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NEW TRENDS IN IMAGING TECHNOLOGIES

Medical imaging is a Life Sciences sector that will particularly benefit from digital technologies and artificial intelligence. More and more players in the field are developing disruptive technologies for image acquisition and interpretation, in order to better diagnose diseases, but also to detect, monitor and prevent them with an improved efficiency. This article is a great length discussion on the topic with Arnaud Butzbach, Chief Technology Officer at Median Technologies.

BIOTECH FINANCES: How would you characterize the Medical Imaging field today? What are the recent evolutions?

Arnaud BUTZBACH: There are numerous medical imaging techniques, from the most classic ones such as conventional and digital X rays (CXR and DXR), Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) to those more innovative or used less frequently such as Positron Emitted Tomography (PET), Optical Coherence Tomography (OCT) and many other refinements of classic techniques.

Imaging, whether in-vivo or in-vitro, i.e. based on body sample and microscopic observations, plays a crucial role in life sciences for disease screening and diagnosis and for assessing patient response to therapy. Imaging is a key tool for researchers to understand biological phenomenon in the human body, the evolution of disease and how treatments work. Imaging accelerates and rationalizes new drug development and helps clinicians reliably measure the therapeutic effects on patients.

New imaging techniques and innovative evolutions of already existing technologies have brought great advances in cognitive imaging, which enables scientists and clinicians to understand how our brain works. These advances include functional MRI or optical coherence tomography, a technology that utilizes the physical properties of light to generate in-depth images of tissue. Great progress has been made as well in the field of echography where elastography measures specific physical characteristics of tissues and organs that reveal disease and its evolution.

In-vitro images typically are generated by analysis with a microscope of biological samples on slides. However, thanks to a more widespread digitization process, the use of software technology to standardize and automate interpretation of in-vivo and in-vitro images is now an important new trend, as the main challenge is about our capacity and capability to take advantage of an always larger quantity of information contained in such high precision images.

Arnaud Butzbach

« Medical imaging will enable improved, less invasive and more efficient disease diagnosis. »

Due to increasing living standards in emerging countries, health care requirements are getting higher. The acquisition of medical imaging equipment is no longer a barrier for these countries but training specialists for interpreting the images generated by these machines is still a challenge. Very significant investments have been made in developing software technology that analyzes medical images, making them more informative than illustrative, limiting operator subjectivity and mitigating lack of trained resources and expertise. Based on image processing and machine learning, such technology brings to life the concept of artificial intelligence applied to medical imaging.

BF: How has the radiologist's role evolved considering these evolutions?

A.B.: In current healthcare systems, reimbursement per procedure is the most common, which favors radiologists performing a higher number of procedures than performing less lucrative complex, in-depth, time consuming analysis of images. This explains the growing number of innovative projects targeting faster, more accurate and reliable image interpretation. Radiologists must take advantage of such progress and focus on activities where human interpretation is required.

BF: Today, what is the medical imaging market size? What are the faster growing therapeutic areas on that market?

A.B.: The global medical market was assessed at around 28.3 B€ in 2015 and could reach 38 B€ by 2021, thanks to a 5.1% annual growth rate. Oncology is expected to be the most rapidly growing market. Many cancers grow at various rates and require imaging over time to assess disease evolution.

BF: What will medical imaging bring to the upcoming era of personalized medicine?

A.B.: Medical Imaging brings new opportunities to personalized medicine, a discipline that has long aimed for research on patient genetics to predict response to treatment. Today, imaging becomes even more instrumental, allowing for image phenotyping, which is all studying all expressed image characteristics that are correlated to a patient's condition, disease evolution and response to therapy. Specific patient phenotypes can be compared to those from other patients or group of patients with known conditions. These comparisons are the foundation for building big databases that allow for complex and in-depth analysis, thus further increasing the potential of medical imaging.

Big data technology combined with machine learning have the potential to determine treatment options based on the patient profile. For example, the screening and early diagnosis of Non-Alcoholic Steatohepatitis (NASH), which has a high incidence in Asia, are quite difficult since existing methods to assess liver fibrosis are suboptimal and often invasive. Median is working on measuring the level of liver fibrosis using standard medical images by searching for the unique signatures of fibrotic livers not perceivable by the human eye and that reflect known fibrosis in image databases.

BF: Which are the most active companies in medical imaging, which countries are the most advanced?

A.B.: The four largest medical imaging manufacturers are Philips Healthcare, General Electric, Siemens, and Toshiba Medical Systems, recently bought by Canon. Many French companies are in this market: Median Technologies, VitaDX, Supersonic Imagine, EOS imaging, Abbelight, LLTech Imaging, Damae Medical, Voxcan, Mauna Kea Technologies, Intrasense, Surgivisio, EOS Imaging, i-Nside, and Echosens. It is an emerging market with many small players developing accurate technology for specific needs. Many of us work on image analysis software to assist or replace the human eye.

BF: How does Median Technologies positioned itself in this picture?

A.B.: By further developing our proprietary technology, our goal is to help patients around the world in accelerating drug development and to identify and extract the image phenotypes useful for screening, diagnostic and assessment of treatment response. One of our current applications assesses response to treatment in a more accurate and reliable way. It brings our pharma industry customers the full benefit of using imaging in oncology drug development and particularly in the promising field of immuno-oncology.

« Medical imaging equipment manufacturers are seeking strong technology differentiators. »

We also currently are extending the use of this technology to ambitious health programs for cancer screening and standardization of cancer follow-up.

The third, and most innovative technology initiative called iBiopy®, leverages big data and machine learning technologies to extract and search signatures in medical images. It brings solutions to targeted unmet healthcare needs and an innovative platform for new application discoveries. The technology is available to research institutes across the world in cooperation with our main development partner. This iBiopsy® platform aims at offering an alternative to invasive biopsies for selected indications.

BF: What are the most promising evolutions?

A.B.: There is a very strong market potential as most countries do not as a rule use innovative and powerful imaging platforms in their healthcare systems. In addition, the ability to extract key information from medical images is underutilized for the prevention, screening, diagnostic and monitoring of disease. There are many diagnostic approaches such as biopsy, which involves capturing tissue samples, and biologic tests that are often invasive (especially in the lungs and the liver), costly or not accurate. Imaging is generally not invasive even though it may result in limited exposition to ionizing radiation.

For instance, bladder cancers are often detected late in the disease process, usually following a biopsy. Emerging technologies can now analyze a simple urine sample for detection of circulating tumor cells that reflect an evolving cancer (VitaDX).

Non-invasive optical technologies, acquiring in-depth microscopic images of the epidermis, allow for screening and characterization of skin cancers (Damae Medical).

Imaging will make complex and difficult diagnostic procedures faster, more accurate and less invasive. While current imaging technologies are often complex and expensive, less expensive, mobile and even miniaturized modalities are emerging. Echosens, a company providing a dedicated ultrasound device for assessing liver fibrosis based on elastography is a good example of this trend.

As far as disease screening is concerned, imaging is key for many cancers. Results of the use of imaging in lung cancer screening in the EU and US are promising. In addition, imaging can be leveraged for prevention, motivating individuals to change their lifestyles. For example, medical images of blurred/diseased lungs have a strong psychological impact on individuals when it comes to getting them to quit smoking. In addition, the effect of environment and lifestyle on individuals is potentially visible through medical images, creating opportunities to leverage them in dealing with public health and environmental problems.

The possibilities of artificial intelligence applied to automated interpretation of images are compelling. The science and technology of imaging is rapidly evolving, so that in the near future disruptive technologies will emerge, bringing new and powerful weapons to help in the fight against disease. The combination of specific image acquisition techniques and very advanced image analysis software will represent a key advantage, for medical technology companies in search of strong market differentiators. This will lead to the emergence of more personalized and disease-targeted imaging modalities as well as disease-specific imaging biomarkers. In line with personalized medicine, imaging will play a more direct role for the patient who will become its first customer.

Inteview by Viviane de Laveleye