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Editorial

Special Issue on New Industry 4.0 Advances in Industrial IoT and Visual Computing for Manufacturing Processes

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The new advances of IIOT (Industrial Internet of Things), together with the progress in visual computing technologies, are being addressed by the research community with interesting approaches and results in the Industry 4.0 domain.

IIoT, industry 4.0, smart factories, and many other related concepts are nowadays a hot topic in industry, far beyond the initial demonstrations and initiatives that started years ago in policy-making, exhibition fairs, and journals. The applied science community is now very active in the context of helping companies and industries, which realize that the connectivity, transmission, curation, storage, analysis and use of data, together with an advanced visual computing technologies, such as visual analytics, intelligent computer vision, and graphics, can empower day-to-day production, processes, final product quality, and post-sale services. The discoveries of new possibilities in the horizontal value chain between different actors factors, the vertical dimension of improving efficiency and productivity in the smart factory, and the end-to-end dimension of considering the full lifecycle (including service) in the re-design of products, are the most relevant Industry 4.0 aspects addressed.

The present special issue involves research groups with interesting contributions in fields such as artificial vision, data analytics, smart factories and case studies, technology surveillance, and other topics closely related to the new industrial revolution. Some authors such as Švarcová et al. [1], focus on macroeconomic indicators. The role of public-private collaboration is also tackled in [2], because new research and development approaches can be applied in a regional agenda, like in the case of the German Industrie 4.0 program, the Industria 4.0 Italian program, the French Alliance Industrie du Futur, the Basque Industry 4.0 strategy, and other regional and international initiatives. All levels of current factories from layout, production scheduling, and even marketing can be affected [3]. Lim et al. [4] analyses the South Korea scenario.

One enabling technology in Industry 4.0 is cyber-physical systems (CPS) and cyber-physical production systems (CPPS). In [5] an interesting approach is presented on low-cost solutions that may cover several needs in machine monitoring without complex hardware. More complex and complete hardware and software solutions are studied in [6,7]. The criteria for selection of maintenance operators are presented in [8]. The capacity adjustment of job shop manufacturing systems is addressed using the advanced control strategy of Operator Theory in [9]. Predictive analytic models are addressed by [10] with a good survey on feature set reduction. In [11], an optimization strategy is presented for a cutting insert using ANNs and a Genetic Algorithm||

It is interesting to note that several contributions are related to the emergence of new types of *services* directly related to Industry 4.0 concepts. In [7], authors propose a PLC as a smart *service* in Industry 4.0 for non-critical processes. Roesch et al. [12] proposes an end-to-end connection

between industrial machines and their actual market demand using IT platforms. Schimanski [13] proposes a bridge between the BIM (Bulding Information Modeling) specifications in the construction industry to the related services in the design of configure-to-order services for construction equipment. A marketing perspective is also given by [3] to address the impact on current enterprises of the new Industry 4.0 technologies.

Regarding visual computing solutions, it is interesting to note that eight papers addressed how computer vision techniques, with the support of new artificial intelligence algorithms, can have direct and straightforward benefits in specific industrial application scenarios. Indeed, Industry 4.0 solutions also focus on bringing a higher degree of intelligence for production problems.

In this sense, there are papers about defect detection in fabrics using L0 gradient minimization and fuzzy C-Means [14]. Surface defect detection in generic cases using bilinear models [15] is introduced, with good classification and localization results: Fibre contour detection for food industry cases (pickles) using dilated convolution [16] is a concrete application case with interesting algorithm improvements. Detection of defects in micro-armatures for mobiles using deep convolution neural networks (CNNs) [17], blister defect detection using CNNs for lithium-ion batteries [18], and object detection using neural networks for identification of cracks [19], are also very good examples of practical problems tackled by the new generation computer vision and machine learning (incl. deep learning) techniques

A special mention should be given to the algorithmic contributions on inline inspection of warm-die forged revolution workpieces using 3D reconstruction (car component case), since it approaches some novel concepts with industrial impact in computational geometry [20], and to the new self-calibration approach of elliptic paraboloid arrays frequently used in precision measurement [21]. A contribution on how to build knowledge graphs for industrial terminology in the automotive sector is presented in [22].

The success of this special issue has motivated us to propose a new edition—New Industry 4.0 Advances in Industrial IoT and Visual Computing for Manufacturing Processes: Volume II.

We invite the research community to submit novel contributions covering both IIOT and/or visual computing aspects in Industry 4.0, with clear preference to articles that address both aspects. Examples of expected papers that extend the current areas covered in this first volume include the semantic-based, digital media oriented Visual Analytics Solutions on IIoT data [23,24] and especially the participation of the Operator as a key area in Industry 4.0 implementations (*Operator 4.0*) as described in [25,26]. The impact of these applied research lines is more and more relevant in the industrial production of today and tomorrow.

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