SAND2018-1965C

2018 IAEA Symposium on International Safeguards: Building Future Safeguards Capabilities

Abstract

Title: Autonomous Systems, Artificial Intelligence and Safeguards

Content (300 words max.):
This study explores the mission space and key safeguards challenges confronting the International Atomic Energy Agency (IAEA) today and how autonomous technologies, e.g. technologies used by systems that are capable of learning and examining, then taking action based on what has been learned, may impact the status quo. Principle issues include the operational value of these systems to safeguards, risks and challenges of deployment (e.g., trustworthiness, security, transparency, explainability), and the likelihood of adoption in the near- to medium term (2-10 years)). We establish a set of criteria to identify autonomous systems and technologies that could impact IAEA safeguards verification activities in the next decade. The criteria are informed by specific safeguards outcomes the IAEA wants to achieve e.g., efficiency, maintaining continuity of knowledge (CoK) on nuclear materials, identifying anomalies in large amounts of data. We develop and assess an inventory of existing and emerging commercial autonomous systems and their underlying technologies based on these criteria. In so doing, we leverage a Sandia-developed framework that considers four dimensions of autonomy: 1) levels of autonomy (e.g., the amount of human input or control in the system); 2) the operating environment (e.g., inspections, information analysis, sample collection); 3) autonomous technology functions (e.g., sensing, reasoning and learning, planning and controlling, acting and communicating); and 4) autonomous system technologies (e.g., systems for knowledge representation, storage, and retrieval; software for learning about and adapting to the environment; information collection for spatial/scene recognition and environmental sensing).[1] Use cases identifying scenarios in which the selected technologies could be deployed inform the potential application space of the autonomous and AI systems, and serve as the foundation for analyzing impact. Finally, an evaluation of three specific technologies assess how they might benefit or challenge IAEA safeguards activities.

Topic (as referred to in the "Final Technical Program Guidance for INDIC" document):

Theme 2: Leveraging technological advancements for safeguards applications (TEC)

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[1] Hayden, Nancy. *Framework for Discussing Autonomy*. Sandia National Laboratories. November 2017.

Which Key Question(s) does your Abstract address? (as referred to in the "Final Technical Program Guidance for INDIC" document):

TEC3.1 How can advanced analytics and machine learning (artificial intelligence) be applied in the work of the Department in areas such as analysis of images from surveillance cameras; monitoring the status of active seals; processing nuclear material accounting reports; matching imports and exports of nuclear material; etc.?

TEC3.4 What are the next generation analysis and collaboration tools, focusing on the computer-intermediated functions, to support and coordinate analytic activities around big data, and the possibilities for machine learning in this respect?

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Track classification:

☐ Leveraging technological advancements for safeguards applications (TEC)