



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

BORDER AND EXTERNAL SECURITY

One of the primary aims of the Secure Societies Challenge is to improve border security and to support the Union's external security policies including through conflict prevention and peace building.



The research of the University of Bologna on border and external security covers a large spectrum of topics ranging from 2D-3D video, lowlight, thermal and visual surveillance to biometrics for persons' identification, image-based self-localization, navigation data processing and algorithm design and history of international relations.

The research of the University of Bologna covers a wide range of issues:

- 2D and 3D satellite aerial monitoring and surveillance
- Real-time automated 2D and 3D video-surveillance
- Image-based self-localization
- Indoor and outdoor augmented and mixed reality
- Visual recognition
- Biometric systems of identification
- Computer Vision, Video Surveillance, Event detection
- Wireless sensor networks for border protection
- International relations and security

HIGHLIGHTS

The University of Bologna can count on modern laboratories to support the multidisciplinary expertise and research lines on Border and External Security, such as:

- The [Biometric System Laboratory](#) is active at the University of Bologna since 1993, and is one of the worldwide leading center for Biometrics research (human identification based on fingerprints, face, iris, etc.). Biometric System Laboratory participated in EU Framework Programmes since FP6 with a total funding of about 2M€.
- **One of the largest drone indoor fly rooms in Europe**, equipped with a network of 22 infrared cameras to allow detection of a target, along with its translational and rotation motion, with millimeter-level precision. It is located in the city of Cesena, in the facilities of the Department of Electrical, Electronic, and Information Engineering (DEI).

European funded projects

FP7 [COEXIST](#) *Statistical Methods for Coexistence in Future Wireless Networks* (2011-2013)

FP7 [FIDELITY](#) - *Fast and trustworthy Identity Delivery and check with ePassports leveraging Traveller privacy* (2012-2016)

H2020 [MARISA](#) - *Maritime Integrated Surveillance Awareness* (2017-2019)

H2020 [iMARS](#) - *image Manipulation Attack Resolving Solutions* (2020-2023)




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DIGITAL SECURITY

Protecting digital data and preserving user privacy are two of most critical challenges of the 21st century.

The University of Bologna is member of the European cyber security organisation ([ECSO](#)).



The research of the University of Bologna on digital security spans from low-level communication and physical channel protection to mid-level protocols, code and infrastructure security to high-level applications in biometrics, video surveillance and data analysis. IT & Law group studies the many interdisciplinary aspects of law and innovative technologies, with special regards to the impact of privacy, data protection and users' awareness.

The research of the University of Bologna covers a wide range of issues:

- Secure Wireless Communications and Radio spectrum surveillance
- Ultra-wide Bandwidth systems and Wireless sensor networks
- Active and passive radio localization and positioning
- Physical-layer security
- Computer and network security architectures and penetration testing techniques
- Mobile systems and applications security
- Blockchain applications to identity management
- Access control models
- Data protection and Identity management
- Security and privacy in the public and private Cloud
- Location Privacy, Antiprofiling techniques
- Smart Cities and Urban security
- Biometric identification based on Fingerprints and Face
- Computer Vision, Video Surveillance, Event detection
- Search and Analysis of Big Data, Anomalies detection

HIGHLIGHTS

The [Biometric System Laboratory](#) is active at University of Bologna since 1993, and is one of the worldwide leading center for Biometrics research (human identification based on fingerprints, face, iris, etc.). Biometric System Laboratory participated in several EU research projects with a total grant of about 1.5M€ such as FP7 - [FIDELITY](#) - Fast and trustworthy Identity Delivery and check with ePassports leveraging Traveller privacy.

The [Computer Science Department](#) fosters active participation to many networks to create synergies along different dimensions, both at the national and the international level including CINI National Laboratory of Cybersecurity and European Computer Security Organization.

The Interdepartmental Centre for Research in the History, Philosophy and Sociology of Law in Computer Science and Law (CIRSFID) is among the leading excellence centres in Italy and over the years has gained international recognition for its work in computer science and law, as well as in the history, philosophy, and sociology of law. Policy and Regulation of technologies related to privacy, profiling, data protection and identity management is a key topic at CIRSFID.



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DISASTER RESILIENT SOCIETY

Securing the society against disasters is one of the central elements of the functioning of any society. There is barely any societal sector which is not to some extent concerned by disasters and related resilience and security issues.



The research of the University of Bologna addresses concomitant technological issues and social problems and it covers:

Prevention and mitigation of adverse events resulting from natural processes

- Large-scale wireless sensor networks for disasters prevention and monitoring
- Methodologies for the assessment and mitigation of seismic risk at urban scale
- Hydrological modelling and estimation of the impact of climate change on water related hazards
- Landslide modeling and risk mitigation
- Novel methods for the use of high and medium-resolution satellite imagery in damage mapping after disasters
- Geomatics in support of emergency response
- Tsunamis, earthquakes, natural hazards assessment and mitigation

Prevention of human-made accidents and technological disasters

- Wireless sensor networks for chemical, biological, radiological and nuclear defense
- Novel radiation sensors, wearable large area detectors
- Diagnostic technologies and portable devices with the potential to diagnose CBRN
- Airborne radiocontamination assessment and modeling
- Nano-biotechnology for the detection of substances components of explosives
- Quantitative Risk Assessment of NaTech accidents
- Cascading events triggered by technological accidents

Civil Protection, Emergency Management and Mitigation

- Wireless communication systems to support public safety and rescue operations
- Robotic platform to support search and rescue activities
- Human factors, psychological and social dimensions: risk and crisis communication; community resilience to disasters and extreme events; psychological and behavioral dimensions of safety
- International and EU legal framework related to crisis management

HIGHLIGHT

Relevant EU funded projects


H2020 - **BRIGAD** Bridging the Gap for Innovations in Disaster resilience (2016-2020); FP7 - **SPARTACUS** Satellite Based Asset Tracking for Supporting Emergency Management in Crisis Operations (2013-2017); FP7 - **EDEN** End-user driven DEmo for cbrNe (2013-2016); FP7 - **iNTeg-Risk** Early Recognition, Monitoring and Integrated Management of Emerging, New Technology Related Risks (2008-2013); FP7 - **THESEUS** Innovative technologies for safer European coasts in a changing climate (2009-2013); FP7 - **BESECU** Human behaviour in crisis situations: A cross cultural investigation to tailor security-related communication (2008 – 2011).



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FIGHT AGAINST CRIME AND TERRORISM

New technologies should support the fight against crime, terrorism, and illegal trafficking, along with understanding and tackling terrorist ideas and beliefs.



The research of the University of Bologna on fight against crime and terrorism tackles the problem from very different perspectives. Research directions span from new technologies for surveillance, detection of malicious people and hazardous substances, to forensic analysis, scene of crime analysis, European regulations and cooperation.

The research of the University of Bologna covers a wide range of issues:

- Reconstruction of the scene of crime
- Identification of species in crime evidence
- Resilience to terrorist actions involving hazardous substances
- Detection of explosives and hazardous substances
- Video surveillance, computer vision, and thermal imaging
- Activity recognition and behavior analysis
- Sensor networks for intruder localization, detection, and tracking
- Radio spectrum activity surveillance
- Big data analysis and cryptographic methods for crime prevention
- Analysis of gaps in EU regulations and issues in their application
- EU-wide cooperation for anti-radicalization
- 2D and 3D satellite aerial monitoring and surveillance

HIGHLIGHTS

The University of Bologna can count on modern laboratories to support the multidisciplinary expertise and research lines on fight against crime and terrorism, such as:

- **Laboratories equipped with** 3D Scanning systems, Thermal/NIR cameras and Digital Photogrammetry workstations, wireless sensors for accurate indoor localization and tracking of moving objects and persons.
- **One of the largest drone indoor fly rooms in Europe**, equipped with a network of 22 infrared cameras to allow detection of a target, along with its translational and rotation motion, with millimeter-level precision. It is located in the city of Cesena, in the facilities of the **Department of Electrical, Electronic, and Information Engineering (DEI)**.
- **Spectroscopic chemiluminescent and fluorescent IE-fast methods** with the use of nano-biotechnology for the detection of substances components of explosives, as part of Forensic Sciences.




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HUMAN, ETHICAL, SOCIO-ECONOMIC AND LEGAL DIMENSION

The so-called crosscutting issues – i.e. human, ethical, socio-economic and legal dimension – represent an essential component of the security research.

The researchers of the University of Bologna offer a strong expertise in incorporating cross-cutting issues in security research.



Topics include *inter alia* human-social resilience, police vocational training, European, international and constitutional law on risk management, social, economic and legal factors linked to crime and punishment, ICT law and legal informatics, victimization, semiotics of conflicts and psychological and behavioral dimensions of safety.

The research of the University of Bologna covers a wide range of issues:

- Design and management of models and guidelines on human&social resilience
- Ethnographic approach to police vocational training
- Semiotic approach to critical studies and methods in security studies
- Deviance and crime
- Victimization and gender-based violence
- International disaster law and EU civil protection mechanism
- Constitutional profiles of emergency management
- ICT law, artificial intelligence and law, legal informatics
- Disaster risk management
- Psychological and behavioural dimensions of safety from the perspective of users (including risk tolerance levels)

HIGHLIGHTS

The Interdepartmental Centre for Research in the History, Philosophy and Sociology of Law in Computer Science and Law (CIRSFID) is among the leading excellence centres in Italy and over the years has gained international recognition for its work in computer science and law, as well as in the history, philosophy, and sociology of law. The Centre takes part in several local, national, and European research projects and promotes and runs undergraduate and graduate programmes, including the only Italian Ph.D. programme in computer science and law, plus a Ph.D. programme in bioethics.

European funded projects

FP7 **ECOSSIAN** - *European COntrol System Security Incident Analysis Network* (2014-2017)


HORIZON 2020 **BISON** - *Big speech data analytics for contact centers* (2015-2017)



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PROTECTION OF CRITICAL INFRASTRUCTURES

The security and resilience of critical infrastructures need to be guaranteed, disruptions in their operations may entail the collapse of large sectors of economic and social activities.



The research of the University of Bologna on protection of critical infrastructures tackles the problem from very different perspectives, addressing all of its facets. Engineering, physics, and computer science approaches are complemented by legal studies, political and social sciences ones, addressing a wide range of issues:

- Analysis of seismic vulnerability and mitigation of seismic risk
- Earth observation (e.g., transport systems) and remote sensing via satellite and drones
- Assessment of the impact on lifelines of accidents involving hazardous substances
- Assessment of damage potential of improvise explosive devices
- Real-time automated surveillance systems for the smart city
- Large-scale wireless sensor networks for critical structures monitoring and early alerting
- Early alerting systems for tsunami and Earthquake events
- Policies and regulations for the protection of critical information infrastructures

HIGHLIGHTS

In FP7 the University of Bologna has been granted for several projects:

FP7 **TRIDEC** - *Collaborative, Complex And Critical Decision-Support In Evolving Crises* (2010-2013)

FP7 **NearToWarn** - *Near-field Tsunami Early Warning and Emergency Planning* (2012-2013)

FP7 **AEROCEPTOR** - *Uav Based Innovative Means For Land And Sea Non-Cooperative Vehicles stop* (2013-2016)

FP7 **ASTARTE** - *Assessment, STrategy And Risk Reduction for Tsunamis in Europe* (2013-2016)

FP7 **SPARTACUS** – *Satellite Based Asset Tracking for Supporting Emergency Management in Crisis Operations* (2013-2016)

FP7 **ECOSSIAN** - *European Control System Security Incident Analysis Network* (2014-2017)