

**Istituto di Scienza e Tecnologie dell'Informazione**  
**Consiglio Nazionale delle Ricerche**  
**Via G. Moruzzi 1,**  
**56124 Pisa (PI)**  
<http://www.isti.cnr.it>



### **Historical notes**

The **Institute of Information Science and Technologies (ISTI)** is part of the Italian National Research Council (CNR). It is located in the CNR Research Campus in Pisa. ISTI was constituted in September 2000 as a result of a merger between the Istituto CNUCE (CNUCE-CNR) and the Istituto di Elaborazione dell'Informazione (IEI-CNR). ISTI is named in honor of Alessandro Faedo, former Rector of the University of Pisa and President of CNR, in recognition of his important contribution to the advancement of Information Science and Technologies in the Italian academic communities.

### **Mission and activity of the Institute**

ISTI is committed to produce scientific excellence and to play an active role in technology transfer. The domain of competence covers Computer Science & Technologies and a wide range of applications. The activity aims at increasing knowledge, developing and testing new ideas and widening the application areas. ISTI is actively involved in collaborations with the academic world and in cooperative research and development programs, both national and international.

Most of the research activity of the Institute is developed in the context of the Engineering, ICT and Energy and Transport Technologies Department (DIITET) of CNR, some of the research activity is also developed in the framework of other CNR thematic departments: Human and Social Sciences-Cultural Heritage, Physical Sciences and Matter Technologies and Flagship Project "Interomics" as well.

The scientific activity can be classified into 6 thematic areas (in parentheses the research personnel, in percentage, working in the area); for each area, the main research topics are reported.

#### **Networking (10%):**

Ambient Assisted Living (AAL)	Domotics and Home Automation
Ambient Intelligence and Smart Spaces	E-Government, E-Democracy
Certified Electronic Mail	Indoor Localization
Common Authentication Technology Next Generation	Mobile Social Computing
Communication Middleware for Context-awareness	Sensing Technologies for Monitoring Systems
Digital Signatures and Cryptography application	Sensor-based Activity Recognition
Domain-based Message Authentication, Reporting, and Conformance	Wireless Communications

#### **Software (13%):**

Advances in Formal Modeling and Applications	Formal Modelling and Verification of Service-Oriented Systems
Algorithmic Network Models of Spacetime	Model-based E-learning Systems
Analysis of Interdependencies in Critical Infrastructures	Modeling and analysis of Railway Control Systems
Analysis, Testing and Monitoring of Dynamic Systems	Models and Methods for Software Product Evaluation
Dependability Assessment and Fault-tolerant Solutions	Software Certification
Formal Approaches to Product Family Engineering	Software Process Assessment and Improvement
Formal Approaches to Requirements Engineering	Software Product Measurement
Formal Modelling and Verification of Collective Adaptive Systems	Testing for Software Quality and Security
	Verification Tools and Techniques

#### **Knowledge (39%):**

Analytical Platforms & Data infrastructures for Social Mining	Content-based Visual Information Retrieval
Assistive Technologies and Accessibility	Context-dependent User Interfaces
Automatic Text Classification	Data Integration and Processing for eScience
Big Data Analytics & Social Mining	Data Mining Algorithms and Statistical Methods
	Digital Libraries: Foundations and Systems

Emotion-based User Interfaces  
End User Development  
Ethics-sensitive and Privacy-aware Data Mining  
Machine Learning  
Mobility Data Mining  
Model-based User Interface Design  
Multimodal User Interfaces  
Natural Language Processing and Text Mining  
Platforms for Cyber-physical Systems

Research Data Infrastructures, E-Infrastructures and  
Virtual Research Environments  
Scholarly Communication Models, Methods and Tools  
Scientific Database Management  
Semantic Web: Reasoning, Learning and Uncertainty  
Social Network Analysis  
Social Sensing & Semantic Enrichment of Big Data  
Tools for Accessibility and Usability Evaluation  
Visual Analytics

#### High Performance Computing (7%):

Cloud Computing, Cloud Federations, and Cloud  
Resource Management  
Data Mining and Machine Learning for Ranking,  
Prediction, Recommendation  
Information Systems for Big Data: Indexing,  
Compression, Responsiveness

Knowledge Bases and Entity Linking  
Scalable Distributed Computing with Map-Reduce,  
Giraph, Spark  
Social Media Analysis

#### Visual (27%):

3D Digitization  
3D Printing Technologies  
Applications to Cultural Heritage  
Assistive technologies and systems integration  
Computational Biology  
Computational Intelligence in Computer Vision  
Computational Topology and Geometry for Vision  
Document Image Analysis and Restoration  
Hybrid intelligent methods

Interactive 3D Graphics  
Nature inspired computation for Smart Sensors  
Real Time Imaging and Embedded Systems  
Reconstruction from Sampled Dataset  
Scientific Visualization  
Shape Analysis and Description  
Statistical Signal Processing  
Web-based Visualization and Mobile Platforms

#### Flight and Structural Mechanics (4%):

Aerodynamics and Space Experiments on  
Fundamental Physics  
Computational Solid Mechanics  
Mechanics of Masonry Structures  
Satellite Re-Entry Predictions

Space Debris  
Space Mission Analysis, Design and Operational  
Support  
Stratospheric Balloons Mission Analysis and  
Operations

### **Major Research Lines**

With reference to the international context, three major lines of research are pursued:

Big Data - ISTI investigates several challenges and opportunities risen by Big Data. Key topics addressed include compression and indexing for efficient data management; mobility data mining methods, systems and applications and social network analysis; improving search engines, especially for multimedia contents; sentiment analysis; measuring well-being of society; enforcing privacy through privacy-by-design solutions; creating research infrastructures for the acquisition and analysis of Big Data;

Smart Cities & Smart Communities - ICT plays a key role in the realization of the city of tomorrow, providing tools to develop intelligent and sustainable services and to manage city services, adapting them to the needs of citizens. ISTI is engaged on crucial fronts such as mobility, smart buildings, security and safety, communication with the citizen, intelligent transport systems and energy distribution and quality of life, including ambient-assisted living solutions for aging well and for well-being. It also investigates enabling technologies such as integrated platforms and methodologies for modeling, verification and validation of software systems;

Technologies for Cultural Heritage - New methodologies for 2D/3D digitization, multispectral data analysis, data visualization, digital fabrication, multimedia installations, structural analysis and data archival; development and assessment are performed in collaboration with national/international museums, conservation institutions and restoration laboratories, funded mostly by EC grants.



### **Research Organization**

The partitioning into 6 thematic areas aims at giving a synthetic view of the scientific activities of the Institute. Of course, dynamic interactions take place among different areas, giving rise to fruitful cross-fertilization. From a practical point of view, the research staff is organized into 12 laboratories, each having a wide scientific and administrative autonomy. Members of the research staff are normally involved in one or more of these units.

In addition to research activities, ISTI is engaged in training young researchers, in steering the research in national and international settings, and in evaluation activity of others' research projects.

In order to help the development of its young researchers ISTI has established four special awards:

- Young Researcher Award - for researchers with high scientific production (31 and 34 age limit);
- Grants for Young Mobility - travel and accommodation grant to carry out research in cooperation with foreign Universities and Research Institutions of clear international standing (34 age limit);
- "ProgettiISTI" - for the presentation of short cross-lab project proposals;
- Young Open Science Award - for open software/datasets produced by young researchers at ISTI.

In recognition of the importance of training in today's Information Society, ISTI pays great attention to involving doctoral students and post-doctoral fellows in research activities and participates actively in the doctoral programs of the University of Pisa and other partner universities. award for open software/datasets produced by young researchers at ISTI

Research Laboratories pursue a well-defined set of strongly related scientific objectives. In addition to research, objectives may also cover technology transfer and training.

The teams include permanent staff, visitors, post-doctoral fellows and doctoral students, with an average number of 10 members per Lab.

With reference to the thematic areas, the laboratories of the Institute are distributed as follows (in parentheses the name of the head of the lab):

<b><i>Thematic Area</i></b>	<b><i>Research Labs</i></b>
<b>Networking</b>	<b>Wireless Networks (P. Barsocchi)</b>
<b>Software</b>	<b>Software Engineering &amp; Dependable Computing (F. Di Giandomenico)</b> <b>Formal Methods and Tools (S. Gnesi)</b> <b>System and Software Evaluation Center (G. Lami)</b>
<b>Knowledge</b>	<b>Human Interfaces in Information Systems (F. Paternò)</b> <b>Knowledge Discovery and Data Mining (F. Giannotti)</b> <b>Networked Multimedia Information Systems (F. Rabitti)</b>
<b>High Performance Computing</b>	<b>High Performance Computing (R. Perego)</b>
<b>Visual</b>	<b>Signal &amp; Images (O. Salvetti)</b> <b>Visual Computing (R. Scopigno)</b>
<b>Flight and Structural Mechanics</b>	<b>Mechanics of Materials and Structures (C. Padovani)</b> <b>Space Flight Dynamics (L. Anselmo)</b>

### **Technology Transfer**

In the past five years, the Institute had an average of 28.5 active technology transfer (TT) projects per year for a total value of nearly 1.2 MEuro per year. Not big numbers when compared with the data of the projects funded by the EC but still significant.

TT is not just signing projects with industrial partners. Here some examples of our TT activities:

- MeshLab is one of the most successful open source projects developed at CNR It is a professional 3D modeling system, covering from 3D scanning to digital fabrication. It has more than 350K downloads per year and a total of 1.3M downloads since its first release;
- ISTI provides automatic text categorization technology to handle large volumes of textual information to Language Logic llc (US), a leading company in customer feedback management that processes 300M textual documents per year;
- A cooperation between ISTI and Gruppo Editoriale l'Espresso on the application of technologies developed in the NeMIS Lab on real-time visual recognition;
- The D-NET system, developed by NeMIS, is now the supporting platform for the national open access repository infrastructures of Poland, Spain, and Argentina;
- ISTI participates in the EIT ICT Labs projects in the area of smart retail environments, digital cities and trusted clouds. The HIIS Lab contribution concerns the design of software components for context-dependent multi-display user interfaces. The KDD Lab brings in the big data analytics and privacy risk analysis.

### **Attractiveness analysis**

At the end of 2016, ISTI employed 36 young researchers with a temporary position and over 60 among postdocs, research fellows, fellowships and Ph.D. students with a university scholarship. A high number of young that denotes a high capacity of self-financing (and thus the possibility to hire young personnel under training) as well as an allure for the research activities of the Institute.

The post-graduate training of ISTI young people is of great quality. Many have found good professional opportunities in Italian or foreign universities or in important industries in the ICT sector. <http://www.isti.cnr.it/about/formercolleagues.php>.

Among the research lines that are more attractive for young people and that offer greater job opportunities, we have:

- Search, machine learning and big data solutions - The techniques of search, machine learning, and processing of big data. Past Ph.D. students work in fact now for well-reputed and competitive companies such as Yahoo (4 researchers), Facebook, Twitter, and Tiscali (istella);
- Text analytics - Text analytics ranges from the extraction of structured information from short pieces of text to aggregated analysis of large collections, always based on supervised machine learning. Each solution is designed not only with the objective of effectiveness but also efficiency and scalability, key requisites for current applications to huge data flows from the Web and social networks;
- Visual analytics, mobility data mining, social network mining and privacy-preserving data mining are the cornerstones of Social Mining. They provide the ability to discover individual and collective behaviors out of Big Data for understanding and forecasting many complex and hidden socio-economic phenomena with the purpose to of adding intelligence to services in a variety of domains such as Smart Cities, Economy, Marketing, Well Being and Health;
- Internet of things - ambient assisted living, smart spaces, and smart communities, wireless communications, mobile social networks; issues that are of great interest today for the society and for industries that operate in the sector;
- Heterogeneous data analytics and multimedia understanding - from intelligent transport systems to lifestyle and environmental monitoring;
- Deep learning – a class of machine learning algorithms that: use a cascade of many layers of nonlinear processing units for feature extractions and transformations; are based on the (unsupervised) learning of multiple levels of features or representations of the data; are part of the broader learning field of learning representations of data.


### **The Management (2017)**

The Director of the Institute (Claudio Montani) is assisted by the *Advisory Committee*. The committee is composed of 6 members elected by research & technology staff (Sara Colantonio, Fabrizio Falchi, Maria Girardi, Salvatore Rinzivillo, Roberto Scopigno, Maurice H. ter Beek) and by 1 member elected by technical & administrative staff (Enrico Fantini).

The committee: (a) provides the director with a quarterly opinion on the development of competence, on the status of activities and on the mission of the institute, (b) formulates proposals to the director for improving quality of research and development of competence, (c) assists the director to draw up the Management Plan and the Annual Report.


### **The staff (2017)**

In parenthesis the number of collaborators with a contract by the Institute:

	<i>Staff</i>	<i>N</i>
	Research staff (Researchers, Technologists)	113 (34)
	Technical and Administrative staff	53 (19)
	Graduate Fellows, Ph.D. Students, Post-doctoral Fellows	51 (39)
	Research Associates, Graduate students, Collaborators	> 70


### **Scientific results (2016)**

The main scientific results of the Institute are reported in the table. Other important aspects to be underlined are (a) the design and implementation of 33 software packages and tools, (b) the activities of training (university courses, other courses) and dissemination (journal editors, program committee members), (c) the activities of addressing (panels, international committees) and evaluation (international or national projects).

	<i>Publications</i>	<i>N</i>
	Journal papers	121
	Books/Monographs (or contribution to)	18
	Conference papers	151
	Journal /Conference Abstracts Comm./ Posters	16
	Editorials	13
	Conference Communications (no published proceedings)	26
	Technical Reports	56
	Other publications	57

### **Active projects (2016)**

The values in the right column indicate the total values of the active projects.

	<i>Financing Entity</i>	<i>Number of Projects</i>	<i>Keuro</i>
	European Commission (or Int. Entity)	28	11.282
	Government, Universities and research institutions	22	2.568
	Regional, local authorities	19	2.786
	Industry	12	331
	<i>Total</i>	<i>81</i>	<i>16.967</i>

The share 2016 is 5.293 KEuro.

No contribution of the central administration of CNR for 2016.

### ***ISTI and ERCIM***

ERCIM - the European Research Consortium for Informatics and Mathematics - aims at fostering collaborative work within the European research community and at increasing co-operation with European industry. Leading research institutes from sixteen European countries are currently members of ERCIM.

CNR has been a member of ERCIM since 1988. Since 2002, ISTI has been delegated to represent CNR into the Board of Directors, the Executive Committee and Editorial Board of ERCIM. The current President of ERCIM, D. Laforenza, Director of IIT-CNR and former head of a lab of ISTI, represents CNR in the ERCIM's BoD. F. Rabitti is part of the Executive committee, C. Peters works for the Editorial Board.

ERCIM publishes a quarterly Newsletter "ERCIM News" as well as a wide variety of technical reports, workshop, proceeding, etc. Visit <http://www.ercim.eu/> for additional information.

### ***ISTI and W3C***

The World Wide Web Consortium (W3C) was created to lead the Web to its full potential by developing common protocols that promote its evolution and ensure its interoperability. W3C is an international industry consortium jointly run by the MIT Laboratory for Computer Science (MITLCS) in the USA, the European Research Consortium for Informatics and Mathematics (ERCIM) and Keio University in Japan. Services provided by the Consortium include a repository of information about the World Wide Web for developers and users, and various prototype and sample applications to demonstrate the use of new technology. To date, over 500 organizations are Members of the Consortium. For more information see <http://www.w3.org/>.

### ***ISTI and the Network Infrastructure***

Among the administrative, technical and support services of the Institute, the network services (NS) have to be underlined. The working group has developed some highly reliable solutions for managing Internet Services, among these, the Internet Network Services Manager (INSM). INSM is an integrated modular system which is composed of MailboxManager, ListManager, AliasManager, DnsManager and DhcpManager. It has permitted to introduce in CNR an organizational model that reduces the cost of managing Internet Services. The cost reduction was realized by concentrating the systems management operations into a small number of servers and by keeping the entire administrative tasks distributed among the organization's operating units by means of web interfaces. The system INSM is currently installed at the ISTI and at the CNR's Research Area of Padova. ISTI is currently managing the network services (e-mail, DNS) for more than 30 CNR Institutes by using INSM on its server. Moreover, a deep knowledge and experience in the application of cryptography to the Internet services and an "Electronic Certified E-mail" system (PEC - Posta Elettronica Certificata) have been developed.

### ***ISTI and the Library***

The ISTI library, which began life in 1954 with the Center for Studies on Electronic Computing (CSCE) of the University of Pisa (later IEI-CNR), is one of the oldest ICT Libraries in Europe and probably the most complete Italian library in the field. It contains over 13500 books and 1000 serial publications. Therefore, access is given to about 6500 electronic journals, more than 9000 proceedings, 300 standard IEEE together with databases and digital libraries and a number of bibliographic, full-text and numeric databases. The Library provides high-quality services with the aim to support a facilitating the research activity of the Institute. For more information please visit <http://library.isti.cnr.it/index.php/en/?lang=en>.

ISTI is a member of the GreyNet International: The Grey Literature Network Service founded in 1992. The goal of GreyNet is to facilitate dialog, research, open access and communication between persons and organizations in the field of grey literature. GreyNet International is joined with ISTI in the development and promotion of the GreyGuide Repository, an online guide to proposed and published good practices in grey literature. Please refer to [Stefania.Biagioni@isti.cnr.it](mailto:Stefania.Biagioni@isti.cnr.it) for more information.

ISTI-Library is a member of COAR-Confederation of Open Access Repositories (Greater visibility and application of research through global networks of Open Access Repositories).