Periodic Reporting for period 1 - AI4DI (Artificial Intelligence for Digitizing Industry)

Reporting period: 2019-05-01 to 2020-04-30

Summary of the context and overall objectives of the project

The mission of the AI4DI project is to devise a harmonized pan-European AI framework for the Manufacturing and Process technology, including prove of relevance of industrial manufacturing and process applications, which may become the optimal resilience for Manufacturing and Process technology. A plausible and reproducible approach for a wide implementation of AI methods in manufacturing industry is chosen by means of the AI deployment plan. The basic structure comprises 7 key targets, which are used in eight Work Packages, to contribute to 5 Objectives.

The key targets (KT) group the specialist environment required for digitizing manufacturing processes
according the criteria area of expertise and necessary functionality. Each KT represents a field of activity and the corresponding target at the same time. In any case, actions are taken within the KT to tackle the challenges that currently prevent achieving the 5 objectives. For example, KT1 addresses all actions concerning the control and optimization of heterogeneous systems (e.g. batch processes) with simultaneously targeting an evolvement of a common AI method understanding in this context. It is intended that each Use Case makes use of several KT since these are intended to interact by sharing data and expertise.

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

In order to achieve the ambitious objectives, AI4DI focusses on four pillars that interact with each other such that they generate a) the methods, b) an AI Deployment plan, and c) the quality reference AI Metrics required for the verification, validation, and AI in real industrial life of automated systems. The advantage of such 4-pillar structure, is that it uses techniques from different expertise areas, which support a 4-dimensional understanding of such a complex problem, being an optimal solution, which can lead to a harmonized certification of Manufacturing and Process technology. Using this approach (covered by reference partners out of this domains), will lead to the alignment with various stakeholders to define a common strategy for virtual and physical relevance and applicability to homologate Digital Industry Industrial processes.

Key achievements during reporting period (M1-M12):
The first project period 1 was characterized by the start and ramp-up phase. Work focused on following items:
- Derivation of requirements and specifications for industrial AI solutions and for the demonstra¬tors to be used for verification and validation in subsequent project phases. Except one deliverable, despite the difficulties and restrictions caused by COVID-19 pandemic, all related deliverables could be submitted almost in time.
- Development of system level designs for industrial AI solutions. Given the COVID-19 restrictions in terms of meetings and laboratory access, work is delayed by few months.
- Also work regarding the development of AI methods, semiconductor components and IIoT devices was started according to plan.
- In the second half of period 1 the development of embedded systems, edge computing and AI applications in industry was started.
- In parallel, first dissemination and standardisation activities took place.

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 fast-developing technologies. These range from a variety of digital technologies (such as 3D printing, the Internet of Things, advanced robotics) and new materials (bio- and nano-based) to new processes (for example, data-driven production, artificial intelligence and synthetic biology). Europe possesses considerable strengths, and in some cases global leadership, in a number of these technologies. This
is particularly true of artificial intelligence, digital security and connectivity. The current AI industry had been built around a centralized distribution paradigm where machine learning solutions are delivered as a part of cloud-based APIs and software packages deployed on remote servers of AI providers. The future requires a paradigm shift by moving toward decentralized AI that can run and train at the edge on local intelligent devices in industrial applications or make decisions in decentralized networks like blockchain.

The transition to decentralized AI is enabled by new technologies, that allow crowd-training of ML algorithms, device-centred AI that runs and trains ML models on mobile devices, and the use of AI in decentralized autonomous organizations on blockchain networks.

Intelligence on an edge device gives it the ability to process information locally and respond quickly to situations, instead of communicating with a central cloud or server. For instance, an autonomous vehicle must respond in real-time to what’s happening on the road. Decisions are time-sensitive and latency could prove fatal. The same requirements are in several manufacturing processes. A goal and outcome of the project is definitely to change the mindset of the public, which is still hesitant and sometimes anxious in respect to new technologies, and to open the public opinion to the idea and the power of the possibilities with AI-driven technologies.

With the dawn of artificial intelligence, many new jobs will be created, but some traditional ones will disappear and most will be transformed. To meet this social challenge, AI-specific expertise needs to be formed by teaching and training, current curriculums in European schools and at universities need to be revised and updated. AI talents in Europe need to be developed and fostered by setting up dedicated training schemes: digital skills, competencies in science, technology, engineering and mathematics (STEM), entrepreneurship and creativity need to be supported. A huge change is coming to societies, and it’s a major task to inspire and fascinate a broad part of the society of positive effects of AI: Not just regarding technologies, but tangible topics also lying behind like healthcare, education and environmental protection.

As with any transformative technology, artificial intelligence may raise new ethical and legal questions, related to liability or potentially biased decision-making. New technologies should not mean new values. To help progressing ethical guidelines on AI development, it is necessary to bring together all relevant stakeholders in a European AI Alliance. AI4DI will actively support any activities guarded by the Commission, also in means of guidance on the interpretation of the Product Liability Directive in the light of technological developments, to ensure legal clarity for consumers and producers in case of defective products.

**AI in 7 Key-targets used in 6 WPs to contribute to 5 Objectives**

**WP1:** Requirements

1. Heterogen control (Factory)
2. Homogen Control (Process)
Validating AI with 7 key targets

6. AI tools & methodology
5. Distributed system Intelligence
3. Human machine collaboration
4. Change detection, abnormalities

WP2: AI Architecture
WP3: AI IoT Devices

AI in 7 Key Targets

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

Objective 2
Roadmaps, exploiting AI for Digital Distributed AI and AI

Objective 4
Build AI community in Europe which is complementary with others initiatives

Objectives

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