Medical Xpress

New technique for increasingly accurate PET scan to detect cancer and heart conditions

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A novel technique which reduces image degradation caused by respiratory motion during a PET scan was developed in a recent study at the University of Eastern Finland. PET scanning is routinely used to detect cancer and heart conditions. The new technique presented in the PhD thesis of Tuomas Koivumäki, MSc (Tech.), is based on bioimpedance measurement and it allows for image reconstruction at a specific phase of the patient's breathing pattern.. This, in turn, makes it possible to reduce image degradation caused by motion.

In the future, the newly developed technique will enable increasingly accurate image acquisition especially during PET scans performed to detect cancers of the chest and upper abdomen, and inflammatory diseases of the heart. PET scanning, or positron emission tomography, is a modern nuclear medicine imaging method, which allows for the detection of cancer and heart conditions.

Thanks to enhanced image quality, PET images provide new and increasingly accurate data, potentially improving diagnosis reliability and treatment response monitoring. High-quality image data makes the treatment more efficient both medically and financially.

The study found that when synchronising images on the basis of bioimpedance, it was possible to discern smaller details. Motion compensation also significantly influenced the parameters measured from the images. Bioimpedance measurement offers a straightforward technique for acquiring the data needed for motion compensation.

Furthermore, the technique can be easily integrated into electrocardiogram (ECG) measurement, which is widely used to monitor heart function during the scan.

Bioimpedance helps assess the patient's breathing

In techniques based on bioimpedance measurement, a very weak electrical current is passed through the patient's chest, and changes in the resulting voltage are measured. The voltage has been observed to change according to the patient's breathing and cardiac function. Earlier, bioimpedance measurements have been used to assess for example body composition, fluid accumulations in lungs, and indicators of cardiac function.

The study focused on the feasibility of bioimpedance-based measurement techniques for respiratory and cardiac motion compensation in PET imaging. The study first used computational models and test subjects to determine an optimised bioimpedance measurement configuration for simultaneous measurement of respiratory and cardiac gating signals. The second phase of the study focused on analysing whether bioimpedance techniques can be used to reduce respiration-related degradation of PET images.

Motion degrades PET scan image quality

PET scanning is used for cancer staging and evaluating treatment response, as well as for studying myocardial blood flow and inflammatory diseases of the heart. Typically, a PET scan takes several minutes, which is why movement caused by the patient's breathing inevitably degrades image quality. Degraded image quality caused by respiratory motion has been reported to affect PET scanning performed to detect cancer and heart conditions in particular. At worst, image

degradation may lead to a wrong diagnosis and inadequate or unnecessary treatment.

The results were originally published in Medical & Biological Engineering & Computing, Physiological Measurement, and *Physics in Medicine and Biology*.

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