A new era of oncology through artificial intelligence

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Patients' care, from diagnosis to treatment, has radically changed; however, the awareness about the ongoing revolution has not yet spread through the oncology community.

To date, due to technical advances, cancer research is producing information at an incredibly rapid pace challenging even the most tech-competent physicians to use these data to significantly improve patient care. An example is the current information about the cancer's genome: millions of molecular alterations that might impact the growth of cancer cells have been discovered and might also influence the response to treatment.

It has been estimated that a physician should read 29 hours per working day in order to stay updated about new medical research. Moreover, every year, the medical literature increases by doubling the amount of information every 3 years. The result is that it is only going to get harder for several generations of oncologists, like me, who have spent hours searching in the literature an answer to a medical question. Several times this ended up in a long process of reading from one article to the next one and possibly missing the answer to the initial problem. There must be a better way to integrate the current knowledge and give to our patients the best possible care.

One such solution was born in 1956 with artificial Intelligence or AI. One of the leading AI or cognitive technologies is IBM Watson, which can learn reason and understand the enormous corpus of the literature available to the scientific community. Such technology will help us make connections among all the data needed to answer a complex medical question in a very short time. Moreover, these technologies can ingest all of the published scientific knowledge, including clinical data of every single patient, ending up with evidence-based and personalised treatment options. For example, Watson for Genomics ingests approximately 10 000 scientific articles and 100 new clinical trials every month.

In one scenario, the clinician may train Watson with the tumours characteristics,

the patients' comorbidities and also add any specific wishes from the patient, for example, if the patient does not want hair loss. Based on these notions and any national and international guidelines, a cognitive computer will be able to generate a ranked list of therapeutical options, including the evidence. Moreover, it will be possible to adapt the suggestions based on the specific constrains of a country. For example, in India, it can take anywhere from 4 months to 2 years for a new product to enter the country[1]. Finally, such a technology could also evaluate inclusion and exclusion criteria of all possible clinical trials for each patient and find a matching list of studies in which the patient can be included.

These capacities and many others have been made possible, thanks to the collaboration between the IBM researchers and the Memorial Sloan Kettering who have also trained Watson on how a decision is made at a tumour board. Recently, at the San Antonio Conference 2016, the results of a double-blind study with 638 patients were presented comparing the decisions made by the tumour board at the Manipal Comprehensive Cancer Center (India) and the ones made by Watson for Oncology. Incredibly, 90% of Watson for Oncology's recommendations for standard treatment or consideration were concordant with the recommendations of the tumour board.[2]

This tumour board was concerning patients with breast cancer and enlightens a great opportunity for big cancer centres where not all patients can be discussed due to time limitations. It is very interesting that the investigators from India, who have been working with Watson, explained how the collaboration between them and Watson was uncomplicated as they entered the electronic patients' charts and asked Watson for an evaluation of the case. All clinical data, laboratory results and physicians' notes were analysed. In about 40 s, Watson gave a treatment suggestion as well as the scientific evidence for each suggestion. How long would it take a physician to

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carefully evaluate the same data without any omission or bias?

These results have been met with great enthusiasm, but also fear between physicians: when will we all be able to use such a tool and are we still going to be fundamental for patients?

Several cancer centres, mainly in the USA, are already working with these platforms and further developing the capacities of such cognitive computers. Indeed, Watson is very young, growing at an incredible speed through the development of new abilities as the cancer genomic project. This is a partnership with the Broad Institute of the Massachusetts Institute of Technology and Harvard with IBM, by which the cancer genome of patient will be fully analysed and all data will be evaluated by the computer for treatment options.

In my opinion, we are entering a new era of oncology and the current generation of physicians must be ready to approach such an evolution with the curiosity that characterises us in this profession. The incredible potential of these technologies is that they can further learn and improve based on the physicians' needs and as new data are ingested.

Indeed, cognitive computing has only just begun. In addition to oncology, such technologies also have applications in radiology where Watson can ingest thousands of radiological scans and detect the pathological findings. Moreover, Watson can help the pathologist in distinguishing a single tumour cell in several histological samples and in supporting the dermatologists, being able to make the diagnosis of melanoma from a smartphone. This is exactly the function of AI: to help physicians in our repetitive daily work to give us more time for our patients and research.

All of these advances do imply that physicians are aware of the capacities and limits of such technologies and are able to keep a critical attitude. Moreover, the physician will stay as the one responsible for decision-taking and further on will always be the reference for the patient at all timepoints.

Some centres already working with cognitive computers are growing a new generation of oncologists. I, for one, am looking forward to have access to such platforms in order to give to our patients more evidence-based therapeutical options and possibly inclusion into new clinical trials; we should all be ready to say: 'Hello Watson!'.

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