age group. The consortium, which brings together linguists, computer scientists and specialized journalists, will seek to characterize the linguistic constraints to be respected for such a purpose and to propose assistive tools (automated textual analysis, search engine, reformulation, good practices). In terms of benefits, the project works in the direction of a "children's Internet" and opens a way to other modalities (speech, images).

This project is coordinated by Delphine Battistelli (MoDyCo lab), assisted by Gw  no   Lecorv  .

#### 5.1.7 MSHB Project SENSIBDATA

**Participants:** Nicolas B  chet, Guiseppe Berio.

SENSIBDATA project, which is based on a plurality of disciplinary viewpoints, aims to respond to ambitions for an integrated understanding, going beyond epistemological quarrels, of the practices of users, whether they are consumer-citizens, or whether they are responsible for managing the relationship with the public, in order to lay the foundations for knowing who, how and within what limits we can hope to raise awareness and make the players in the fixed and mobile net and the world of IOTs more responsible.

#### 5.1.8 OPLB Breton Synthesis

**Participants:** Damien Lolive, Gw  no   Lecorv  , Ga  lle Vidal, Hassan Hajipoor.

This project aims at building speech resources and a speech synthesis engine for the Breton Language. It started in August 2019. This project is funded by OPLB - Office Public de la Langue Bretonne and lasts 18 months.

## 5.2 International Initiatives

### 5.2.1 H2020 NADINE

**Participants:** Damien Lolive, Gwéno   Lecorv  , Arnaud Delhay, Waseem Safi.

NADINE project aim is to develop a novel way of integrating migrants and refugees through ICT-enabled solutions that will automatically adapt to the specificities of each person. The consortium agrees that one of the main enablers of migrants/refugees inclusion, in the host societies, is their ability to work. Hence NADINE’s motto is "Give migrants and refugees their dignity back by giving them a decent job with a decent salary". Taking into account this important factor, NADINE will create an adaptable platform able to: 1) Provide functionalities for skill assessment, 2) dynamically create tailored suited training programs to adapt existing skills into host societies needed skills, 3) provide a digital companion that will suggest and assist the end-users through administrative tasks and 4) create a data lake available to public administration bodies for better organisation of migration flows. NADINE will innovate in several directions from novel training tools, adaptable to different learning setups, to novel ways of information flow handling for public administrations to work efficiently in both business as usual contexts and migration bursts ones. NADINE platform will create potential new markets in different market areas and also will provide novel open tools that will foster new innovation capacity to the EU area.

## 5.3 National Collaborations

- In the frame of the TREMoLo and TextToKids projects, the team works with members of the MoDyCo lab, especially Delphine Battistelli, full professor at University of Paris-Nanterre. 2 MSc interns have been co-supervised (Alexis Blandin, Aline   tienne), while Jade Mekki’s PhD entered its second year.
- Since PEPS APA in 2013, Nelly Barbot collaborates with Henri Prade, research director of CNRS at IRIT Toulouse and Laurent Miclet (former) emeritus professor at University of Rennes 1 about the formalization of analogical proportions and relational proportions in the framework of formal concept lattice.

## 5.4 International Collaborations

- In 2017, we have developed a collaboration with Ingmar Steiner and S  bastien Le Maguer from Saarland University, Saarbruck, Germany. Notably, we recruited an internship to work together on the construction of a common interface for Speech synthesis systems enabling to visualize and interact with several systems, like Expression TTS systems and also MaryTTS. We have continue this collaboration in 2018 with S  bastien Le Maguer, who has moved to the ADAPT center, Trinity College Dublin.
- The collaboration started in 2018 with John D. Kelleher (TU Dublin) has continued with the beginning of Somaye Jafaritazehjani, co-supervised by Damien Lolive and Gw  no   Lecorv  .

- Since November 2019, Antoine Perquin is working as an invited PhD student at the National Institute of Informatics (NII, Tokyo, Japan). He collaborates with Junichi Yamagishi (full professor) about multi-speaker TTS for French. This stay will last 5 months.
- A new collaboration with McGill University (IDMIL) started in September 2019, with the postdoctoral internship of Felipe Verdugo, supervised by Marcelo Wanderley and Sylvie Gibet. The post-doc subject is about the visible and the invisible of the pianistic gesture: optimization of the sound production and internal dynamics of the musical expression.

## 6 Dissemination

### 6.1 Involvement in the Scientific Community

- Pierre-François Marteau served as a reviewer in international journals (IEEE Trans. on NNLS, Journal of Soft Computing, Pattern Recognition, IEEE Trans. on Information Forensic and Security). He serves as an expert for French Ministry of Research (CIR/JEI). He was member of a thesis committee at XXXX , and participated in a few local PhD defense juries. He presented three seminars as a guest speaker: TS days INRIA/IRISA RENNES, 25th and 26th March 2019, SEC DAYS INRIA/IRISA RENNES, 9th January 2019, Data Science workshop at Bilbao Center for Applied Mathematics, Bilbao, 7th and 8th November 2019. He had co-organized the FDST2019 workshop dedicated to "Learning from Data Streams and Time Series" at Telecom ParisTech, 12 September 2019. He is member of the Strategic Orientation Committee at IRISA.
- Sylvie Gibet has served as a reviewer for national and international conferences, including Motion in Game (MIG2019), TALN 2019, and Sign Language Translation and Avatar Technology (SLTAT 2019). She was a member of a thesis committee at INRIA-Imagine in Grenoble in December 19, 2019. She was invited to present a seminar to the transversal workshop "Art, Culture and Heritage" at IRISA on February 11, 2019. She participated to the working group "Health" at UBS on December 5, 2019.
- Giuseppe Berio served as reviewer for national and international conferences: Extraction et Gestion de Connaissances (EGC2019), Practice of Enterprise Modelling (2019), Trends in Enterprise Architecture Research (TEAR2019), Research Challenges in Information Science (RCIS2019). He also acts as steering committee member of the International Conference on Advances in Semantic Processing (SEMAPRO).
- Jonathan Chevelu has served as a reviewer for the International conference of the International Speech Communication Association (Interspeech), the International Conference on Audio, Speech and Signal Processing (ICASSP). He served as an expert for the French research agency (ANR).

- Arnaud Delhay, after completing his term on the 'Commission Recherche' (Research committee) of the IUT of Lannion, was appointed as a member by the Director of the IUT for the present term. He has served as a reviewer for the International conference of the International Speech Communication Association (Interspeech), the International Conference on Audio, Speech and Signal Processing (ICASSP), the international Language Resources and Evaluation Conference (LREC).
- Caroline Larboulette is a member of various program committees for international conferences (ACHI2019, WSCG2019, MIG2019, SITIS2019), a member of the editorial review board of the international journal of computer graphics and creative interfaces (IJCICG) and serves as a reviewer for various journals (Computer & Graphics, TVCG, CAVW, Arts). She is a member of the ACM SIGGRAPH Specialized Conferences Committee that attributes the ACM SIGGRAPH labels to conferences and supervises the budget of conferences sponsored by ACM SIGGRAPH and the liaison agent from this committee with the ACM SIGGRAPH Students Travels Grants committee that has been created this year. Since november 2019, she is co-director of the GTAS, the "Groupe de Travail Animation et Simulation" of the GdR IG-RV (Informatique Géométrique et Graphique, Réalité Virtuelle et Visualisation) of the CNRS INS2i and also member of the direction committee of the GdR.
- Gwénolé Lecorvé is an elected member of the laboratory council of IRISA, and of the board of directors of the French speech communication association (AFCP). Since December 2019, he is also a nominated (deputy) member of the National Council of Universities (*Conseil National des Universités, CNU*) in the Computer Science section, and an elected member of the Scientific Council of ENSSAT. In 2019, he also served as a reviewer for conferences and journals (Interspeech, ICASSP, TALN, Journal of Applied Soft Computing).
- Damien Lolive has been an elected member of the 'Conseil Scientifique' (Scientific council) of ENSSAT, Lannion, until 2019. He is also part of board of directors of the French speech communication association (AFCP). He serves as a reviewer for the IEEE Transactions on Speech and Language processing, for the *Traitement Automatique des Langues* journal, for the International conference of the International Speech Communication Association (Interspeech), the International Conference on Audio, Speech and Signal Processing (ICASSP), the international conferences LREC and Speech Prosody, as well as for the *Journées d'Études sur la Parole* conference. He has also served as an expert for the french research agency, ANR.
- Nicolas Béchet is a member of program committees for international conferences International Conference on Natural Language & Information Systems (NLDB) and Language Resources and Evaluation Conference (LREC). He also has served as a reviewer for the Intelligent Decision Technologies Journal (IDT).



## 6.2 Teaching

- Giuseppe Berio teaches courses on design and implementation of decision information systems at IUT Vannes and faculty of sciences (master level), Université Bretagne Sud. A project management course is also taught at IUT Vannes.
- Nelly Barbot teaches the following mathematics courses at École Nationale Supérieure des Sciences Appliquées et de Technologie (ENSSAT): algebra and analysis basis, mathematical logic in Licence level, probability and statistics in Master level.
- Vincent Barreaud teaches the following computer science courses at École Nationale Supérieure des Sciences Appliquées et de Technologie (ENSSAT): Web Programming, Web Services and Distributed Algorithms in Licence level. He is director of studies at ENSSAT.
- Nicolas Béchet teaches various computer sciences courses at the Statistique et Informatique Décisionnelle department of IUT Vannes.
- Arnaud Delhay teaches databases and web programming (server- and client-side) in Licence levels at IUT of Lannion, calculability and computational complexity of problems in Master level at École Nationale Supérieure des Sciences Appliquées et de Technologie (ENSSAT).
- Jonathan Chevelu teaches the following computer science courses at École Nationale Supérieure des Sciences Appliquées et de Technologie (ENSSAT): cybersecurity in Licence and Master level, operative systems in Licence level and natural language processing in Master level.
- Sylvie Gibet teaches the following Computer Science courses at the faculty of sciences, Université Bretagne Sud: Algorithmic at Bachelor level (Python), an introduction of Digital Signal Processing and Machine Learning (1st year master level), and Movement and Artificial Intelligence (2nd year master level).
- Jean-François Kamp teaches human-computer interaction, programming at the computer science department of IUT Vannes. He is responsible for student internships.
- Caroline Larboulette teaches character animation as part of an introductory lecture of computer science for freshmen and logic for undergraduates of the UFR SSI; C++ programming for ENSIBS graduate students; introduction to computer graphics (I2G) and simulation and interactive applications (SAI) at the master level (Master of Computer Science, AIDN (Interactive Applications and Data)).
- Gwénolé Lecorvé teaches the following computer science courses at École Nationale Supérieure des Sciences Appliquées et de Technologie (ENSSAT): distributed algorithmics; artificial intelligence; and machine learning in Master level. He also teaches automatic speech recognition and speech synthesis in Research Master program of University of Rennes 1, in Rennes.

- Damien Lolive teaches the following computer science courses at École Nationale Supérieure des Sciences Appliquées et de Technologie (ENSSAT): object-oriented programming in Licence level, compilers architecture and formal languages theory in Master level, speech and language processing in Master level, and pattern recognition in Master level.
- Pierre-François Marteau teaches programming languages, logics, introduction to cryptography and information retrieval, machine learning and intrusion detection courses in computer sciences License and Master levels, mostly at École Nationale Supérieure de Bretagne Sud (ENSIBS). He is responsible of the bachelor level for the computer science program at ENSIBS.
- Gildas Ménier teaches various computer sciences courses at the faculty of sciences, Université de Bretagne Sud.

### 6.3 Conferences, workshops, invitations

- Pierre-François Marteau, Nicolas Béchet, and Gwénoél Lecorvé were part of the organization committee of CORIA-TALN-RJC 2018, in Rennes.
- In 2019, Gwénoél Lecorvé was part of the program committee of TALN 2019. He was also invited in January at MoDyCo lab (Nanterre, France) for a talk entitled "Linguistic Modeling of the Oral Spontaneous Style".

### 6.4 Meetings, other dissemination

- Caroline Larboulette and Lucie Naert participated to the day "Numérique: des métiers en tous genres", on January 17th, 2019.
- Caroline Larboulette and Lucie Naert participated to the action "développer la mixité et tendre vers la parité dans les filières scientifiques", on March 12th, 2019.
- Caroline Larboulette and Sylvie Gibet participated to the "Nuits de la Science" at UBS, in October 15, 2019.
- Sylvie Gibet and Caroline Larboulette participated to the JSM (Journée Science et Musique) day in October 19, 2019.

### 6.5 Graduate student and student internship

- Frédéric Le Bellour has done his Master level internship in Lannion and in collaboration with the LIUM in Le Mans, France. He has been supervised by Damien Lolive and has worked on the semi-supervised annotation of emotions in audio-books.
- Alexis Blandin has done his Master level internship in Lannion, supervised by Gwénoél Lecorvé and Delphine Battistelli. He has been working on the prediction of age recommendations for texts.

- Aline Etienne has done his Master level internship in Nanterre (MoDyCo lab), supervised by Delphine Battistelli and Gwéno   Lecorv  . She has been studying linguistic cues of interest to explain how a child may understand or not a given text.
- Cl  mence Mertz has done her Master level internship in Lannion. She has been supervised by Vincent Barraud, Damien Lolive, and Sylvie Gibet. She has worked on the recognition of LSF gestures with neural networks.

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