NuSec Technical Meeting 18th September 2017

Wellcome Collection, 183 Euston Road, London NW1 2BE, London

Algorithms for Autonomous Decision Making in Nuclear Security

The Nuclear Security Sciences Network (NuSec) will be holding their annual technical meeting on 18th September 2017 at the Wellcome Collection, London. The title of this year's meeting is "Algorithms for Autonomous Decision Making in Nuclear Security" and the scope of the workshop includes algorithms for automated decision making, the interpretation and analysis of complex multiple data streams, and the practical implementation of decision making systems in the context of Border Protection and other scenarios.

The workshop will consist of technical presentations in the morning and interactive workshops in the afternoon. The afternoon session will focus on two key areas for improving the use of algorithms in nuclear security: what algorithms emerging from today's research could provide benefit to nuclear security applications and how can we provide the data required for the application and testing of these algorithms.

The workshop will also include poster presentations from our summer 2017 Research Pilot Projects and details of our ongoing NuSec and External Funding Opportunities. There be plenty of time for networking opportunities with fellow Academic, Industrial and Government colleagues.

Agenda

9:30 Registration and Refreshments

10:00 Morning Programme:

NuSec & STFC news

Academic speakers: Matt Stapleton (AWE) "Algorithms in Nuclear Security"

Simon Maskell (University of Liverpool) "Future Algorithmic Processing"

Industrial Members' introductions

Nusec Pilot Projects update

Student posters 'elevator pitch'

12:00 – 13:00 Lunch & Poster Display

Afternoon workshops: (1) Algorithms in Nuclear Security – Matt Stapleton

(2) Future Algorithmic Processing – Simon Maskell

Update on EPSRC 'M2D' and 'CRUISSE' decision making networks

Final Discussions, Networking and Refreshments

16:00 Meeting close

Student Posters showing results from the 2017 Summer Pilot Projects

Thallium Bromide as a radiation sensor for security applications, *Josiah O Brien, University of Liverpool*

A Study of Van Allen Belt Signatures of Nuclear Weapon Tests for Future CTBT Technologies *Filip Wach, University of Bristol*

Compact X Ray Sources, *Christopher Murphy & David Jenkins**,** University of York*

Enhancing source localisation for threat detection, *Antonin Vacheret & Sakari Ihantola, Imperial College London*

Fluorescence spectra of alpha emitting isotopes for stand-off detect, *Anita Crompton, University of* Lancaster *University & Andrew Wilson Capula Limited*

PSA for temperature dependent scintillator signals, *Stefanos Paschalis, University of York & Ian Radley, Kromek*

Afternoon Workshops – please choose which workshop you wish to attend

Workshop 1: Algorithms in Nuclear Security – Matt Stapleton (AWE)

I will talk about the use of algorithms and automated decision-making in nuclear security, giving an overview of the applications and challenges. A major theme will be the modelling of complex real-world scenarios in order to design and test algorithms to robustly make automated decisions with high level of confidence. Modern algorithms arising from Bayesian techniques or Machine Learning will help move this area forward, but they will require better models and larger, higher quality datasets than those typically available. I will provide a (personal) view on the challenges and progress that needs to be made in order to turn this into a reality.

Workshop 2: Future Algorithmic Processing – Simon Maskell (University of Liverpool)

Processor clock speeds haven't changed significantly in recent years. However, the increasing availability of multi-core processors means that Moore's law is still being delivered. This shift is mirrored by the increasing affordability and accessibility of many-core processors (typified by GPUs). Frameworks (e.g., CUDA for GPUs and Hadoop/Spark for clusters of commodity hardware) exist that ease the process of writing software for these emerging computational resources. However, there is still a significant investment of time and money required to progress a specific algorithm's implementation. This perhaps explains why Deep Learning has experienced its many recent successes: I perceive that a reusable implementation that can exploit the power of GPUs has been critical to researchers' ability to apply Deep Learning so pervasively and so successfully. I believe that the implication is twofold. First, popularity should not be confused with optimality, particularly if the context of interest has a fundamentally different "shape" to those that are popular. Second, it seems likely that future progress in developing algorithmic tools will not take the form of large numbers of incremental advances but will involve small number of large leaps, in directions that should be informed by the needs of key communities. Those communities include those who need to maximise performance in applications (e.g., national security) where data is sparse, ambiguity pronounced and performance cannot afford to be compromised.