Editor's Note

The term 'Digital Economy' was coined for the first time by Don Tapscott in 1995 in his best-seller *The Digital Economy: Promise and Peril in the Age of Networked Intelligence*.[1] . When he wrote the book 20 years ago, he announced how he thought the Internet would fully transform the nature of business and government.

We have now extended the concept, illustrating how digital technologies are rapidly transforming business practices, the economy and societies. Technology, and its impact on business strategy and society, continues to rise in importance. The Digital Economy, sometimes also called "Digital Business" has become a philosophy for many top executive teams as they seek competitive advantages in a world of fast moving technological change. When we talk about digital technologies, we are not only talking about the internet, nor only ICT (Information and Communications Technology), but other concepts such as mobile, telecommunications or content.

The digital economy is by no means an exclusively economic concept. Therefore, it might be more appropriate to speak of digital society or digital technology. What matters is that digital is a transverse concept that affects individuals, businesses and public administrations.

People are progressively entering the digital world. In our daily life we are in direct contact with digital devices such as cars, electrical appliances etc. People increasingly communicate digitally; through mobile devices, internet, and social networks. In addition, our leisure, education and health are largely being integrated into a digital environment.

Likewise, organizations are progressively incorporating digital technology in their production and distribution processes, conducting research and also in the process of decision making. In this sense the emergence of Big Data has been one factor that has accelerated an already observed trend.

Public administrations and political institutions are incorporating digital into both their internal procedures and in their relationships with citizens. An example is the role played by Big Data in the two elections won by Obama. Another example may be the way the ISIS terrorist group uses social networking to publicize their activities and secure funding.

But digital technology and information are not only affecting the daily behavior of individuals, businesses and public administrations. They are also playing a very prominent role in the knowledge of the fundamental laws of nature. In this sense we can highlight the contribution of digital technology in the computer modeling of fundamental elements of life, and consequently in the creation of artificial life [2]. Likewise, you may also note the role in deepening the knowledge of the universe. [3]

Bearing in mind that Digital Economy is becoming more relevant from the economic perspective, we decided to star this issue with something unusual in this magazine: a paper that discusses the economy. It's interesting from our point of view, as it underscores the fact that digital technologies, which of course include Artificial Intelligence and Interactive Multimedia, are not only relevant from the technical point of view, but from the business and society perspective as well.

The paper *Differences in Measuring Market Risk in Four Subsectors of the Digital Economy* by Sonia Benito, Rebeca de Juan, Ricardo Gómez and Francisco Mochón, emphasizes two concepts: the Digital Economy is more than only ICT, (actually they identify four main sectors - Telecom Companies, Mobile/Internet Contents and Services, SW&IT Services and Application Software); and the Digital Economy is a heterogeneous sector, which is best to consider as the result of adding the four different subsectors.

The paper tests whether indeed the economic and financial performance of a portfolio of listed companies in each of the four subsectors presents relevant differences. In order to measure the risk, they use the average value at risk to estimate market risk of the four subsectors of the digital economy. The nature of the business models of these subsectors is different, each one presenting very different risk profiles. The riskiest subsectors are Mobile/Internet Contents & Services followed by SW&IT Services and Application Software. On the contrary, the Telecom sector is by far the safest. These results support the hypothesis that the Digital Economy is not a homogeneous sector.

It is estimated that currently two billion people are connected to the internet. The internet has transformed the way we live, the way we work, the way we socialize and meet, as well as the way our countries develop and grow. In less than two decades, the internet has changed from a network for researchers, scientist and geeks, to a day-to-day reality for billions of people which in itself is a defined part of business opportunity and interaction where individuals have taken it upon themselves to create and refine the digital age. Even though Social Interaction was not one of the subsectors previously commented, it has become essential in everything related to digital where its importance is above question. People have already mastered the use of Social interaction to the point where they demand them. To this end Companies are improving their mastery of them, as they have found out that using them they can enhance operation, exploit new markets or customers loyalty.

In paper *The Digital Economy: Social Interaction Technologies – an Overview* by Teofilo Redondo exposes how Social Interaction Technologies (SIT) has had a transformational effect in many aspects of our lives. Since they touch so many parts of our lives, they have impacted on so many fields, in a clear social and technical convergence. Daily

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activities of many businesses are being socialized, incorporating the central themes of social software (create, connect, contribute, and collaborate) into a multidisciplinary ecosystem of interactive and networked computing.

The paper reviews a number of social interaction tools and some special use cases and their greatest impact. The economic results of the so-called social media economy have yet to be produced, but only in terms of increased productivity, employees and customers satisfaction, that certainly have remarkable value.

Content is an essential part of the Digital Economy and a crucial player in one of the four subsectors discussed in the paper: Mobile/Internet Contents and Services. One of the challenging issues that needs to be dealt with when working with content as a digital business, is that the content needs to be adaptable for a wide variety of devices and platforms, acceptable to the consumer and the business. (smartphones, tablets, web browsers, eBooks …). The paper *New challenges on crossplatform digital contents* by Jesús Iglesias Feijoo and Guillermo Amat Gomariz, reveals a new challenge as there are more devices and platforms available (e.g. watches, glasses, cars) and many more to follow. The Internet of things will transform the technological world in which we develop an amalgamation of devices and interfaces. According to a study by Cisco[3], in 2015 there will be twenty billion connected devices, and this figure could be doubled by 2020.

Based on the work done under the Visio Project, funded by the Spanish Ministry of Industry, Energy and Tourism, the paper analyses the challenge over the next coming years for getting all devices to communicate between each other, regardless of technology and platform. Ultimately, a truly universal platform to avoid market fragmentation and provide access to information and services is proposed.

Another important challenge, when working with content, is how the end user discovers it. On one hand, customers don´t always know exactly what they want and specifically what they are looking for, and on the other hand, there is huge content growth, available in their various content types (video, Apps, Websites, etc.) on the Mobile/Internet. Our culture and economy is increasingly shifting away from the focus on a relatively small number of "hits" with a big number in sales. This in turn to the development of niche items with a small number of sales. Anderson predicted that we are "leaving the age of information and entering the age of recommendation" [4].

To face these challenges, recommendation engines (RE) are becoming highly popular. An RE offers new items (products or content) to users, based on their profile and historical data. The most popular algorithms used in RE are based on collaborative filtering [5]. This technique makes recommendations based on the past behavior of other users and the similarity between users and items. RE bases their results on data analysis. The greater the amount of pertinent data, the more accurate the recommendation will be. And the application of different Data Mining algorithms, in the case of the next paper, the application of Social Network Analysis (SNA).

In the paper *Empirical Comparison of Graph-based Recommendation Engines for an Apps Ecosystem* by Luis F. Chiroque, Héctor Cordobés, Antonio Fernández Anta, Rafael A. García Leiva, Philippe Morere, Lorenzo Ornella and Fernando Pérez, Agustín Santos, evaluates the performance of several REs based on the properties of the networks formed by users and items. The REs use a novel approach to graph theoretic concepts like edge weights and network flow. The evaluation has been conducted in a real environment (ecosystem) for recommending apps to smartphone users. The analysis of the results allows for the possibility that the effectiveness of an RE can be improved if the age of the data and a global view of the data is considered. It also shows that graph-based RE is effective, but more experiments are required for a more accurate characterization of their properties.

The Entertainment industry is one of the biggest source of content and videogames as well as one of the most important and profitable within it. Even though videogames are considered content themselves, the creation process requires the generation of several other pieces of content. At the moment, the creation of a videogame is often a large-scale endeavor and bears many similarities with, e.g., movie production. On the central tasks in the development of a videogame is content generation, namely the definition of maps, terrains, non-player characters (NPCs) and other graphical, musical and AI-related components of the game. Such generation is costly due to its complexity, the great amount of work required and the need of specialized manpower, hence the relevance of optimizing the process and controlling costs.

Paper *Procedural Content Generation for Real-Time Strategy Games* by Raúl Lara-Cabrera, Mariela Nogueira-Collazo, Carlos Cotta and Antonio J. Fernández-Leiva, exposes how procedural content generation (PCG) comes in handy as a means of reducing costs by using algorithmic techniques to automatically generate some game contents. PCG refers to the algorithmic creation of content for video games possible, such as maps, levels, terrains, graphic textures, music, rules, quests, narrative, and missions among other things [6]. PCG also provides advantages in terms of player experience, since the contents generated are typically not fixed but can vary in different playing sessions, and can even adapt to the player. For this purpose, the underlying algorithmic technique used for PCG must be flexible and adaptable. This is the case of computational intelligence in general and evolutionary algorithms in particular. In this work we shall provide an overview of the use of evolutionary intelligence for PCG, with special emphasis on its use within the context of real-time strategy games. We shall show how these techniques can address playability and aesthetics, as well as improving the AI game.

Since the Internet opened a new way to communicate in

many different forms, several sectors have adopted it. One of the most relevant has been the educational sector, which adopted such technology and developed the Web-based Educational Systems (WBES). Today this has become even more popular with the eruption of MOOCs (Massive Open Online Course). WBES platforms store and manage huge amounts of data. The stores of data are growing exponentially and contain hidden information that could be very useful to the users (both teachers and students).

The paper *Mining Web-based Educational Systems to Predict Student Learning Achievements* by José del Campo-Ávila, Ricardo Conejo, Francisco Triguero and Rafael Morales-Bueno studies how data mining can be used to induce student models from the data acquired by a specific Web-based tool for adaptive testing, called SIETTE [7]. Consequently top down induction decision tree algorithms are used to extract patterns, because these models (decision trees) are easily understood. In addition, the validation processes conducted have assured high quality models.

Digital technologies can be applied to different sectors and healthcare has been always a sector that demands creative, thoughtful uses of technology in different areas: devices, diagnosing, as well as management. In the management area, the development of health information systems has been guided by the need to manage the huge amounts of information that make the use of physical methods unfeasible [8]. However, these systems are not usually constrained set protocols. The result is that different hospitals working together or even different services within the same hospital cannot share information about their patients.

The paper *A Repository of Semantic Open EHR Archetypes* by Fernando Sánchez, Samuel Benavides, Fernando Moreno, Guillermo Garzón, Maria del Mar Roldan-Garcia, Ismael Navas-Delgado and Jose F. Aldana-Montes describes a repository of openEHR archetypes [9] that have been translated to OWL (Ontology Web Language). In the work, five different CKMs (Clinical Knowledge Managers) have been downloaded and the archetypes have been translated to OWL. This translation is based on an existing translator that has been improved to solve programming problems within certain structures, as part of the repository, a tool that has been developed to keep it up-to-date. So, any change in one of the CKMs (addition, elimination or even change of an archetype) will involve translating the changed archetypes once more. The repository is accessible through a Web interface (http://www.openehr.es/).

Another application for healthcare technology, in this case, a variety of disciplines, are shown in the paper *Auto-adaptative Robot-aided Therapy based in 3D Virtual Tasks controlled by a Supervised and Dynamic Neuro-Fuzzy System* by L. D. LLedo, A. Bertomeu, J. Díez, F. J. Badesa, R. Morales, J. M. Sabater and N. Garcia-Aracil. It presents an application formed by a classification method, based on the architecture of ART neural network (Adaptive Resonance Theory) [10] and the Fuzzy Set Theory, to classify physiological reactions in order to automatically and dynamically adapt a robot-assisted rehabilitation therapy to the patient needs, with the aid of 3D tasks in a virtual reality environment. Firstly, the mathematical and structural model of the neuro-fuzzy classification method is described, together with a signal and a data training acquisition. The virtual task is designed along with its physical behavior and procedures. Finally, the general architecture of the experimentation for the auto-adaptive therapy, is presented using the classification method with the virtual reality exercise.

The last paper in this issue *GPGPU Implementation of a Genetic Algorithm for Stereo Refinement* by Álvaro Arranz and Manuel Alvar, explores the advantages of using GPGPU implementation to speed up a genetic algorithm used for stereo refinement. The main contribution of this paper is analyzing which genetic operators take advantage of a parallel approach and the description of an efficient state- of-the-art implementation for each one. As a result, speeds of up to 80x can be achieved, which is close to real-time performance.

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