Researchers develop algorithm to improve remote electrocardiography

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Today someone in a remote village in India is able to run an electrocardiogram (ECG) via their smart phone on a loved one having a potential heart attack and send to a doctor in New Delhi for analysis.

Mobile technology is already bringing health care to places it has never been able to reach. However, there is still room for error that can lead to misdiagnosis.

Xiaopeng Zhao, assistant professor in the Department of Mechanical, Aerospace and Biomedical Engineering at the University of Tennessee, Knoxville, is working to eliminate these errors. Zhao and his team of graduate and undergraduate students and physicians have developed an award-winning algorithm that improves the effectiveness of ECGs.

The ECG is the most commonly performed screening tool for a variety of cardiac abnormalities. However, it is estimated that about 4 percent of all ECGs are taken with misplaced electrodes, leading to faulty diagnoses and mistreatments.

Zhao's algorithm examines interferences that result from electrode misplacement and disturbances, including patient motion and electromagnetic noise. Unlike conventional algorithms used to evaluate ECGs, Zhao's algorithm is more reliable because it is based on a matrix which simultaneously tests for irregular patterns caused by such interferences. Therefore, instead of a typical "yes-no" type of classification result, Zhao's produces a more accurate A-F letter grade of

the ECG—indicating specific weaknesses in the test. The algorithm also makes recommendations as to where to accurately place the electrodes.

Zhao's team has implemented the algorithm in a java program, which can be installed and operated on a smart phone. The program takes only a split second to execute on a smart phone and assess a 10-second ECG. The speed is key in situations where a second can mean the difference between life and death.

The goal is for users in remote areas to be able to know which ECGs are accurate to decrease misdiagnoses and ultimately save lives. The algorithm is also helpful in intensive care units where medical staff may be overworked, as well as for novice health professionals.

"There is a large population that does not receive good health care because they live in rural communities," said Zhao. "This algorithm helps to bring the doctor to their home through the help of mobile phone technology. We hope our invention brings their health care quality more in line with that of the developed world by reducing errors and improving the quality of ECGs."

The algorithm recently won the top spots in Physionet Challenge 2011—first, first and third places. Sponsored by the National Institutes for Health, Physionet and the annual Computing in Cardiology conference jointly host a series of challenge problems that are either unsolved or not well-solved. Starting in 2000, a new challenge topic is announced each year, aiming to stimulate work on important clinical problems and to foster rapid progress towards their solution.

More information: Zhao and his team will receive an award of $2,000 and present their work at the Computing in Cardiology 2011 conference on September 18-21, at Hangzhou, China. For more information, visit physionet.org/challenge/