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Editorial

New Industry 4.0 Advances in Industrial IoT and Visual Computing for Manufacturing Processes: Volume II

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The second volume of the Special Issue New Industry 4.0 Advances in Industrial IoT and Visual Computing for Manufacturing Processes is now closed with 17 interesting research contributions and 1 review. Two years since the previous Special Issue, industrial factories have been experiencing a rapid digital transformation because of the introduction of emerging ICT technologies, such as the industrial Internet of things (IIOT), industrial big data and cloud technologies, deep learning and deep analytics, artificial intelligence, intelligent robotics, cyber–physical systems, digital twins and visual computing (including augmented reality, visual analytics, cognitive computer vision, and new HMI interfaces and simulation and computer graphics), among others. This is evident in the global trend of Industry 4.0 and related initiatives, which are present in one way or another in many different production strategies at an international level. In recent times, the term Industry 5.0 has been used to strength the meaning of the influence of human-centric manufacturing and sustainability.

Both classical and new manufacturing processes are being enhanced by the use of big data analytics on industrial sensor data. In the current machine tools and systems, there are complex sensors that are able to gather useful information, which can be captured, stored, and processed with edge, fog, or cloud computing technologies. Manufacturing process modelling can lead to improvements in productivity and quality and, in several cases, are implemented by means of digital twins on cyber–physical production devices and systems.

In this line, manufacturing process models (e.g., thermal, vibration, deformation) can be improved with digital monitoring, digital twins, visual data analytics, artificial intelligence, and computer vision in order to achieve a more productive and reliable smart factory.

On the other hand, the role of the human factor is absolutely fundamental in these new paradigms. Collaborative robots are spreading in several applications in order to work along with human skillful workers. New approaches for augmented reality and immersive virtual reality, as well as other multimodal ways of improving human computer interaction in manufacturing scenarios, are enhancing the capabilities of operators and engineers so as to capture and reproduce human knowledge, improve their performance in operational tasks, and seamlessly integrate their valuable experience and flexibility in smart factory scenarios for manufacturing. Visual analytics can help in decision-making by management, domain experts, operators, engineers, and so on, by providing user-specific interactive visualization and the exploration of operational data in combination with machine learning approaches.

Regarding the Special Issue contributions, Červeňanská et al. [1] addresses an approximate solution to the multi-objective optimization problem for a black-box function of a manufacturing system. Sasian et al. [2] focused on the influence of new 5G networks in factories; 5 g and field buses are key enabling technologies. Ojstersek et al. [3] makes a

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contribution based on three-dimensional modelling made from capturing spherical camera data. Edge-computing devices and architectures are currently being implemented in factories; this is the context of contributions [4–6]. Redondo et al. [7] aims at hybrid unsupervised exploratory plots (HUEPs) as a visualization technique that combines exploratory projection pursuit (EPP) and clustering methods. Erasmus et al. [8] summarizes the so-called HORSE Project, investigating several of the new technologies to find novel ways to improve the flexibility as part of the Horizon 2020 research and innovation program. Serras et al. [9] introduced extended reality (XR) technologies (such as virtual, augmented, immersive, and mixed reality), with a focus on speech and AR interaction complementary to the work of Simoes et al. [10,11], as is the case in Kim et al. [12], who present a new data-augmentation method.

In the work [13], Mejia-Parra et al. present four different schemes that translate the problem of laser heating of rectangular plates into equivalent FFT problem. The presented schemes make use of the FFT algorithm to reduce the computational time complexity of the problem, improving his previous work in [14].

The authors of contributions [15–17] introduced algorithms and applications in the field of machine learning, a classic effort nowadays because artificial neural networks or Markov nets, etc., help to solve problems in manufacturing. In [18–20], three applications are shown. The closing work by Prinsloo et al. [21] is a review about cyber-security risks because the Internet and connectivity are key in automated systems.

The future will bring more challenges and opportunities; in fact, digitalization is a global trend with multiple possibilities, and a Special Issue is only a humble attempt to go a step beyond, adding new ideas to other approaches, such those in the previous Special Issue [22], or other related works in European projects [23]. In the not-so-distant future, factory workers will be helped by new digital twins, utilities, and software toolboxes to improve the production quality, productivity, and health of workers. Other related Special Issues are [24,25], where Industry 4.0 technologies are now a hot topic.

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