Contribution ID: **176** Type: **poster**

Automatic detection of scintillation light splashes using conventional and deep learning methods

Wednesday, 15 September 2021 13:02 (1 minute)

The Hybrid Gamma Camera (HGC) [Lees et al, Sensors, 17(3):554, 2017] has applications in intraoperative imaging guidance and nuclear decommissioning. The HGC gamma detector comprises an Electron Multiplying Charge-Coupled Device (EMCCD) coupled to a columnar CsI: Tl scintillator. Each absorbed gamma photon will produce a scintillation light splash on the EMCCD; the number, location, and size of these splashes on each frame is unknown. For real-time imaging, these splashes must be identified and characterised quickly (10fps) and with minimal processing overhead. The current technique used in the HGC is automatic scale selection [Hall et al, NIMA,604:207-210, 2009]. However, there alternative solutions including object recognition deep learning models may have superior performance.
Six automatic detection implementations - four traditional blob detection algorithms (two Laplacian of Gaussian (LoG) detectors: LoG(1) is our implementation of LoG algorithm based on the HGC's automatic scale selection and LoG(2) is the LoG detector from Python scikit-image library, one Difference of Gaussian (DoG) detector, and one Hessian of Determinant (DoH) detector) and two Region-Based Convolutional Neural Networks (RCNNs) based on the VGG16 and ResNet-101 models were compared for the task of scintillation light splash identification.
An image dataset was simulated based on statistics of experimental data from the HGC for a range of radioisotopes. This provided ground truth values for location, intensity, and size of expected splashes for training RCNN models. The testing performance of each technique was compared based on results from 360 simulated images. The F1-scores obtained were: LoG(1): 69.98%, LoG(2): 98.85%, DoG: 94.03%, DoH: 32.05%, VGG16: 90.37% and ResNet-101: 89.95% . Their average speed for per frame was LoG(1): 0.358s/f, LoG(2): 0.024s/f, DoG:0.021s/f, DoH: 0.069s/f, VGG16: 0.057s/f, ResNet-101: 0.072s/f. We will discuss the physical parameters that affect algorithm accuracy and performance.

Title

Ms

Your name

Yangfan Jiang

Institute

University of Loughborough

email

Y.Jiang@lboro.ac.uk

Nationality

Chinese

Primary authors: Ms JIANG, Yangfan (Loughborough University); Dr BUGBY, Sarah (Loughborough University); Dr COSMA, Georgina (Loughborough University)

Presenter: Ms JIANG, Yangfan (Loughborough University)

Session Classification: Poster Session 2 (X-ray and Gamma Ray Detectors; Applications in Nuclear Physics and Nuclear Industry; Detectors for FELS, Synchrotrons and Other Advanced Light Sources; Detectors for Neutron Facilities; Novel Ionising Radiation Detection Systems)

Track Classification: X-ray and Gamma Ray Detectors