# ARTEMIS

ARTEMIS (Advanced Research and TEchniques for Multidimensional Imaging Systems) is a team of scientists whose research focuses on the **Digital Imaging Sciences and Technologies** field. Its research area covers the analysis, enrichment and exchange of 2D or 3D, static or animated, natural or synthetic visual contents. This recognized expertise is deployed in exploratory or pre-competitive projects, mainly in the fields of electronic communications, e-health and biosciences.

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## € PRESENTATION

### THE TEAM

To fulfill its research activities, ARTEMIS relies on a team of scientists consisting of 7 professors, 3 research engineers, 12 doctoral students and 2 post-doctoral students. The department regularly hosts intern students from French or foreign Engineering Schools and Universities. Administrative support is provided by an administrative assistant.

### RESEARCH THEME

The core of ARTEMIS research activities concerns **Digital Imaging Sciences and Technologies**. These technologies pose significant challenges to economic and academic players who need to design innovative methods and new services for the information society.

Today, digital imaging covers a broad spectrum of visual data:

- 2D (radiography, photo, etc.) or 3D (industrial CAD, video game objects, etc.),
- static (photos, drawings, etc.) or animated (videos, dynamic meshes, deformable objects, etc.),
- natural (from the physical world) or synthetic (computer-generated),

in a fixed or mobile environment.

ARTEMIS deals with the **image chain**, from the creation of digital contents to their transmission.

The challenge is to create, model, analyze, index, animate, protect, manipulate, enrich, encode, distribute and visualize heterogeneous and complex contents for economically viable emerging services. The main properties and constraints that need to be mastered are:

- scalability in the context of very large-scale databases,
- management of asynchronism,
- user-friendly and intuitive interactivity,
- confidentiality and security,
- access by the end-user to his/her usual personalized environment irrespective of the platform used,
- adaptation of quality of service according to available resources: transmission, processing, display capacities, etc.

In order to contribute to this rapidly evolving field, ARTEMIS deploys a wide range of expertise.

### SCIENTIFIC EXPERTISE

This expertise lies in three areas:

- **analysis:** modeling, reconstruction, shape / motion / texture segmentation, etc.
- **enrichment:** indexing, protection, animation, interactivity, enhanced reality, etc.
- **exchange:** compression, transmission, visualization, interoperability, etc.

Mastering the bilateral analysis-exchange, analysis-enrichment, enrichment-exchange interactions, ARTEMIS owns a global expertise in the digital image production chain.

In recognition of its achievements, ARTEMIS has been awarded the *Marie Curie Training Site* label by the European Community. This label acknowledges the laboratories that combine scientific reputation with proven experience in doctoral training programs in a European context.

### STANDARDIZATION

ARTEMIS plays an active role in the standardization of multimedia contents as:

- a representative of France in ISO SC29, covering the MPEG and JPEG standardization activities,
- an official liaison between SC29 and CEN (the European Committee for Standardization),
- an AFNOR expert and vice HoD (Head of Delegation),
- a co-publisher of the MPEG-4 standard,
- an author of technical contributions to MPEG-4, MPEG-7 and MPEG-21 standards.

### APPLICATION AREAS

- Communicating Society: secure video services on mobile terminals, virtual signer- and lip reading-based communication systems for the hearing-impaired, remote-assistance for the car industry…
- Culture and entertainment: online gaming, interactive digital television, cartoon creation, video on demand on ADSL…
- e-health and biosciences: computer-assisted diagnosis in cardiology, pneumology and neurology, genomics, etc.

# ARTEMIS: a player in ICST competitiveness

The ARTEMIS expertise in the field of digital image science and technologies and open multimedia standards contributes to the excellence of two competitiveness clusters based in the Ile-de-France region.

As part of **SYSTEM@TIC**, devoted to complex software and systems, and **Cap Digital**, which focuses on multimedia digital contents, ARTEMIS is involved in 3 structuring projects: **FAME 2**, **HD3D-IIO** and **Terra Data**.

### FAME 2
### *Flexible Architecture for Multiple Environment*                     SYSTEM@TIC

| | |
|---|---|
| To develop a new generation of high-performance servers adapted to data-intensive computing and multimedia content processing by 2008. | **ARTEMIS contributions:** To create a software architecture for a real-time platform for intelligent access to enriched video contents. |

### HD3D-IIO
### *Initiative for an Open Industry*                     CAP Digital

| | |
|---|---|
| To provide the digital content creation and production sector with open-ended, collaborative and interoperable technologies for enhanced operational efficiency and security. | **ARTEMIS contributions:** To develop the representation models for the indexing and protection of natural and synthetic visual contents. To promote open standards in order the interoperability of exchanges. |

### Terra Data                     CAP Digital

| | |
|---|---|
| To model and enhance territorial heritage by creating production and consultation platforms integrating virtual environment and augmented reality facilities. | **ARTEMIS contributions:** To design and implement scalable representation, compression and transmission technologies for 3D graphic contents. |

## ARTEMIS STRUCTURING PROJECT

The research and standardization activities conducted by ARTEMIS represent the **ARTEMIS** structuring project which contributes to GET's **Communicating Multimedia** program.

The ARTEMIS structuring project capitalizes on the results of exploratory and pre-competitive projects, be they European, national, industrial or institutional, drawing upon the team's scientific expertise.

Alongside ARTEMIS involvement in competitiveness clusters (see box), 2005 saw the continuation of multi-year projects already underway, as well as the beginning of some new projects: Cream-3D, Hepatic View, IDIM, JEMTU, LABIAO, MICA, Passepartout, RIMES and TAMUSO.

Through these projects, ARTEMIS works in collaboration with many French or foreign industrial, institutional and academic partners including:

- Air Liquide, Bull, BCE, CEA, EDF, DGA, France Telecom, IMEC, Philips, Renault, SFR, Thalès, Telefonica, Telvent, Thomson, TGS…
- A2IA, Arcadia design, Chartoon, Larian Studios, Prewise, Quadraxis, Stoneroos, V2 …
- CNEFEI, CNRS, CRP-HT Luxembourg, DATHA…
- Centre de Génétique Moléculaire d'Orsay, ETRI, Faculté de Skopje, GET, INRIA, INSERM, INSA de Lyon, Loria, Technische Universiteit Eindhoven, Université Paris 5 René Descartes, Université Paris 6 Pierre et Marie Curie, Université Paris Dauphine, Université Paris Sud 11, Université Paris 12 Val de Marne et Université Paris 13 Nord, Université Polytechnique de Madrid, UTC-Gradient…

The various projects developed in 2005 are presented in the rest of the document.
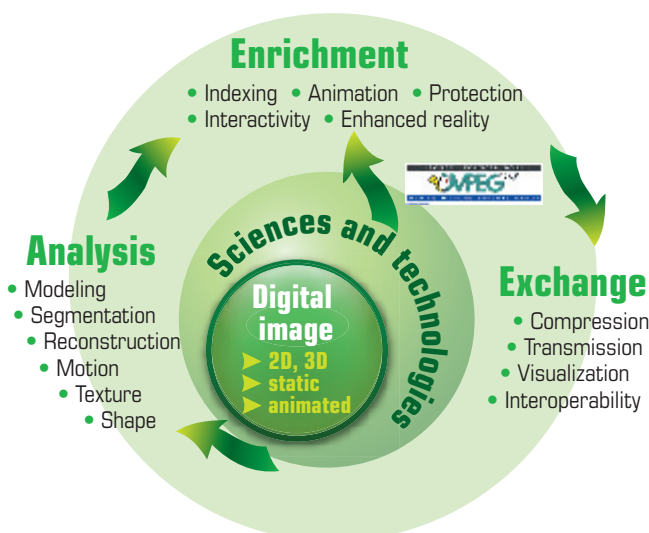
## PATENT

It should be noted that following developments resulting from the TAMUSO project, a French patent application No. 05 54132 has been filed jointly by SFR and GET/INT concerning a "video sequence watermarking process", the inventors being Mihai MITREA, Françoise PRETEUX and Jean NUNEZ.

**Enrichment**
- Indexing • Animation • Protection
- Interactivity • Enhanced reality

**MPEG**

**Analysis**
- Modeling
- Segmentation
- Reconstruction
- Motion
- Texture
- Shape

**Sciences and technologies**

**Digital image**
▶ 2D, 3D
▶ static
▶ animated

**Exchange**
- Compression
- Transmission
- Visualization
- Interoperability

# ARTEMIS

| | Project | | Expertise (Analysis / Enrichment / Exchange) | | | Type |
|---|---|---|---|---|---|---|
| | 3D ANDALUS | Pulmonary nodule screening | Analysis | Enrichment | | Institutional |
| | BronWall | Bronchial reactivity and asthma | Analysis | Enrichment | Exchange | Institutional |
| | CardioPerf | Myocardial perfusion in MRI | Analysis | | | Industrial |
| | Cream-3D | MPEG-4 platform | | Enrichment | Exchange | European |
| | Hepatic View | Computer-assisted preoperative analysis of the hepatic vessels | Analysis | Enrichment | | Institutional |
| | IDIM | Dynamic imaging in genomics | Analysis | Enrichment | Exchange | Institutional |
| | JEMTU | Mobile phone games | | | Exchange | Institutional |
| | LABIAO | Communication systems for the hearing-impaired | | Enrichment | Exchange | National |
| | MICA | Video on demand over ADSL | | Enrichment | Exchange | National |
| | OLGA | Online gaming | Analysis | Enrichment | Exchange | European |
| | Passepartout | Interactive and scalable digital TV | Analysis | Enrichment | Exchange | European |
| | RIMES | Handwritten document recognition and indexing systems | Analysis | Enrichment | | National |
| | RMOD | Morphofunctional simulator of the airways | Analysis | Enrichment | Exchange | National |
| | SEMANTIC-3D | Remote assistance for the car industry | Analysis | Enrichment | Exchange | National |
| | TAMUSO | Mobile telephony watermarking | Analysis | Enrichment | Exchange | Industrial |
| | TOON | 3D cartoons | Analysis | Enrichment | Exchange | Industrial |

**Expertise**
- 🔴 *Analysis*
- 🟡 *Enrichment*
- 🔵 *Exchange*

**Type**

*Institutional*  *Industrial*  *National*  *European*

## 3D ANDALUS

### Computer-assisted diagnosis for the screening of pulmonary nodules

3D ANDALUS contributes to the implementation of a computer-assisted diagnosis system for lung cancer screening.

From methodological advances achieved in collaboration with Pitié Salepêtrière hospital (Central Radiology Department) for the automatic detection of pulmonary nodules by CT scanning, research work has continued within the context of honeycomb and frosted glass-type lung diseases. A collaborative agreement with the National Chung Cheng University of Taiwan is currently being set up.

**Partner:** AP-HP
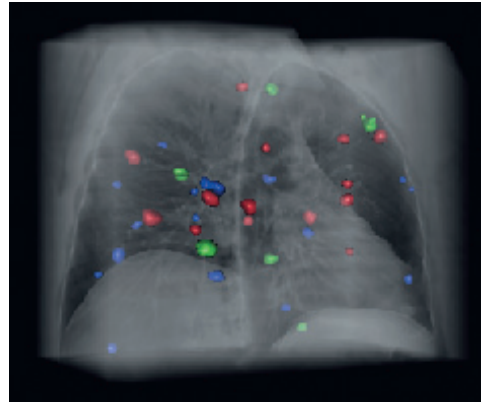


*Automatic detection of isolated (in red), juxtavascular (in green) and sub-pleural (in blue) pulmonary nodules. The sensitivity and specificity of the method are 95% and 97% respectively (Patent No. 03/13280).*

## BronWall

### Bronchial reactivity and asthma

Launched in 2004 in collaboration with Pitié Salepêtrière Hospital (Central Radiology Department) and Glaxo France, the objective of *BronWall* is the quantitative evaluation of bronchial reactivity and bronchial wall thickening in asthmatic subjects. In 2005, the project continued with the development of a fully-3D bronchial wall segmentation model, which allows the limitations inherent to a 2D approach to be overcome. Ultimately, advances in galenic, concerning new therapeutic protocols and improved patient follow-up are expected.

**Partner:** AP-HP

*Meshed model of the internal (in green) and external (in red) bronchial walls generated automatically from high-resolution CT data.*



*Axial CT slices illustrating the accuracy of the segmentation of internal and external walls.*
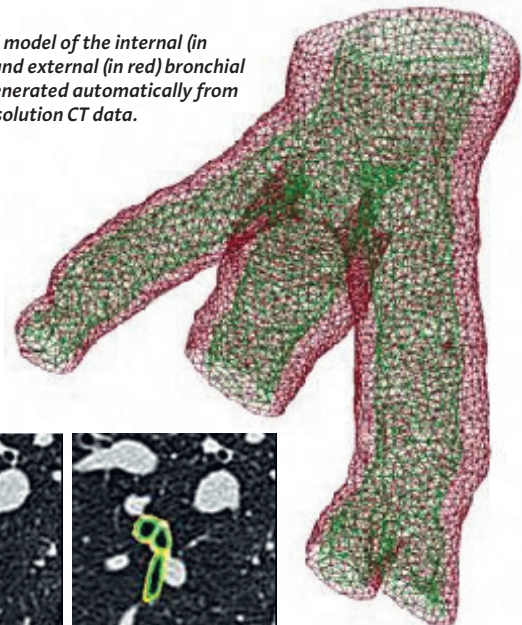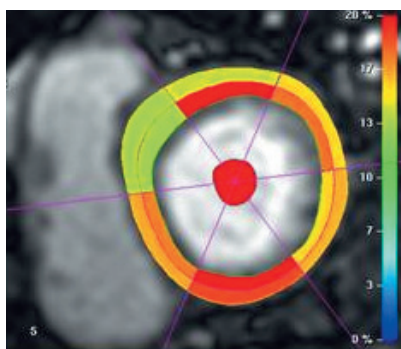


## CardioPerf

### Quantitative analysis of myocardial perfusion in MRI

Following on from the CardioMeter project dedicated to the quantitative analysis of heart function in tagged MRI, the CardioPerf project,

*Automatic quantification of myocardial perfusion*



conducted in partnership with Philips Medical Systems, focuses on measuring myocardial perfusion in MRI, with a view to a joint analysis of perfusion/contraction.

Research work in 2005 related to the development and preliminary clinical validation of an unsupervised methodology for the quantitative analysis of perfusion MRI examinations, enabling first pass graphs to be computed automatically for each myocardial segment. This approach is based on the extraction of a cardiac region of interest by mathematical morphology, the compensation of cardio-respiratory artifacts by region-based nonrigid statistical registration, and the dynamic segmentation of the heart during transit of a contrast agent via a new class of statistical active contours (*info-snakes*).

**Partner:** Philips

## Cream-3D

### MPEG-4 platform

In partnership with the *Computer Science and Distance Education Lab.* of the *Faculty of Electrical Engineering* (CSDE/FEE) (Skopje, Macedonia), this project aims at establishing a comprehensive MPEG-4 platform to promote the deployment of the ISO MPEG-4 standard in scientific and industrial communities.

Early results and spin-offs have led to the development of new products and services for interactive digital television and online games within the framework of the OLGA and Passe-partout projects.

**Partner:** Université de Skopje

## Hepatic View

### Computer-assisted pre-operative analysis of the hepatic vessels

Launched in 2005 within the context of cooperative work with AP-HP - Pitié Salpêtrière Hospital (Central Radiology Department), the Hepatic View study relates to the automatic segmentation of the hepatic vessels during various phases of perfusion in CT scanning. The derived information is then exploited within the framework of computer-assisted pre-operative analysis, both in the case of healthy donors and in the ablation of diseased regions.

In this context, ARTEMIS has developed a semi-automatic technique modeling the hepatic vascular network combining 3D mathematical morphology and multi-criteria Markov random fields. Evaluation of the results obtained is currently ongoing within the context of a national scale clinical protocol.

**Partner:** AP-HP
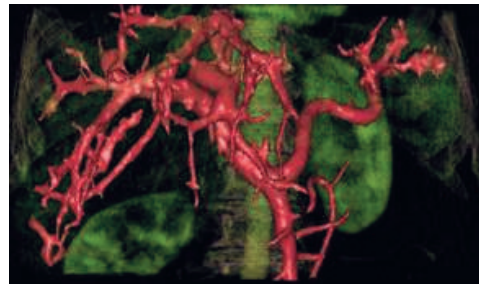


*Portal and hepatic veins (early portal phase).*
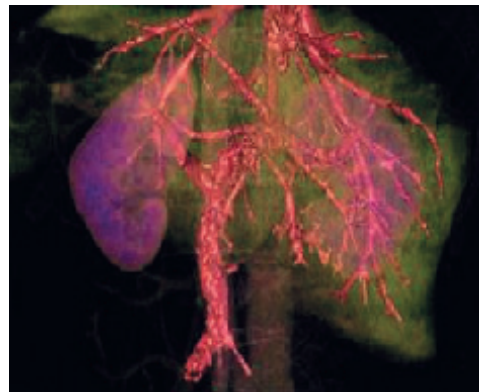


*Portal and hepatic veins (late portal phase).*

## IDIM

### The dynamic analysis of interactions between macromolecules

The rapid expansion of biotechnologies paves the way for numerous applications in the field of genetics, such as the classification of gene expression profiles, functional genomics, diagnosis and medical treatment support. These applications rely on the synthesis of biochips, the simulation of biological interactions, their analysis and interpretation using an optical sensing system such as fluorescence or surface plasmon resonance.
The analysis of DNA::DNA interactions using these technologies consists in grafting markers onto the DNA sequences being studied in the form of spots on a glass support (biochips),

causing the marked DNA sequences to interact with the target DNA sequence (hybridation) and monitoring the progress of the reaction in real time using an optical sensing system. The images produced reflect the quantity of matter of each spot having interacted with the target between two successive readings. Quantifying the hybridation of each spot requires precise segmentation of the spots on these images, in spite of their high variability in terms of shape, intensity and spatial location.
The IDIM project conducted in collaboration with the Molecular Genetics Center in Orsay (CGM) is contributing to the development of tools for the automatic segmentation and analysis of spots in dynamic biochip images.

**Partner:** Centre de Génétique Moléculaire

## JEMTU
### Mobile phone games

The today available computational power on mobile phones enables the integration of complex multimedia applications, such as 3D games. Their implementation nevertheless requires the optimization of the manipulation content representation. In order to guarantee interoperability, in particular during design and production of the hardware components (chipsets), a standardized representation must be adopted.
In this context, ARTEMIS is contributing to GET's innovative JEMTU project, ensuring the integration in the mobile platform of the specific tools for the representation and manipulation of synthetic 3D contents in MPEG-4 format.

In addition to seeking new, efficient and scalable 3D compression architectures, the objective is to analyze and evaluate the relevance of the MPEG-4 standard with respect to the constraints imposed by mobile environments.

**Partners:** Télécom Paris, ENST Bretagne, CNAM.

*Mobile telephone (Nokia 6630) integrating the 3D MPEG-4 player developed by ARTEMIS.*

## LABIAO
### Communication systems for the hearing-impaired

The objective of the LABIAO project (*Lecture lABIale Assistée par Ordinateur* or computer-assisted lip reading) is to design, develop and distribute a software suite that increases the autonomy of deaf and hearing-impaired people in their day-to-day professional and social lives. In this context, ARTEMIS is developing a comprehensive solution for facial animation compression, transmission and visualization (3D pose and expressions), compliant with the MPEG-4 standard.

In particular, the *morphing* technology promoted in 2005 by ARTEMIS in MPEG-4 Part 16 is used to animate a synthetic face realistically at low bitrates.
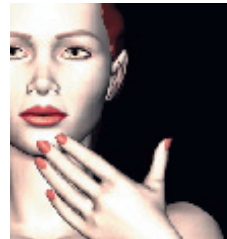
**Partners:** EDF, DATHA, LORIA, LINC, CNEFEI.

*Combining gestures with the articulated speech is the objective of the supplemented spoken language used by the hearing-impaired to communicate.*

## MICA
### Innovative MPEG-4 coding for audiovisual contents over ADSL

With MPEG-4, a significant advance in terms of audiovisual usage and consumption has been made allowing a "triple play" (Internet, Telephone and Television) service subscriber to two audiovisual programs over a single ADSL line. The objective of the RIAM MICA-ADSL project is to demonstrate that it is possible to:
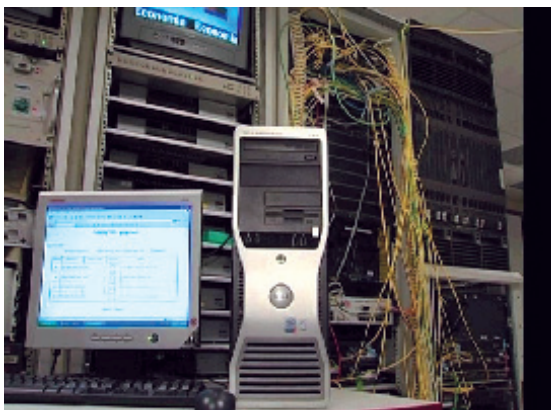• develop and validate interfaces towards Ethernet-type networks (as well as an architecture for cohabitation with and migration to ATM networks) integrating jitter and error rate control;
• increase by a factor of 2 the broadcast capacity of ADSL networks by implementing the new MPEG-4 Part 10 – Advanced Video Coding (AVC) video compression standard;
• develop new video-on-demand services (VOD) adapted to MPEG-4/AVC format.

The contributions of ARTEMIS are related to:
(1) the development of an MPEG-4 AVC encoder, achieved using the ISO reference software and validated by crossover exchanges with the Thomson encoder;
(2) the development of an entire distribution chain for a VOD service.
The project is now operational and is the first demonstration of the deployment of a VOD service with MPEG-4 AVC contents via the ADSL network.
ARTEMIS' developments have been integrated into the global platform of the project set up by France Télécom. Early results and spin-offs have led to the creation of new products and services for interactive digital television and network games, within the context of the OLGA and Passepartout projects.

*The platform for the VOD service integrating ARTEMIS technologies*

**Partners:** Grass Valley, Thomson, France Télécom.

## OLGA
## Online video games

Today, the video games industry faces new challenges represented by online games.
In addition to high-level graphics applications, the entire dimension of a complex software and hardware infrastructure now has to be taken into account in order to consistently manage:



- multimedia contents in a distributed environment,
- real-time interactivity,
- the diversity of platforms (PC, PDA, mobile phone, etc.) and heterogeneity of networks.

The interoperability of applications and the scalability of contents therefore represent technological foundations for which ARTEMIS is developing innovative solutions. In 2005, and for the very first time in the world, the OLGA European consortium demonstrated the feasibility of deploying a 3D game in a heterogeneous environment using a scalable content representation. A multi-player, multi-network (IP, GPRS, UMTS), multi-terminal (PC, Nokia 6630) game was thus successfully prototyped and implemented. ARTEMIS technologies were an integral part of this achievement.

**Partners:** Philips, IMEC, UPM, Telefonica, Arcadia Design, Larian Studios

*In order to adapt 3D graphic contents for online games, ARTEMIS developed a hierarchical modeling of articulated 3D objects along with a scalable compression architecture for animation streams which dynamically selects the parameters to be encoded and controls the transmission rate.*

## Passepartout
## Interactive and scalable digital television

Technological convergence, seamless integration and universal access are the key words in today's multimedia. In this context, digital television plays a central role and is raising new challenges for the scientific community in terms of functionalities, usages and services. How can we reconcile the worlds of the web and television? How can we distribute content everywhere, on different networks (fixed or mobile) and terminals (PC, STB, PDA, mobile phone, etc.), while at the same time exploiting unconventional interaction modalities inspired by virtual reality applications? How can we share, exchange, enrich and customize these contents in an efficient and scalable manner? How can we make the science fiction reminiscent scenarios real and operational today those scenarios more reminiscent of science fiction? Numerous questions within one main one: how can we create a new type of digital television, accessible everywhere and available to all? This is the ambitious challenge being tackled by the Passepartout project, bringing together a European industrial and academic elite within a broad consortium. Within this stimulating context, ARTEMIS is responsible for the *Content & Tools* sub-project, the most innovative component of Passepartout.



*Interactive and personalized digital television: ambient intelligence for 3D navigation through enhanced reality scenes.*

This concerns, firstly, the development of authoring tools for TV content creation based on MPEG-4/7/21, MHP, SMIL and TV-Anytime standards and, secondly, the development of new interaction mechanisms, founded on advanced vision and analysis techniques for 2D and 3D multimedia content.

**Partners:** Philips, Thomson, VTT, Telvent, LORIA, UPM, TUE, CRP HT, ETRI, Cardinal, Prewise Oy, Saint-Thomas, CharToon, Jutel Oy, UVIGO, Stoneroos, V2, CWI, IRUTIC

## RIMES

### Textual document character recognition and indexing systems

The RIMES project ("*Reconnaissance et Indexation de données Manuscrites et de fac similÉS*" or Recognition and indexing of handwritten and faxed documents) is aimed at enabling evaluation of systems for recognizing and indexing handwritten documents sent by individuals to companies by mail or fax. This involves:
• creation of a broad database of such documents,
• specification of the protocol (criteria, metrics, etc.) for the assessment campaign on the basis of these data,
• conduct of the said campaign,
• study, analysis and synthesis of the results,
• disseminating the resulting database to the scientific community at the end of the campaign.
ARTEMIS supervises the project, is involved in the various phases for implementation and specification of the campaign, and has created the project's website and that for voluntary writers.

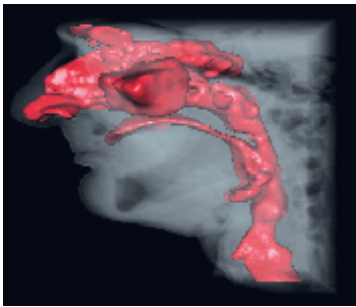**Partners:** A2iA, DGA-CTA, Technovision

## RMOD

### Morphofunctional simulation of the airways

In 2005, significant progress was made within the context of the RNTS R-MOD project, concerning the 3D reconstruction and functional exploration of the airways. The results concern, the first simulations of air flow within the bronchial network and, secondly, the development of new tools for 3D segmentation and analysis of the upper airways in the context of a concerted study with Air Liquide, INSERM and INRIA.
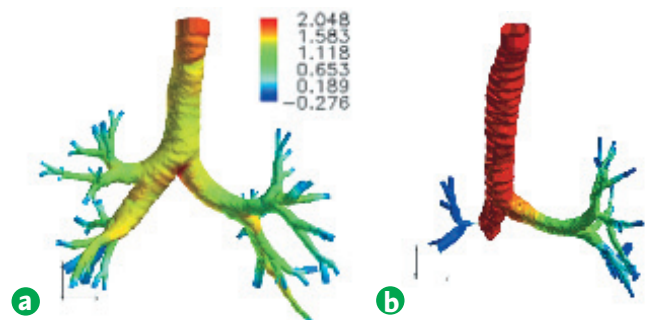A test platform integrating the simulator has been deployed on the Air Liquide site to study respiratory system diseases on a real scale and to specify inhaled drug delivery protocols.

**Partners:** Air Liquide, CNRS, INRIA, INSERM, Université Paris VI


3D reconstruction of the upper airways



*Quantification of parietal pressures in a bronchial network: normal (a), with stenosis on the right bronchial stem (b).*

## SEMANTIC-3D

### Remote assistance for the car industry

The leading French car manufacturer, RENAULT, wants to develop and exploit an information and communication system compliant with heterogeneous nomadic environments, to bring into operation new remote consultation, assistance and maintenance services.

*For the indexing component of the project, ARTEMIS has developed 3D and 2D/3D shape descriptors adapted to the various remote enquiry scenarios along with description schemes combining semantic and geometric features to create virtual repair manuals.*



To respond to these requirements, the RNRT SEMANTIC-3D project is aimed at proposing new approaches for (de)coding 3D graphic objects, developing user interfaces based on virtual reality to simplify access to various contents and securing data exchange.
Ultimately, new compression, indexing and watermarking techniques will be incorporated in the information and communication system between mechanical parts designers, nomadic users, represented by either car mechanics or dealers, by means of a central 3D data server, and using various wired or wireless communication networks.
ARTEMIS has developed methodological and technological solutions for dynamic adaptation of contents to the resources available (bandwidth, terminals, etc.), manufacturer data protection (identification, authentication, traceability), description of heterogeneous multimedia contents and real-time intelligent access to large-scale databases.

**Partners:** LIRIS, ENIC, EURECOM, RENAULT, TGS

## TAMUSO

### Watermarking in mobile telephony

With the rapid development of 3G mobile telephony, operators need to offer operational solutions to protect copyright related to multimedia contents distributed on nomadic terminals.

In this context, the TAMUSO project (*TAtouage Multimédia et ses Usages dans les réSeaux mObiles*



*Interface of the website developed*

– Multimedia watermarking and its applications in mobile networks) is aimed at developing robust multimedia watermarking methods, meeting the stringent requirements imposed by the interactivity-reactivity-adaptability triptych in mobile environments.

Combining an original statistical approach with an innovative communications paradigm derived from the classic noisy channel model, the main features of the solution developed by ARTEMIS are:

- a unified general-purpose theoretical framework, jointly applying the two major paradigms of watermarking, i.e. spectrum spread and side information;
- a versatile algorithmic approach to content heterogeneity (video, audio, 3D), terminals, networks and services;
- a certain longevity in terms of withstanding ever-evolving attacks, made possible by a modular algorithmic structure.

This research has been the subject of a joint SFR/GET-INT patent application.

**Partenaire :** SFR

## TOON

### 3D cartoons

Today, automating the animation process in the cartoon production process has become a major economic issue for the entertainment industry. A privileged partner of this industry, Quadraxis proposes interactive and user-friendly authoring tools to aid cartoon design and production, respecting the traditional practices of creative artists and at the same time incorporating them within a unified and standardized architecture in order to cut off production costs.

The TOON project is aimed at transfering to Quadraxis of innovative technological approaches developed by ARTEMIS, concerning:

- modeling and reconstruction of 3D objects from a few (4 to 8) 2D drawings corresponding to its projections,
- animation and deformation of virtual characters,
- 2D/3D registration of virtual characters according to the story-board defined by the script-writer,
- projection and rendering of 3D characters into a 2D scene.
- scene coding, compression and visualization according to the MPEG-4 standard.

**Partenaire :** Quadraxis



ORIGINALS DRAWS DRAWN BY HAND ... THEN TREATED BY COMPUTER
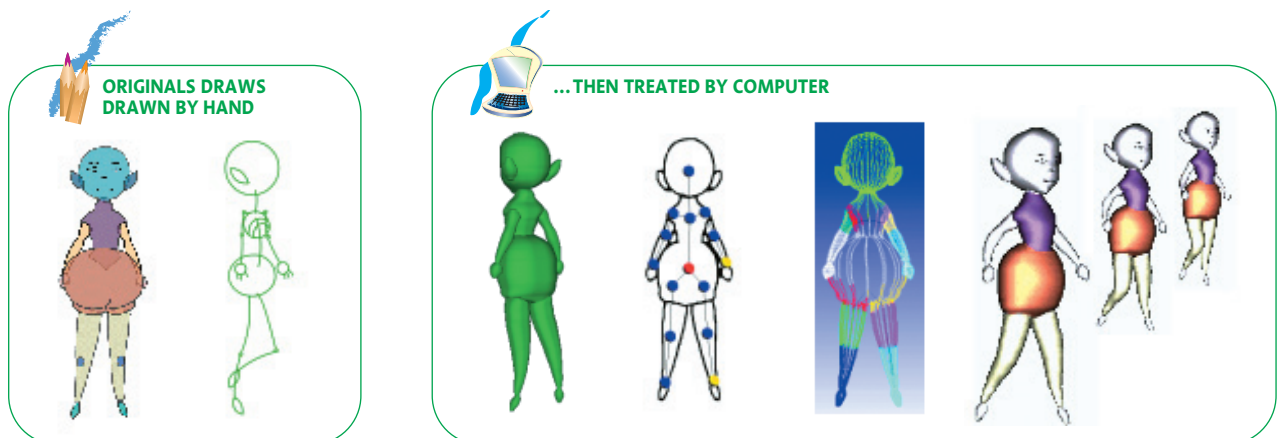
*Creation and 3D modelization of virtual toon caracters.*

## ⓔ EXTERNAL COLLABORATIONS

### NATIONAL COLLABORATIONS

In academic terms, these involve:

- the Schools in the Telecommunications Schools Group (GET), the universities of Paris V, Paris VI, Paris IX, Paris XI, Paris XIII, Evry-Val d'Essonne, the Ecole Polytechnique and ENSMP,
- INSA Lyon, INRIA (Rocquencourt Unit), Loria, CNRS (Molecular Genetics Centre – UPR 2167), INSERM (Research Unit 494).

In institutional terms, these involve:

- the CNRS: participation in the Board of the Information Signal-Image-viSion (ISIS) research network, in the ICST-Health (STIC-Santé) research network and in the Mathematics of Perceptive and Cognitive Systems (MSPC) research network.
- the Centre National de la Cinématographie (CNC), the Institut National de l'Audiovisuel (INA), AFNOR.

In terms of industry, collaborations are being developed through bilateral partnerships (industrial contracts) or within consortiums, in the context of National Research and Technological Innovation Networks.

### INTERNATIONAL COLLABORATIONS

In academic terms, these involve the universities of Texas A&M (USA), ETS in Montreal (Canada), the Politécnica University of Madrid (Spain), the Politehnica University of Bucharest (Romania), Trois Rivières University of Quebec (Canada), the Ecole Supérieure des Communications of Tunis (Tunisia), the Ecole Polytechnique of Tunis (Tunisia), Skopje Faculty of Electrical Engineering (Macedonia).

In industry terms, they fall within the scope of European consortiums and within the context of evaluation of new technologies subject to MPEG standardization processes.

### INFLUENCE

The members of ARTEMIS contribute to INT's scientific influence, as:

- Co-Presidents of Scientific Conferences (2),
- Members of Scientific Conference Program Committees (10),
- Session Chairs at Scientific Conferences (3),
- Reviewers for scientific journals (15),
- Editors, Associate Editors, Co-editors in Scientific Journals or Books (5),
- Members of Research Working Groups (7),
- Positions as chairpersons, reviewers or editors in Standardization Groups (9),
- Experts and reviewers for the European Commission (2),
- Experts (21),
- Reviewers or members of national research accreditation (HDR)/thesis committees (17),
- Invited conference speakers, etc.

## ARTEMIS in brief:

Over the last three years, the research developed at ARTEMIS has led, among other achievements, to:

- the publication of 3 scientific books, an ISO standard, 33 publications in international journals and 7 contributions to scientific books, 75 (resp. 11) papers at international (resp. national) conferences with review committees and proceedings, 55 international contributions to the ISO MPEG standard,
- numerous contractual partnerships - 5 European, 5 national, 5 industrial – worth a total of 4 million euros,
- the supervision of 18 doctoral students - 6 of whom defended theses- and 7 post-doctoral students,
- application for 4 patents, 2 with international extensions.

## DOCTORAL PROGRAM

### Ph.D. theses defended by:

- Olfa Triki for research in the field of "Modeling, reconstruction and animation of virtual characters" (**René Descartes University**, Paris V, *magna cum laude*),
- Diane Perchet for research in the field of "In-silico modeling of the airways: morphological reconstruction and functional simulation" (René Descartes University, Paris V, suma magna cum laude),

### Ph.D. theses initiated in 2005:

- Sorin Duta for a thesis on "Protection of visual contents by robust watermarking: from modeling to standardization",
- Corneliu Dumitru for a thesis on "Protection of multimedia data in mobile environments",
- Rachid Guerchouche for a thesis on " 3D object multiview analysis for collaborative interactions"
- Benoît Le Bonhomme for a thesis on "Simulation and information processing for a multimedia dissemination service",
- François Nicolas for a thesis on

"High throughput analysis of interactions between macromolecules: quantitative imaging on biochips",
- Julien Royer for a thesis on "New interactive multimedia services for mobile television".

### Ongoing Ph.D. theses:

- Antoine Discher for research in the field of "Joint quantitative analysis of myocardial perfusion and function in MRI",
- Pierre-Yves Brillet for research in the field of "Respiratory insufficiency, lung cancer: from imaging to pharmacology",

- Khaled Mamou for research in the field of "New representations of 3D objects for compression, indexing and watermarking",
- Perrine Monjaux for research in the field of "Realistic facial modeling and animation ",
- Amaury Saragaglia for research in the field of "Modeling of bronchial remodeling in volumetric CT scanning",
- Mélanie Lemaître for research in the field of "Robust recognition of logos in complex documents".