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INFORMATION ANALYTICS FOR SPACE ENTITIES USING 3D MODELS AND ARTIFICIAL INTELLIGENCE

Abstract

Information about space entities is necessary for conducting space operations in a congested, competitive and contested space environment. Information analytics for space entities aims to transform disparate sources of data into information upon which space operations decisions can be based.

In the case of satellites, characteristics such as the orbit, attitude, shape, size, mass, function, communication frequencies, manoeuvre capabilities, mission function, owner, operator and historical activities may be useful to inform space operations.

Defence Science and Technology Group (DSTG) is developing a Space Information Integration and Fusion Experimentation (SPINIFEX) system as a concept demonstration capability under the Research and Development Space Target Awareness and Response (RED STAR) program. SPINIFEX is used to integrate data from disparate sources for experimentation of data fusion approaches that transform the data into information.

Space entity characterisation has traditionally relied on ground-based observations such as those obtained from radar and optical sensors. However, commercial companies like HEO are employing space-based optical sensors to capture Non-Earth Imagery (NEI) of space entities, which allows for additional characterisation and generation of 3D models. These 3D models offer a new way to understand space information, providing analysts with direct insights and supporting further modelling and simulation.

The emergence of Artificial Intelligence technologies such as Large Language Models (LLMs) enables information analytics of multiple types of data and information about space entities.

This paper describes DSTG's SPINIFEX system which is used for research and development of information analytics for space entities. Various inputs are outlined, including NEI base 3D models and documents from publicly available sources. Information analytics is described including the generation of 3D models and the application of LLMs to respond to specific requests.