New sound synchronization technology holds the key to earlier diagnosis of heart disease

2 June 2011

Innovative UK technology is contributing to the development of a revolutionary digital stethoscope that could make it easier for GPs to spot the first signs of heart disease.

With Engineering and Physical Sciences Research Council (EPSRC) funding, a Queen Mary, University of London (QMUL) team has developed a computer-based technology that synchronises the various sounds collected by the new stethoscope and which make up a human heartbeat.

The sounds can then be analysed by an existing technique called ICA (independent component analysis), with data presented on a laptop or desktop computer in easy-to-understand graphs. These provide a visual representation of the heartbeat and any anomalies in it. Currently, such anomalies can be missed by doctors who aren't experts in cardiac care.

ICA can only analyse heartbeats if all the different sounds that make up an individual's heartbeat are brought together as one overall sound.

Like a conventional stethoscope, the new stethoscope captures four sounds one after another. The computer-based technology developed by the QMUL team then turns these separate sounds into one combined signal which ICA can then process. The QMUL synchronisation technology therefore plays a vital bridging role between the new stethoscope and ICA.

With conventional stethoscopes, the identification of a potential heart problem is completely reliant on the expertise and listening skills of the GP.

QMUL's technology was unveiled on 25th May at the 36th International Conference on Acoustics, Speech and Signal Processing held in Prague in the Czech Republic.

The overall stethoscope development project is an international collaboration led by Portugal's University of Porto and Centro Hospitalar Alto Ave, Guimarães.

"Heart disease is still the UK's number-one killer", says Professor Mark Plumbley, who has led the QMUL work. "Our work here is making a vital contribution to an invention that will help GPs identify heart problems before they become serious - even when patients come to surgery about a totally unrelated health matter. Early interventions not only help patients but also reduce the burden on healthcare resources."

As well as being suitable for use in GP surgeries, the stethoscope - called the DigiScope - will be ideally suited to outpatient clinics, accident & emergency units and other hospital departments where doctors are not necessarily cardiac specialists.

The DigiScope is designed to be used by doctors in exactly the same way as they use a conventional stethoscope. They position the end piece, in turn, on four different places on the patient's chest. However, with the DigiScope these four separate sounds are then transmitted wirelessly to a laptop or desktop and synchronised by the QMUL technology as if they were all transmitted simultaneously. They are then analysed using ICA.

With the new system, doctors can compare the visual graphs produced with 'normal' readings while the patient is there, or save the graphs and study them later. Or a second opinion on the data can be obtained, via the internet, from another doctor located miles away.

"It's the multidisciplinary character of this exciting international collaboration that has enabled it to produce such a promising outcome," says Professor Plumbley. "Two prototype DigiScopes are already in use to test their capabilities. The development will not remove the need for specialist cardiac units, it will simply make it easier to identify potential heart problems at an earlier stage."

Provided by Engineering and Physical Sciences Research Council