AI in France: History, Lessons Learnt, State of the Art and Future

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Abstract This chapter begins by a short history of AI in France since the early 1970s. It gives some examples of industrial applications developed since the 1980s. It also introduces AFIA, the French Association for AI, and describes some activities such as the main conferences and publications. The main French AI research domains and actors such as public and private laboratories are listed and some of their activities are briefly presented. A table of AI-based French software and service companies is reprinted from the AFIA Bulletin. A presentation of the main national research programs is followed by the description of two international AI labs Sony CSL (Paris) and XRCE (Grenoble). Finally some future trends and challenges are discussed.

1. Introduction and Historical Sketch

To the best of my knowledge Artificial Intelligence was introduced into France by Professor Jacques Pitrat in the early 1970s. At the same time Alain Colmerauer's team in Marseille invented Prolog for natural language processing. Laforia (lip6), LRI Orsay, UTC Compiègne, IRIT Toulouse, Marseille, Nancy and LIRMM Montpellier were among the first academic AI research teams. Real interest in AI began in the early 80s. Main industrial companies initiated AI activities. Groupe Bull founded a research centre for AI in 1981 to work on natural language access to data bases, object programming and expert systems. The first European Computer Industry Research Center ECRC was founded by Bull, ICL and Siemens in 1984 and was devoted to constraint programming, design of a Prolog machine and deductive data bases. CEDIAG[2] was founded in 1985 to work on AI tools development such as KOOL, KOOL 4WD, EDEN, CHARME, Open KADS and applications [Mercier 1994]. In 1991 a global approach to corporate knowledge modelling, collecting, navigation and deployment through decision support systems was initiated [Mercier 2004]. In the middle of the 80s main industrial French and international companies such as Aerospatiale, Dassault Aviation, Dassault Electronique, IBM Scientific Centre France, CGE Marcoussis,

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2 Centre d'Etudes et Développement en Intelligence Artificielle Groupe Bull

Matra, Thomson (Thales) France Telecom, Rhone Poulenc, Total, Renault, Peugeot, SNCF and others had their AI teams devoted to AI applications.

The Avignon conference series on 'Expert Systems and Their Applications' (1985-1994) was the first national event bringing together research and industrial AI workers.

The first French AI software companies were born, as well as AI-based service providers.

Many industrial applications were developed during this period. The software and services companies flourished. The main applications developed in CEDIAG during this period were the following:

- ALPIN Expert system for medical insurance with natural language module for automatic processing of medical reports
- NOEMIE Configuration system for Bull computers
- Diagnosis and help desk for customer support
- KRONES configuration support system and diagnosis for bottle-washing engines
- Danish Customs' decision support system for interpretation of ECC regulations. A similar system was later developed for Argentina Customs.
- ARAMIS-GM French national Guards Missions planning system (resource allocation, crisis situation management). This first hybrid system was composed of database natural language retrieval, expert system and constraint programming techniques.
- RAMSES Security of the Winter Olympic games Albertville 1992, in which experience from ARAMIS-GM development was reused.
- SACHEM, decision support system for blast furnaces, one of the largest industrial AI projects worldwide, Sollac (Groupe Arcelor)
- Knowledge acquisition from telemetric data for Formula 1 racing cars, reusing prior experience
- Computer network diagnosis
- Optimized keys designing
- Scheduling, time-tables for colleges, universities and engineering schools
- Planning and resource allocation for orange picking and optimizing juice production [Mercier 1995], [Mercier 1996].

Many industrial people who experienced success with AI techniques and tools had no time to communicate about it. To communicate was not a part of their objectives and some applications were highly strategic and confidential. There were also many failures due to undervaluation of the difficulties and applying the same tool for solving all kind of problem. From 1994 AI was no more in fashion. Many people removed AI from their business cards; some laboratories changed the name from AI to Advanced IT.

Then the Internet came, bringing a lot of data and the information overload. It created the opportunity for new kinds of service, including e-business, e-learning, e-administration and other e-ware. In the same time the Globalization phenomenon created complex problems to solve in cross-cultural environments, the need for quick access to collective knowledge and experience, for effective distance work and decision taking, for real-time translation [Mercier 2006]. Knowledge Management became a new fashion. Due to the lack of feedback from the AI applications, the first KM tools and solutions were AI-less. When in 1996 building websites using KADS conceptual models was suggested [Verbeck and Gueye 1996] for effective retrieval, nobody believed that it could really be useful.

Globalization and the mobile phone created new needs for easy, quick and effective access to coherent information and sources of knowledge from everywhere [Mercier 1997]. Internet, Globalization, KM movement and mobile life are the extraordinary opportunities and enablers for AI techniques, tools and research. I strongly believe that web 3.0 will be *AI inside*.

French applied AI is a mix of existing techniques and hybrid ones such as Knowledge Discovery from data, text and images; Semantic web using NLP, Knowledge models and knowledge discovery techniques; Multi Agent Systems including many different techniques; hybrid solutions for complex problems such as text understanding, automatic indexing and retrieval of multimedia documents, Business Intelligence, and others.

AI is applied in various domains such as Aerospace, Insurance, Medical domains, Transportation, Design, Manufacturing, Forecast, Financial, Biotechnology, Agriculture, Military and Marketing.

AI is inside decision support systems for technical and medical diagnosis, help desk, maintenance, scheduling, optimization, risk analysis, process control, traffic control, design, CAI, advisory systems. AI is maybe not used enough in IP, e-ware, m-ware, HMI, Simulation, Learning, Image Processing, VR, entertainment and KM [Mercier 2006].

2. Actors and Topics

2.1. AFIA

The French Association for Artificial Intelligence was founded in 1989 to drive the French-speaking AI community, and to promote and support the development of Artificial Intelligence. AFIA is a member of ECCAI (European Coordinating Committee on Artificial Intelligence) and the founding member of ASTI (Association des Sciences et Technologies de l'Information). AFIA acts on behalf of the French AI community towards our country's public authorities, and towards

ECCAI. Among AFIA members there are researchers, engineers, AI software designers, consultants, teachers, artists and students. They are frequently active in several areas of AI.

AI gathers various topics such as knowledge engineering, natural language processing, machine learning, multi-agent systems, to mention only some of them. AI has links with many other fields in computer science, including statistics, data analysis, linguistics and cognitive psychology, optimisation techniques etc. Our members are not only AI practitioners, but they also know and use "non-AI" techniques in relation to their specialities.

The main topics of interest are represented on the “AFIA diamond” below.

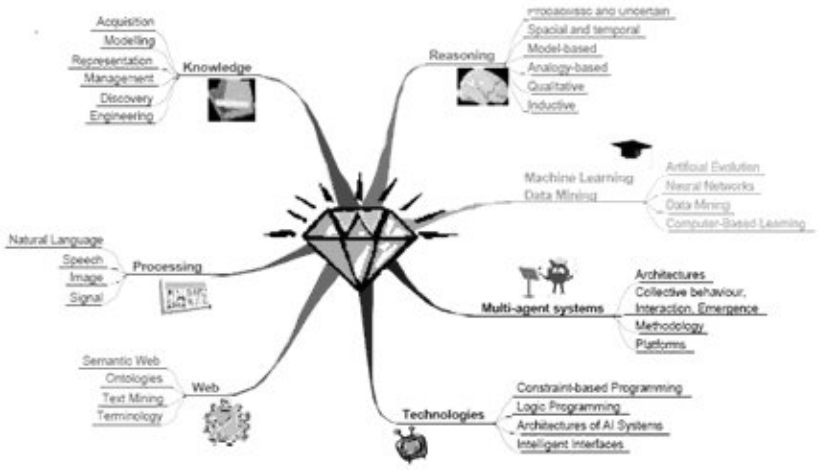

Figure 1. The AFIA Diamond

The AFIA Bulletin is the publication which is the link with the members; it is also a federating tool for our community. Each Bulletin is dedicated to a specific topic as for example bioinformatics, industrial AI, Web engineering, AI and images, CBR, multimedia and AI, scheduling and others. It also contains some presentations of academic and industrial research groups focusing on specific scientific or application topics, information about conferences, books, AI publications, PhDs etc. An electronic newsletter, AFIA Infos is sent periodically to the members.

The AFIA website http://afia.lri.fr/ is designed and operated by members. Its public part contains a wealth of information, forums, links to our individual and institutional members' homepages, news of the AI community, links to conferences and other events organized and sponsored by AFIA, tutorials on AI technologies, classified announcements, etc. The private members’ area gives access to a subset of the website such as studies, conference reports, book

summaries, etc. It also contains a wiki for collaborative work on specific topics and allows all members to contribute to our vision on the future of AI.

Conferences and Workgroups

AFIA organised IJCAI 1993 and ECAI 2002. Since 1997 many efforts have been made to bring together several AI communities running separate conferences and industrial actors to the one common event. The first SSI[3] was held in Paris in 1998. In the next year the first Plate-forme[4] was held in Palaiseau, near Paris. It brought together several communities, such as Knowledge Engineering, Case-based Reasoning and Machine Learning. It included also ISAI[5]99 as the result of our workgroup on Operational AI applications. Since 1999 the Plate-forme has been held each odd-numbered year, the last was held in Grenoble http://afia2007.imag.fr/.

AFIA also runs colleges and workgroups. The workgroups address focused topics, can be organised as projects, and are expected to have a short or medium-term lifespan. A workgroup which grows can evolve into a "college". Our two colleges are: SMA on multi-agent systems, which itself is made up of three workgroups, and which organises annually the JFSMA conference; and CAFE (French acronym for Machine Learning, Data Mining and Knowledge Discovery), which organizes every year the CAP conference (Conference on Automated Learning).

Other AFIA activities

AFIA also organizes Industry/Research seminars on specific topics and gives out awards and grants.

AFIA is currently the only French association whose main focus is artificial intelligence. Other associations are interested in AI and thus can have relations and share actions with AFIA. For example, collaborating with AFRIF, the French Association for Pattern Recognition, AFIA organises the RFIA "Pattern recognition and Artificial Intelligence" conference every even year. Our community is one of the first three in Europe, and is a significant contributor to European AI research.

Other French associations related to AI:

[3] Solutions et Systèmes Intelligents, organized by Infopromotions
[4] Plate-forme is the name of the conference
[5] Intelligence, Systèmes, Applications Innovantes

- EGC (for Knowledge Discovery and Management) http://www.polytech.univ-nantes.fr/associationEGC/
- ATALA Automatic language processing http://www.atala.org/
- PoBot (Robotics) http://www.pobot.org/
- Automates Intelligents http://www.automatesintelligents.com/
- Artificial life http://www.vieartificielle.com/
- ARCo Association for Cognitive Research http://www.arco.asso.fr/
- Recently created consortium for AI and games http://ja.games.free.fr/Consortium_Academique/ Consortium_academique_jeu.pdf

2.2. Main French Actors of AI

The Bulletin AFIA N° 49-50 published for ECAI 2002 and elaborated by Sylvie Pesty and Gilles Bisson from IMAG Grenoble included a short presentation of 141 laboratories and enterprises involved in AI research, software and applications. Some of them are listed below. The National Research System is currently being redesigned, so some of the listed labs are changing or may change in the near future.

- **CEA-DRT** (LIST-Electronics and Information Technology, LETI-Integration of Systems and Technologies, LITEN Innovation for New Energies and Nano materials) http://www-drt.cea.fr
- **CIRAD,** Montpellier, Resources & Environment, Multi Agent Systems, Collective decision making, applications
- **CRIL**, Lens, www.cril.univ-artois.fr Autonomous intelligent systems, Handling of imperfect, incomplete, context-sensitive, time-sensitive and multi-source knowledge, Inference and Decision Process
- **Crip5,** Paris, http://www.math-info.univ-paris5.fr/crip5/, Multi-Agent Systems, Knowledge Representation, Reasoning; Signal, Language and Image Processing
- **DGA**
- **DPA/DSI/AP-HP**, Paris, medical applications
- **DYNAFOR,** Castanet-Tolosan http://www.inra.fr/toulouse_dynafor. Applications of AI, Neural Networks, landscape ecology, agro-eco-systems, biodiversity
- **ENIB,** Brest http://www.lisyc.univ-brest.fr/. Five multi-disciplinary teams work on MAS for Virtual reality, bioinformatics, ecosystems modelling and simulation of complex biologic phenomena, Model engineering, process improving, learning in virtual environment, rehabilitation of handicaps in virtual environment linking VR and

movement analysis, languages for automats and robots, distributed systems.

- **EAT,** Toulouse, *www.toulouse.archi.f.* Li2a team AI applied to architecture
- **EMN,** Nantes, constraint programming
- **ENSAIS,** Strasbourg, LIIA
- **ENSM-SE,** Saint-Etienne, MAS
- **ERIC**, Bron http://eric.univ-lyon2.fr
- **ERTI,** Illkirch
- **ESPCI,** Paris
- **ETIS-Imag,** Cergy
- **EURISE,** Saint Etienne, IT for environment, socio-dynamics
- **GRAVIR,** St Ismier, LAPLACE Probabilistic Models for Perception, Inference and Action)
- **GREYC,** Caen**,** I3 (Information, Intelligence, Interaction)
- **Grappa,** Villeneuve D'Ascq
- **HEUDIASYC – UTC,** Compiègne.
  http://www.utc.fr/recherche/Heudiasyc.php, Heuristics and Complex Systems Diagnosis: Machine Learning, Statistics, Form Recognition, Image, Decision ; Algorithms for Networks and Optimization; Documents and Knowledge; Perception and Control Systems
- **IAE**, Lyon, MODEME (Models and Methods for Advanced Information Systems
- **I2S,** Lieusaint
- **I3S,** Sophia Antipolis**,** TEA Techniques for Artificial Evolution
- **IFP,** Rueil Malmaison, Intelligent Information Exploration
- **IIM,** La Défense**,** International Institute of Multimedia
- **Innovation 3D**, St Drezery, AI for Knowledge Management and Innovation
- **INRA, MIG,** Versailles
- **INRA, UBIA,** Toulouse, Methods for Decision making, Bioinformatics, molecular biology, genetics
- **INRETS,** ESTAS, Villeneuve d'Ascq, AI applied to transport systems evaluation, automated transport and security
- **INRIA** Rocquencourt, FRACTALES (complex models and artificial evolution)
- **INRIA** Montbonnot, EXMO (Computer mediated exchange structured knowledge)
- **INRIA** Sophia Antipolis
  ACACIA (Knowledge Acquisition and Capitalization)
  AxIS (Conception, Analysis and improvement of Information Systems
  ORION (Reusable Intelligent Systems and cognitive vision).
- **INT** EPH**,** Evry INTERMEDIA (Interactions for Multimedia)

- **IREMIA,** Saint-Denis
  ECD (Knowledge Discovery from Data
  MAS2 (Multi Agent Systems Modelling and Simulations)
  Equipe GCC (Constraints)
- **IRIN,** Nantes, CID (Knowledge, Information and Data)
- **IRISA,** Rennes
  TEXMEX (Techniques for multimedia documents exploration).
  DREAM (Diagnostic, Recommendations and Modelling)
  CORDIAL (Multimodal Human-Machine Communication
  SYMBIOSE (Systems and models for biology, bioinformatics and sequences)
- **IRIT,** Toulouse http://www.irit.fr
  Research topics: Image Analysis and Synthesis, Indexing and Information Search, Interaction, Autonomy, Dialogue and Cooperation, Reasoning and Decision, Modelling, Algorithms and High Performance Computing, Architecture, Systems and Networks and Safety of Software Development
- **ISEN,** Lille
- **L3I** (Informatics, Image, Interaction)**,** La Rochelle
  ImagIN http://imagin.univ-lr.fr/
  Models, architectures, tools for interactive environments
  ImeDoc: Image, Media and Document http://imedoc.univ-lr.fr
  Sido: Semantic and Data Intermediation http://sido.univ-lr.fr/
- **LAAS-CNRS,** Toulouse
  DISCO (Qualitative Diagnostic, Supervision and Process Control)
  RIA (Robotics and Artificial Intelligence)
- **LAB,** Besançon
  MSF-LAB (Maintenance and Safety)
  Mobile Micro robotics
- **LAG,** Grenoble, http://www.lag.ensieg.inpg.fr
  Automatic Process Control, Safety, Supervision, Diagnostic
- **LAGIS**, University of Science and Technology, Lille, http://lagis.ec-lille.fr/
  François Cabestaing is working on EEG-based Brain-Computer Interface for Enhanced Communication [Cabestaing 2007]. Brain-Computer Interface (BCI) is a system that allows direct communication, i.e. without requiring muscular activity, between a person and a computer. In a BCI, cortical activity is recorded, analyzed and translated into orders sent to the computer. The two main approaches to EEG-based BCIs are: asynchronous, for example analyzing sensorimotor rhythms, and synchronous, for example detecting event related potentials (ERP). Further information is available from fcab@ieee.org.

- **LaLICC,** Paris
- **LaMI,** Evry, SyDRA (Distributed, Reactive and Adaptative Systems
- **LAMIH,** Valenciennes, RAIHM (Automated Reasoning and Human-Machine Interaction
- **LAMSADE,** Paris
  SIGECAD (Knowledge and Information Systems, Decision Support)
  SMA (Multi Agents Systems)
- **LaRIA,** Amiens**,** IC (Knowledge Engineering)
- **LEG,** Grenoble
  CDI (Integrated Design and Diagnostic)
  Modélisation (Modeling and CAD)
- **LCIS,** Valence, CoSy (Complex Cooperative Systems
- **Leibnitz IMAG**, Grenoble, Following the new organisation of research in Grenoble in the domain of applied mathematics, computer science and signal, the Leibniz Laboratory has finished its contract. The teams are participating in new laboratories:
  - LIG, including two AI groups MAGMA (MAS) and MeTAH (Models and Technologies for Human Learning);
  - TIMC Techniques for biomedical engineering and complexity management – informatics, mathematics and applications.
    The TIMC-IMAG laboratory gathers scientists and clinicians towards the use of computer science and applied mathematics for understanding and controlling normal and pathological processes in biology and healthcare. This multi-disciplinary activity both contributes to the basic knowledge of those domains and to the development of systems for computer-assisted diagnosis and therapy.
- **LERI,** Reims MODECO-IUT (Multi Agent in Uncertain Environment Modelling)
- **LERIA,** Angers
  GII (Management of Imperfect Information)
  MOC (Metaheuristics and Combinatory Optimization)
  SBCI (Knowledge-based Interactive Systems)
  TALN&Rep de Co Natural Language Processing and Knowledge Representation
- **LESCOT,** Bron, **Ergonomics** and Cognitive Science for Transportation
- **LGP,** Tarbes**,** PA (Automated Production)
- **LIA,** Chambéry
- **LIA,** Avignon
- **LIF,** Marseille**,** BDA (Data Bases and Machine Learning
- **LIFL,** Lille, SMAC (Multi Agent and Cooperative Systems
- **LIFO,** Orléans.CA - LIFO (Constraints and Machine Learning

- **LIH,** Le Havre MAS
- **LIL,** Calais**,** MESC (Modelling, Evolution and Simulation of Complex Systems)
- **LIMA,** Toulouse**,** GRAAL (Reasoning, Action and Language)
- **LIMSI – CNRS,** Orsay
  AMI (Architectures and Models for Interaction)
  G&I (Gesture and Image)
  LIR (Languages, Information and Representation)
  PS (Situated Perception)
  TLP (Processing of Spoken Language)
- **LIP6,** Paris
  LIP6 has a very large spectrum of research activities: networks, distributed systems, databases, languages and proofs, simulation and distributed programming, digital and symbolic computation, software for research on Computer Sciences and decision support, symbolic methods and proofs, artificial life, entity and the society of robots.
  Two main groups are involved in AI: Decision, Intelligent Systems, Operational Research and Databases and Machine Learning. The others groups are AI users.
  The first group is composed of five teams: RO (Operational research), Decision, AnimatLab, SMA (Multi agent Systems) and Mocah (Knowledge Engineering Models and Tools for Human Learning).
    - The **Decision** team works on decision under uncertainty, multi-criteria decision making and context-based decision aiding.
    - The **AnimatLab** is devoted to the animat approach, i.e., to the design of simulated animals or real robots, whose inner mechanisms are inspired from those of animals, and that are able to develop, learn and evolve. In the short term, the objective of the animat approach is to understand the mechanisms that make it possible for animals to adapt and survive, then to implement these mechanisms into artefacts that are also able to adapt and fulfil their mission in environments more or less changing and unpredictable. Such artefacts may be instantiated as autonomous robots that must move and explore an unknown environment, or as seemingly living characters able to interact with an human in a video game. In the long term, the objective of the animat approach is to contribute to the advancement of cognitive science by seeking in what sense human intelligence can be explained by simple adaptive behaviours inherited from animals, in a bottom-up, evolutionary and situated perspective.

  In the second group, the most interesting team from the AI point of view is **ACASA**. This team, led by Jean-Gabriel Ganascia, initially

focused on Knowledge Acquisition and Machine Learning. Its scientific orientations evolved to Scientific Discovery and the design of Intelligent Agents. Thus research was recently undertaken on literary analysis (genetic criticism, stylistic analysis), on modelling social representations (rebuilding of social stereotypes from newspapers), on Scientific Discovery (modelling theories in medicine), on musicology and music (detection of recurrent patterns), on multi-media, on intelligent TV and on the improvement of electronic reading facilities. Moreover, in the last few years, the ACASA team has begun work on natural language semantics, on system biology and on computational philosophy with the aim of exploring individual or social representation of knowledge, i.e. to investigate human cognition from a cultural point of view [ACASA Presentation].

- **LIPN,** Villetaneuse,
  ADAge (Machine Learning, Diagnostic and Agents)
  RCLN (Knowledge Representation and Natural Language)
- **LIRMM,** Montpellier, http://www.lirmm.fr
  Laboratory of Computer Science, Robotics, and Microelectronics
  INFO (Computer Science): constraints, learning, knowledge representation, multi-agent systems, data mining; Human-Computer Interaction: e-learning, natural language processing, hypermedia, visualization.
  Robotic Department
- **LISI,** Villeurbanne D2C (Data, Documents, Knowledge
- **LISTIC,** Le Bourget du Lac, Condillac (Ontology)
- **LIUM,** Le Mans, AI for Learning and Teaching
- **LOG,** Toulouse
- **LORIA,** Vandoeuvre-les-Nancy http://www.loria.fr/
  Natural Language Processing and multimodal communication
  Knowledge Representation and Management
- **LRI,** Orsay http://www.lri.fr
  Algorithms and Complexity
  Artificial Intelligence and Inference Systems
  Bioinformatic Team
  Inference and Learning
- **LRL,** Clermont-Ferrand
- **LSIIT,** Illkirch, AFD (Learning and Data Mining)
- **LTCI – ENST**, Paris, TII (Image Processing and Interpretation)
- **NELLE,** Colombes
- **ONERA – DCSD**, http://www.cert.fr/dcsd/en
  Systems Control and Flight Dynamics Department
- **PSI,** Mont-Saint-Aignan**,** DSI (Document and Interactive Systems)
- **Pôle Cindyniques,** Sophia-Antipolis,

http://www.sophia.ensmp.fr/recherche/cindy.html
Pôle Cindyniques, Risk Prevention and Crisis Management

- **Programme Vision HyperArtLedge**, Cesson Sévigné
- **SeT**, Belfort, MAS
- **THALES Aerospace,** Elancourt
  One of the topics this group works on is a distributed approach for coordination and control of several Unmanned Aerial Vehicles (UAVs) in temporally constrained missions. This approach combines multi-agent and trajectory planning techniques and provides a coordination model taking both deliberation and planning durations into account. Recent advances made in the field of Unmanned Aerial Vehicles (UAVs), suggest that in the near future, fleets of UAVs will be deployed in order achieve various temporally constrained missions such as surveillance, intelligence or suppression of enemy air defences. Thus new algorithms and architectures have to be proposed to ensure a coordinated control of the fleet. This problem can be tackled in various ways, such as optimization, multi-agent simulation based on autonomous agents and using a biologically-inspired approach. Many research solutions were already proposed. The planning and deliberation process takes time and has to be handled. For this reason a distributed approach was followed, combining multi-agent and trajectory planning techniques, which in addition to allowing coordination and control of several UAVs involved in temporally constrained missions, takes both deliberation and planning durations into account. More information is available from patrick.taillibert@fr.thalesgroup.com and from [Marson, Soulignac and Taillibert, 2007].
- **Tech-CICO,** Troyes, http://tech-cico.utt.fr
  Knowledge engineering for Knowledge Management and Distributed Information Systems
- **VALORIA,** Vannes, http://www-valoria.univ-ubs.fr
  Ambient Computing, Interaction and Intelligence: providing end-users with technological, innovative means for greater user-friendliness, more efficient services support and user-empowerment, while contributing to user-friendly, dependable, adaptive and non-intrusive hardware/software environments.

AFIA Bulletins 62 and 64 (updated in July 2007) contain Gérald Petitjean's presentation of 47 enterprises working in the area of AI for decision making. They are listed in Table 1. Their activities represent the following categories:

1. **Optimization** : dynamic optimization, combinatorial optimization, constraints programming, linear programming, operational research, meta heuristics, planning, scheduling

2. **Machine Learning / Data Mining/ Knowledge Transfer:** Statistics, Data Analysis, Neural Networks, Bayesian Networks, Decision Trees, Evolutionary Algorithms, Classification, Regression
3. **Knowledge Engineering / Documents Engineering / Semantic Web / Ontologies**
4. **Multi Agents Systems**
5. **Image Processing / Vision / Forms Recognition** ;
6. **Image Processing/ Natural Language Processing/ Signal Processing**
7. **Expert Systems /Logic / Reasoning** : Rules, Case-based Reasoning, Logic Programming, Fuzzy Logic
8. **Human-Machine Communication**
9. **Robotics**
10. **3D / Virtual.Reality/Games/Serious Games**

	Topics									
Society	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
A2IA					X					
AKIO SOFTWARE		X					X			
ALCTRA		X								
ALDEBARAN ROBOTICS									X	
APODIS	X									
ARDANS			X							
ARTELYS	X	X								
AXLOG Ingénierie	X			X			X			
BAYESIA		X								
BOUYGUES E-LAB	X		X							
CANTOCHE				X		X		X		X
CODEAS		X								
CO-DECISION TECHNOLOGY SAS		X	X	X				X		
COSYTEC	X									
DAUMAS AUTHEMAN et Associés	X						X			
EUROBIOS	X	X		X						
EURODECISION	X						X			
EVITECH		X			X		X	X		
Facing-IT		X			X					

FircoSoft							X			
FRANCE TELECOM R&D Pôle Data@ledge		X	X			X	X			
GOSTAI				X	X	X			X	
ILOG	X						X			
I-NOVA		X								
INOVIA	X									
INTELLITECH		X					X		X	
KAIDARA		X					X			
KOALOG	X									
KXEN		X								
KYNOGON	X	X		X			X			
MASA	X	X		X						
NORMIND		X	X				X			
ONTOLOGOS Corp.			X							
OSLO				X						
PACTE NOVATION	X	X					X			
PERTIMM			X			X				
PERTINENCE		X					X			
PROBAYES		X								
RENAULT DTSI/T2IA/ IAA-SICG	X	X					X			
ROBOSOFT									X	
ROSTUDEL	X									
SEMANTIA						X		X		
SKYRECON		X					X			
SOLLAN			X							
TREELOGIC		X				X	X	X		
VECSYS						X		X		
VirtuOz		X		X		X		X		

Table 1. Enterprises Working in AI for Decision Making

2.3. National Research and Applied Research Programs including AI

AFIA supports the RNTL (National Network for Software Technologies) which aims at providing our country with a leading software industry building upon its excellent academic research.

AI is also included in the national programs as PRIAM and RIAM, ANR and several Pôles de Compétitivité. Pôles de competitivités were created to bring together research and industrial specialists and work on common programmes under a common development strategy. http://www.competitivite.gouv.fr

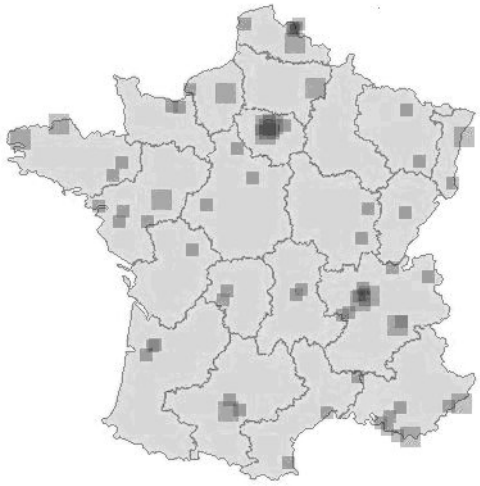

Fig. 2. French Poles of Competivity. Squares represent private-public research activities. The largest and the international ones are in the Paris and Grenoble areas.

Among 71 clusters there are 7 Global competitiveness clusters such as Aerospace Valley, Finance Innovation, LYONBIOPOLE, Medicen, MINALOGIC, SCS and SYSTEM@TIC; and 10 Globally-oriented competitiveness clusters such as AXELERA, Cap Digital, Images & Networks, i-Trans, Industries & Agro-Resources, Therapeutic Innovations, MOV'EO, Pôle Mer (sea) Bretagne, Pôle Mer PACA and Végépolys. Some of them have AI teams and almost all clusters are concerned with AI as users.

ANR (National Agency for Research) http://www.agence-nationale-recherche.fr/ was created in January 2007 to finance innovative projects of public research and enterprise. The aim of ANR is to create new knowledge and to enable relations between the public and private research laboratories through innovative projects.

Many French AI actors are involved in European Community projects, such as IST or 7FP and others.

2.4. International AI Research Labs in France

2.4.1 SONY CSL

Sony Computer Science Laboratory Paris (Sony CSL Paris) is an offshoot of the successful Sony Computer Science Laboratory in Tokyo http://www.sonycsl.co.jp/. Both laboratories were created by Sony to perform basic research in computer science and related fields.

Sony CSL Paris research areas are language, music, sustainability, art and science, their previous work was on robotics and neuroscience.

Language is considered as a complex adaptive system that emerges through adaptive interactions between agents and continues to evolve in order to remain adapted to the needs and capabilities of the agents. The full cycle, presented in Figure 3 of speaker and hearer is explored while they play situated language games.

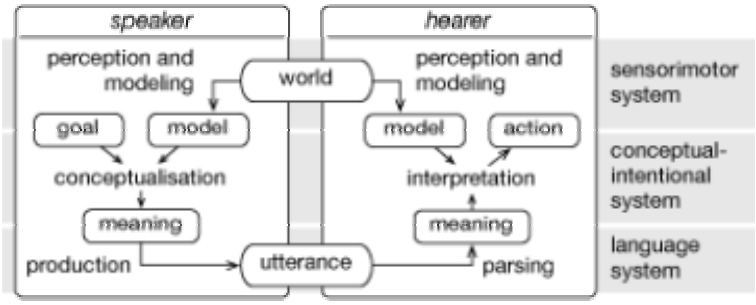

Fig. 3. Speaker and Hearer Cycle

The 'naming game' experiments used computer simulations of communities of language users to explore the emergence of shared lexicons in a population. In the naming game, software agents interact with each other in a stylised interaction (termed a 'language game'). Repeated interactions lead to the development of a common repertoire of words for naming objects. By varying experimental parameters, it is possible to explore the effect of environmental factors such as noise and uncertainty, memory limitations and contact between different language groups.

The Talking Heads experiment studied the evolution of a shared lexicon in a population of embodied software agents. The agents developed their vocabulary

by observing a scene through digital cameras and communicating about what they have seen together. To add an extra level of complexity to their task, agents were able to move freely between different computer installations located in different parts of the world. Members of the public were able to influence the course of the experiment by logging on to the Talking Heads website to create and teach their own agents.

The ability to express and recognize emotions or attitudes through the modulation of the intonation of the voice is fundamental to human communication. In particular, it allows coordinating the social interactions with babies, like in language games (giving feedback, calling for attention). Any robot designed to interact with humans in a natural manner needs these skills.

Emotions have some mechanical effects on physiology, like heart rate modulation or dryness in the mouth, which in turn have effects on the intonation of the voice. This is why it is possible in principle to predict some emotional information from the prosody of a sentence.

Sony CSL are investigating how to control the pitch (fundamental frequency) and energy of synthetic speech signals so that a robot can express attitudes or emotions that can be recognized by humans. They have designed an algorithm which generates lively cartoon emotional speech, stylized so that people of many different native languages can reliably identify the emotion. The degree of emotion can continuously be varied. The technology was validated with human subjects.

Sony CSL have also made a large scale experiment in order to find out which features and which machine learning algorithms are best to recognize the emotion in the voice of human speakers. State-of-the-art data-mining techniques were used to find the best feature set among more than 400 features together with the best learning algorithm, ranging from nearest-neighbours, Bayesian classifiers, neural networks and support vector machines. Tests were made with a database of 6 Japanese speakers, with five emotions (neutral, anger, sadness, bored, happiness). There were 6000 sound samples in total. Surprisingly, it was found that the best features were not those used in the psycho-acoustic literature, but new ones based on the quartiles of the distribution of the energy values and of the minimas of the pitch contour.

Sony CSL investigates the mechanisms that enable humans and robots to learn new words and to use them in appropriate situations. They have built a number of robotic and computational experiments studying the mechanisms of concept formation, joint attention, social coordination and language games, and articulating the roles of learning, physical and environmental biases in language acquisition. The unifying theme of all these experiments is development: they explore the hypothesis that language can only be acquired through the progressive structuring of the sensorimotor and social experience.

Sustainability

Human economic and technological activities are beginning to impact the Earth's ecosystems at an alarming rate, leading to global warming, climate instability, stress on natural ecosystems, pollution and many other negative effects. Since 2006, CSL has begun to focus its attention very seriously on this important problem. The goal is to develop the infrastructure for *community memories* which empower a community to manage its commons with tools such as participatory sensing, environmental modelling and prediction, social tagging, geographic localisation and visualisation.

Music

Music research at Sony CSL Paris is concerned with three areas: the multiple facets of interaction in music, the challenges of robust music description and the mechanisms of music sharing on ad hoc networks. Dynamic relationships may exist between gesture and system response or among communities of connected users. Meta-data spans the space between high-level personal taste and low-level sonic content. Social dynamics on wireless and peer networks hold the potential to give rise to new forms of musical content. This work leads to the creation of intelligent musical systems that propose new modes of access to music, interaction with sound, and human interaction.

Art and Science

Art-science interactions help to stimulate intuitive thinking that is not reachable by pure rational inquiry alone. Lab members therefore regularly engage in dialogues with major artists and musicians to develop new creative works shown in major exhibition spaces and theatres.

2.4.2 XRCE

Xerox Research Centre Europe http://www.xrce.xerox.com

Xerox is a company that is founded upon and thrives on innovation. The Xerox

Innovation Group explores the unknown, invents next generation technology and creates new business and shareholder value through its worldwide research centres.

Xerox established its European research centre in Grenoble, France in the early 90s to create innovative document technology and drive the corporate transition to becoming a services-led technology business. The centre coordinates research, engineering and the Technology Showroom, a showcase for Xerox research and a technology exchange forum with thousands of customers every year. XRCE also develops connections within the wider European scientific community through collaborative projects and partnerships.

XRCE is part of the global Xerox Innovation Group made up of 800 researchers and engineers in four world-renowned research and technology

centres. Approximately 100 people work at the European research centre. Researchers and engineers in Grenoble collaborate with private and public research institutions in the area as well as with their Xerox colleagues at the Webster Research Centre in New York and the Palo Alto Research Center (PARC) both in the USA.

Research & Technology

Research in Europe takes a strongly inter-disciplinary approach, ranging from cognitive vision, computer science, statistics and mathematics to linguistics and sociology. All research projects revolve around documents and related services to improve customer communications and productivity in the workplace. There are six complementary research areas within the laboratory. Most employ machine learning and/or rule-based methodologies in multilingual text, image and data processing with the exception of the Work Practice Technology Area. This group develops a deep understanding of customer document processes to help design new technologies to support them. The applications developed at XRCE aim at streamlining document intensive processes, bridging the paper and the digital worlds and facilitating information management in multiple languages. The centre is at the heart of many of the components in Xerox's 'Smarter Document Management' suite such as text and image categorization, XML conversion and advanced linguistic analysis tools. Their deployment automates customer processes and provides value added functions such as indexing, semantic search, document routing and publishing in multiple formats.

The XRCE text categorization tool automates manual categorization and has demonstrated enormous customer cost savings and enhanced business performance. The tool works in over 20 languages.

Image categorization performs a similar function to the text categorizer but for digital images with many different kinds of content. It is useful in a number of applications in the document lifecycle including document creation using auto-illustration, digital asset management, image retrieval and image enhancement for printing.

Document conversion to the eXtensible Markup Language (XML) enables unstructured documents to be processed like structured data. The growing demand to streamline document intensive processes such as authoring and publishing or manufacturing and new drug approval is addressed by being able to automatically convert scanned documents into XML.

The underlying technology uses a unique combination of methods so that it learns and adapts itself to achieve the best results yet is reusable and hence affordable.

Text mining and semantic search tools are required too. Unstructured text is estimated to make up four fifths of the information created by companies worldwide. XRCE tools master the finely grained semantic processing required to identify business critical information for corporate finance, risk management and litigation or new drug discovery.

XRCE collaborates with academic, government and industrial research groups and participates in a variety of national and European Commission funded projects. Researchers are members of research review boards and expert panels and hold positions at other academic institutions. The centre welcomes visiting professors and students from across the world. It runs an extensive annual intern programme and also partners with universities through the Xerox Foundation which each year funds around 40 projects at 30 colleges and universities worldwide.

3. Future Trends

In 2006 AFIA organized a celebration of 50 years of AI[6]. The programme was elaborated to bring some interesting points of view on AI research, applications and future:

- **AI and time for experiences**: Jacques Pitrat
- **Back to the Future: retrospective glance on the anticipations of AI**, Jean-Gabriel Ganascia (lip6)
- **Artificial Intelligence and Informatics**, Round table animated by Jérôme Euzenat (INRIA)
  - Could the information system be intelligent? Yves Caseau (Bouygues Telecom)
  - Creativity and Informatics Jean-Luc Dormoy (CEA)
  - In search of the machine to learn with, Pierre Tchounikine (LIUM)
  - Agents and Humans Yves Demazeau (IMAG)
  - Web and language : in search of relevance, Luc Steels (Sony CSL)
  - Human-machine Communication: Interaction, brain and cognitive science, François Cabestaing (Université Lille 1)
- **AI in National and European Programmes** Patrick Corsi (Kinnsys), Bertrand Braunschweig (ANR), François Cuny (Pôle System@tic),
- **AI : Towards New Frontiers, opportunities and challenges** Round table animated by Eunika Mercier-Laurent (Université Lyon 3), with the participation of Patrick Albert (Ilog), Paul Bourgine (CREA), Vincent Lemaire (France Télécom), Michèle Sebag (AFIA) and Patrick Tallibert (Thales)

Among the challenges: AI has to bring more services for today's life, help to preserve our planet, bring assistance to older people or persons with handicaps, aid us in real-time learning, creativity and problem solving [Amidon, Formica and Mercier 2005], [Mercier 2006]. The paradox is that AI have to be integrated

6 The video from the 50th anniversary is on
http://ru3.com/luc/tag/afia/50-ans-intelligence-artificielle-afia.html
http://ru3.com/luc/tag/people/luc-steels-50-ans-intelligence-artificielle.html

everywhere, but when inside, AI is no more visible. To make AI visible we probably need to create a label *AI inside*.

Concerning the challenges for research – a lot of ideas can come from the "real" world - applied research is difficult but exciting.

A recent trend is to put more AI into interactive electronic games, both individual and collective, as well as into serious games. It is also to connect digital and symbolic AI as for example voice interface [Boulanger, du Chateau and Mercier-Laurent 2008].

4. References

[ACASA Presentation] ACASA Lip6 Research Group presentation: Cognitive Agents and Automated Symbolic Learning. http://www-acasa.lip6.fr/index.php?choix=0&langue=en

[Amidon, Formica and Mercier 2005] P. Amidon, E. Formica and E. Mercier-Laurent: Knowledge Economics: Emerging Principles, Practices and Policies, Tartu University Press, 2005

[Boulanger, du Chateau and Mercier-Laurent 2008] D. Boulanger, S. du Chateau and E. Mercier-Laurent E. 2008, System for the inventory of cultural heritage using voice knowledge acquisition. Accepted for AI 2008, Cambridge.

[Cabestaing 2007] F. Cabestaing, EEG-based Brain-Computer Interface for Enhanced Communication, HuMaN'07 First International Conference on Human-Machine iNteraction, Timimoune, Algeria

[Marson, Soulignac and Taillibert 2007]. P.E. Marson, M. Soulignac and P. Taillibert, Combining Multi-Agent Systems and Trajectory Planning Techniques for UAV Rendezvous Problems, Cogis 2007, Paris

[Mercier 1994] E. Mercier-Laurent, Right tool for the right problem. Expersys 94 Houston

[Mercier 1995] E. Mercier-Laurent, Methodology for Problem Solving using AI. Expersys95.

[Mercier 1996] E. Mercier-Laurent, Knowledge Management some industrial examples Expersys 96 Paris

[Mercier 1997] E. Mercier-Laurent, Knowledge based Enterprise - How to optimise the flow of knowledge - theory and practice. Knowledge Acquisition Szklarska Poreba Poland 25-27 April 97

[Mercier 2004] E. Mercier-Laurent, From Data Programming to Intelligent Knowledge Processors, Cutter IT Journal December 2004

[Mercier 2006] E. Mercier-Laurent Brain Amplifier for Holistic Knowledge Management using New Generation of AI, ICAI, Beijing 2006

[Verbeck and Gueye 1996] P. Gueye and F. Verbeck: Open KADS & Hypertexts, Bull DSIS-CEDIAG. 1996