

Agile AI development for Real World Solutions

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Key Note

Artificial Intelligence revived in the last decade. The need for progress, the growing processing capacity and the low cost of the Cloud have facilitated the development of new, powerful algorithms. The efficiency of these algorithms in Big Data processing, Deep Learning and Convolutional Networks is transforming the way we work and is opening new horizons. Thanks to them, we can now analyse data and obtain unimaginable solutions to today's problems. Nevertheless, our success is not entirely based on algorithms, it also comes from our ability to follow our "gut" when choosing the best combination of algorithms for an intelligent artefact. Their development involves the use of both connectionist and symbolic systems, that is to say data and knowledge. Moreover, it is necessary to work with both historical and real-time data. It is also important to consider development time, costs and the ability to create systems that will interact with their environment, will connect with the objects that surround them and will manage the data they obtain in a reliable manner.

This is where the role of tools such as Deep Intelligence comes into play, they are essential because they allow us to capture all types of data, from sensors, databases, internet, social networks and other sources. Such tools then visualize the data they have captured, complete them or normalize them if necessary and finally use them to create highly sophisticated models. In the case of Deep Intelligence, dashboards can also be created so as to fully adapt to the nature of each problem. Moreover, tools of this type help us choose the best algorithm and optimize it so that it meets the needs of the problem to be solved. This shows just how familiar we already are with Machine Learning and how it makes the prototyping and creation of computer systems much simpler.

In this keynote, the evolution of intelligent computer systems will be examined. The need for human capital will be discussed, as well as the need to follow one's "gut instinct" in problem-solving.

This keynote will analyse the importance of IoT, Blockchain and Edge Computing as contributors to the development of distributed intelligent systems that have the capacity to interact with the environment "Smart" infrastructures need to incorporate all added-value resources so they can offer useful services to the society, while reducing costs, ensuring reliability and improving the quality of life of the citizens. The combination of AI, IoT and Blockchain in an Edge Computing model or elsewhere, offers a world of possibilities and opportunities.

Smart cities, bioinformatics, smart grids, industry 4.0, etc. will experience major improvements if AI is used in a wise and sustainable manner. As part of this keynote several use cases of intelligent systems will be presented, and it will be analysed how the processes of implementation and use have been optimized by means of different tools [1-310]: hybrid AI models, Dynamic Data Assimilation Systems and Smart Cities models.

Hybrid artificial intelligence

The integration of different artificial intelligence techniques such as learning models, knowledge representation models, expert systems, fuzzy logic, data mining or natural language processing systems has allowed the development of platforms that allow the design and application of optimal solutions to problems that individually these techniques would not even be able to solve. The synergies produced between various techniques within a hybrid artificial intelligence architecture make it possible to strengthen and increase the potential of each of them while minimising the disadvantages that each of them may have.

However, since the first advances in this field through the hybridization or fusion of these techniques, there has been no relevant progression. These intelligent systems have been limited to the inclusion of diverse techniques within the same system and the application of

one or another depending on the context, but not in such a way that several techniques are applied at the same time in a complementary way for mutual enhancement. Security is a problem with these architectures and must be taken into account especially when processing data on people in a Smart City.

Smart Cities are an ideal field for the deployment of hybrid architectures since the modules that make them up can provide solutions to multiple areas. To name a few, it can be applied to the efficient management of emergency or panic situations through the application of hybrid models of knowledge and learning representation to avoid crowding of people or vehicles. Logistics management is another area of application in which a high degree of optimisation can be obtained, above all in last mile transport for efficient distribution in a collaborative manner that respects natural resources. It is necessary to investigate and design models of hybrid architectures that allow not only an efficient distribution, but also a more ecological one. There is nothing developed in this area today, although there are similar approaches at the industry level of process optimization for precise manufacturing and lower resource consumption at the Smart Cities level is a focus for innovation. Hybrid architectures allow to improve the potential of each of the artificial intelligence techniques to be integrated, while minimizing the disadvantages of each of them. However, there is still a long way to go at the design and integration level in which research must be done to evolve these architectures one step further for their application in the Smart Cities. These architectures can be adopted to optimize logistics management processes while minimizing resource consumption and transforming to more ecological processes within the Smart Cities.

Dynamic data assimilation for crowd and traffic dynamics

The internet of things has exploded in recent years and smart cities are full of sensors that constantly collect information. This makes Dynamic Data Assimilation (DDA) more interesting for researchers to support simulations and real-time systems. It is essential to assimilate the data in real time in order to successfully assist online simulation, allowing the simulation to dynamically adapt according to the information of the real-time data.

However, even though data assimilation has been addressed in other fields such as meteorology and geosciences, the work of real-time data assimilation has not attracted enough focus in the scientific community. As DDA plays an expanding part in supporting real-time decision making, new DDA models are emerging that increase the accuracy of the algorithm.

The assimilation of real-time sensor data into a simulation model allows for dynamic data-based simulation in which a simulation system is influenced by a real physical system under study. Using the DDA, the simulation system uses the data in real time and creates multiple scenarios to evaluate them through simulation and find the most optimal ones, in fact, this makes the precision of the models higher. However, the DDA simulations have to be initialized with some initial conditions and it is also necessary to assume that the physical system can be observed correctly. Many researchers have proven that if data are added to a running model in real time, better estimates of the variables of interest are produced. Data assimilation is necessary because no model is perfect, and the available data often have errors. Early research on data assimilation focused on geosciences, where numerical models are used to capture the dynamics of the systems under study. More recently, with the increasing use of computer models in decision-making, data assimilation has been applied in many other fields, such as oil and gas pipelines [8], forest fire management and traffic control. The ability to assimilate observational data is especially critical for real-time decision-making in dynamically changing environments. This project will investigate new DDA methods to support decision-making systems and improve their efficiency.

Smart City Models

Statistics from the Department of Economic and Social Affairs of the United Nations, DESAP, indicate that 68% of the world's population will live in cities or urban areas by 2050, which means rapid and even uncontrolled growth with consequent challenges for governments, for example: pollution, problems of travel due to traffic and congestion; high costs of housing, food and basic services; as well as security problems .

During the last years to attend this growth, the Smart City (SC) concept emerged as the integration of the urban with the information and communication technologies (ICTs), obtaining the interest of all sectors (governments, universities, research centers, etc.) to present solutions or developments to achieve a SC. The objective of the SC paradigm is the effective management of challenges related to the growth of urban areas through the adoption of ICTs in developments, solutions, applications, services, or even in the design of state policies.

Currently the term Smart City is widely used, for example in systematic reviews of the literature more than 36 definitions are identified that address different dimensions of the urban environment such as: mobility, technology, public services, economy, environment, quality of life or governance. One of the most widely used definitions is: "an intelligent city is one that incorporates information and communication technologies to increase operational efficiency, shares information independently within the system and improves the overall effectiveness of services and the well-being of citizens". However, since 2017 with the growth of the Internet of Things, and the volume of devices permanently connected to the Internet, there has been increasing interest in data management and security as new challenges and a cause for debate as important elements not only for urban management, but also for the well-being of the population.

The security of information, devices, infrastructure and users, managing large volumes of data in real time is the current objective of the research being carried out, because it is a critical element in the design of solutions aimed at intelligent cities. This challenge has generated a research trend: Edge Computing and its integration with IoT, which is reflected in statistics and in the interest of large corporations in research, development and implementation opportunities in SC scenarios to increase their profits and market shares. In this context, most cities are not trained and do not have the policies to understand and ensure the confidentiality of a huge amount of data that they must also process and store. Another important factor is the application of artificial intelligence techniques to extract

useful information for the management of the infrastructures, systems and devices that make the city functional and efficient, but maintaining a rapid response time that is fundamental for the functioning of an SC. In addition, the large volume of data from an SC that is sent directly to the cloud has high associated and variable costs, forcing cities to seek solutions that reduce the costs of payments to cloud service providers, as well as energy and bandwidth consumption.

CV

Juan Manuel Corchado (born May 15, 1971 in Salamanca, Spain). He is Full Professor with Chair at the University of Salamanca. He was Vice President for Research and Technology Transfer from December 2013 to December 2017 and the Director of the Science Park of the University of Salamanca, Director of the Doctoral School of the University until December 2017 and also, he has been elected twice as the Dean of the Faculty of Science at the University of Salamanca. In addition to a PhD in Computer Sciences from the University of Salamanca, he holds a PhD in Artificial Intelligence from the University of the West of Scotland. Juan Manuel Corchado is Visiting Professor at Osaka Institute of Technology since January 2015 and Visiting Professor at the Universiti Malaysia Kelantan.

Corchado is the Director of the European IoT Digital Innovation Hub and of the BISITE (Bioinformatics, Intelligent Systems and Educational Technology) Research Group, which he created in the year 2000, President of the AIR Institute, Academic Director of the Institute of Digital Art and Animation of the University of Salamanca and has been President of the IEEE Systems, Man and Cybernetics Spanish Chapter. He also oversees the Master's programs in Digital Animation, Security, Blockchain, IoT, Mobile Technology, Information Systems Management and Agile Project Management at the University of Salamanca.

Corchado has supervised more than 25 PhD theses, is author of over 800 research peer review papers and books, has chaired the scientific committee of more than 30 international conferences, and is also Editor-in-Chief of Specialized Journals like ADCAIJ (Advances in

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