

# Treating tumours: Machines learn, humans decide

Alfredo Vellido, principal researcher of the AIDTumour Project, works transversely. He and his colleagues aim to design and develop in his project a prototype of decision support system to assist the diagnosis of brain cancer patients. This initiative is good news, in a country that lags behind in terms of translational and clinical initiatives for the development of these technologies.



How did this project begin?  
Liverpool

I had my first contact with the field of biomedicine while I was living in Liverpool doing postgraduate research in Artificial Intelligence applied to Medicine. Unfortunately, this was just an introduction to an exciting world that I had to leave aside for a few years. An opportunity to resume my research in this field came in 2005, when I was working in the Soft Computing (SOCO) group at the LSI Department in the UPC.

In 2003, I arrived to Barcelona to work at SOCO with a Ramón y Cajal research contract, and landed in an environmental application project that had already started. In SOCO, we carry out theoretical and applied research in fields such as environment, business, e-learning and medicine, amongst others. We aim to make AIDTumour the core of our research, while continuing our work in the rest of fields.

How would you define the project?

We are looking for methods to assist on the diagnosis of brain tumours. We don't expect our technologies to make decisions, but to support them. We want them to become some sort of "second opinion". In medical diagnosis, and especially in oncology, machines learn, but humans are the ones who ultimately decide.

AIDTumour entails the design of a decision support system for oncology based in advanced soft computing and visualization methods.

Transversality is a fact on your daily research life. How is it working with scientists from different fields?

Luckily, SOCO works with other institutions who helps us a lot. The data for this project were gently provided by the Grup d'Aplicacions Biomèdiques de l'Espectroscòpia de Resonància Magnètica Nuclear (GABRMN) from Universitat Autònoma de Barcelona. Their data, which have been studied in other European

Projects, have an extraordinary value.

On another hand, we also collaborate with other International Universities and Institutions, as well as with individual scientist with expertise in cancer research. We work with Professor Paulo J. G. Lisboa and with Dr. Terence Etchells from Liverpool John Moores University. We also count on Dr. Julio Valdés, a member of the Integrated Reasoning Research Group at the National Research Council from Canada, who has worked in medical applications for a long time. Also from the UK, a pioneer country in medical decision support systems research, we have on board Dr. Wael El-Derey from The Manchester University and Drs. Man Choi Helen Wong and John A. Green from the National Health Service Clatterbridge Centre for Oncology at Bebington.

We are especially concerned about the viability of the system prototype we are designing. For that reason, and in partnership with UPC's Innova program, there is a telecommunications engineering student who will analyze the project's technological and economic viability as part of his final year project. And on top of that, the project is supported by, amongst others: Aleasoft Company, Microart Company and Hospital Vall d'Hebron, Hospital Universitari de Bellvitge, Hospital Sant Joan de Séu, Parc de Recerca Biomèdica and Cetir Grup Mèdic.

As you can see, this is a complex interdisciplinary project and, yes, we work with people from very different scientific backgrounds and nationalities. As you were saying at the beginning, transversality is necessary in our interdisciplinary research, which I think enriches us as scientists although sometimes it makes more difficult to coordinate research and find a common ground and language for it. As everything in life, the biggest challenges are the hardest and the most interesting ones. It is important that, given that the project is transversal and interdisciplinary, you are ready to learn in an interdisciplinary way, too.

Could you explain a little bit to us the science that is behind it...

The typology of brain tumours that we are studying is rather complex. In fact, the best way to nail a tumour diagnosis is to perform a biopsy. This is not acceptable if the tumour is located in the patient's brain. We have to work with non-invasive techniques and that entails many restrictions.

The multi-centre data we work with are Nuclear Magnetic Resonance spectra. Some of the frequencies in these spectra are known to be associated to the presence of specific chemical compound, or metabolites in the tumour tissue, and can therefore be used as a tumour type indicators. An expert oncology radiologist with enough training is usually able to identify each tumour by just looking at its spectra; therefore, as I said before we are not pretending to substitute the doctors' diagnose, but the techniques we work with can extract patterns and knowledge from very complex databases in a way humans cannot. In fact, the system that we are designing is more effective for uncertain cases. When a patient shows an atypical signal that could be caused for many different reasons. It could be just a really unusual tumour, but it could also be the result of a measurement artefact. With this support technology, the clinician can be aware of these unusual patterns and make more informed decisions.

How are you going to present it?

That is our second goal. We want to integrate these tools within a web-accessible clinical oncology decision

support system, including flexible visualization methods integrated within a virtual reality environment.

The developed tool prototype will be evaluated and validated by several collaborating hospitals specialized in oncology. We will then find out if we have reached the goals we set for the project...

To know some more:

I'm absolutely convinced about the success of this project. I believe people from SOCO and its collaborators will succeed in it. I want to thank Alfredo Vellido for his time and I encourage you to have a look at the AIDTumour project web page: [www.lsi.upc.edu/~websoco/AIDTumour](http://www.lsi.upc.edu/~websoco/AIDTumour).

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