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Guest Editorial

Smart environments and ambient intelligence in agricultural and environmental technology

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Recent years have witnessed significant advances in Information and Communication Technology elements related to the research fields of agricultural and environmental sciences. New sensing elements have been developed to enable the collection of a wide range of data from agricultural machinery and structures, soil and water management systems, and environmental monitoring devices. By combining this equipment with Artificial Intelligence techniques, a promising breed of intelligent environments and smart applications are expected to emerge with the aim of fostering the current systems and processes involved in agricultural and environmental technology. Guided by our experience in these fields, we, the Guest Editors, have elaborated this Thematic Issue in an effort to identify the latest advances in helping to bridge the gap between the needs of farmers, environmental managers and stakeholders in the agricultural and environmental sectors and the solutions offered by smart environments and intelligent applications. As a result, a total of five contributions have been selected ranging from detection of diseases in tomato crops to a system for predicting the air quality in cities.

We would truly like to thank all reviewers for their great work in providing their evaluations and constructive comments. We would also like to thank all authors for their contributions to this Thematic Issue. Finally, we are also grateful to the JAISE Editors for supporting this Thematic Issue.

The paper "**Machine learning for air quality prediction using meteorological and traffic related features**" by Ihsane Gryech, Mounir Ghogho, Hajar Elhammouti, Abdellatif Kobbane and Nada Sbihi develops an application to predict air quality in cities through a low-cost system based on weather stations and traffic sensors. The data collected by this system are analyzed by machine learning techniques, resulting in Random Forest (RF) and Support Vector Regression (SVR), which best describe the impact of traffic flows and meteorology on the concentrations of pollutants in the atmosphere. Other features found in this work show that more accurate prediction models can be obtained when the concentration of some pollutants are included as predictors, as well as temperature and traffic concentration.

In the paper entitled "**Analysis and prediction of big stream data in real-time water quality monitoring system**" by Jindong Zhao, Shouke Wei, Xuebin Wen and Xiuqin Qiu, the authors deal with a system of wireless sensors for monitoring water quality in real time and on a large scale. Considering the problem of handling the vast volume of data produced by the system, the authors propose a system based on Apache Storm and Kafka to process the data streams. These are analyzed using a combination of the Daubechies Wavelet and Long Short Term Memory Network (LSTM) models. The results of the application in the Xin'an river in Yantai City reveal that the proposed system has the capacity to model large data with high predictive accuracy of over 95% in real time, thus providing a reliable early warning system for water quality monitoring.

The paper "**The detection of *Alternaria solani* infection on tomatoes using ensemble learning**" by Bogdan Ruszczak, Krzysztof Smykała and Karol Dziubański presents a complete system to detect a pathogen, namely *Alternaria solani*, in tomato crops. The system is trained through machine learning techniques such as Decision Tree and Ensemble Learning. This training uses the data set of hyperspectral measurements of two varieties of tomatoes, one inoculated with the pathogen and the other one treated as a reference. After the training, the system has been used on tomatoes cultivated under foil tunnels to detect infected tomatoes and the results show satisfactory accuracy for the Random Forest method with an F1 score of 0.98. This work has also studied the spectral range needed for the identification of *Alternaria solani*. As a result, the models based on the VIS and NIR spectral range have obtained the highest accuracy using the full spectrum of measured absolute reflectance.

In the paper "**Development of an application to make knowledge available to the farmer: Detection of the most suitable crops for a more sustainable agriculture**" by José M. Cadenas, M. Carmen Garrido and Raquel Martínez-España, the authors introduce the SUSPRO_F app for mobile devices integrated within an IoT system. This app advises farmers about which type of crop will obtain a better yield and will be more sustainable in their area, in order to reduce costs and improve the environmental impact. The application processes the information received through the IoT system sensors to create a model that groups areas according to their climatic conditions using a fuzzy clustering algorithm that handles imperfect data. Furthermore, adding more information to this model, such as farmers' preferences and agricultural policies, the application offers a ranking of the most sustainable crops in the farmer's area. To show the app functionality, a case study is shown in the Region of Murcia (southeast of Spain) where an IoT system is deployed.

Finally, the paper "**Indoor air quality prediction systems for smart environments: A systematic review**" by Jagriti Saini, Maitreyee Dutta and Gonçalo Marques reviews the literature in the domain of intelligent systems used for indoor air quality (IAQ) prediction. The authors perform a selection of articles published in three major scientific databases, namely PubMed, IEEE and ACM by using a PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) methodology and guided by a set of research questions defined by the authors. The reported results indicate that most of the analyzed systems collect the data through IoT architectures and wireless sensor networks and analyze the data through neural network-based models. The sensors included in these systems are intended to record mainly Co2, temperature and humidity values. The authors conclude that the main challenges in the development of smart environments for IAQ reside in measuring the impact of different contaminants taking into account context information, such as geographic and habitat conditions. They also identify the need to develop sensor networks that can be calibrated automatically and that allow measuring IAQ levels in real time.

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