

## IT wins all the awards at the XI Congresso Português da URSI 2017



On the photo, from left to right: Hafssaa Latioui, Vera Pedras, Carolina Gouveia and João Felício

For the second consecutive year, IT researchers won all the awards in dispute at the “XI Congresso do Comité Português da URSI”, held last November 24 at the Fundação Portuguesa das Comunicações, in Lisbon.

João Felício, from the Antennas and Propagation group of IT in Lisbon (AP-Lx), won the ANACOM-URSI Portugal Award with his work “Microwave Imaging for Breast Cancer Screening: Experimental Validation”. Currently, the primary imaging technique to detect breast cancer is mammography, which uses ionizing radiation and requires the compression of the breast. João Felício, supervised by Carlos Fernandes and Jorge Costa (both from the AP-Lx group), developed methods and technology intended to help detecting breast cancer at an early stage, without any contact with the breast, using Microwaves. “Microwaves are showing great potential as an alternative pre-screening method. Contrarily to X-rays, Microwaves are non-ionizing and, therefore, do not have any long term consequences to health”, said João Felício.

As for the Best Student Paper Award, the winner was Carolina Gouveia, (IT in Aveiro/UA), supervised Pedro Pinho and José Vieira (both also from IT in Aveiro), with her work “Bio-radar performance evaluation for different antenna design”. The second place went to Hafssaa Latioui (IT in Lisbon), supervised by Mário Silveirinha (IT in Lisbon), for the work “Electromagnetic “transparency in a material with two distinct topological phases”. And finally, the third place was attributed to Vera Pedras (IT in Lisbon/IST), supervised by Paula Queluz, Pedro Vieira and António Rodrigues (all from IT in Lisbon), for her work “Development of QoE models (No Reference) for voice and Web Browsing based in 3G/4G radio measures”.

## Editorial

Modern society has quickly adopted the fact that Information should be always available everywhere to such an (addictive) extent that we tend to forget that most of the enabling technologies are fairly new, many less than 20 years old.



Taking Portugal as an example, and economy as the measure of the importance, we should note that the telecommunication sector represented about 3 % of the gross internal product in 2012. How to provide the first class telecommunication networks and services, required for a modern economy in times of very fast technological changes is a question that deserves to be addressed.

Some argue that technology should be bought on the market. However nice this statement may sound, nevertheless it forgets a basic truth. If all technology is bought on the market, then anyone can buy it and so the required competitive edge can only be achieved by underpaying human resources.

Admittedly no one, particularly in a small country, can develop all the required technologies. But it is essential to develop some technologies in order to gain or to remain competitive or at very least to be able to choose the right technology.

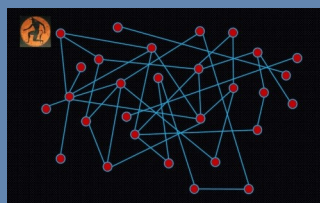
Research and development and advanced training in telecommunication technologies, are thus a most required factor to develop a modern, competitive economy.

When 2017 is coming to an end I would like to take the opportunity to send all of you and your families my very best wishes for a Merry Christmas and Joyful 2018.

Carlos Salema

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By Yasser Omar

IT is a private non-profit association of Universities (UA, UC, IST, UBI, UP, ISCTE-IUL), Polytechnic of Leiria, Altice Labs and Nokia, with a mission to create and disseminate scientific knowledge in telecommunications. IT hosts and tutors graduate and postgraduate students.

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## Verónica Orvalho on the 40 Woman in Emerging Tech list

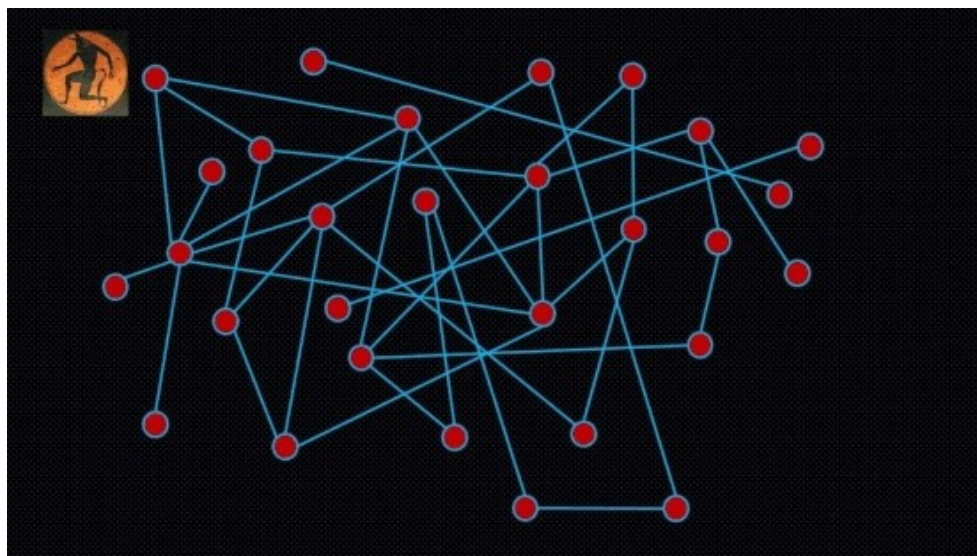
In a recent online article Allison Kaplin, the Founder of Woman Who Tech, presents a list of “Woman in Emerging Tech YOU Need to Know”, calling on investors to follow 40 woman that have founded successful tech startups. Verónica Orvalho and MyDidimo (www.mydidimo.com), a technology that “Automatically creates a 3D virtual character starting from a single photo — and in about 2 minutes you have a lifelike avatar that can speak, move, and represent you in a 3D world.”, as explained on the article, appear on #4.

In this article Kaplin addresses the difficulties woman-led startups still face to get the investors to bet on them. “Even with studies showing that woman-led tech startups generate 35% higher ROI and 12% higher revenue than startups run exclusively by men, woman still face significant obstacles raising money”. For instance, in the US only 2% of Venture Funding goes to Woman-led Ventures.



## PROJECT SNAPSHOT

### Quantum Computing before Democritus



Imagine you are lost in a random labyrinth, looking for the exit. Or that you are the ancient Greek hero Theseus searching for the Minotaur in such a labyrinth. How can we even describe a random labyrinth? Let us represent it by a network with  $n$  nodes, where each pair of nodes is connected only if you get heads after tossing a biased coin. Imagine the Minotaur standing in one of these nodes, with the power to determine how connected the labyrinth is by controlling the bias of the coin whose tossing decides if each pair of nodes is connected or not.

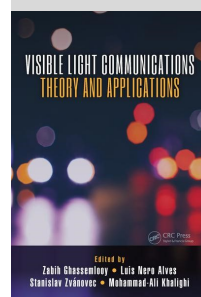
Recently, it was proven that above a certain threshold of connectivity in the labyrinth (related to the bias of the coin), a quantum computer would offer the fastest way for Theseus to find the Minotaur (<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.116.100501>). But below this threshold, that quantum speed-up would be lost, and Theseus would take longer to find his half-human enemy. Is there something Theseus can do about it, or can the Minotaur always escape Theseus' quantum computational advantage by simply choosing the adequate bias for the coin?

Imagine now that Theseus has the power to replace the entire labyrinth at regular time intervals. Each time, he deletes all the connections between the nodes, and then introduces new random connections by tossing the biased coin for each pair of nodes, thus effectively generating a new labyrinth. The number of nodes remains fixed. And the Minotaur is still the one deciding how connected or not the new random labyrinth is overall, by setting the bias of the coin. But Theseus can re-generate the labyrinth as frequently as he wants (see an example in the Figure below). That's his power.

In their work published in Physical Review Letters, Shantanav Chakraborty, Leonardo Novo, and Serena Di Giorgio, students from the Doctoral Programme in the Physics and Mathematics of Information at IST (<http://www.dp-pmi.org/>), jointly with their supervisor Yasser Omar, all of them members of the Physics of Information and Quantum Technologies Group at IT (<http://www.phys-info.org/>), have proven that now the Minotaur can no longer escape the optimal quantum search by Theseus. In particular, whatever connectivity (or coin bias) the Minotaur chooses, there is always a frequency for generating new labyrinths that Theseus can choose to find the Minotaur in the fastest way possibly, taking full advantage of quantum computation. Even if the Minotaur imposes a bias leading

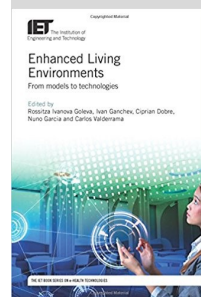
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## Books



**Visible Light Communications: Theory and Applications** by Z. Ghassemlooy, L. Alves, S. Zvanovec and M. Khalighi

This book provides a comprehensive overview of theory, stimulation, design, implementation, and applications. The book is divided into two parts – the first devoted to the underlying theoretical concepts of the VLC and the second part covers VLC applications.



**Enhanced Living Environments: From models to technologies** by R. Goleva, I. Ganchev, C. Dobre, N. Garcia and C. Valderrama

Enhanced living environments employ information and communications technologies to support true ambient assisted living for adults and people with disabilities. This book provides an overview of today's architectures, techniques, protocols, components, and cloud-based solutions related to ambient assisted living and enhanced living environments



**Optical Communication Technology** by P. Pinho

The optical world is continuously and rapidly evolving, and new challenges arise every day. This book presents an overview of new optical communication technologies and a bird's-eye view of some of the more promising technologies among them.

to labyrinths with very low connectivity, including with many nodes isolated from the rest of the network, Theseus can simply generate new labyrinths more frequently and still use quantum search to find the Minotaur in the fastest way possible.

Besides an (altogether unexpected) taste for quantizing ancient Greek mythology, the motivation of the authors for their study was twofold: to investigate the robustness of analog quantum computation to time-varying defects, as well as to investigate the possibility of performing quantum information tasks on temporal networks. Most real networks (social, natural or technological), like Facebook or the internet, are not static: they lose and gain links as time evolves. One would expect that when performing quantum computation in such messy, and more realistic, scenarios, the fragile quantum advantage would be lost. However, the authors found that this is not the case. They proved that the fundamental quantum search algorithm for finding a given node in a network retains its full quantum speed-up even for random networks varying in time. In fact, they show that one can use this temporal feature as a knob to control the performance of the computation.

Furthermore, their results can also be exploited for networked quantum communication, well beyond the usual requirement where the sender and the receiver need a direct link to communicate quantumly. These discoveries open way to study quantum information technologies, for communication, computation and sensing, on realistic complex networks.

Yasser Omar

## TailorPhy: Smart Sensors and Tailored Environments for Physiotherapy



A multidisciplinary research team, coordinated by Octavian Postolache (IT / ISCTE-IUL), has developed several ICT's applications and equipment with the general aim of improving physiotherapy processes. The research team designed software applications to allow physiotherapists to manage, in their clinic or remotely, the routines and exercises for the training of upper and lower limbs functional movements; kinect-based applications with serious games (JustPhysioKidding, Apple Harvesting) for training the upper limbs movements; kinect-based application with serious games for training the lower limbs movements and overall body balance (Step the Tile, Leaning); application based on Leap Motion Controller for training the hands movements; and application for monitoring the physiotherapy results of patients using a walker by measuring the pressure center distribution during the gait. These prototypes were thought of as solutions to help people who need to train movements for their motor rehabilitation (eg. people recovering from a stroke, children with brain paralysis or elderly people with neuro-motor disabilities), especially those who live faraway from the institutions that provide these services. The technologies being developed by this IT research team allow monitoring the exercises for training the movements of the arms, hands, legs or for training of the body balance, in institutions that provide physiotherapy services, or for those patients who perform these exercises at home with the supervision of a physiotherapist.

The main goal of project TailorPhy - Smart Sensors and Tailored Environments for Physiotherapy, funded by the FCT, is the development, application and evaluation of a system of information whose configurations can be tailored to measure the patient's balance and functional movements during their physiotherapy sessions. Through this research we wish to contribute to the development of a system that can adapt to the needs of both the users and physiotherapists, to increase the effectiveness of the intervention in general and to help improve the users' postural control, balance and the control of functional body movements in particular.

The developed prototypes allow non-invasive and non-intrusive objective measures that can aid in the assessment of both movement dysfunctions and the effects of physiotherapy interventions, contributing to the process of reasoning and clinical decision making. In this way we intend to contribute to the optimization of physiotherapy through the development of information systems that allow: improving the clinical management of the evaluation and intervention processes in physiotherapy; facilitating the communication with other health professionals and the users; promoting greater accuracy and objectivity in the evaluation of the user and in intervention results; and providing data and tools for clinical research.

## Newsflash

### IT with the only Portuguese team on a project funded by QuantERA

The European project TheBlinQC – Theory Blind Quantum Control, in which Instituto de Telecomunicações participates, has been selected for funding in the call QuantERA Call 2017 in Quantum Technologies.

The project involves José Leitão and Yasser Omar, both researchers from IT in Lisbon, as well as partners from Austria, Czech Republic, Germany, Poland, and the United Kingdom.

There were 221 projects submitted to this European call, applying for over €235M. Only 26 were selected with TheBlinQC being the only approved project involving a Portuguese team.

### Caroline Loss reaches the podium on International Textile Competition

Caroline Loss, a current post-doc researcher from IT in Aveiro, achieved the third place in the Graduate Student Paper Award of The Fiber Society's 2017 Fall Technical Conference, held in Athens, USA, last November 8-10.

The work that got Caroline the third place in the podium was entitled "Influence of Some Structural Parameters of Textile on Their Dielectric Behaviour", which integrates the PhD thesis supervised by professors Rita Salvado (UBI-DCTT) and Pedro Pinho (ISEL/IT in Aveiro).

This paper focuses on the study of wearable antennas and describes how the applied manufacturing technique can affect the return loss parameter of printed textile antennas. The work was distinguished for its contribution to analyze the influence of the laminating manufacturing technique on the electromagnetic behavior of the conductive and dielectric textile materials, giving guidelines to optimize the manufacturing process of the textile antennas and thus increase their performance.



## Filipa Prudêncio

In November 2014 I finished my PhD in Electrical and Computer Engineering under the supervision of Professor Carlos Paiva and co-supervision of Professor Sérgio Matos, at IST and IT. My work was focused on new analytical and geometrical approaches in bi-isotropic media. My dissertation received the Abreu Faro Award (1<sup>st</sup> edition) which was distinguished as the best PhD thesis in IST among the scientific areas of electrical and computer engineering, informatics engineering, mathematics and physics, in the biennium 2013/2014. In 2015, I joined the Antennas and Propagation group of IT in Lisbon which allowed me to continue my research on electromagnetic materials.

In the same year, I successfully applied to a postdoctoral fellowship of FCT. The post-doctoral grant gave me the possibility to investigate several exciting and exotic solutions to create nonreciprocal electromagnetic responses and asymmetric light flows in novel photonic platforms. In particular, I have recently studied the opportunities provided by novel materials with a spontaneous nonreciprocal response, such as electronic topological insulators and composite anti-ferromagnets, in the context of optical isolation and light trapping in open optical cavities. Furthermore, since 2014 I am an invited assistant professor at ISCTE in Lisbon. As a professor at ISCTE I prepared and lectured on several occasions a new course on "Cloud Computing" integrated in the department of technology and information. Currently, I am lecturing a course on mechanics and electricity in the same department.

I really thank IT for all the great support to my career: it has really been a privilege to work with and among so many excellent researchers and to be a part of this unique organization.



*Season's  
Greetings*



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Guido Reni / *The Nativity at Night*, 1640 (oil on canvas),  
National Gallery, London, UK  
The Bridgeman Art Library



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