

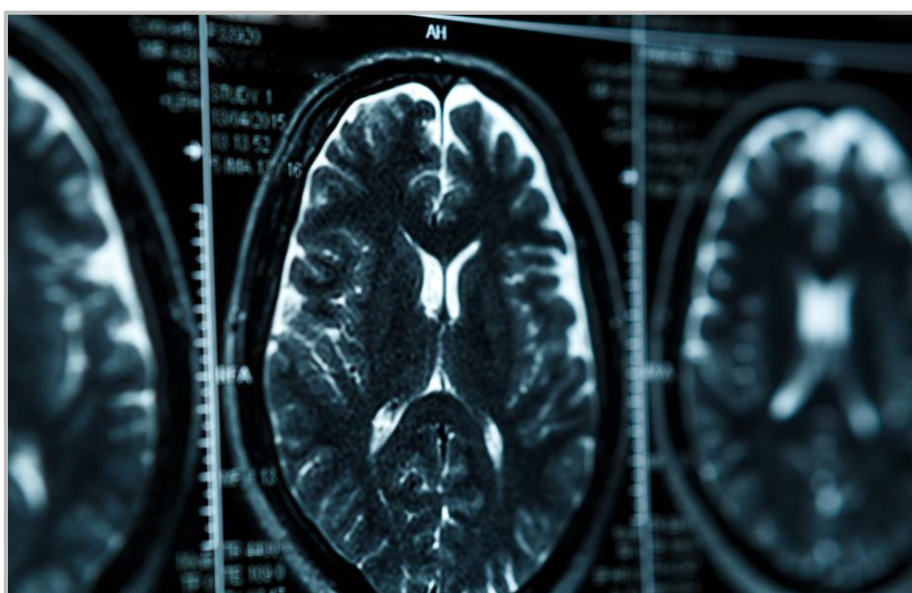
## TECHNOLOGY OFFERS

# 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

Devices,  
Software

### Indication

Tomography

### Development stage

Pre clinical

### Seeking

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 1<sup>st</sup> reference] and clinical PET imaging [see 2<sup>nd</sup> 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.

### DKFZ Contact:

Dr. Frieder Kern  
Deutsches Krebsforschungszentrum  
Innovation Management T010  
Email: [F.Kern@dkfz.de](mailto:F.Kern@dkfz.de)  
Tel.: +49-(0)6221-42-2952  
Fax: +49-(0)6221-42-2956

## ABOUT THE DKFZ INNOVATION MANAGEMENT

Working at the interface of research and industry, the Innovation Management of the German Cancer Research Center (DKFZ) helps to get new cancer medications, diagnostic tests, and research instruments onto the market as quickly as possible.

The DKFZ with its more than 3,000 employees is the largest biomedical research institution in Germany. At the Center more than 1,300 scientists investigate how cancer develops, identify cancer risk factors and endeavor to find new strategies to prevent people from getting cancer. They develop novel approaches to make tumor diagnosis more precise and treatment of cancer patients more successful. DKFZ is a member of the Helmholtz Association of National Research Centers, with ninety percent of its funding coming from the German Federal Ministry of Education and Research and the remaining ten percent from the State of Baden-Württemberg