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Chief Digital & Artificial Intelligence Office

JATIC: Joint AI T&E Infrastructure Capability

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Program Background

- Funded by Congress as a Program of Record
- Started in 2023, funded through 2028
- An investment of nearly $200 MM for AI Test & Evaluation (T&E)

Program objective:
Develop software to **accelerate** and **enable** AI test & evaluation for DoD testers

In order to…
Provide rigorous assurance of the effectiveness, robustness, and safety of the DoD's AI-enabled systems

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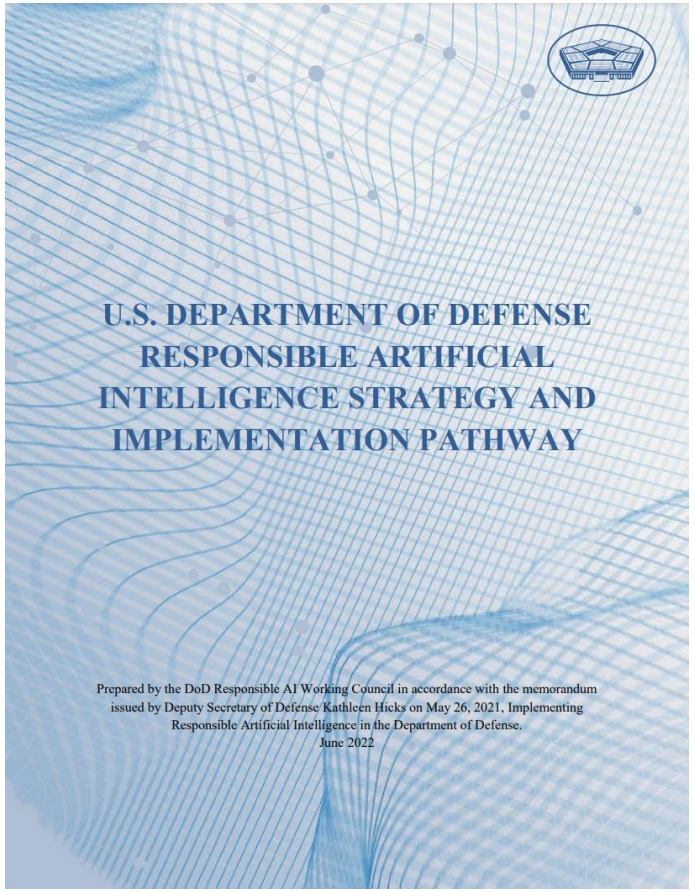
Program Background

RAI Strategy & Implementation Pathway

- Signed by Deputy Secretary of Defense, Kathleen Hicks, June 2022
- **LOE 2.1.2:** Develop or acquire AI-related Test & Evaluation (T&E) tools to be used as a resource for AI developers and testers… drawing upon best practices and innovative research from industry and the academic community, as well as commercially available technology
- **LOE 2.1.3:** Create a central repository of tools for T&E of AI… that enables easy and continuous testing for DoD testers



https://www.ai.mil/docs/RAI_Strategy_and_Implementation_Pathway_6-21-22.pdf

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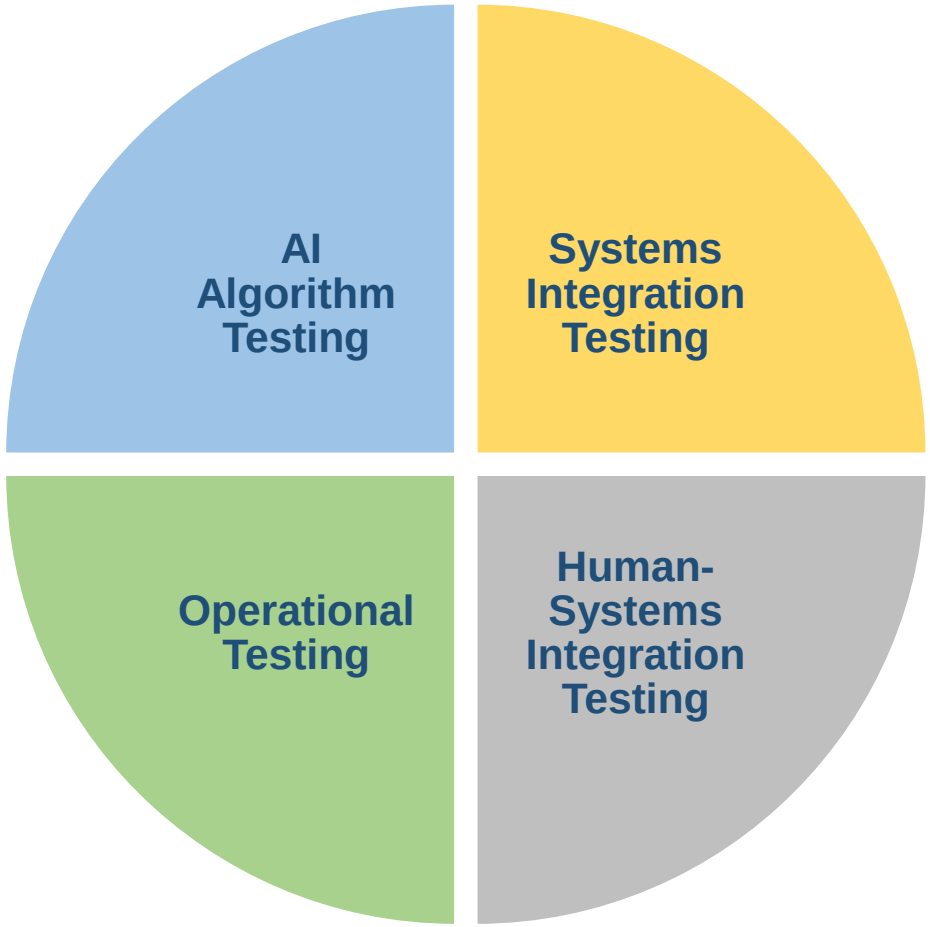
Scope


AI
Algorithm
Testing
Systems
Integration
Testing
Operational
Testing
Human-
Systems
Integration
Testing

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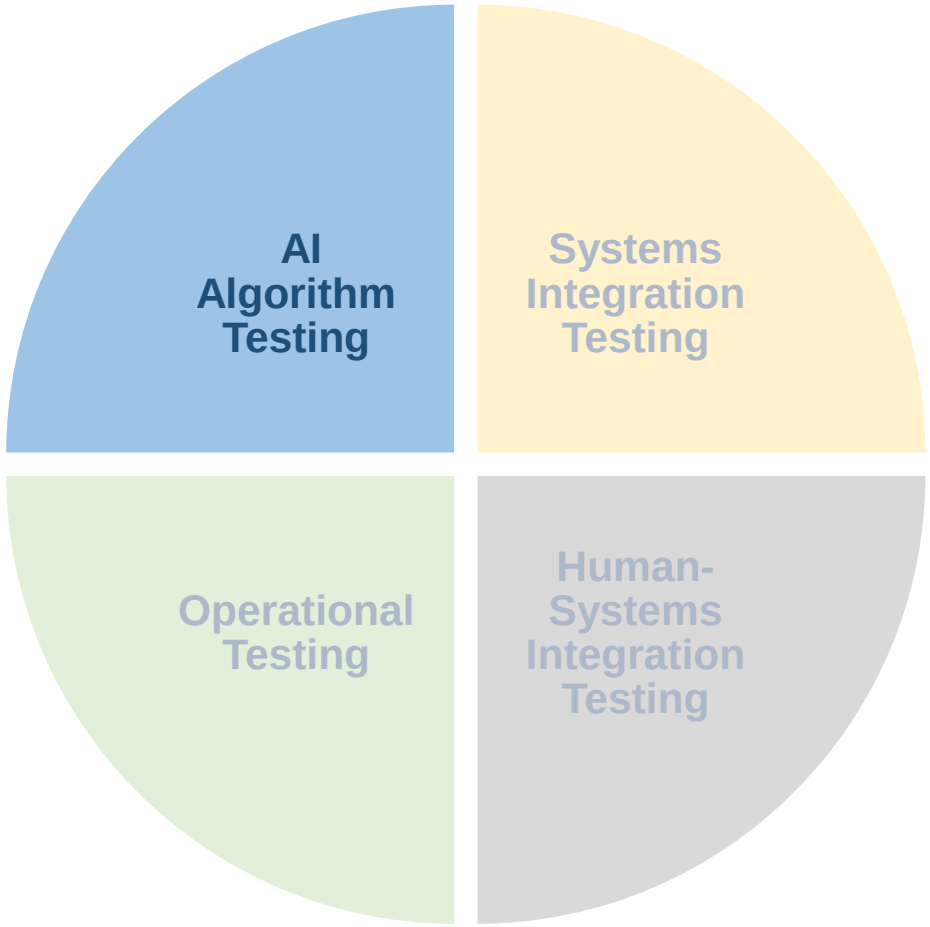
Scope



- We are focused entirely on **AI Algorithm Testing**
- Why?
  - Applicability of tools across multiple missions and systems
  - Required domain knowledge for further stages of testing
- Within that, our initial focus is **CV Classification & Object Detection**

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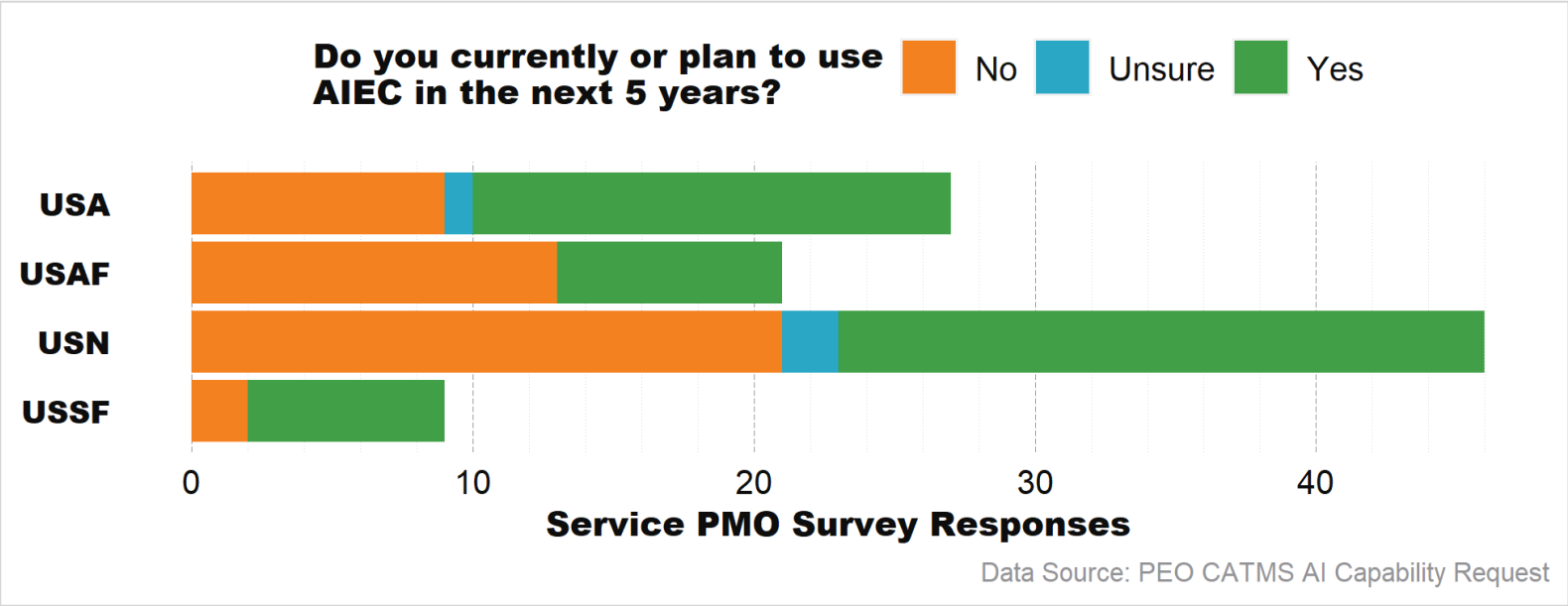
AI Adoption DoD-wide



Among surveyed offices, 55% of Service Program Management Offices (PMOs) indicate they currently or plan to use AI-enabled capabilities (AIEC)

*CDAO Report: The National Artificial Intelligence Test and Evaluation Infrastructure Capability, July 2023

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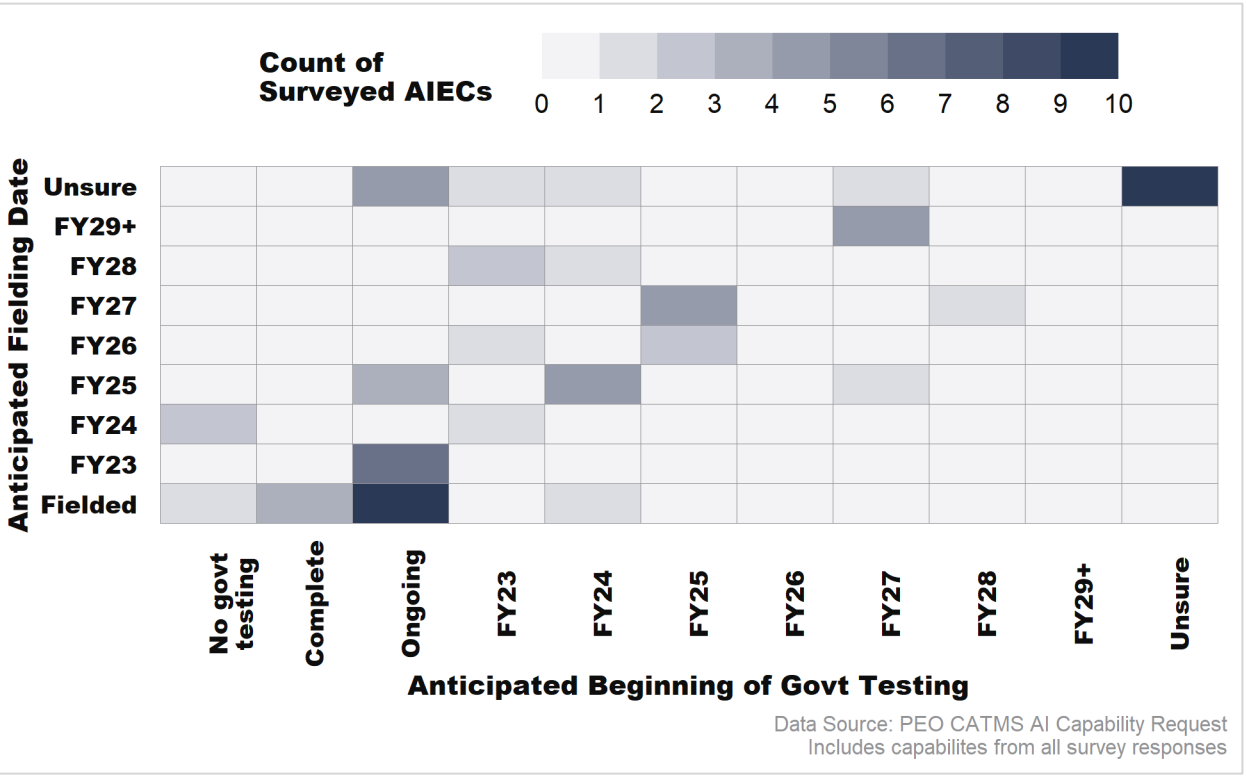
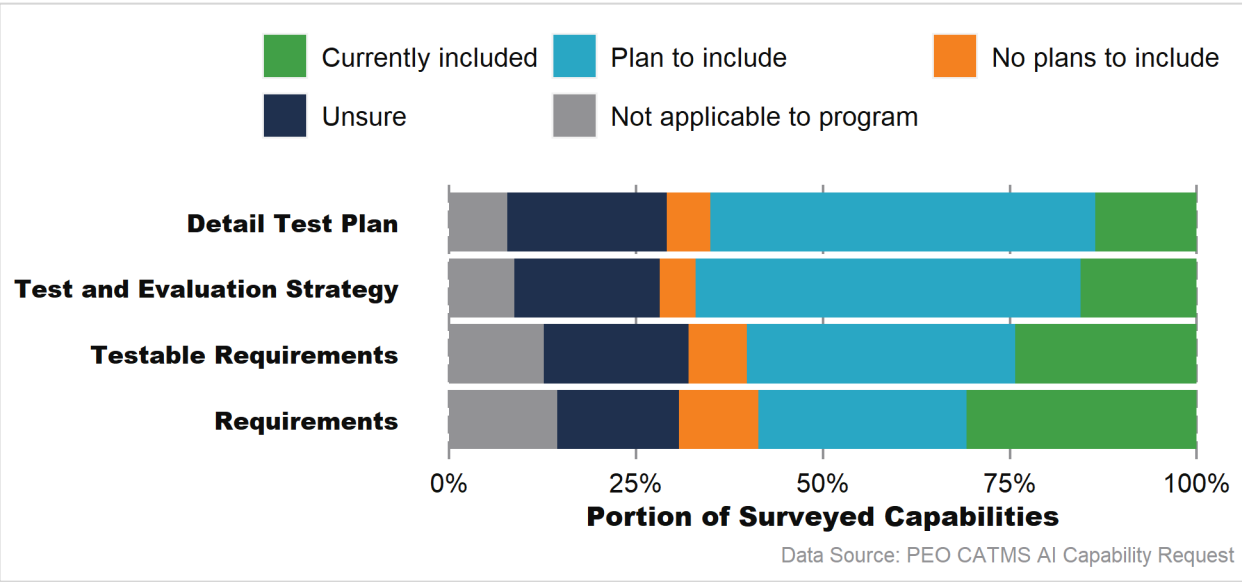
AI Test & Evaluation Maturity DoD-wide



Data Source: PEO CATMS AI Capability Request
Includes capabilites from all survey responses



Data Source: PEO CATMS AI Capability Request

Despite wide interest:

- Huge amount of uncertainty across the DoD in performance of AI T&E
- Demand for guidance and resources
- Uncertainty on novel risks and impacts on existing systems

*CDAO Report: The National Artificial Intelligence Test and Evaluation Infrastructure Capability, July 2023

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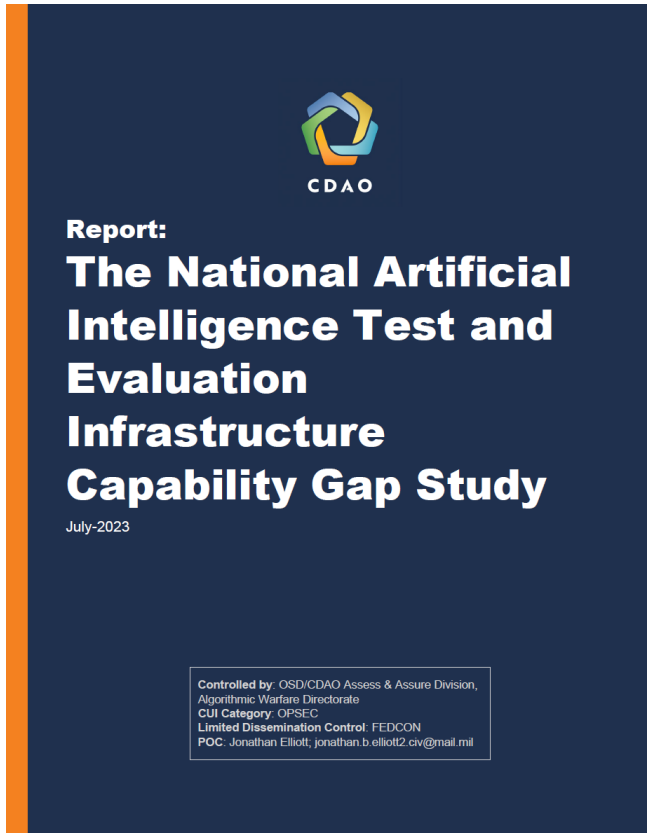
What are the key problems?

Report on AI T&E demand and gaps

- “There is widespread interest for DoD enterprise-level T&E infrastructure to address the novel and exacerbated challenges posed by the T&E of [AI].”

- “While programs are currently investing locally in T&E resources… there is still a consistent desire across survey programs for DoD enterprise support.”



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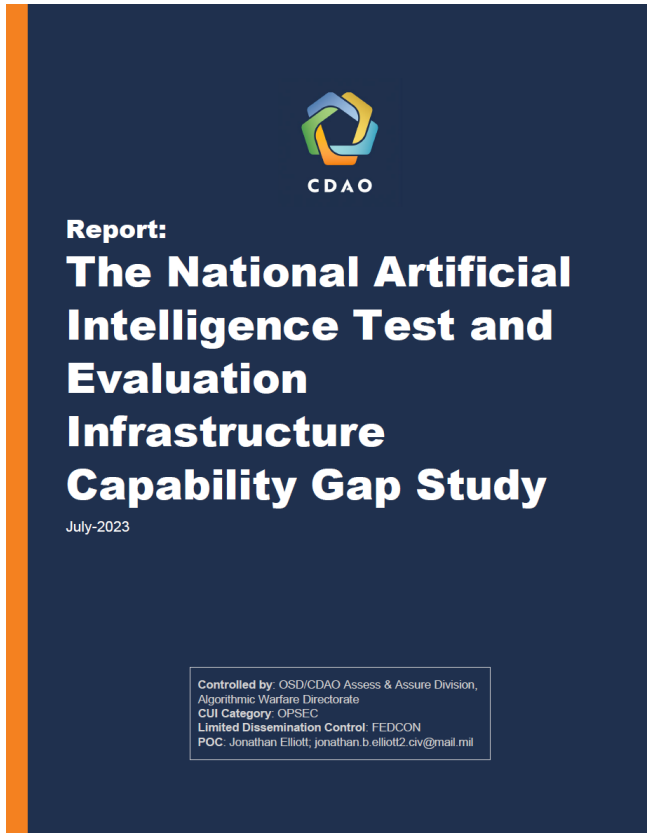
What are the key problems?

1. Lack of maturity and domain knowledge in DoD AI testers
2. Difficulty in scaling tools across various DoD environments, platforms, and missions
3. Lack of tools for operationally-realistic conditions



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Key Problems

Problem 1:

Lack of maturity and domain knowledge in DoD AI testers

Our focus:

- Education on advanced AI testing
- Accessibility of tools
- Ease of use of tools

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Key Problems

Problem 2:

Difficulty in scaling tools across varied environments, platforms, and missions

Our focus:

- Ease of deployment to DoD environments
- Interoperability of tools with each other and AI/ML platforms

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Key Problems

Problem 3:

Lack of tools for operationally-realistic conditions

Our focus:

- Tailor functionality to apply to operationally-realistic DoD use cases

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Bridging the gap

Research & Engineering

Research into advanced applications of AI for DoD-unique modalities:

- T&E of operator-AI performance
- T&E of AI in systems of systems
- Realistic adversarial attacks
- Use of simulation for DoD modalities, e.g., sonar, radar
- AI monitoring at the edge

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- Transition existing AI T&E work into DoD by increasing maturity and usability
- Increase speed and rigor of AI T&E by providing common tools, standards, infrastructure
- Inform future DoD research investments

DoD Service PEOs, PMOs

- Testing and fielding AI-enabled capabilities across:
  - Logistics
  - Intelligence
  - Operations
  - Health
  - …
- Huge interest and demand to employ AI
- Lack of knowledge, expertise, or centralized investment
- Uncertainty on novel risks and impacts on existing systems

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AI Assurance Toolbox

A set of **python libraries** to enable rigorous AI T&E, designed for interoperable usage, easy deployment, and wide integration

- Straightforward deployment, setup, and use within variety of development or testing environments
- Seamless integration with key MLOps platforms and capabilities
- Using standardized model, data, and metrics protocols which are:
  - widely compatible
  - easy-to-satisfy
  - informative
  - dependency-free

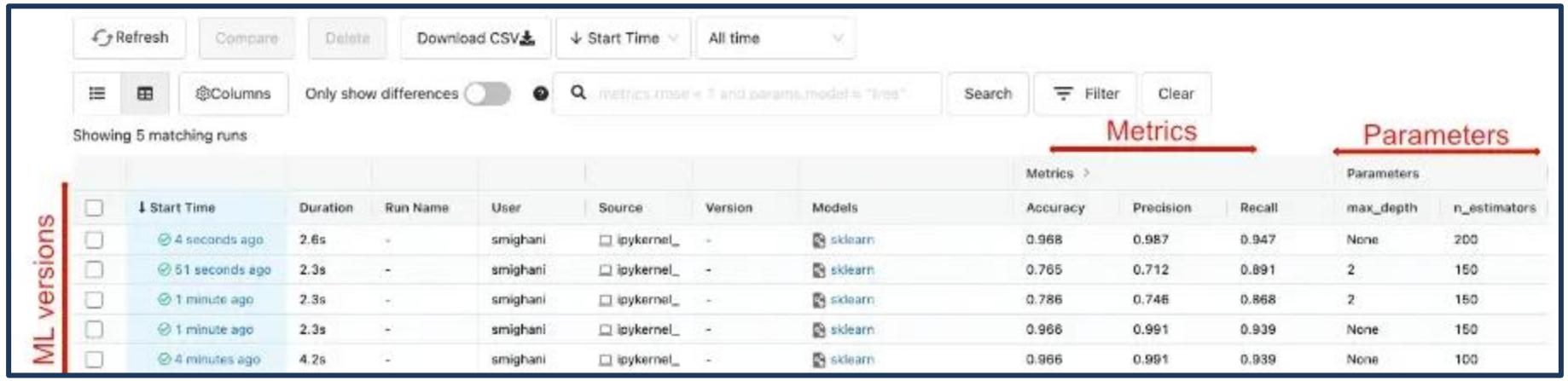
Amazon SageMaker

W&B

T&E + MLOps

To be effective, AI T&E capabilities **must** *integrate seamlessly* with MLOps pipelines

- *Continuous testing* of AI models **requires** this close integration, especially as AI models are retrained more frequently
- Integration into MLOps provides incredible synergies between T&E and other AI/ML capabilities:
  - T&E + Workflow orchestration -> automated execution of model test plans
  - T&E + Model registries & experiment tracking -> improved T&E traceability and enhanced model metadata
  - T&E + Visualization dashboards -> seamless comparison between many models across test cases
  - T&E + Hyper-parameter optimization -> optimize model hyperparams for robustness, explainability, etc.
  - T&E + Labeling -> model T&E inference results inform potential errors in ground truth labels



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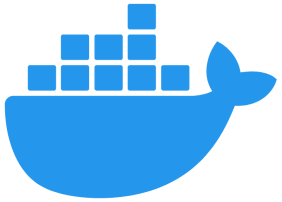
AI T&E Platform

An orchestrated MLOps solution composed of open-source capabilities, specifically tailored for AI/ML testing

- JATIC python libraries are ideal for organizations who have *already adopted* an enterprise MLOps platform, such Databricks or Sagemaker
- For those without infrastructure, the **JATIC AI T&E Platform** provides best-of-breed open-source tools to **jumpstart AI T&E from Day 1**
  - Deployable quickly to commercial cloud, on-prem, local machines, or HPC using Infrastructure as Code

- JATIC AI T&E Platform will provide capabilities for :
  - Workflow orchestration
  - Model registry, experiment tracking
  - Database / object store
  - Visualization dashboard
  - Jupyter lab / IDE
  - Multi-GPU resource management


Capabilities

Tool	AI T&E Capability	Developer
Adversarial Robustness Toolbox*	State-of-the-art library of **adversarial attacks** and **defenses**	IBM
Armory*	Testbed for scalable evaluations of **adversarial attacks** and **defenses**	TwoSix Tech
Dataset analysis metrics library	Evaluate datasets for similarity, drift, and complexity	ARiA
XAI Toolkit*	Generate **visual saliency maps** on AI predictions using black-box and white-box techniques	Kitware
Natural Robustness Toolkit	Generate **operationally realistic data perturbations** and **augmentations** in-silico using **sensor-model** based techniques to test model robustness	Kitware
jatic toolbox	A source of common types, protocols, and utilities to enable synergistic and streamlined AI T&E workflows	MIT
rAI Toolbox*	Generate **data perturbations** and **augmentations** in-silico to test model robustness	MIT
Nebari*	Open-source AI & data science platform, designed for collaboration, scalability, and rapid deployment	Quansight
Terminus	Split dataset into training, validation, and test sets, without **bias across population subclasses**	MORSE Corp
RealLabel	Using model inferences, identify potential **ground label errors** within data	MORSE Corp
Gradient	Develop standard **AI T&E reports** in Powerpoint, directly from python	MORSE Corp
ALICE	Assess **model competence** on given input, based on estimated similarity to training data	JHU

***indicates existing open-source capability**

Target Mission Use Cases

Mission Use Case	Open-source dataset	DoD Mission Partner / Project
Satellite Imagery	xView	National Geospatial-Intelligence Agency
Unmanned Aerial Vehicles	VisDrone	CDAO
Unmanned Ground Vehicles	KITTI	Army Ground Vehicle Systems Center
Medical Imagery	CheXpert	Defense Health Agency

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Deployment

The **AI Assurance Toolbox** and **AI T&E platform** will be freely distributed and easily portable to DoD environments

Enterprise-wide availability

- Many JATIC python libraries will be made **publicly available** on GitHub, PyPI, and conda
- DoD-specific source code and containers images will be hosted on Repo1 and IronBank

Secure & hardened

- JATIC software will be hardened for deployment onto IL-2, IL-6 and other classified information systems
- CDAO will work closely with DoD organizations to support deployment of JATIC tools into environments
- JATIC will never collect testing data or results – your models & data, your results

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Collaboration & Access

CDAO T&E is actively seeking key government partners leading AI/ML to:

- *Transition research or S&T technologies for AI T&E and AI Assurance*
- *Support developmental testing of AI technologies to be integrated and fielded into larger systems*
- *Understand your AI T&E requirements, building AI T&E tools within JATIC to support*
- *Obtain feedback from you to iterate and mature our capabilities*

Join at https://gitlab.jatic.net with a *.mil*, *.gov*, or FFRDC/UARC email to get access to our current tools!

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