Press Release

Breast screening breakthrough to end unnecessary biopsies

Harnessing photonics, European scientists have created a new mammographic imaging system that determines benign or malignant breast lesions - spelling an end for unnecessary biopsies and anguish for millions of women.

Scientists from the Horizon2020 project SOLUS have developed a non-invasive, multi-modal, imaging system that uses ultrasound and light technologies to easily differentiate between benign or malignant lesions – without having to perform a biopsy.

Similar to a pregnancy ultrasound appointment, a clinician scans the breast with a handheld 'smart optode' pen probe that combines light and sound to collate blood parameters and tissue constituents.

Using a technique called 'diffuse optical imaging' – a method that has provided breakthroughs in neuroscience, wound monitoring, and cancer detection – scientists can monitor changes in concentrations of oxygenated and deoxygenated haemoglobin, collagen, lipids and water present in a suspected tumour against a pre-programmed set of results.

While mammography is accurate in detecting breast lesions, many women encounter false positive results – a positive detection of a lump but with no malignant cancer present. Clinicians, however, do not necessarily know whether a lesion is cancerous or harmless and have to resort to invasive procedures, such as biopsies, to make an accurate diagnosis.

According to a recent study, false-positive breast biopsies cost more than €1.85 billion ($2 billion) per year in the United States alone.

While You Wait

Able to provide a malignant or benign diagnosis, the SOLUS scanner reads a number of different parameters to create a thorough characterization of tissue. Gathering the total blood volume and oxygenation, collagen, water and lipid content, together with stiffness and morphologic information, the system produces an accurate, while-you-wait diagnosis.

Aiming for 95% sensitivity and 90% specificity, the project has combined commercial ultrasound imaging and elastography with novel diffuse optical imaging approaches.

The scientists behind the 'SOLUS' project are confident their new system will revolutionise breast cancer diagnosis. Professor Paola Taroni from Politecnico di Milano, Italy, said: "Women may have to wait days or weeks for a malignant or benign result to come back, which causes distress, as well as great discomfort from an invasive biopsy.

"Astonishingly, millions of unnecessary biopsies are currently carried out across the world at a cost of millions of Euros in Europe, and potentially billions worldwide."

"Having undergone extensive laboratory trials, the SOLUS team plan to validate the system in real clinical settings at the end of this year and through into 2021," Professor Taroni said.

Diffuse Optics

With 'diffuse optical imaging' the system uses light as an investigative tool to look beneath the surface of the skin, without making an incision.

Harnessing photonics and acoustics, this new system gathers diagnostic information from the composition of tissue and blood by sending pulses of infrared light and ultrasound a few centimetres into the breast tissue.

A clinician can then determine whether a lump is benign or malignant given that cancerous tissue is characterized by high haemoglobin and water content, and low lipid content.

"We have been applying diffuse optics to different aspects of breast cancer (lesion discrimination and an estimate of cancer risk) for 20 years now. Our team developed a multi-wavelength time-domain optical mammography which was used in clinical studies on more than 400 patients.

"Now an upgraded version has just entered clinics for the monitoring of neoadjuvant chemotherapy of breast cancer. Furthermore, our group performed a lot of work on other diagnostic applications, such as functional brain imaging and muscle oximetry," said Professor Taroni.

Peter Gordebeke, Research Manager from the European Institute for Biomedical Imaging Research said: "While SOLUS is developing biomedical imaging technologies to improve the diagnosis of breast cancer, we are making good use of diffuse optics for breast cancer and other medical diagnostics applications.

"SOLUS has created a user-friendly, non-invasive, low-cost, multi-modal imaging system for high-specificity diagnosis of breast cancer."

"While our multi-modal imaging system can save millions of Euros by reducing the number of unnecessary biopsies, helping women across the world avoid these needless, painful procedures is priceless," Gordebeke said.

SOLUS is supported by the European Commission in the framework of the EU Horizon 2020 ICT programme with a grant of € 3.8 million under the Photonics Public Private Partnership.

The project is coordinated by Politecnico di Milano and includes nine partners from European countries, including CEA-LETI, Commissariat à l'Energie Atomique et aux

Energies Alternatives in Grenoble, Supersonic Imagine in Aix-en-Provence, Vermon in Tours, (France); University College London, (United Kingdom); Micro Photon Devices in Bolzano, San Raffaele Hospital in Milan, (Italy); The European Institute for Biomedical Imaging Research (EIBIR) in Vienna, (Austria); iC-Haus in Bodenheim, (Germany).

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About Photonics21

Photonics21 is the European Technology Platform (ETP) for photonics, a technology encompassing all of the products and processes around the emission, manipulation and detection of light. Photonics is integral to a wide range of industries that include the medical, healthcare, transport, manufacturing, and telecommunications sectors.

"Photonics21" was set up in December 2005 to bring the community of photonics researchers and industries together. The European Commission defined photonics as one of five European Key Enabling Technologies (KET's) in September 2009. Shortly after, the European Research & Innovation Program "Horizon 2020" invited Photonics21 to become a "Public-Private Partnership" (PPP). The "Photonics 21 Association", a legal entity under Belgium law, became the private contract partner in November 2013 in a Public-Private Partnership (PPP) in conjunction with the EU Commission.

Today Photonics21 represents more than 3000 personal members from across Europe and abroad. Our members are experts in the photonics industry, research organisations and universities who actively engage with us to develop a joint photonics strategy for future research and innovation in Europe.

With the global photonics market growing from €350 Billion in 2011 to €447 Billion in 2015, Photonics remains a strong industry. The European photonics industry, estimated to be worth €70 billion, has considerable global leadership positions and employs over 300,000 people directly.

With positive growth forecast, current industry trends like digitalisation, resource efficiency, individual and zero failure production will drive the photonics industry further.

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