Office of Environment, Health, Safety and Security
Operating Experience Summary

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Trending Analysis and Machine Learning (ML) Part 4: References on Artificial Intelligence Best Practices and Principles

Introduction

This Operating Experience Summary (OES) presents Part 4 of a four-part series and provides information about the lessons learned from the design, development, and deployment of data analytics and machine learning (ML) tools used in support of the most recent U.S. Department of Energy (DOE) Office of Environment, Health, Safety and Security (EHSS) fire protection data trends report issued for calendar years (CY) 2015-2019 (report link). The OES presents important artificial intelligence (AI) related references design principles, best practices, and requirements to consider when developing and using AI-based applications.

Background

Executive Order (EO) 13859 – Maintaining American Leadership in AI, and EO 13960 – Promoting the Use of Trustworthy AI in the Federal Government, were issued in February 2019 and December 2020, respectively. These EOs establish federal principles and strategies to strengthen the nation's AI capabilities and promote scientific discovery, economic competitiveness, and national security. In addition, the EOs direct federal agencies to design, develop, acquire, and use AI in a manner that protects privacy, civil rights, civil liberties, and American values.

Since then, several Federal agencies have published frameworks to identify essential practices to help ensure accountability, identify, and mitigate risks with AI applications, and promote the responsible use of AI.

These frameworks include:

1. Government Accountability Office (GAO), AI: An Accountability Framework for Federal Agencies (GAO-21-519SP),
2. Office of Science and Technology Policy (OSTP), AI Bill of Rights.
3. DOE AI and Technology Office (AITO), AI Risk Management Playbook (RMP),
4. National Institute of Standards and Technology (NIST) AI Risk Management Framework (RMF), and

These frameworks further expand on the principles outlined in the EOs and are considered the main AI requirements for the development and deployment of DOE/EHSS environment, safety, and health (ES&H) data analytics and ML tools.

Discussion of References

Developers of AI-based analytical tools, including those used by DOE/EHSS to analyze ES&H data, need to incorporate the principles and best practices referenced in these publications into their applications. The DOE/EHSS ES&H data analytics and ML tools are designed and built with these principles in mind and capture specific details within the application's documentation.

EO 13960 requires that deployed and operating AI systems are consistent with nine (9) principles outlined in the order, which include:

1. Lawful and respectful
2. Purposeful and performance-driven
3. Accurate, reliable, and effective
4. Safe, secure, and resilient
5. Understandable
6. Responsible and traceable

7. Regularly monitored
8. Transparent
9. Accountable

The OSTP AI Bill of Rights further expands the EO 13960 principles and includes discrimination protections, data privacy, notification of automated system use, and alternatives.

The GAO, DOE, OSTP, and NIST AI frameworks were each developed through collaboration with AI leaders, subject matter experts, practitioners, program officials, and procurement teams. The development processes included representatives from federal and state government entities, academia, industry, and other organizations.

The GAO AI Framework comprises four (4) complementary principles and describes critical practices for federal agencies considering and implementing AI systems. These principles include (1) governance, (2) data, (3) performance, and (4) monitoring. In addition, each principle consists of a set of guiding questions and auditing procedures for entities to consider.

The DOE AI Framework is a dynamic, searchable website that outlines AI risk identification and recommends mitigations. It is organized into four areas: (1) AI lifecycle, (2) risk type, (3) primary EO 13960 principles, and (4) regulatory considerations. The RMP allows a user to navigate through the document quickly and identify potential risks and recommended pathways to reduce the risk.

The NIST AI Risk Management Framework is still in draft as of this writing. The document is being developed through a consensus-driven, open, transparent, and collaborative process that includes workshops and other opportunities to provide comments. The framework continues to build upon AI principles and best practices. The NIST document is broken into three main parts:

1. The context for the AI risk management process.
2. Guidance on outcomes and activities to carry out process to maximize benefits and minimize the risks of AI.
3. Information to assist in using the AI RMF and offer sample practices to be considered in carrying out the guidance before, during, and after AI products, services, and systems are developed and deployed.

Each of these three (4) frameworks leverages their organizational strengths to identify and develop best practices and guidelines in support of advancing AI in a manner consistent with the outlined principles.

Summary

The advent of AI and the ease of programming tools have made it easy to leverage capabilities that were not possible a few years ago. With such capabilities, questions and concerns have risen about when, why, and how AI applications are used for decision-making. The EO and AI frameworks guide and promote the responsible implementation and use of AI applications and make it easier to find best practices to implement within your application.

The Office of Environment, Health, Safety and Security (EHSS), Office of ES&H Reporting and Analysis publishes the Operating Experience Summary to promote safety throughout the Department of Energy (DOE) Complex by encouraging the exchange of lessons-learned information among DOE facilities.

Please contact Felix Gonzalez at 301-903-9311 or Felix.Gonzalez@hq.doe.gov for questions regarding this OE Summary.

OES Series: Trending Analysis and ML

This OES is part of a series of articles focused on the application of trending analysis and machine learning to DOE fire protection data and other ES&H trending analysis reports. The series includes the following four parts:

Part 1: *DOE Fire Protection Trends*
Part 2: *DOE Fire Protection ML Text Clustering*
Part 3: *Lessons Learned on ML Tools Design, Development and Use*
Part 4: *References on Artificial Intelligence Best Practices and Principles* **(this OES document)**

Please contact DOE AITO at DOEAIMAILBOX@hq.doe.gov for question on AI initiatives at DOE.