GERMAN CANCER RESEARCH CENTER IN THE HELMHOLTZ ASSOCIATION

Research for a Life without Cancer

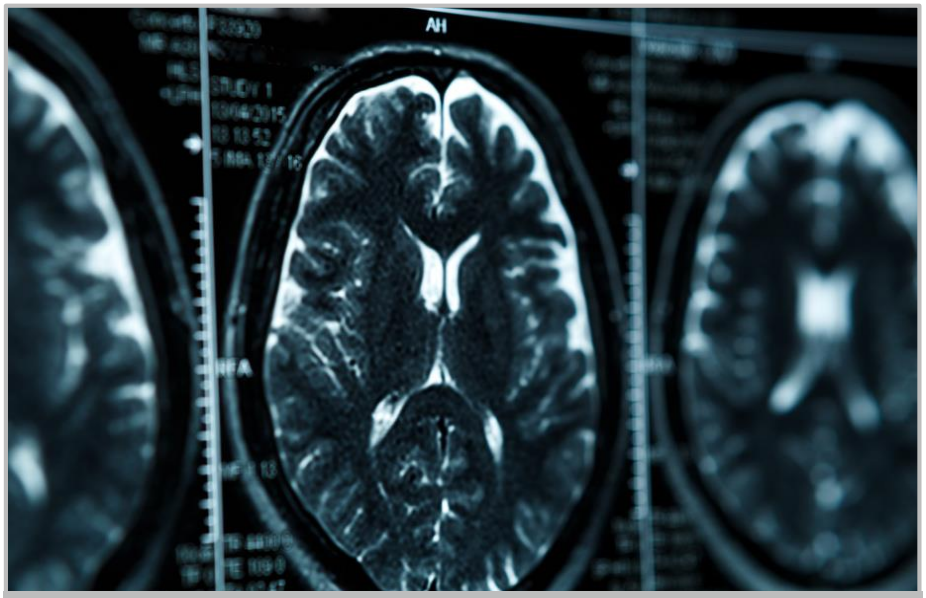
TECHNOLOGY OFFERS

Scatter Estimation Using Measured Energies in CT, PET, SPECT or Other Imaging Modalities (P-1375)

Real-time scatter estimation, enabled by machine learning with improved

EXECUTIVE SUMMARY

This invention is based on the assumption that large-angle, low-energy scatter (which is often discarded as much as possible) contains useful information about low-angle, high-energy scatter (which shall be estimated and removed from the measured data) that can be leveraged by machine learning. The invention uses energy measurements to discern measured photons by energy bin. Multiple raw-data images can be formed from raw data acquired in multiple energy bins, and used for machine-learning approaches such as convolutional neural networks. This invention involves using multiple energy bins, including the ones below the full-energy peak, for additional information about scatter contributions within the full energy peak.



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Category	Indication	Development stage	Seeking
Devices, Software	Tomography	Pre clinical	Licensing, Development partner

BENEFITS

- Real-time scatter estimation, enabled by machine learning
- Successful demonstrations in X-ray computed tomography and positron emission tomography
- Improved accuracy promised by using energy measurements

TECHNOLOGY BACKGROUND

In imaging modalities that use ionizing radiation, such as X-ray computed tomography (CT) or positron emission tomography (PET), photon scattering decreases image contrast and impedes image quantification. Therefore, scatter correction is essential, but accurate scatter estimation is often prohibitively time-consuming. Machine-learning can be employed for real-time, highly accurate scatter estimation (Deep Scatter Estimation, DSE), but so far, accuracy is limited by the use of measured photons in only a single energy bin.

DEVELOPMENT STAGE

Deep scatter estimation has been successfully demonstrated in clinical X-ray CT [see 1st reference] and clinical PET imaging [see 2nd reference]. Employing additional energy measurements is currently under investigation at the DKFZ.

APPLICATIONS

The invention can be used in any industrial or medical imaging modality which uses ionizing radiation and suffers from scattered photons, and which can differentiate measured photons by their energy e.g., positron emission tomography, single photon emission computed tomography, energy-selective X-ray computed tomography).

INTELLECTUAL PROPERTY

The priority patent application “A method for generating an image of an object from measurement data” EP 18186298.8 was filed July 30th, 2018, but has not been published yet.

- The international PCT application has been published as WO2020/025537.

PUBLICATIONS & REFERENCES

- Siewerdsen JH, Jaffray DA. “Cone-beam computed tomography with a flat-panel imager: magnitude and effects of x-ray scatter”. Med Phys. 2001;28:220–231..
- Berker Y, Maier J, Kachelrieß M. “Deep Scatter Estimation in PET: Fast Scatter Correction Using a Convolutional Neural Network”. IEEE NSS/MIC 2018.

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