



FONDAZIONE
BRUNO KESSLER

CENTER FOR
DIGITAL SOCIETY

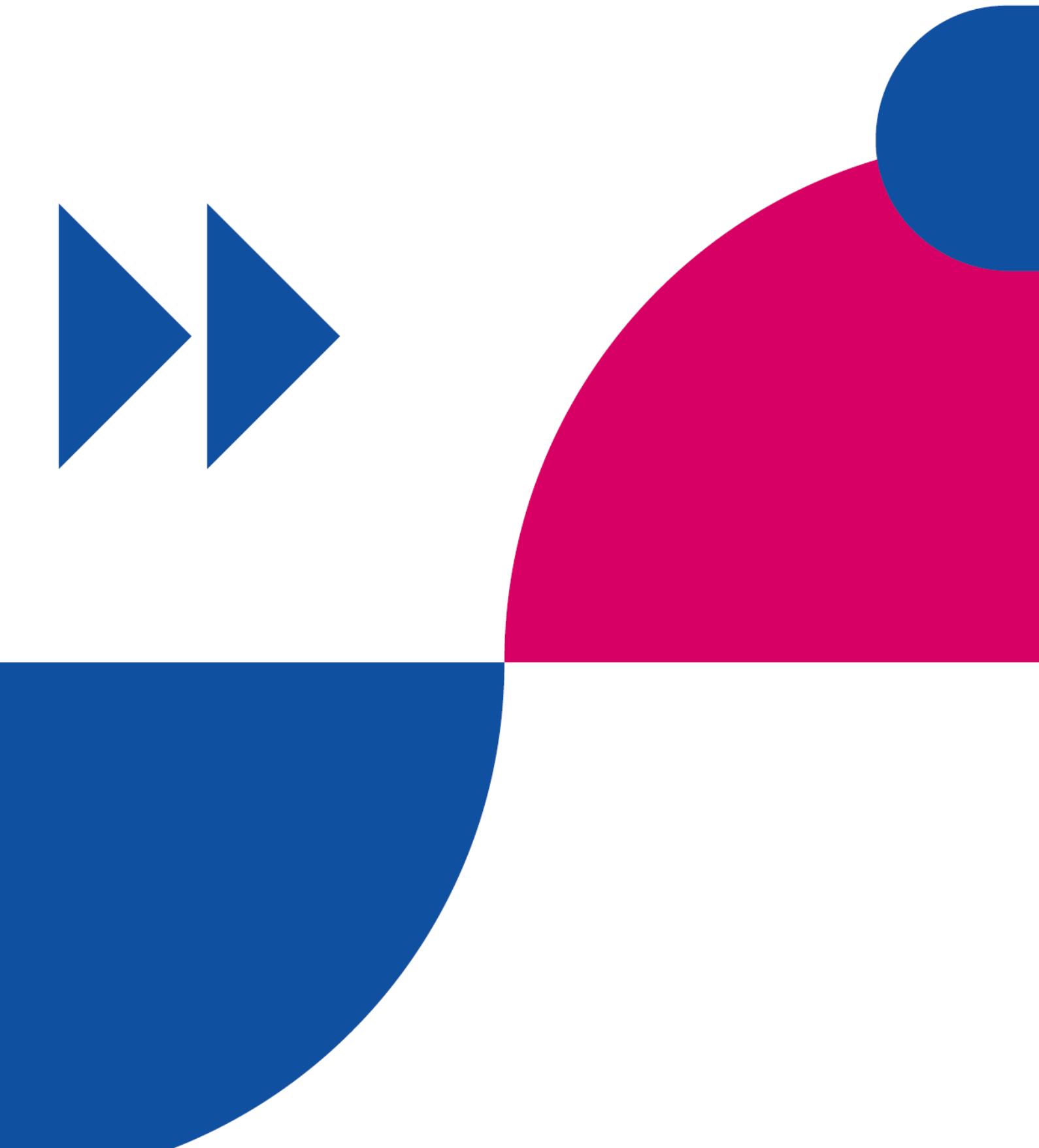


Table of Content

- 1. The Center for Digital Society**
- 2. The Collaborations**
- 3. The Center's Vision**
- 4. The Center's Mission**
- 5. Research Focus**
- 6. Research Units**
- 7. Impact Areas**
- 8. Target Groups**
- 9. Exploitable and Transferable Assets**

1. The Center for Digital Society

Digital Society is a research center of Fondazione Bruno Kessler (FBK) formed by a multidisciplinary team of more than 110 researchers and technologists organized in **7 research units** dedicated to specific research areas in the ICT domain and **2 support units** focusing on project management and technology maturation.

The Center for Digital Society (DIGIS) brings together a wide range of complementary competences at the intersection of **artificial intelligence, data science, digital systems, and socio-technical innovation**. Its researchers combine expertise in computer science, engineering, social sciences, and the humanities to address pressing technological, societal, and environmental challenges with a strong interdisciplinary approach.

A core strength of the center lies in the ability to design and apply **advanced data-driven methodologies**. This includes the entire pipeline from **data acquisition and curation** to **statistical modeling and machine learning**, to **deployment of predictive and prescriptive systems** in real-world contexts. Particular expertise exists in handling **complex, heterogeneous, and multimodal data** such as sensor streams, mobility data, geospatial information, communication networks, social media content, archival material, and remote sensing imagery. The center develops robust pipelines that enable the **characterization, prediction, and simulation of human, organizational, and environmental behaviors**.

On the AI side, the center has developed strong competences in **trustworthy and sustainable artificial intelligence**. This includes research in **model compression, distillation, edge intelligence, and energy-efficient digital architectures**, which are crucial for enabling scalable AI adoption in domains where computational resources are constrained. Equally important is the center's expertise in **synthetic data generation and augmentation**, which is particularly relevant to privacy-preserving AI, as well as in **remote sensing and Earth observation**, where advanced deep learning techniques are applied to heterogenous multi-sensor and multi-source (multi- and hyperspectral, synthetic aperture radar, etc.) data for monitoring, environmental analysis, and space applications.

The development of **ethical, robust, and regulation-ready AI** is another defining competence. The center contributes methods for **bias detection, explainability, adversarial robustness, fairness, and cybersecurity**, embedding these into AI systems to ensure compliance with evolving regulatory frameworks such as the **EU AI Act**. This compliance-by-design approach positions the center at the forefront of efforts to create **responsible AI technologies** that can be adopted safely in sensitive domains like public services, healthcare, education, and industrial manufacturing.

Beyond purely technical innovation, the center is distinguished by its **human-centric and socio-technical perspectives**. Researchers explore the role of AI in shaping human behavior, motivation, and decision-making, applying insights from behavioral science, psychology, and game design. Competences in **game-based engagement systems, personalization, and motivational design** support the creation of digital tools that foster long-term adoption, behavior change, and user empowerment. In parallel, strong expertise in **participatory design, civic technologies, and open data governance** ensures that digital systems are developed in ways that are transparent, inclusive, and aligned with societal values.

The center also emphasizes the importance of **open digital infrastructures**. Researchers have extensive experience in developing **open-source platforms, interoperable data infrastructures, and visualization tools** that enhance interpretability and accessibility of data for diverse stakeholders. Competences in **geospatial data visualization, territorial intelligence, and data storytelling** play a key role in supporting policymakers, communities, and organizations in evidence-based decision-making. This extends to the global digital commons, with contributions to shared resources such as **OpenStreetMap**, reinforcing a commitment to openness, transparency, and digital sovereignty.

Altogether, these competences position the center as a **multidisciplinary hub for responsible digital innovation**. Its researchers are uniquely capable of bridging **fundamental research with applied solutions**, ensuring that breakthroughs in data science and AI are translated into **scalable, trustworthy, and impactful technologies**. Whether addressing sustainability in urban mobility, resilience against online misinformation, efficient use of embedded AI in smart environments, or data-driven policymaking, the center provides the expertise needed to tackle complex problems at the interface of technology and society. At the same time, it contributes to reinforcing **European leadership and sovereignty in digital technologies**, ensuring that innovation is aligned with both industrial competitiveness and societal well-being.

DIGIS acts as a bridge between research and society, developing digital technologies as common goods to serve the public interest. We believe in open collaboration, transparency, and ethical innovation.

2. Collaborations

The DIGIS center fosters **collaborations at all levels**: internally with other FBK centers, externally with Universities and research institutions. We believe collaboration is crucial for fostering cross-fertilization, and the co-creation of transformative pathways that shape a sustainable, ethical, and human-centered digital future.

Internally DIGIS has defined strategic collaborations with the following FBK centers: Augmented Intelligence, Digital health, Digital Industry, Digital Energy, Cybersecurity and the Research Institute on the evaluation of public policies.

We collaborate with Italian Universities (Politecnico di Milano, University of Bologna, University of Padova, University of Trento, University of Pisa, University of l'Aquila, University of Udine, University of TorVergata, University of Rome, University of Pavia, University of Genova, research centers (Consiglio Nazionale delle Ricerche - CNR, EURAC, ASI), international collaborations with Universities (University of Helsinki, University of Tampere, University of Waterloo, University of Exeter, TUD, Johns Hopkins) and CREAf, DLRM OHB, Thales Alenia, ESA, NASA, JPL.

3. The Center's Vision

Digital technology is transforming our society has a pervasive impact on our lives and is reshaping our society, improving the quality of our lives. Our **challenge** is to harness its potential to **build a sustainable, resilient, inclusive and secure society, putting people and public interest at the center.**

Digital technology is fundamentally reshaping the way we live, work, learn, govern, and interact. It is transforming our economies, redefining our cultural landscapes, and altering the nature of our social institutions. From artificial intelligence and big data to virtual environments and social media, the digital transformation is not a distant future—it is a present reality that is accelerating at an unprecedented pace.

The **Digital Society Center** approach to digital transformation is pursued through the lens of language, culture, algorithms, models and data by our work on disinformation, algorithmic bias, and civic engagement.

While this transformation brings immense promise, it also presents profound challenges. Inequality, misinformation, surveillance, and digital exclusion risk undermining the democratic and inclusive values we seek to uphold. At this pivotal moment, our challenge is not only to keep efficiency and safety with innovation, but to **actively shape** it in ways that benefit people, society, and the planet.

Our vision is to **build a sustainable, resilient, inclusive, and secure digital society**, one where digital technologies are designed and governed to serve the public interest, uphold human rights, and reinforce democratic accountability. We envision a society in which all individuals, regardless of background or circumstance, can access and meaningfully participate in the digital world; where innovation is guided by ethical reflection and social responsibility; and where digital infrastructures enhance trust, equity, and well-being. To this end, we promote participatory planning methods and open digital infrastructures that foster transparency and empower communities.

To realize this vision, we must move beyond siloed thinking. The future of a thriving digital society lies at the intersection **of technology, governance, culture, ethics, and human behavior**. This calls for new forms of participatory planning and collaboration between researchers, policymakers, civil society, industry, and communities. It requires critical, interdisciplinary engagement and bold experimentation to reimagine how digital technologies can be harnessed to address societal challenges, from climate change and sustainability to education and democratic participation.

This interdisciplinary perspective is embedded in our work on social digital twins, behavioral modeling, environmental monitoring, and edge computing for sustainability.

The **Digital Society Center** will serve as a lighthouse for this effort: a hub for knowledge, foresight, and impact. We aim to bring together diverse voices to explore, test, and shape the digital transformation in ways that are inclusive, just, and forward-looking. By cultivating a space where research, innovation, and civic values converge, we will help to ensure that the digital future is one **not merely built for people, but with them, and by them**.

This vision is made concrete through our applied platforms, project ecosystems, and high-Technology Readiness Level solutions for public value.

4. The Center's Mission

The Digital Society center mission is to perform advanced **research** and develop innovative **open, AI-centered, trustworthy and compliant digital technology** to address key **challenges** of the future digital society. The center is also driving a cross-centre **mission on AI compliance**, supported by interdisciplinary contributions that transform legal and ethical principles into operational models, tools, and technical architectures, to translate regulations on AI and data into actionable, technical requirements of AI systems.

The Digital Society Center is committed to performing world-class, interdisciplinary research and development in digital technologies, particularly in Artificial Intelligence (AI), to help shape a future society that is open, inclusive, trustworthy, and aligned with democratic and ethical values.

Our mission is to **design, build, and promote digital technologies that are open, transparent, trustworthy, and compliant by design**, addressing the major societal, economic, and environmental challenges of our century. At the heart of our work is a deep commitment to ensuring that digital transformation serves the public interest: supporting human development, social cohesion, and institutional resilience rather than exacerbating inequalities or undermining fundamental rights.

Our research responds to these challenges through digital commons approaches, socio-technical simulations, and environmental intelligence systems.

We believe that achieving this goal requires not only technical innovation, but also **critical engagement with the legal, ethical, cultural, and political dimensions** of digital systems. Our work is grounded in the conviction that digital technologies, especially those driven by AI, must be accountable to society. This includes a deliberate focus on how such systems are designed, how they are governed, and how they can be aligned with human values and regulatory frameworks. This requires insights from behavioral science, language technologies, and governance models of AI.

A core part of our mandate is to lead the **FBK mission on AI compliance**, serving as a national and international reference point for translating regulatory principles into concrete, operational tools and standards for trustworthy AI. In particular, we work to implement the requirements of key frameworks such as the EU AI Act, GDPR, and sector-specific legislation. We translate these into actionable technical guidelines, design patterns, auditing protocols, and system-level architectures to ensure that AI systems are not only legally compliant but **verifiably aligned with ethical and societal expectations**.

To fulfill this mission, the Center brings together a unique constellation of expertise—spanning AI and machine learning, data science, law and policy, human-computer interaction, natural language processing, ethics, sociology, systems and platform design. This interdisciplinary approach allows us to address digital challenges holistically and to engage meaningfully with both technical and societal dimensions of innovation. This constellation is reflected across all our units, from embedded AI to digital humanities, behavioral modeling, and policy co-design.

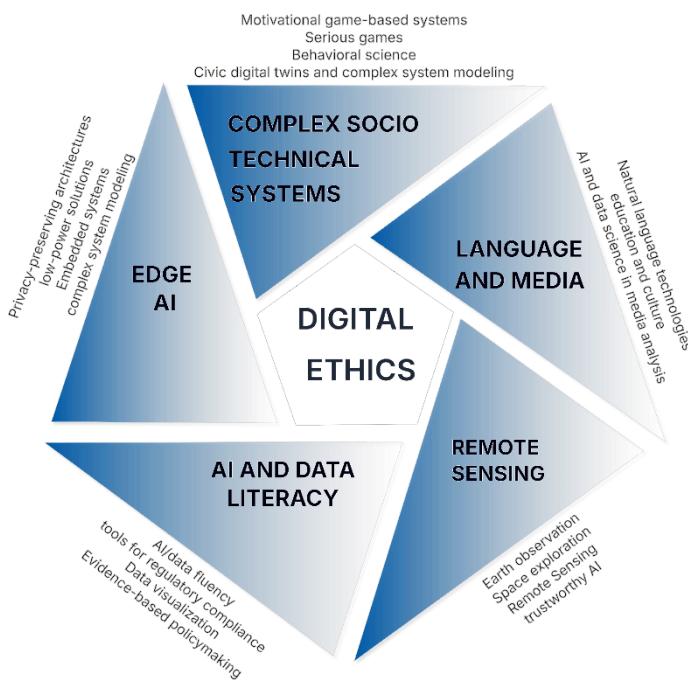
We collaborate actively with academia, government bodies, public administrations, and civil society to co-create knowledge and tools that foster responsible innovation. Our aim is not only **to anticipate and mitigate risks, but also to unlock the full potential of digital technologies** to support democratic governance, equitable access to opportunity, and long-term sustainability. Through participatory planning, motivational platforms, and civic technologies, we foster inclusive innovation pathways.

By anchoring our work in research excellence, regulatory relevance, and social responsibility, the Digital Society Center positions itself as a catalyst for shaping a digital future that is **human-centered, right-based, and grounded in the public good**. All DIGIS units contribute to this collective mission, with AI compliance as a unifying cross-center effort.

5. Research Focus

The Digital Society Center's research strategy is organized around five interconnected domains that collectively address the complexity of digital transformation. These domains, **Complex Socio-Technical Systems, Language and Media, AI and Data Literacy, Edge AI, and Remote Sensing**, are unified and guided by a central commitment to **Digital Ethics**. This structure ensures that technological innovation is not only advanced and interdisciplinary, but also ethical, trustworthy, and socially responsible.

At the heart of the DIGIS research activity lies **Digital Ethics**, understood not only as a set of philosophical and ethical principles but as a collection of technical and actionable methods for compliance, trustworthiness, and responsible AI adoption. This central role reflects the idea that every technological innovation must be developed and deployed in ways that safeguard human rights, ensure fairness, and respect societal values. Each of the five research domains connects to this



ethical core in complementary ways. **Complex socio-technical systems and motivational game-based systems** require ethical oversight because they directly model, influence, and motivate human behavior. Decisions and interventions at this level impact collective well-being and civic participation, demanding transparency, inclusiveness, and fairness. **Language and media technologies** are central to human interaction and social communication, making ethics indispensable in ensuring that tools used for social media analysis, misinformation detection, and countering cyberbullying respect diversity, avoid biases, and promote healthier information ecosystems. **AI and Data Literacy** embody the ethical obligation to

empower citizens, organizations, and policymakers to understand opportunities and risks of digital technologies. By fostering critical awareness and informed decision-making, this area strengthens democratic resilience and trust in AI systems. **Remote sensing applications**, from civil protection to climate change monitoring, carry ethical implications as they generate knowledge with direct consequences for societies and ecosystems. Ensuring trustworthy AI in these contexts means guaranteeing reliability, accountability, and equitable access to information that supports sustainability and risk mitigation. **Edge AI** brings intelligence closer to people and environments, raising crucial questions of privacy, security, and

data sovereignty. Embedding ethical principles in this domain ensures that applications are not only efficient and sustainable but also privacy-preserving and aligned with societal expectations. Through these interconnections, Digital Ethics acts as the unifying backbone of the research agenda, ensuring that technological progress across all domains remains human-centered, trustworthy, and socially beneficial.

Digital Ethics (Cross-cutting Core)

Digital Ethics is a cross-cutting core of the Center's research agenda. It has the twofold purpose of (1) ensuring that all digital technologies developed within the Center respect fundamental rights, legal standards, and democratic values, and (2) develop tools for checking the compliance of AI systems with respect to trustworthy AI principles and to regulations (in particular, the AI Act and sectorial regulations). Its key objectives:

- Translate ethical principles and regulatory frameworks (e.g. AI Act, GDPR) into actionable, technical design and operational standards.
- Ensure **trustworthiness, privacy, transparency, accountability**, and **human oversight** in digital systems.
- Guide interdisciplinary collaborations through frameworks that prioritize fairness, inclusion, and societal benefit.

STRATEGIC CHALLENGE

Transforming high-level legal and ethical principles into actionable technical requirements constitutes a significant research challenge. This process necessitates an interdisciplinary approach, combining expertise in legal and regulatory frameworks with deep technical knowledge of data governance, algorithmic design, and model behavior. The translation is not merely a matter of compliance; it involves reconciling abstract, context-dependent principles with precise, implementable specifications that can be operationalized in AI systems. A critical component of this work is the development of robust methodologies for defining and implementing metrics that enable automated compliance assessment and the proactive enforcement of mitigation measures. Such methodologies must be sensitive to the socio-technical environment in which the AI system operates, as the interpretation and application of legal and ethical norms are influenced by cultural, sectoral, and institutional contexts. Research in this area must also consider the dynamic nature of both technological capabilities and regulatory landscapes, ensuring that compliance mechanisms remain adaptive, transparent, and accountable over time.

Complex Socio-Technical Systems

This area addresses the challenges of designing, understanding, and governing large-scale systems that blend human, institutional, and technological components. The focus is on systems that shape public life, education, mobility, and governance.

In particular, this research area investigates:

- **Motivational game-based systems and serious games** to engage citizens and promote positive behavior change.
- **Behavioral science** to model and improve system interaction and user experience.
- **Digital twins** tailored to human and social dynamics and complex system modeling to support smart cities, critical infrastructure, and public sector innovation.
- **Evidence-based policymaking** powered by real-time, data-rich system insights.

STRATEGIC CHALLENGE

Our central challenge in this domain is the integration and governance of complex socio-technical systems, where technological innovation must align with human behavior, institutional structures, and societal values. While tools such as motivational game-based systems, digital twins, and real-time data analytics hold transformative potential for public life, their effectiveness depends on fostering citizen trust, accurately modeling social dynamics, and ensuring transparent, ethical, and adaptive governance. Bridging these dimensions is essential to translate technological sophistication into equitable, sustainable, and impactful solutions for education, mobility, and governance.

Language and Media

Language and media are central to cultural expression, democratic participation, and digital communication. This area focuses on understanding and shaping how people engage with information and narratives in a digital society. The research area covers:

- **Natural language technologies** for multilingual access, AI-driven communication, and content moderation.
- Research on **education and culture** in digital contexts to support inclusive, equitable access to knowledge.
- Tools for **AI and data science in media analysis**, misinformation detection, and public discourse.
- **Data visualization** to enhance comprehension and decision-making in complex scenarios.

STRATEGIC CHALLENGE

Our vision for this domain is to harness language and media as powerful enablers of cultural expression, democratic participation, and equitable access to knowledge in the digital age. By advancing natural language technologies, AI-driven media analysis, and innovative tools for detecting misinformation, we can foster more inclusive, trustworthy, and participatory digital communication. Indeed, while AI can be used to make online environments more toxic by flooding them with massive amounts of automatically generated misinformative data, it can also drive awareness-raising initiatives and be integrated in human-in-the-loop frameworks to support de-toxification of online media. Through research on education, culture, and data visualization, this area seeks to empower citizens to navigate complex information landscapes, strengthen public discourse, and ensure that the digital society reflects diversity, transparency, and shared understanding.

AI and Data Literacy

A digitally empowered society depends on people's ability to understand and critically engage with AI and data systems. In the AI Act, literacy is a central theme. This area promotes literacy, transparency, and compliance through accessible tools and frameworks, by investigating

- Educational initiatives to improve public and professional **AI/data fluency** with a particular emphasis on the design and development of use cases in several public administration areas, targeting different levels of previous expertise in the field of AI.
- Development of **tools for regulatory compliance**, especially around AI accountability and explainability.
- Strategies to democratize access to AI, reducing asymmetries in power, knowledge, and control.

STRATEGIC CHALLENGE

Our central challenge in this domain is to close the gap between the rapid pace of AI innovation and the slower development of the skills, trust, and governance mechanisms needed to engage with it responsibly. While AI systems are becoming increasingly embedded in public services, workplaces, and everyday life, large parts of society lack the literacy to critically assess how these systems function, what risks they carry, and how they can be used to create public value. This gap reinforces asymmetries in knowledge and power between institutions, citizens, and private actors, creating barriers to transparency, accountability, and equitable participation. Addressing this challenge requires not only targeted educational initiatives that speak to diverse levels of expertise, but also the development of accessible frameworks and tools that support regulatory compliance, explainability, and responsible innovation across contexts.

Edge AI

As computing shifts toward the edge, closer to sensors, devices, and environments, where data are produced, this research area explores how to build intelligent, privacy-aware, and efficient AI systems outside centralized infrastructures. Main research directions are:

- **Privacy-preserving architectures** and **low-power solutions** for real-time, local processing.
- **Embedded systems and tiny ML** for adaptive, autonomous behavior in constrained environments.
- Integration with **complex system modeling** and **digital twins** for local decision-making and resilience.

STRATEGIC CHALLENGE

Our main challenge in this domain is to design and deploy edge AI systems that combine efficiency, adaptability, and privacy without sacrificing performance or trust. While advances in TinyML and embedded intelligence enable real-time processing in highly constrained environments, scaling these solutions to support diverse applications—from critical

infrastructure to everyday devices—raises significant hurdles. These include ensuring energy efficiency and security at the hardware level, balancing local autonomy with system-wide coordination, and creating interoperable frameworks that can seamlessly integrate with digital twins and complex system models. Meeting this challenge is essential to unlock resilient, trustworthy, and human-centered edge intelligence that reduces dependence on centralized infrastructures.

Remote Sensing

This area develops AI-enabled sensing systems to understand, model and monitor physical, environmental phenomena at both Earth and planetary scale.

- **Earth observation** for climate monitoring, disaster response, and environmental sustainability.
- **Space exploration** and AI-driven analysis of planetary sub-surface.
- Integration of **Remote Sensing with trustworthy AI** to support mission-critical, safety-relevant applications.

STRATEGIC CHALLENGE

Our challenge in this domain is to develop AI-enabled remote sensing image processing systems that can reliably monitor and analyze complex environmental Earth and planetary phenomena at scale, while ensuring accuracy, trustworthiness, and operational resilience. Earth observation and space exploration demand models that handle massive, heterogeneous data streams in (near) real time, integrate uncertainty, and support critical decision-making in safety- and mission-critical contexts. Balancing the need for high-performance AI with reliability, explainability, and robustness—particularly in extreme or remote environments—remains a key strategic hurdle for advancing sustainable Earth environmental management and planetary exploration and understanding.

6. Research Units

To achieve the vision, mission and research activities outlined above, the DIGIS center features nine research units focusing on various aspects of technology as a means to create a better, safer, and more resilient society.

CHuB Complex Human Behavior Lab

The CHuB research unit explores methods and systems aimed at applying data-informed statistical modeling to understand individual and collective human behavior across complex societal systems. We work with mobility data, urban infrastructure systems, online communication networks, and cooperative behavior patterns in societies integrating both human and artificial agents. Our focus is on developing models and analytical frameworks for **describing and predicting real-world societal dynamics and providing robust, actionable insights**. We address all steps of the behavioral modeling pipeline, from data collection to statistical characterization of patterns and social interactions to implementing predictive systems and assessing policy interventions. Key application domains include spatiotemporal dynamics of sustainable urban mobility and tracking and modeling online misinformation spread. All applications are rooted in data-driven models that effectively quantify intervention effects, predict future behaviors, and understand network properties influencing information spread. Modeling systems that combine data science, network science, computational methods, and theoretical frameworks are paramount to bridge fundamental research with practical solutions that inform public policy, technological innovation, and complex socio-technical system development at scale.

DCL Digital Commons Lab

The Digital Commons Lab conducts research on socio-technical systems that treat data as commons, emphasizing openness, transparency, and participatory governance. Our work bridges civic technologies, data governance, and ethical AI, with particular attention to public sector innovation and community-driven processes. We develop open-source platforms and methodologies for the collection, management, and visualization of complex datasets, with a strong focus on geospatial data and map-based representations to support **territorial intelligence and evidence-informed policymaking**. **Data visualization** is a core component of our approach, enabling the co-construction of narratives and improving interpretability and accessibility of data across diverse audiences. We **promote AI literacy** to foster critical understanding of algorithmic systems and to democratize access to decision-support tools. We draw on and contribute to **global digital commons** (e.g. OpenStreetMap), supporting community-based data infrastructures that integrate local knowledge and foster digital

sovereignty. Our research domains include urban and rural planning, environmental monitoring, and collaborative public services.

DH Digital Humanities

The DH research unit explores methods and systems aimed at applying natural language processing to humanities and social sciences problems. We work with historical archives, social media data, domain-specific and nonstandard language. We are particularly interested in multilingualism and low-resource languages. Our focus is on the **development of robust and fair NLP technologies**, addressing the needs of diverse users in an inclusive and unbiased way. We address all steps of the NLP pipeline, from the creation of linguistic training data for supervised systems to the implementation of text analysis systems to the assessment of biases in the final output, including text generated with LLMs. An application domain of particular interest is **social media data**, where NLP tools can be effectively used to detect and counter high-risk phenomena such as dis/misinformation, propaganda, conspiracy theories and hate speech. In this context, text analysis systems that are fair, robust and easy-to-use are of paramount importance to increase users' awareness and resilience at scale.

E3DA Energy Efficient Embedded Digital Architectures

E3DA explores embedded, networked, energy-efficient systems, such as IoT nodes, wireless sensor networks, and wearable devices, addressing both algorithmic and system-level aspects. By leveraging **TinyML approaches** that are suitable for systems with limited energy, processing power, and storage, we bring intelligence closer to sensors, users, devices, and environments. We design scalable neural architectures and adaptive models, aware of hardware constraints, addressing the challenges of the edge–cloud continuum, marked by heterogeneous data sources and platforms.

Edge intelligence enables **privacy preservation, sustainability, low-latency, energy and bandwidth efficiency**, fostering the development of responsible and ethical AI. By processing data locally, we reduce data transfer and centralized computation, aligning technological innovation with societal and environmental concerns. We also explore novel wireless communication protocols and distributed intelligence frameworks to support fog, edge, and mist computing. Our expertise spans low-power signal processing, hardware-aware on-device learning, and multimodal data processing (audio, biosignals, and vision) in resource-constrained settings. Applications include smart cities, wildlife monitoring, proximity detection, ambient intelligence, wearable computing, and human-computer interaction.

MoDiS Motivational Digital Systems

The MoDiS research unit explores advanced **game-based methodologies and techniques to support user engagement, motivation, and behavior change**. Personalization is recognized as a key success factor in motivational systems; therefore, special attention is devoted to game-based motivational and persuasive strategies that dynamically tailor the user

experience to maximize both user retention and the effectiveness of individual and collective behavior change. MoDiS brings long-standing expertise in game design, games user research, behavioral science, AI-driven personalization of player experience, game analytics, and player profiling. The unit also has substantial experience in the design, development, and deployment of **game-based motivational systems and long-term engagement campaigns** targeting diverse user groups (e.g., the general public, students, employees, vulnerable populations) across various domains, including education, environmental sustainability, and digital transformation.

MoST Modeling and simulation of Socio-Technical systems

The MoST unit investigates **AI- and data-driven methods to model and simulate complex socio-technical systems** in support of public decision-making and civic participation. As societies face rapid transformations and increasing interdependence between technical and social systems, we envision a future in which digital technologies become essential for society to make sense of complex environmental, social, and technological challenges and transformation processes. This requires not only more effective and efficient analysis and decision-making tools, but also new approaches to democratize the access to these tools. To this end, we champion a vision in which data-driven systems are open, interpretable, co-designed with the relevant institutions, organizations, and communities. Our goal is to research models, **analysis and simulation of complex socio-technical systems** and blend them with methods and tools to **support collaborative design, participatory planning, and accountable public decision-making**. Our applications are in key domains such as cities (mobility, urban planning, tourism, studentification, etc.), rural areas (tourism, climate neutrality, etc.), and large organizations (in particular, Public Administration).

RSDE Remote Sensing for Digital Earth

RSDE develops advanced systems, end-to-end chains, and methods for **satellite and airborne remotely sensed image processing**. We range over concepts like pattern recognition, machine learning, deep learning methodologies, foundational models in domain adaptation, transfer learning, and we work on on-board processing solutions. We develop and exploit in real-world applicative contexts supervised, semi/partially supervised and unsupervised learning architectures. We have long-term experience and knowledge of time series analysis, change detection, semantic segmentation, parameter estimation, we work with multispectral, hyperspectral images and radar/radar sounder data with low-to-high spatial and temporal resolutions, and when possible, we integrate publicly accessible geographic information system (GIS) data. Active research in these fields requires synergistic use/exploitation of cutting-edge technologies, know-how and well-grounded methodologies to accomplish the needs of modern-days real-world. RSDE is actively involved in both **Earth Observation and Space Exploration** activities.

DSLab Digital Society Laboratory (Support Unit)

The goal of DSLab is to **create innovative open digital platforms and advanced tools to support research and innovation activities** performed by the units of the center. DS Lab aims at exploiting the research results to improve quality of life and increase sustainability in cities and other communities of people, to experiment new modalities of service delivery to citizens, communication between citizens and government, new ways to explore and elaborate information. Throughout these activities, DSLab implements and delivers to the end users the software assets of high technology readiness levels to enable their validation in practical settings and scenarios. The solutions covered by DSLab represent a wide range of technologies and application domains, including AI-based tools, Cloud applications and middleware, advanced technological platforms, data management and analysis solutions, identity management, innovative Web and mobile applications for end users.

PMG Project Management Group (Support Unit)

The Project Management Group (PMG) was established to assist research units with all of their **project management** needs. The PMG works across research units and administrative offices assisting and managing local, national and European projects and providing guidance and support to maximize efficiency, optimize results and reduce costs. The purpose of the PMG is to provide a unified approach for defining, managing, reporting and supporting the project management practices for the Digital Society research units. Its goal is to build and maintain transparent, predictable, and repeatable project management processes to collaborate with researchers both in the pre-award and post-award phases of the project lifecycle. The three main areas of activities are: i) identification of EU, national and local funding opportunities; ii) writing project proposals, including setting-up and guiding large consortia during proposal preparation; iii) managing complex collaborative projects; iv) communication and dissemination of project results.

7. Impact Areas

Digital Empowerment of Communities and Public Administration

Tools for digital sovereignty and participation

The Digital Society Center is committed to advancing the digital empowerment of communities and public administrations through research, innovation, and the development of practical tools that support sovereignty, inclusion, and democratic engagement in the digital age. As digital technologies reshape governance and civil society, the Center provides a platform for creating trustworthy, participatory systems that place people and public institutions in control of their digital infrastructures. This work builds on open civic technologies, participatory modeling, and platform co-design. This includes the development of open-source tools and ethical frameworks for civic digital twins, serious games, and policy modeling environments that allow citizens and policymakers to co-design solutions and simulate future scenarios. These tools integrate approaches from commons-based infrastructures, game-based engagement, and socio-technical simulations. The Center also supports public administration in aligning digital transformation efforts with emerging legal, ethical, and societal expectations, such as those articulated in the European AI Act, through applied research on AI compliance, algorithmic transparency, and human oversight. This effort is part of the cross-unit AI compliance initiative, which translates regulatory principles into operational practices. By fostering collaboration between communities, technologists, and decision-makers, the Center aims to strengthen democratic resilience, increase digital participation, and ensure that the digital transformation serves the public interest rather than private monopolies or opaque systems of control. In doing so, it positions public institutions and civil society as co-creators and stewards of a digital future that is sovereign, inclusive, and aligned with shared values.

Education and Culture

From literacy to co-creation: inclusive access to digital knowledge

Education and culture are foundational pillars of any equitable and vibrant digital society. The Digital Society Center pursues research and innovation that enable inclusive access to digital knowledge and cultural participation for all. Our work includes AI and data literacy, civic education, and cultural accessibility through open and inclusive technologies. This includes a strong commitment to AI and data literacy, equipping individuals not only with the technical skills to use digital tools but also with the critical understanding to question and shape them. The Center develops novel approaches to digital education, blending

AI-driven personalization with pedagogical values such as equity, openness, and co-creation. These approaches combine adaptive systems for engagement with educational tools grounded in openness and fairness. At the same time, it champions the preservation and accessibility of cultural heritage in the digital realm through language technologies, media innovation, and multilingual resources. Language-aware systems and multilingual NLP tools help to protect cultural narratives and increase inclusion. Research in this area focuses on ensuring that digital systems respect linguistic diversity and cultural narratives, while enabling new forms of expression, storytelling, and collaborative knowledge production. Through participatory media, natural language processing, and data visualization, the Center empowers educators, learners, and cultural practitioners to co-create content and engage meaningfully with digital ecosystems. We use inclusive NLP, open data visualization, and civic media to foster engagement across contexts. This work supports lifelong learning, strengthens democratic culture, and ensures that all members of society—regardless of age, background, or geography—can contribute to and benefit from the digital age.

Secure and Resilient Societies

From Robustness to Resilience: Trustworthy Digital Systems for Societal Protection

In a world of accelerating change and complex global challenges, ensuring the security, resilience, and trustworthiness of digital systems is more critical than ever. The Digital Society Center conducts cutting-edge research aimed at building technologies and infrastructures that can operate reliably under pressure, respond to crises, and protect the fundamental rights of individuals and communities. Our work spans mission-critical applications of Edge AI and Earth Observation for real-time, reliable decision-making. This includes innovations in Edge AI and Remote Sensing, where real-time, privacy-preserving, and energy-efficient AI systems are developed for deployment in mission-critical applications—from disaster response and earth observation to smart cities and space exploration. These technologies are designed not only for technical robustness, but also for ethical and social alignment, with a strong emphasis on embedding transparency, accountability, and safety from the ground up. We embed ethical principles and social foresight into technical systems from design to deployment. Complementing this is the Center's expertise in modeling complex socio-technical systems, which enables the design of interventions that anticipate cascading risks and foster systemic resilience across sectors. This modeling capability supports scenario planning and policy resilience strategies. Whether responding to natural disasters, public health emergencies, or cyber-physical threats, the Center's integrated approach ensures that digital infrastructures are capable of supporting society in moments of uncertainty. We combine technology, regulation, and ethics to ensure trust and stability in uncertain conditions. By combining technological excellence with regulatory foresight and ethical reflection, the Center aims to build digital ecosystems that citizens can trust and that societies can depend on in the long term.

8. Target Groups

The Digital Society Center (DIGIS) is designed to serve a broad ecosystem of stakeholders, reflecting its mission to shape a digital society that is inclusive, democratic, and resilient. Its work is grounded in real-world impact and shaped through collaboration with diverse communities, institutions, and sectors. The Center actively engages with three main target groups: communities, public administration, and companies, each of which plays a critical role in the co-construction of digital futures.

Real and Virtual Communities

At the heart of DIGIS's mission is the empowerment of individuals and communities—both geographically rooted and digitally connected. The Center develops tools and frameworks that amplify the voices, knowledge, and agency of citizens, students, rural populations, cultural associations, and social media users. We focus on community-centered data, digital expression, and civic participation. Through participatory platforms, accessible AI, and inclusive data practices, DIGIS supports communities in understanding, shaping, and governing the technologies that affect their lives. Our tools aim to bridge digital divides and foster agencies in both online and offline spaces. Special attention is given to marginalized or underrepresented groups, enabling digital sovereignty, creative expression, and civic engagement in both online and offline spaces. Non-governmental organizations (NGOs) are also key collaborators, particularly in areas such as digital inclusion, ethical advocacy, and community-based innovation. We partner with NGOs to co-develop civic technologies and inclusion strategies.

Public Administration and Policy Makers

DIGIS supports local, regional, and national governments in the ethical and effective adoption of digital technologies. By offering decision support tools, AI policy intelligence, and evidence-based modeling grounded in transparency and accountability, the Center helps administrations build trustworthy digital infrastructures. We work with institutions to develop interoperable and accountable digital solutions. From municipalities and provinces to national ministries, DIGIS collaborates with institutions to co-develop systems that are not only efficient and interoperable but also aligned with democratic values and legal obligations such as the AI Act. Our AI compliance work translates legislation into actionable policies and tools. These collaborations enable public institutions to play a proactive role in digital transformation, foster public trust, and enhance resilience in the face of societal challenges.

Companies

The Digital Society Center works with the private sector to co-create innovative, socially responsible, and ethically sound digital solutions. DIGIS offers companies a dual engagement strategy. First, it fosters long-term strategic partnerships focused on co-design and experimentation, allowing companies to actively participate in applied research and shape digital technologies from the early stages of development. We collaborate on ethical innovation, from design to experimentation. Second, it facilitates last-mile innovation by involving companies in the deployment and refinement of tools and services created within the Center. Through technical partnerships, we ensure that our research translates into real-world solutions. This approach ensures that research outputs are not only theoretically robust but also practically viable and market ready. Through this model, DIGIS supports the private sector in navigating the ethical and regulatory landscape of digital transformation, while aligning innovation with societal needs. Our AI compliance and governance frameworks help companies meet legal and social expectations

9. Exploitable and Transferable Assets

The Digital Societies center has developed some exploitable and transferable assets that will be further developed by our researchers and could be even improved to higher TLRs by companies.

AI Platform

The AI Platform is an Open-Source platform for building, executing, and managing Data and AI applications and services. Bringing the principles of DataOps, MLOps, DevOps and GitOps, and integrating the state-of-art open-source technologies and modern standards, the platform extends the development process and operations to the whole application life cycle, from exploration to deployment, monitoring, and evolution. To support this functionality, the platform relies on scalable Kubernetes platform and its extensions (operators) as well as on the modular architecture and functionality model that allows for dealing with arbitrary jobs, functions, frameworks and solutions without affecting the development workflow. The underlying methodology and management approach aim at facilitating the re-use, reproducibility, and portability of the solution among different contexts and settings. With this modularity and extensibility, the platform serves as a baseline for incorporating and supporting new functionalities, domains, and frameworks, including AI compliance, collaborative AI, high performance computing, etc.

The screenshots illustrate the Dataiku DSS platform's capabilities for machine learning development and monitoring. The first screenshot shows the project structure and key metrics for the 'faudit-classifier' project. The second screenshot provides a detailed view of a specific run, including its logs and resource usage. The third screenshot shows a real-time or historical metric, likely classifier confidence, plotted against time.

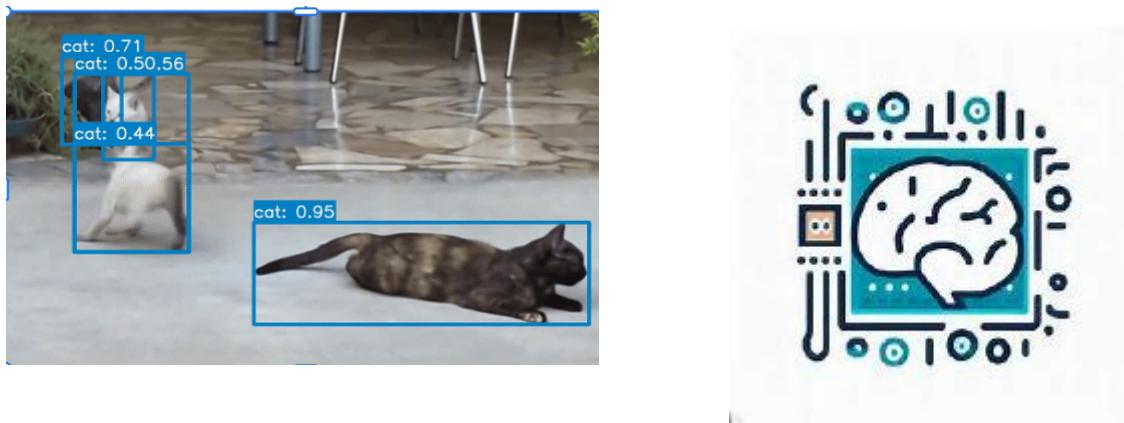
TinyML Libraries for Specific Tasks Based on Hardware-Aware Scaling Principles

Within the Hardware-Aware Scaling (HAS) approach, we have developed a set of lightweight neural network targeting distinct vision and generative tasks, optimized for deployment on constrained edge devices. These libraries apply HAS principles to

adapt model complexity to the computational and memory budget of the target hardware while maintaining task-specific accuracy.

Micromind (<https://github.com/micromind-toolkit/micromind>)

Open-source research toolkit for tinyML developers. It includes PhiNets, XiNets (neural architecture based on hardware-aware scaling principle) and pre-trained examples of tiny models (e.g. image classification, object detection and tracking).



Pose detection (Xinet-Pose) based on Xinet

Based on the Xinet backbone, Xinet-Pose is a compact neural network for human pose estimation. It extracts body keypoints in real time from RGB images, employing depth- and width-scaled convolutional blocks to minimize latency and energy consumption. The model architecture is tuned to edge hardware constraints, enabling inference on microcontrollers and low-power AI accelerators without significant degradation in detection precision.



“Tiny” Neural Style Transfer for creativity or anonymization — based on XiNet

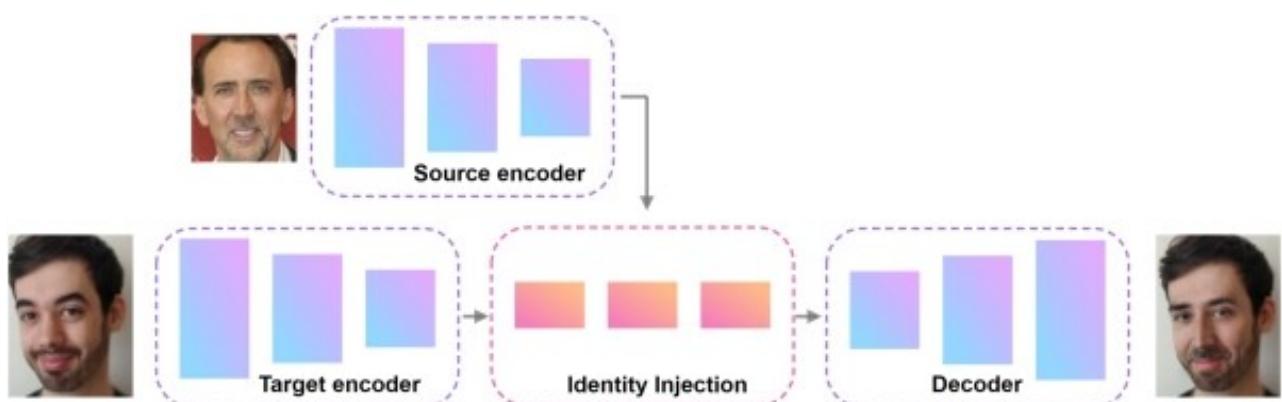
A scaled-down convolutional encoder-decoder network for real-time neural style transfer. Using the HAS methodology, the neural network is scaled to the hardware resources available while preserving perceptual quality, allowing artistic

transformations of images to be applied directly on-device. This task can be used for creativity or anonymization purposes. The library supports a range of pre-trained styles and can be adapted to different device profiles, from MCU-class processors to embedded GPUs.



Face-Swapping — PhiNet-GAN and XimSwap

- **PhiNet-GAN:** A hardware-scaled generative adversarial network tailored for face-swapping tasks. It combines a lightweight generator with an efficient discriminator, both optimized for low-power execution. The HAS-based scaling preserves facial detail fidelity while reducing model size to fit edge deployment requirements.
- **XimSwap:** An even more compact alternative for face-swapping that uses a feature-mapping and blending approach rather than a full GAN pipeline. It is ideal for ultra-constrained devices where latency and memory footprint are critical, leveraging HAS to balance transformation realism with processing limits.



Audio Anonymization — AudioAnony (in cooperation with SpeechTek, FBK AI Center)

The goal of this component is to anonymize audio stream by replacing the speaker voice with another one while preserving the other speech features and the environmental background. Operating close to the microphones on edge device, or at the beginning of the procesing pipeline, audioanony limits possible privacy issues in the collection and processing of audio data. The component can be deployed on a low-end edge device connected to the microphones to provide an anonymized stream in a transparent way.

Audio Event Classification — tinyCLAP

TinyCLAP is a compressed and hardware-optimised implementation of the CLAP (Contrastive Language–Audio Pretraining) model for audio event recognition and retrieval. By applying HAS-driven quantization, pruning, and architectural scaling, tinyCLAP achieves high classification accuracy while fitting within the memory and compute limits of microcontrollers and embedded devices, enabling on-device sound understanding with minimal latency.

Play&Go (<https://playngo.it>)

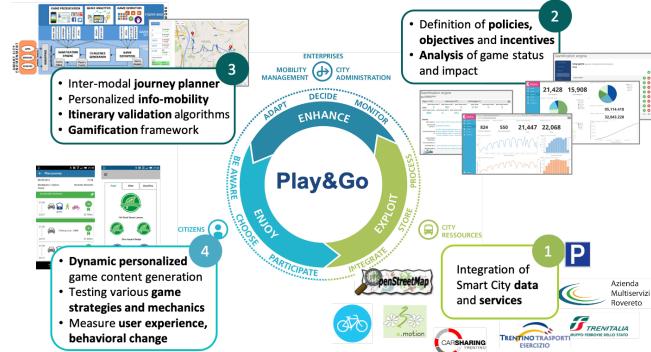
Is an Open Source platform (Apache 2.0 license) developed by the Digital Society research center at the Bruno Kessler Foundation. It supports the design and management of various types of sustainable mobility campaigns, which can be customized according to specific mobility goals and target user groups.



In particular, the campaigns enabled through Play&Go aim to:

- make the use of sustainable transportation enjoyable and rewarding by leveraging gamification techniques to engage and motivate users;
- induce significant and lasting changes in participants' mobility habits;
- make the results and impacts on the mobility system measurable.

Play&Go targets the following stakeholders. First, administrators and mobility managers who wish to promote sustainable mobility policies tailored to a specific area, city, organization, or company, by launching behavior change initiatives aimed at specific goals and closely monitoring the results and impact. Second, campaign managers, who use the platform's features to design and develop mobility campaigns aligned with policymakers' strategies and objectives. Lastly, citizens, who collectively participate in sustainable mobility actions, interact with the gamified application, and receive both virtual incentives (enabled by gamification elements) and real rewards (e.g., economic incentives, prizes, coupons, or other benefits). Play&Go has been successfully tested in several Italian cities in Trentino, Emilia-Romagna, and Lombardia through the implementation of sustainable mobility campaigns that involved several thousand users, organizations, and companies.



Kids Go Green (www.kidsgogreen.eu)

Is a platform developed by the Digital Society Center of the Bruno Kessler Foundation that engages the entire school community by offering a playful and educational tool for innovative, multidisciplinary learning, aimed at encouraging sustainable mobility behaviors.

In this educational game, the sustainable kilometers traveled daily by children on their home-to-school routes are added up to advance the group along a virtual educational journey. The progress and milestones reached are displayed on an interactive multimedia map, helping to convey the value of the kilometers traveled collectively. The journey and its stages are customizable according to the interests and curriculum of the teachers. Moreover, each class can associate multimedia educational materials with each stage of the journey.

The project began in 2016 with a pilot at the S. Vigilio di Vela primary school. Thanks to the positive reception from students, teachers, and families, it was expanded to numerous schools in Trentino, Emilia-Romagna, and Lombardy, and has already involved 120 schools and more than 14,000 children and their families.

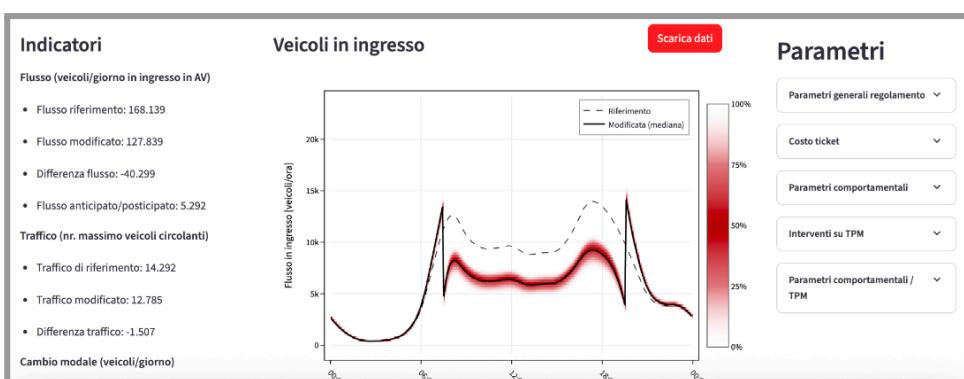
These pilot programs showed an impact on home-to-school mobility that exceeded all expectations: in schools that implemented Kids Go Green, a 53% reduction in car trips to school was observed. The project has also demonstrated high educational value, especially thanks to its customizable virtual routes and the use of technologies that support active student engagement and participation in learning. Teachers and school leaders report that Kids Go Green has been “a completely new way of teaching,” enabling interdisciplinary and inclusive learning paths, collaboration within and between classes, and enthusiastic participation from both students and educators.



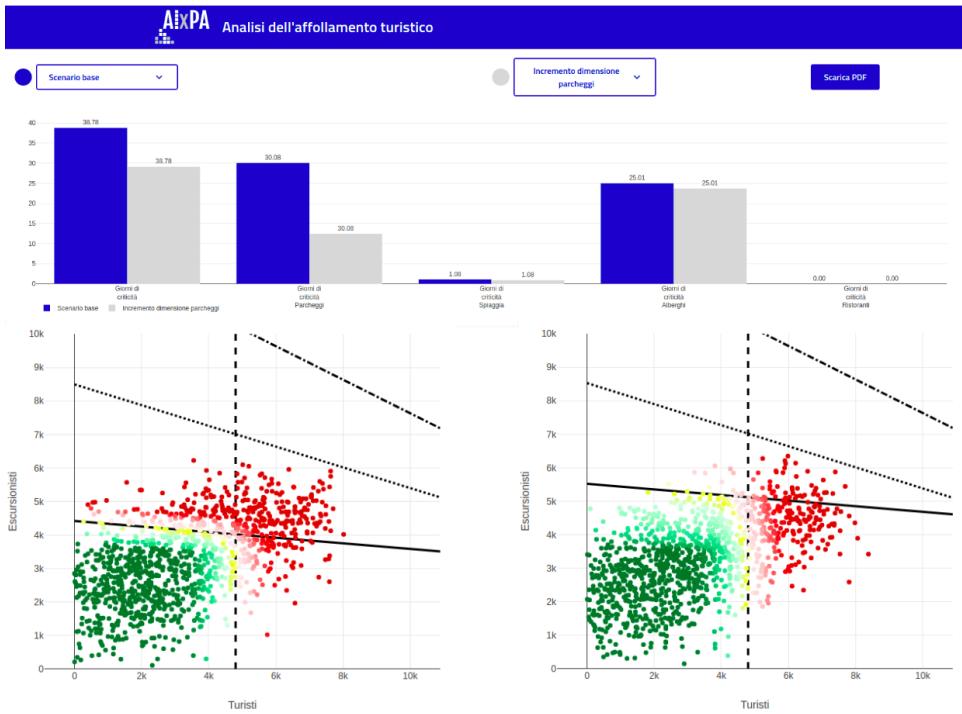


Civic Digital Twin (<https://github.com/fbk-most/civic-digital-twins>)

A digital twin is a dynamic and interactive digital model of a real system, fed by data collected from the real system, and capable of faithfully reproducing its aspect and behavior through the use of advanced modeling, data science and AI-based approaches. FBK's CDT addresses the problem of modeling social contexts - such as cities, rural areas and complex organizations - where human factors are a key component of the real system. CDT can model individual behaviors and habits, social relations, conflictual and/or cooperative attitude, in particular in relation to urban transformation processes. It supports the analysis and the simulation of "as-is" and "what-if" scenarios for phenomena such as mobility, urban security, overtourism, resilience to climate change, where the social behavior and the physical infrastructure of a city are integrated in a complex socio-technical system. The current readiness level of CDT is TRL-6 (Technology demonstration in a relevant environment).



Evaluating the impacts of traffic regulation policies with CTD



Evaluating impact of overtourism
and mitigating actions in
mountain villages.

The social media listening and analysis platform

The social media listening and analysis platform integrates a diverse range of online sources, including traditional news outlets, social media platforms such as YouTube and Telegram, and other emerging platforms like Bluesky. The platform is built on a modular, cloud-native architecture comprising four core layers: a Lakehouse-style data repository, a dynamic ingestion layer, a real-time streaming and preprocessing layer, and a serverless environment for AI-ready data transformation and enrichment. The system allows for a precision-oriented keyword-based collection model that significantly improves signal-to-noise ratios, enabling detection of relevant content and narratives with greater thematic accuracy and computational efficiency.

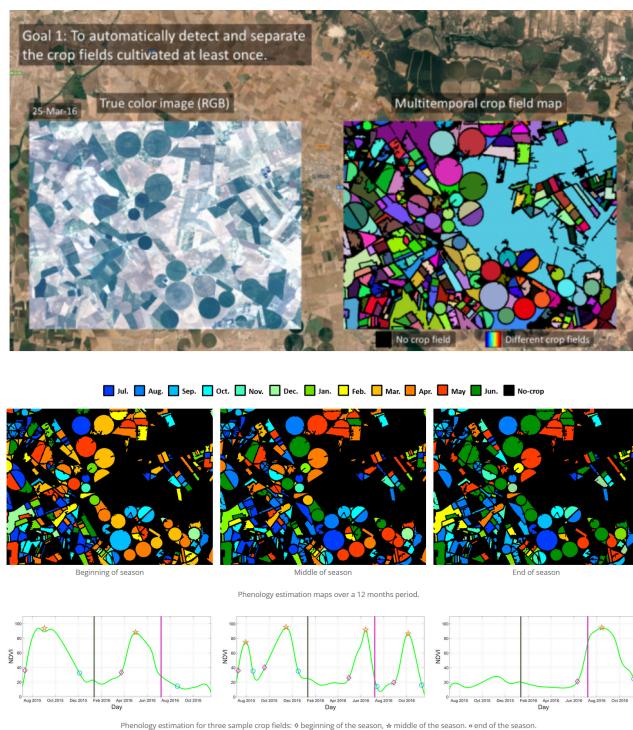
Data privacy and GDPR compliance are prioritized through privacy-preserving techniques such as pseudonymization, strict minimization of personal data, and secure, role-based access. All data collection aligns with ethical and legal standards, ensuring transparency and consent throughout the platform's governance framework. The platform supports different social networks and is able to analyse networks of users according to different metrics, identify the topics most debated among communities, detect the presence of hateful content and assess the need for fact-checking. It delivers curated datasets

through sophisticated filtering mechanisms and provides dataset statistics and analysis capabilities across different platforms.

In summary, this platform establishes a resilient and ethically sound data ecosystem, enabling reliable and scalable data flows to empower the scientific analysis of online content and support comprehensive social media monitoring and community analysis.

Agricultural fields delineation and characterization — TRL 5

It is an AI based tool to process time series of remote sensing images acquired over the same geographical area at different times by focusing on agricultural areas. Within agricultural zones we model crop fields and orchards as man-managed objects: i) behaving homogeneously from the spectral viewpoint in both space and time domain and behaving differently from neighboring different species. The tool generates crop field/orchards associated objects and provides information about each accounting for both spatial and temporal behaviours. For example, it identifies starting, middle and end of growing season(s), separates summer, winter, summer/winter crops, establishes the number of production cycles.



Change detection — TRL 5

Tools are available to identify changes on the ground induced by catastrophic events (floods, fires, earthquakes, storms, etc.) and/or environmental management (forest clear cut, urban growth, etc.) by processing Earth remote sensing images. Available tools may work in different set ups: i) anomaly detection in single date remote sensing image, ii) change detection in pairs of remote sensing images, iii) change detection in (multiannual) time series of remote sensing images. The different

approaches are tailored according to application requirements in terms of target change temporal behaviors (short abrupt changes may be approached with methods in i or ii; long term changes are better modeled with methods in iii) and operational needs (e.g., real time applications need lower number of images and thus data volume).

