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BIG DATA AND HEALTH: A PROMISING DIALOGUE FOR MEDICINE OF THE FUTURE

Interview with Michele Stasi, President of the Italian Association of Medical Physics (AIFM) and Director of the Health Physics Department of the Ordine Mauriziano Hospital of Turin

On 12 December, AIFM and INFN organised the "Big data and Health in the perspective of the Bologna Technical Hub" conference, with the aim of discussing the issue of the impact that big data will have on the medicine of the future and the challenges related to the analysis and management of this valuable digital mine of information with a multidisciplinary and territorial approach. The conference was a first opportunity for discussion among experts from research communities and institutions working in the field of big data and AI, having the skills and technologies crucial to building a new digital alliance for public health. The choice of organising the conference in Emilia Romagna stems from a uniqueness that characterises this region: the future Bologna Technical Hub, which will be one of the eight centres selected by the European Union, the only one in Italy, to host a pre-exascale class computer, a supercomputer with extremely high computing power. A project with a total investment of approximately 240 million euros for Italy and approximately 900 million at the European level and in which INFN can make a fundamental contribution thanks to decades of experience in the management and analysis of big data accessible through efficient cloud platforms, also using machine learning techniques.
We met Michele Stasi in Reggio Emilia, at the Oncology and Haematology Centre of Reggio Emilia (CORE), venue of the conference.

AIFM and INFN have recently signed a collaboration agreement. What does it concern and what are the objectives?

This is a long-term collaboration agreement that stems precisely from the need to give an initial response to a health system that in the future will be increasingly multidisciplinary and multi-professional, and this Reggio Emilia event is the first implemented within the scope of this agreement. The objective, together with scientific companies in the radiology area, is to address the new challenges of an increasingly personalised medicine, in which technological innovation and artificial intelligence will be the protagonists. Hence an idea

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emerges: combining the expertise of INFN researchers and the computing infrastructure available to them (such as the future Technical Hub in Bologna), with the health and medical physics facilities in which AIFM is present, which are disseminated throughout the country, also exploiting both the technology transfer know-how of medical physicists, as well as the crucial possibility of using health technologies.

What are the most significant recent advances in medical physics and what are the most interesting prospects that are opening up for the coming years, particularly with regard to the big data issue?
The applications of physics to medicine have been fundamental, starting from the end of 19th century, with the discovery of X-rays and the X-ray tube by Roentgen, of radioactivity by Marie Curie and Bequerel and, subsequently, with the Nobel Prize winners for the invention of CT and MRI. Certainly, in recent years, the most important technological transfer from the world of fundamental research to medicine has been that of accelerators which, from basic research in particle physics, subsequently found applications in radiotherapy and hadrontherapy, where the example of the CNAO in Pavia represents the highest point of integration between research and medicine in recent years. The future is what we mentioned at the beginning of this interview: big data and Artificial Intelligence (AI) are now fundamental tools to study the state of health of individuals and define personalised treatment plans.
Automatic learning (machine and deep learning) techniques, borrowed from the field of artificial intelligence (AI), are, in fact, able to recognise patterns or causal relationships in phenomena or in the health data of individuals, thus providing new knowledge useful to produce forecasting models. These techniques exploit the ability of computers to handle huge amounts of data and to adopt reasoning typical of the human mind, demonstrating to be capable, for example, of extrapolating the guidelines to be adopted to solve new problems from previous knowledge. However, these new processes must be governed, verified, validated and optimised. In this context, the collaboration between INFN and AIFM is a fundamental element.

“BIG data and health” is a topic with promising applications extended to many areas of biomedicine, including molecular biology, genomics, oncology, immunotherapy, radiology and precision radiotherapy. Where are we on this and what are the challenges?
There are countless applications and systems based on Big Data and Artificial Intelligence that are used in many areas of medicine, especially in the field of diagnostics and the process of introducing machine learning or deep learning systems into health is more ongoing than ever before. Suffice it to say that this year, at the Radiology Society of North America (RSNA) Congress, there were more than 160 companies dealing with artificial intelligence. Of course there are still many problems to be solved, including those of an ethical nature, but certainly, as far as the management of Big Data is concerned, the main problem to be addressed

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is that of privacy and of the correct application of the new general Data Protection Regulation (GDPR) in this context.

Going back to medical physics, could you tell us what AIFM does and what are the issues that characterise the work of the association? Why is it important that there is an association for this type of professional?

The Italian Association of Medical Physics (AIFM) represents specialists in medical physics at the scientific and professional level who work in the health field, both as hospital employees as well as freelance professionals, but also physicists who deal with medical physics in research, university teaching and industry. We are speaking of a community of approximately 1200 physicists. AIFM is the only scientific society, recognised by the Ministry of Health, for medical physicists pursuant to Legislative Decree 24/17 (Gelli Law). For this reason it can participate in drafting guidelines that represent good practice also for the purpose of professional liability. AIFM is also a national provider of continuous medical education (ECM), both for residential as well as on-line courses, and with its post-graduate school of medical physics and the radiation protection school, it organises more than 15 training courses per year for medical physicists.

How has the profession changed in recent decades?

It has changed a lot and a lot more will change in the future. The health physics facilities in Italy (and beyond) were created to manage the problems of radiation protection of workers and patients due to the use of ionizing radiation. For many years, the medical physicist was seen as the radiotherapy physicist or qualified expert. Today she/he is a health professional who works with all types of radiation, with technology to support clinicians but above all provides her/his fundamental contribution to prevention, quality and safety in increasingly personalised medicine. In short, we can say that the paradigm has changed: from Physics in Medicine (with technology at the centre) to a Physics for Medicine (with people at the centre).

And how does Italy compare to other European countries?

Italy is at the forefront in Europe for basic and continuous education, application to diagnostics and treatment, for its scientific and research role and also in terms of the size of the community. As a demonstration of this, suffice it to say that next year, from 23 to 26 September 2020, in Turin, Italy will host the third European Congress of Medical Physics (ECMP III) together with the XI National AIFM Congress.

What is the path to be followed for a career in medical physics and what are the most promising career opportunities?

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To become a professional in medical physics, the path is quite long: five years for the Master's degree and then three years of specialisation in medical physics (often unpaid). The main job opportunities are in the National Health System in the public sector and as a physicist manager in the private sector. At the moment there is a lot of demand in the job market and, in some regions, in fact, demand is higher than supply, with positions not being filled, especially for fixed-term contracts. My advice to youngsters is to choose this profession for many reasons: first of all you work as a physicist, or rather a physicist at the service of patients, and then there is demand in the job market and it is also a well-paid profession. ■