



U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND – ARMAMENTS CENTER

CCDC Armaments Center Systems Engineering Directorate AI Initiatives

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HELLO



Hello
my name is

Roshan Patel

Systems Engineer, Data Scientist

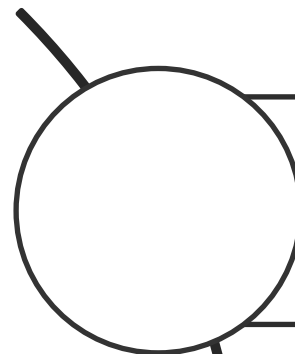
- MS Computer Science, Rutgers University.
BS Mechanical and Aerospace Engineering,
Rutgers University.
- Engineer at CCDC Armaments Center focusing on
systems engineering infrastructure, statistical
modeling, and the analysis of weapon systems
- System Engineering Directorate's AI lead
 - Point of contact for SED's AI activities
 - Strategist and project coordinator



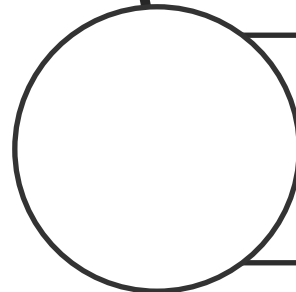
MAIN POINTS



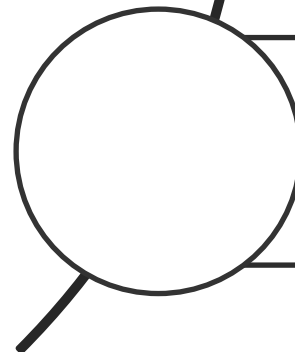
The Systems Engineering Directorate (SED) is investing in AI4SE and SE4AI



SED is entering an 18-month sprint to kick-start multidisciplinary SE-AI activities



SE methodology will be refined for application on the development of AI technologies



Project applications will give experiential lessons learned



SED AI INITIATIVES



Purpose:

- (U) Support the application of SE on AI/ML efforts
- (U) Investigate the use of AI/ML within SE practice
- (U) Inform workforce on SE/AI interaction

Approach:

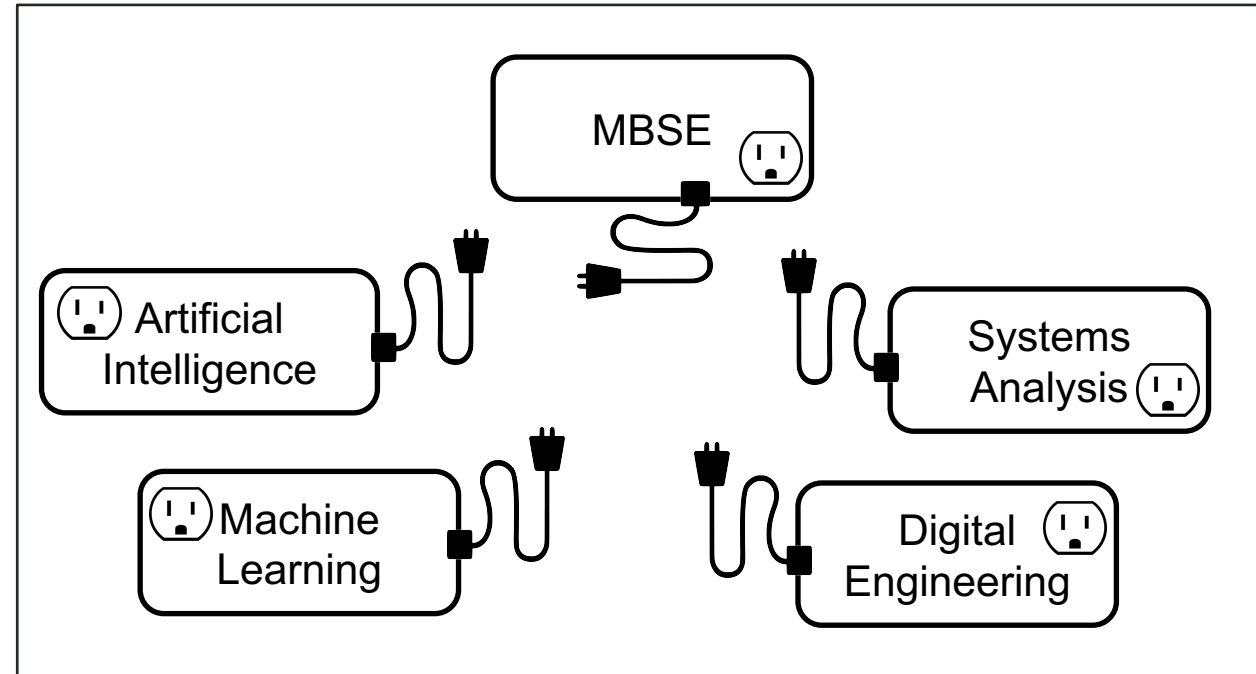
- (U) Develop SE methodology that utilizes AI/ML
- (U) Identify and address gaps in SE processes when applied to AI technologies
- (U) Leverage industry, academia, and Government agencies
- (U) Pilot experimental tools and techniques on existing armaments system projects

Products:

- (U) Comprehensive set of SE best practices for the application of SE on the development of AI technologies
- (U) Prototype AI tools that empower SE practice
- (U) Computing lab equipped with data science capabilities for secret data
- (U) Workforce trainings for educating systems engineers on AI/ML

Payoff:

- (U) Increased quality of SE services provided to Armament projects including projects with AI technology
- (U) Cultivating relationships with industry, academia, and Government agencies



	Q1FY21	Q2FY21	Q3FY21
Workforce Development	█	█	█
NGCV/NGIFC "pilot" efforts		█	█
AI agent for requirements dev	█	█	█
Operational analysis with AI		█	█
iMBE AI services		█	█
AI Data Management Strategy		█	█
SE policy for AI technology	█	█	█



SED AI INITIATIVES

AI4SE

SE4AI



Task	Topics
Workforce Development	AI/SE training & education
Piloting AI/SE on NGCV/NGIFC	Hybrid Human/AI Systems Managing AI Risk and Limitations DoD Doctrine SE approaches to AI Architecting Test & Evaluation of AI Systems
AI-assisted Requirements Development	AI for requirements/specification Natural Language Processing
Digital Thread AI Services (iMBE)	AI curation Digital Twin Automation
Operational Analysis Empowered by AI/ML	Multi-Agent AI Environment Adaptive Simulation Ontological Modeling Reinforcement Learning
Systems Analysis ML Infrastructure	Data Science Programming Infrastructure HPC Big Data Analytics Distributed Computing Data Collection
Update SE Process/Methods for AI applications	SE approaches to AI Architecting Test & Evaluation of AI Systems
Systems Analysis Grassroots Pilots	Predictive Modeling Deep Learning
AI Data Management Strategy	Data Collecting AI Data Governance Classified Data Management



WORKFORCE DEVELOPMENT

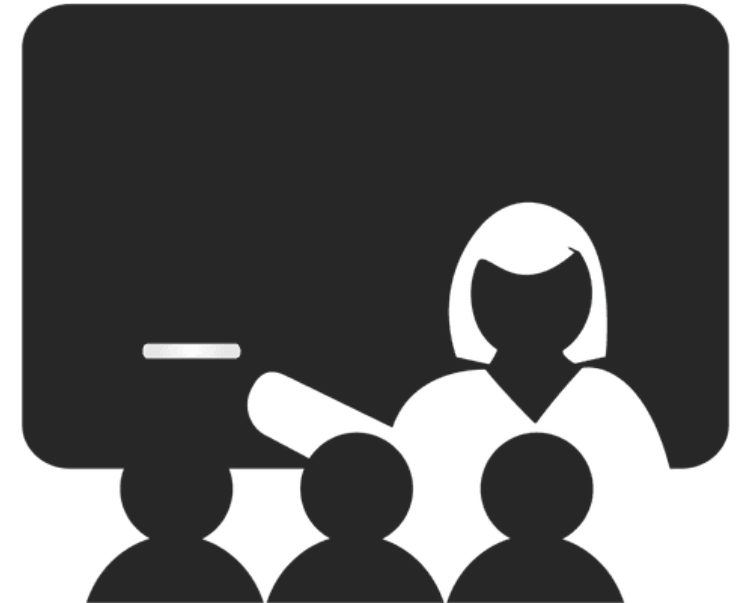


Purpose:

- Members of the SED workforce require basic AI literacy to support efforts that involve AI technology
- Analysts and software developers require in depth knowledge of machine learning techniques

Activities:

- Machine learning with Python training for practitioners
- Artificial intelligence overview training for general workforce
- CCDC Armament Center's Graduate School (AGS) provided AI/ML training

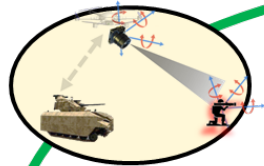




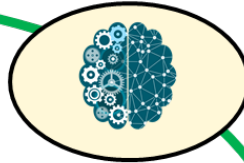
NEXT GENERATION INTELLIGENT FIRE CONTROL QUAD CHART



Off Board FC Enabler Package
(Extended Range Engagement)

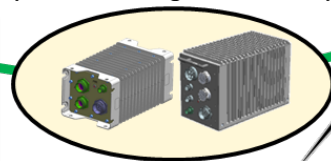


Embedded AI
(Accelerating Engagements)



NEXT GENERATION INTELLIGENT FIRE CONTROL

Modular Fire Control
(Reduce Integration Time)



(U)Schedule

MILESTONES	FY18	FY19	FY20	FY21	FY22
Capability Set 1 (Modular Fire Control)				5	6
Capability Set 2 (Extended Range Engagement)		3		4	6
Capability Set 3 (AI Prioritization Aid)				4	5

S/W Drop Spirals

(U) Purpose:

- (U) Optimize the delivery of decisive lethality for NGCV Manned/Unmanned Armament Systems through the development of hardware and machine learning algorithms
- (U) Reduce the cognitive load on the Warfighter, extend engagement range and accelerate the target engagement process

(U) Results/Products:

- (U) Database and training environment for continuous AI algorithm development
- (U) Modular FC product capable of augmenting direct fire engagements (threat assessment alg, coded CONOPS, hand-off, automation)
- (U) Fire control architecture documents for industry use
- (U) Demonstration finding and fixing for a direct fire solution using a off-board fire control enabler package

(U) Payoff:

- Enhances the Armament System to both control and expedite the Speed of Battle
- Reduces cognitive load through simplifying and streamlining task
- Modular design allows for easy adaption on to different weapon platforms, accelerating and reducing the cost of fire control development

SE4AI & AI4SE concepts are being piloted on NGIFC to provide experiential lessons learned

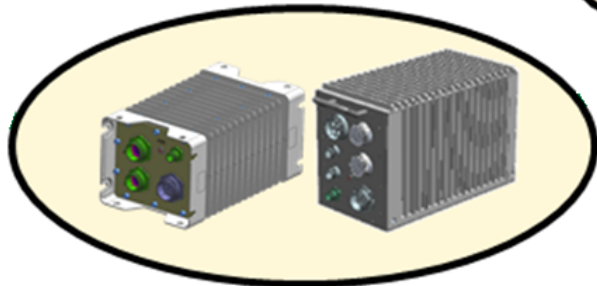
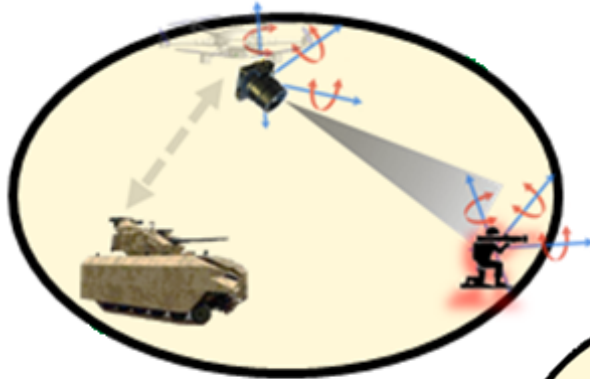


NEXT GEN COMBAT VEHICLE NEXT GEN INTELLIGENT FIRE CONTROL



Purpose:

- Support NGIFC mission by providing specialized AI/ML expertise
- Glean experiential lessons learned from applying AI4SE and SE4AI concepts



SE for AI

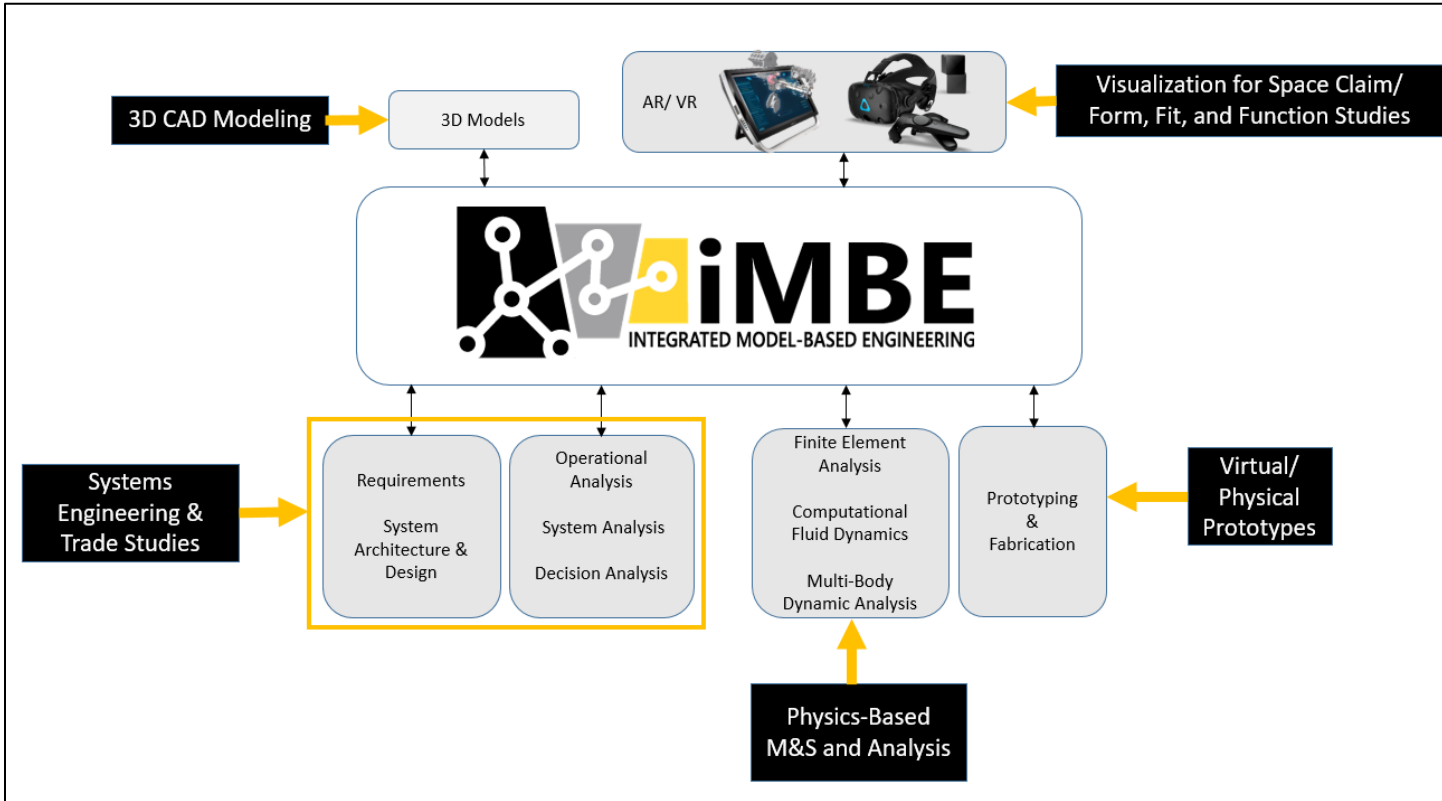
- Timeline Analysis to identify efficient system logic and delegation of tasks to agents
- Human factors engineering & cognitive load
- Document best practices for applying SE to AI technology
- Doctrine and AI technology interaction

AI for SE

- AI assisted requirements recommendations based on NLP
- Improving agent behavior in OneSAF operational modeling (enemy engagement, scenario development)



DIGITAL THREAD AI SERVICES (IMBE)



The integrated Model-Based Engineering (iMBE) Environment is a prototype digital thread environment centered around the use of Siemens Teamcenter.

Purpose:

- Incorporate AI/ML into the iMBE environment and the digital thread concept

Activities:

- Integrate iMBE with software development tools that support the development of AI technologies
- Incorporate AI services within the platform to efficiently classify product data

How can a digital thread support the development of AI/ML technology?
Can AI/ML technology support a digital thread concept?



OPERATIONAL ANALYSIS EMPOWERED BY AI/ML



Operational modeling seeks to provide environmental context to supplement and expand upon item-level analysis by considering correlation of forces/battle potentials. The software platform is PEO STRI's OneSAF.

Purpose:

- Empower operational modeling and analysis with AI/ML
- Provide operational context for AI programs

Activities:

- Improve operational modeling practice via reinforcement learning, closed-loop simulations, and other machine learning techniques
- Provide testbed environment for evaluating AI/ML programs in an operationally relevant context
- Build data collection scheme to allow for data mining





UPDATE SE PROCESS AND METHODS FOR AI APPLICATIONS

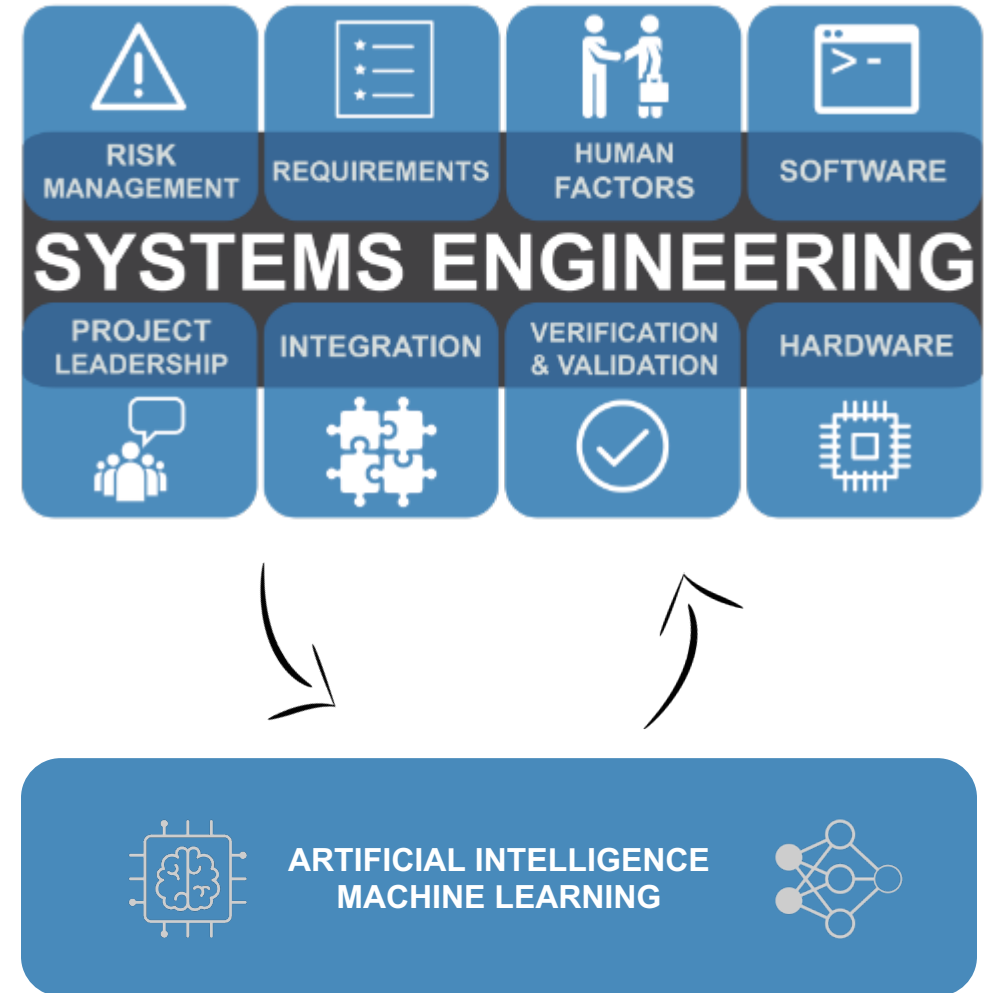


Purpose:

- Provide systems engineering support to the development of AI technologies
- Advance SE practice with AI/ML

Activities:

- Update SE processes to address projects working with AI technologies (SE4AI).
 - Compose best practices of applying SE to the development of AI technology. Leverage ongoing SE activities on AI projects
- Add more SE activities that utilize AI technology (AI4SE)
 - Improve SE on all armaments projects





AI DATA MANAGEMENT STRATEGY

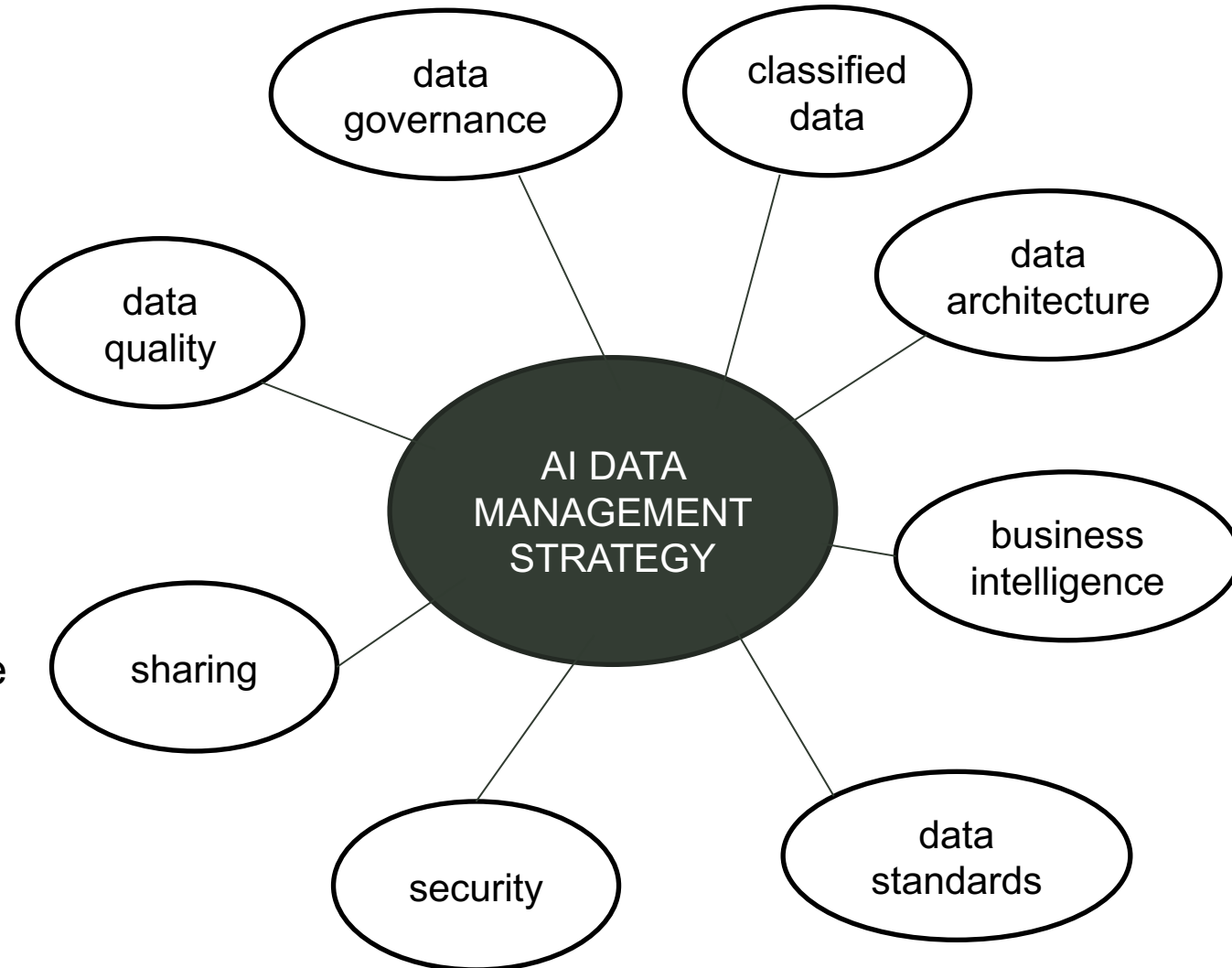


Purpose:

- Understand CCDC Armament Center's management of AI related data
- Optimize AI data management to support the development of weapon systems

Activities:

- Study data storage patterns in existing CCDC projects that involve AI technology
- Document best practices for AI data governance
- Leverage Army, Joint-services, academia, and industry for insights on AI data management





SYSTEMS ANALYSIS ML INFRASTRUCTURE

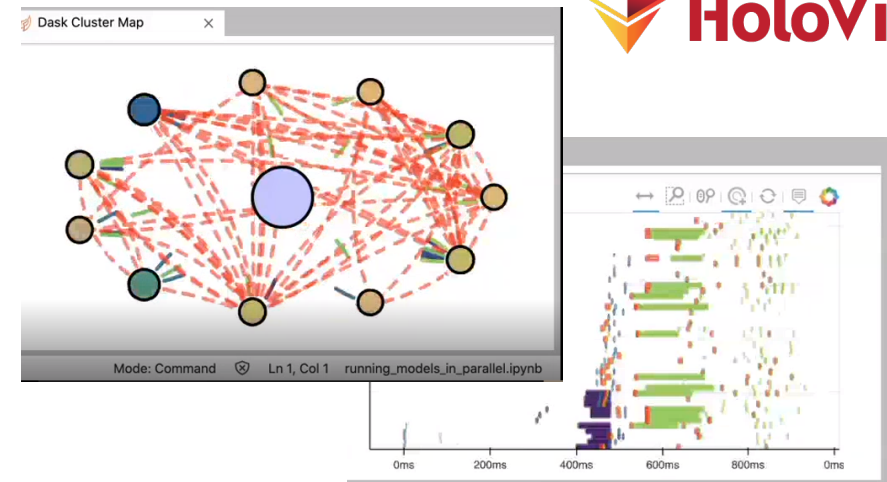


Purpose:

- Modernize system analysis methodologies with AI/ML tools and techniques

Activities:

- Configure basic IT infrastructure to support ML software stack
- Explore parallel processing and distributed computing for system analysis models
- Adapt existing workflows to utilize GPU-based high performance computing clusters
- Develop partnerships with industry, academia, and Government agencies





SUMMARY



- SED is entering an 18-month sprint to kick-start multidisciplinary SE-AI activities
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QUESTIONS?



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SE4AI



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