

# MULTIDIMENSIONAL AND MULTIMODAL CONTENT AND MEDIA

## CNR Project

The rapid explosion of mono- and multi-dimensional signals (voice, music, video, images, charts, 3D scenes, animations, etc.) on the web and within the diverse applications (industrial design and production, environment, entertainment, cultural heritage, medical diagnosis, education, surveillance, industrial diagnostic, e-Inclusion, etc..) makes the acquisition, processing, communication, retrieval and re-use of multidimensional media a key issue for the ICT research. Moreover the vision of ambient intelligence, which emphasizes the user's role in the future developments of a knowledge-based society, demands for new human-centered and multimodal interaction capabilities.

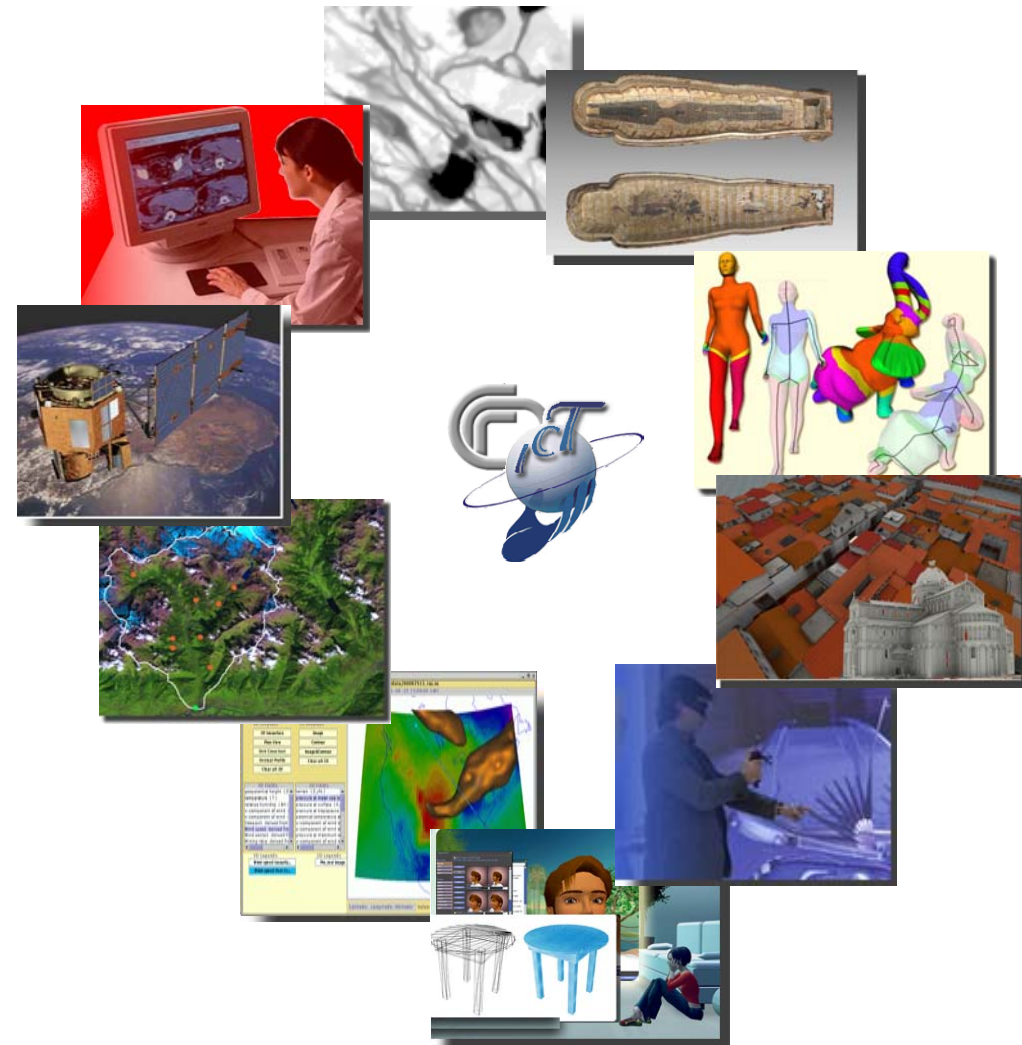
The national project "Multimodal and Multidimensional Content and Media" of the ICT Department of CNR aims at collecting, coordinating and integrating the multidisciplinary research carried out by the CNR institutes on the creation, processing and context-dependent representation and restitution of multidimensional media content.

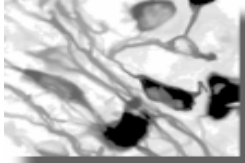
The project aims at radical improvement and innovation in the representation and access to multidimensional contents (images, videos, 3D models, sensor data, sound...) finalised at the achievement of "intelligent" contents, enabling contextual representation and presentation readily comprehensible and re-usable both by experts and by analysis and evaluation tools. At the same time, a more realistic multi-sensorial interaction is being provided, e.g. virtual reality and haptic interaction, to guarantee an easy access to any user following the ambient intelligence and e-Inclusion principles. To achieve these goals, the adopted approach involves the enhancement and integration of the different processes along the whole life cycle of digital content in an efficient and effective way, at different levels of abstraction and meaning.

The project is coordinated by Franca Giannini and is carried out by 10 Research Units, grouping researchers belonging to different CNR institutes.

### The involved Institutes

- ICAR - Ist. di Calcolo e Reti ad Alte Prestazioni
- ICIB - Ist. di Cibernetica "Edoardo Caianello"
- IEIT - Ist. di Elettronica e di Ingegneria dell' Informazione e delle Telecomunicazioni
- IFAC - Ist. di Fisica Applicata "Nello Carrara"
- IMAA - Ist. di Metodologie per l' Analisi Ambientale
- IMATI - Ist. di Matematica Applicata e Tecnologie Informatiche
- IREA - Ist. per il Rilevamento Elettromagnetico dell'Ambiente
- ISTI - Ist. di Scienza e Tecnologie dell'Informazione "Alessandro Faedo"
- IBB - Ist. di Biostrutture e Bioimmagini
- IDPA - Ist. per la Dinamica dei Processi Ambientali





## Analysis and Description of 2D and 3D Images

- Discrete methods for object identification in 2D images
- Discrete methods for 2 and 3D image segmentation
- Morphological, geometrical and structural feature extraction in voxel models

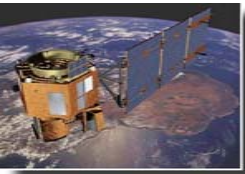
Responsible: Dott. Gabriella Sanniti di Baja  
g.sannitidibaja@cib.na.cnr.it



## Elaboration and Integration of multisource signals and images

- Feature extraction and interpretation in multimedia objects (video, nD images, signals)
- Diagnostic imaging
- Real-time audio signals synthesis and processing
- DSP based audio systems and micro-controllers
- Automated spectrometry, colorimetry and diffraction tomography
- Watermarking techniques for video transmission
- Multimedia metadata extraction, analysis and management
- Hypermedia synthesis

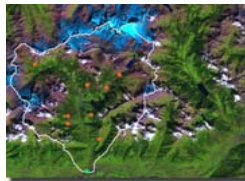
Responsible:  
Dott. Ovidio Salvetti  
ovidio.salvetti@isti.cnr.it



## Systems and techniques for acquisition and processing of remote sensing data

- Instruments for high-resolution data and image acquisition
- Remote sensing data processing: compression; quality assessment; calibration and validation; radiometric, atmospheric and geometrical corrections; restoration; multi-sensor and multi-resolution data fusion

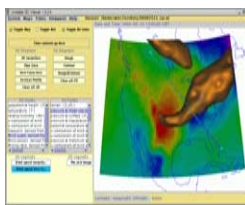
Responsible: Dott. Stefano Baronti  
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## Interpretation techniques of multidimensional remote sensing data

- Integration of multi-temporal, multi-scale, multi-spectral and multi-source data
- Soft computing and clustering techniques for representation, retrieval, analysis of large collections of multidimensional data.
- Computational and statistical methods for detection and synthesis of multidimensional data information content.
- Environmental processes representation

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## Distributed management of multidimensional Earth Science data

- Middleware services for processing and accessing multidimensional data from Earth and Space Science information systems
- Data and metadata models and procedures for the mediation between Earth and Space Sciences and Geospatial Information systems
- Service platforms for enabling Space Data Infrastructure for data sharing

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## 3D scene reconstruction through Computer Vision techniques

- Algorithms and systems for computer vision
- Geometric and colorimetric survey of 3D objects
- Automatic registration of 3D point clouds
- Survey and monitoring of Cultural Heritage Artifacts

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## 3D digital shapes analysis and synthesis

- Geometric and topological methods for the segmentation and synthesis of 3D shapes
- Structural descriptors for the representation of 3D objects at different levels of abstraction
- 3D shape generalization methods

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## 3D visualisation and interaction

- 3D digitization: from point clouds to a complete model
- Interactive visualization of large datasets
- Modelling deformable objects for real time interaction

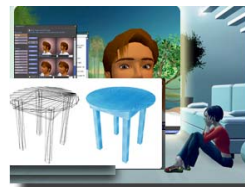
Responsible: Dott. Fabio Ganovelli  
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## Highly Immersive Virtual Reality Systems

- Hardware/software architectural models and infrastructures for Virtual Reality environments
- Middleware infrastructure for multimodal context-based interaction systems
- Advanced techniques for gesture recognition
- Alignment and registration of multimodal images

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## Coding, elaboration and restitution of multidimensional media knowledge

- Context dependent knowledge formalisation for shapes and tools
- Techniques for 3D knowledge exploitation and content annotation
- 3D search engines
- Design for All approach for multimedia application in eInclusion.

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