Data Science in Nuclear Disarmament Verification – Extracting Verification-relevant Information from Geospatial Big Data

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INTRODUCTION

Verification-relevant information includes
- information provided by States, mainly reports and declarations,
- information from verification activities
- information from open sources and third parties.

Data collected, processed, integrated, analyzed and managed for verification purposes is not only increasing in volume, but also getting more heterogeneous, unstructured and complex in nature.

Data science and modern data analytical tools can pave the way to a more effective exploitation of 'big data' in nuclear verification.

STATE-OF-THE-ART

Automation of open source information collection and processing
- e.g. IAEA (1), KCL (2)

Natural language processing
- e.g. University of New South Wales (3)

Supporting safeguards inspection activities and information analysis by machine learning (CNN, SVM)
- e.g. SNL (4,5), LLNL (6), BNNL (7), Aquila (8), Jülich (9)

Data integration using semantic graphs
- e.g. SNL (10)

Improving reporting, matching, tracking and monitoring by block chain/shared ledger technologies
- e.g. PNNL (11,12), JRC Ispra (13)

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Data analytical tools are expected to pave the way to a **more effective exploitation** of geospatial 'big data' in support of nuclear disarmament verification.

OBJECTIVES & APPROACH

Bring forward the application of data science in nuclear disarmament verification

Advance and prioritize the development and implementation of relevant data sciences methods and techniques

Identify complex data analysis problems in nuclear disarmament verification that may potentially be mitigated or solved by data science

Investigate and evaluate data science methods and techniques that were established in non-nuclear verification sectors with regard to their potential suitability for nuclear disarmament verification

Analyze and prioritize needs and objectives of promoting data science in nuclear safeguards.

(Further) develop and evaluate specific data science methods and techniques.

The first subproject aims at developing an automated procedure that allows for an **effective integrated analysis of any number of geospatial data acquired over the same area of interest and providing a suitable visualisation of relevant trends, patterns and anomalies of verification-relevant information in the area of interest**.

Categories of verification-relevant geospatial information types to be considered:
1. Image data from earth observation satellites;
2. Information derived from satellite imagery;
3. Supplementary geospatial datasets obtained from other open sources.

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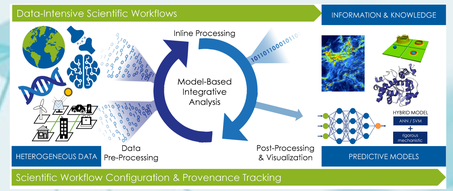

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