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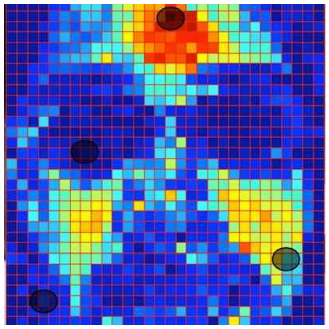
Video and Vital Signs: New System Permits Touch-Free Monitoring



Engineering researchers associated with Rice University's Scalable Health Initiative are devising a way to monitor patients' vital signs without touch. The Distance PPG system allows physicians to diagnose patients remotely by using a video camera and specially designed software that detects nearly imperceptible shifts in skin tone. The researchers hope that the software will someday be used on smartphones, tablets and computers so that people can monitor their own vital signs.

It is not the first time scientists have used video cameras to detect subtle changes in patients' skin colour that indicates shifts in blood volume beneath the skin. Those changes express alterations in breathing rate and pulse. Distance PPG improves upon an existing idea by addressing some of the main challenges to suitable working conditions. It was developed by graduate student Mayank Kumar and two professors of computer electrical engineering, Ashok Veeraraghavan and Ashutosh Sabharwal.

Inspiration From the NICU

According to lead researcher Kumar, DistancePPG will be especially useful in monitoring premature infants, since other means of measuring vital signs such as wired probes and blood pressure cuffs can be dangerous for newborns. The wires themselves are not necessarily problematic, but babies tend to roll over them. The wires can also make it difficult for mothers to interact with their infants, requiring removal and reapplication over delicate skin.

"This story began in 2013 when we visited Texas Children's Hospital to talk to doctors and get ideas," said Kumar. "That was when we saw the newborn babies in the neonatal ICU. We saw multiple wires attached to them and asked, 'Why?'"

Adjusting For Colour, Light and Movement

The team faced a number of challenges in developing an improvement over the existing technology. First, it was difficult to detect shifts in skin tone in people with darker skin. Second, the brightness of the light was sometimes insufficient. The third and more challenging problem was that patients sometimes move in front of the camera; even a smile can affect the readings.

To address these obstacles, Kumar and colleagues incorporated a way to average change signals in skin colour from different parts of the face. They also added an algorithm for tracking participants' eyes, nose, mouth and whole face. To compensate for movement, DistancePPG perceives pulse rates to within a single beat per minute, regardless of skin tone and lighting condition.

"Our key finding was that the strength of the skin-colour change signal is different in different regions of the face, so we developed a weighted-averaging algorithm," said Kumar. "It improved the accuracy of derived vital signs, rapidly expanding the scope, viability, reach and utility of camera-based vital-sign monitoring."

The research paper has been published in the Optical Society journal *Biomedical Optics Express*. The study was supported by the National Science Foundation, a Texas Instruments Fellowship, the Texas Higher Educaiton Coordinating Board and a Rice University Graduate Fellowship.

Source: Rice University

Image Credit: Mayank Kuman/Rice University

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