Contribution ID: **68** Type: **Panelist (Panel Session)**

Using deep machine learning to conduct object-based identification and motion detection on safeguards video surveillance

Video surveillance is one of the core monitoring technologies used by the IAEA Department of Safeguards at safeguarded nuclear facilities worldwide. Current IAEA image-review software has functions of scene-change detection, black image detection and missing scene analysis, but their capabilities are not optimum. Because of this limitation, detection of safeguards relevant events heavily depends on inspectors'visual examination of surveillance videos, which is a time-consuming process prone to errors. To improve the process, we are developing a deep machine learning technique to detect objects of interest in video streams and conduct object-based motion detection. We hypothesize that deep machine learning is effective in solving problems with multi-dimensional features/parameters such as different geometries of casks and fuel assemblies and different configuration settings from one facility to another. A trained deep machine learning algorithm can process video streams automatically to flag, locate, and identify objects of interest in the images. The initial focus of our research is for application at nuclear reactors, such as pressurized heavy-water reactors, where video surveillance is broadly deployed. In a proof-of-concept experiment, we trained and tested a computationally efficient convolutional neural network (CNN) –You Only Look Once (YOLO) –with data collected at a test bed at Brookhaven National Laboratory (BNL). This quick study showed promised for high precision and real time identification of target objects and sequences for image resolutions comparable to those of IAEA's surveillance system. Currently we are tuning our model with representative training data sets, which are being collected at simulated nuclear facilities at Sandia National Laboratories (SNL) and BNL. In this paper, we will discuss the development of the CNN model and report the results of this study in detail. Our tuned model and algorithm could eventually be integrated with IAEA image review software to significantly reduce the inspector image review burden.

Which "Key Question" does your Abstract address?

TEC3.1

Topics

TEC3

Which alternative "Key Question" does your Abstract address? (if any)

Primary author: Dr CUI, Yonggang (Brookhaven National Laboratory)

Co-authors: Dr SMARTT, Heidi (Sandia National Laboratories); Dr THOMAS, Maikael (Sandia National Laboratories); Dr SMITH, Michael Reed (Sandia National Laboratories); Dr YOO, Shinjae (Brookhaven National Laboratory); Mr STERN, Warren (Brookhaven National Laboratory); Dr REN, Yihui (Brookhaven National Laboratory); Dr LIN, Yuewei (Brookhaven National Laboratory); Ms GASTELUM, Zoe (Sandia National Laboratories)

Presenter: Dr CUI, Yonggang (Brookhaven National Laboratory)

Session Classification: [TEC] Collection, Processing and Analysis of Surveillance Data

Track Classification: Leveraging technological advancements for safeguards applications (TEC)