The industrial revolution we are witnessing is driven by increasing complexity, automation, more intelligence and continuous focus on optimization. Today, Artificial intelligence (AI) accelerates this transformation by remodelling industries with new processes and capabilities, enabling enhanced product control and development. Intelligent machines, better diagnostic tools, and robots can help observe, analyse, and learn from vast amounts of data, extending and supporting humans in complex environmental situations.
AI4DI's mission is bringing AI from the cloud to the edge and making Europe a leader in silicon-born AI by advancing Moore's law and accelerating edge processing adoption in different industries through reference demonstrators.

AI4DI objective is to research and develop AI technologies implemented to different industrial sector applications and deployed under conditions as close as possible to real-life. The project aims to enhance processes based on repetitive tasks, focusing on replacing process identification and validation methods with intelligent technologies across industries such as automotive, semiconductor, machinery, food and beverage, and transportation.

AI4DI is building a roadmap on AI-based technologies, exploitation studies, business cases that are supporting accelerating the adoption of AI hardware (HW) and software (SW) solutions by the European industry for approaching its most urgent priorities in digitisation and moving the intelligence to the edge and providing new distributed reference architectures that are aligned with the industrial requirements.

AI4DI provides a high-level reference hybrid system architecture for the digitising industry and defines the different building blocks, functions, interactions, and workflows based on AI and IIoT solutions for seamless integration and scalability. The hybrid system architecture is applied to distributed and heterogeneous systems as reflected by the AI4DI applications in the different sectors.

The project's ultimate goal is to provide AI-based technologies at the edge for digitising the industry by reducing costs, save time, optimising/improving processes/products/services, increasing quality by enhancing industrial processes and built and sustain a dynamic AI technology ecosystem in Europe.

Work performed from the beginning of the project to the end of the period covered by the report and main results achieved so far

The AI4DI consortium gathered requirements and specifications for industrial AI solutions and demonstrators, including AI Road Mapping, presented future trends in artificial technology research and innovation, and proposed requirements for the roadmap of AI activities in the digitisation of industry, including trend analysis of social and technological challenges.

Regarding functional and non-functional requirements, an AI4DI conceptual framework and visual representation for a high-level hybrid reference system architecture was produced, describing the elements of the different views and providing the definition of all domains, properties and functions of the system. The hybrid high-level reference system architecture is applied to distributed and heterogeneous systems as reflected in the description of the different use cases in the industrial sectors covered by the AI4DI project.

The project's supply chains (SCs) mapped the use cases to the reference architecture by presenting the data/knowledge flows and the flows between the different architectural layers, which allowed each use case to identify the use of common data/knowledge formats as an integration method and facilitated assessments of the level of integration of subsystems at system level and how to combine existing, often disparate AI technologies.

The AI4DI consortium also worked on the identification of modelling and simulation tools for processes at system and sub-system level and approaches for the integration of AI methods within the developed solutions.
The development of methodologies and tools was continued and in this context it was planned to create a mapping and classification of them in order to identify commonalities across sectors. Clearly, the availability and quality of data are of great interest to enhance the value of the AI technologies adopted. Last but not least, a great effort has been made to implement an IoT/Edge infrastructure, aiming especially at the development of distributed AI solutions.

Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far)

The ongoing revolution in industrial production - Industry 4.0 - results from a confluence of rapidly developing technologies. These range from a variety of digital technologies (such as 3D printing, the Internet of Things, advanced robotics) and new materials (bio-based and nano-based) to new processes (e.g. data-driven manufacturing, artificial intelligence and synthetic biology). Europe has significant strengths, and in some cases global leadership, in a number of these technologies. This is particularly true for artificial intelligence, digital security and connectivity. The current AI industry has been built around a centralised deployment paradigm where machine learning solutions are delivered as part of cloud-based APIs and software packages deployed on remote servers of AI vendors. The future calls for a paradigm shift moving towards decentralised AI that can be run and trained at the edge on local smart devices in industrial applications. Intelligence on an edge device gives it the ability to process information locally and respond quickly to situations, instead of communicating with a cloud or central server.

One goal and outcome of the project is surely to change the mindset of the public, which is still hesitant and sometimes anxious about new technologies, and to open up the public to the idea and power of possibilities with AI-driven technologies.

With the dawn of artificial intelligence, many new jobs will be created, but some of the traditional ones will disappear and most will be transformed. To address this societal challenge, AI-specific skills need to be trained through education and training, the current curricula in European schools and universities need to be reviewed and updated. AI talents in Europe need to be developed and promoted through the creation of dedicated training programmes: e-skills, science, technology, engineering and mathematics (STEM) skills, entrepreneurship and creativity need to be supported. Enormous change is coming to societies, and it is an important task to inspire and fascinate a large part of society about the positive effects of AI: not only about technologies, but also about tangible topics such as health, education and environmental protection.

As with any transformative technology, artificial intelligence may raise new ethical and legal issues, relating to liability or potentially distorted decision-making. New technologies should not mean new values. To help advance ethical guidelines on AI development, it is necessary to bring all stakeholders together in a European AI Alliance. AI4DI will actively support all activities overseen by the Commission, including through guidance on the interpretation of the Product Liability Directive in the light of technological developments, to ensure legal clarity for consumers and producers in the event of defective products.
SEVEN KEY TARGETS FOR AI VALIDATION

AI for Digitisation

**Mission**
Make Europe the leader in Silicon–Born AI

**Objective 1**
AI applications to be demonstrated under conditions as close as possible to real-life

**Objective 2**
Roadmaps, exploiting business

**Objective 3**
Build AI community in Europe which is open

**Objective 4**
Build and sustain dynamic AI technology and ecosystems in critical real time
OBJECTIVES and MISSION OF AI4DI

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