**LOCKHEED MARTIN ARTIFICIAL INTELLIGENCE - IDEATION THROUGH DEPLOYMENT**

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The webinar covered several important discussion topics related to Artificial Intelligence (AI) at Lockheed Martin. The first topic was an overview of AI at the company, which provided a general understanding of the various ways AI is being used to improve the company's operations and products.

The next topic focused on exemplars and stories, which are real-world examples of AI applications that have helped Lockheed Martin gain information superiority. These exemplars and stories demonstrate the practical and impactful benefits of AI in areas such as decision-making, analytics, and automation.

The third topic addressed the challenges that come with implementing AI and the engineering frameworks and processes used to mitigate these challenges. This includes ensuring the safety, security, and reliability of AI systems, as well as addressing ethical concerns.

Finally, there was a discussion on the skills needed for careers in AI, as well as the different career paths available. Collaboration was also highlighted as a critical aspect of successful AI implementation, both within the company and with external partners.

Overall, the webinar provided valuable insights into the current state of AI at Lockheed Martin and the opportunities and challenges that lie ahead.

**Machine Learning** is a method of teaching computers to learn from data, without being explicitly programmed. It involves the use of algorithms that can learn from and make predictions on a given set of data. The process by which an algorithm learns a mapping between a set of input features and a set of interesting or outcomes in a flexible way is known as machine learning.

**Artificial Intelligence** is a broader concept than machine learning and encompasses a variety of techniques that can be used to enable computers to perform tasks that typically require human-like intelligence, such as speech recognition, language translation, image recognition, and decision-making. Artificial Neural Networks are a type of machine learning algorithm that is modeled on the structure and function of the human brain, and are used for more human-like tasks such as speech, vision, and autonomy.

**Typical machine learning tasks** include classification, clustering, regression, and anomaly detection. Classification involves categorizing data into one of several predefined classes, clustering involves grouping similar data points together, regression involves predicting a continuous value based on input features, and anomaly detection involves identifying data points that differ significantly from the rest of the data.

Lockheed Martin uses AI to teach machines to do things—like spot patterns, learn from experience, draw conclusions, make predictions, and take action—that would otherwise require human intelligence. More than three hundred people work for the company in artificial intelligence and machine learning. In addition, they have provided their AI services to more than 30 external clients.

Lockheed Martin invests heavily in research and development across all of their divisions to improve their use of AI. To hasten the implementation of reliable AI across Lockheed Martin, they established the Lockheed Martin AI Center (LAIC). Lockheed Martin has also set up the Lockheed Martin Artificial Intelligence Laboratory (LAIL) to lay groundwork, boost innovation, and speed up the transition.

Cognitive baseline, industry integration, and defense integration are just a few of the places where the company is using AI integration. Other areas of advancement include computer vision, cognitive signals, autonomous agents, and artificial intelligence mesh. The AI Factory, in addition to consulting and aimlabs, have been established as AI backbones to sustain these initiatives.

The strategic goals of Lockheed Martin's AI initiative are centered on reducing operational reaction time to advanced threats while managing the volume, velocity, and variety of multi-domain data. They are making use of people, resources, systems, collaborations, and plans to get where they need to go.

**Artificial Intelligence Solution Space**

The available data dictates an increasing range of capabilities within the Artificial Intelligence Solution Space. Support function capabilities, cognitive assistance capabilities, artificial intelligence (AI) enabled tactical capabilities, and AI enabled asset management are just a few examples. The more data that is available, the more sophisticated the AI solutions can become, allowing them to offer more sophisticated capabilities.

**The following are some of the ways that Lockheed Martin has implemented AI:**

Project Airborne Cognition is an effort to enhance aircraft's intelligence, surveillance, and reconnaissance (ISR) capabilities through the use of AI to aid pilots in making more informed decisions in the field.

The goal of this project is to enhance the processing and analysis of signals intelligence (SIGINT) data by employing deep learning algorithms.

Artificial intelligence is being used in this project to improve the efficiency of ISR systems at the tactical edge, where resources like bandwidth are scarce.

The goal of this project is to create an intelligent autopilot system for airplanes that makes use of AI to maximize efficiency and security.

The goal of the Autonomous Integrated SIGINT and ISR at the Tactical Edge project is to develop an AI-powered, fully autonomous system for SIGINT and ISR missions at the tactical edge.

**Project Airborne Cognition**

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**Alpha Dogfight**

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Over the course of three days, competitors in the AlphaDogfight Trials show off their best dogfighting simulations using cutting-edge algorithms. The F-16 Al agent developed by Heron Systems bested those developed by seven other companies to advance to the finals, where it defeated a veteran Air Force F-16 pilot 5-0 in a series of simulated dogfights. DARPA's Air Combat Evolution (ACE) program aims to demonstrate a collaborative relationship between an AI agent handling tactical tasks like dogfighting and an onboard pilot focusing on higher-level strategy as a battle manager supervising multiple airborne platforms, and the competition was created to broaden the pool of AI developers available for this purpose. As a result of the competition's success, human and machine teams have taken a step forward in their ability to simulate aerial combat. Less than a year was spent by the eight participating companies teaching their AI agents to fly and perform well in mock aerial combat.

**Alpha pilot:**

Lockheed Martin's Alpha Pilot is a drone racing competition with the lofty goal of giving the sport its own "Deep Blue" moment. This race pits AI drone pilots against human pilots in a head-to-head showdown that puts their skills to the test in a variety of high-stakes situations. The goal of the competition is to showcase the potential of human-AI collaboration while also advancing the state-of-the-art in artificial intelligence for autonomous vehicles, particularly in the aerospace industry. University teams from all over the world are welcome to enter, and the winners will split the prize money.

**Cognitive Mission Manager for Wildfire Suppression**

The following components would make up an AI-based reference architecture for wildfire suppression missions:

Data ingestion refers to the process of importing information gathered by sensors (such as satellite images, drone footage, weather reports, and readings from sensors on the ground) into a data platform.

Predicting the fire front's speed and direction, classifying the fire's state, and determining its topology and nearby fuel sources all require processing data collected by sensors.

Distributing situational awareness and decision aids to incident command teams, air support, and different ground crews constitutes decision support.

Strategic and tactical decision-making for fire suppression based on multi-agent, multi-domain planning, and asset coordination. Both centralized and decentralized tasking, as well as understanding the will of higher-ups, fall under this category.

Incorporating the outcomes of firefighting activities into data processing and decision support components through a feedback loop allows for continuous strategy adjustment in the heat of the moment.

Using these components, a Cognitive Mission Manager for Wildfire Suppression could better coordinate and direct efforts to put out fires in a given area, shortening response times and increasing efficiency.

**Reference Architecture for Mission Management**

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highlighted some of the most pressing issues surrounding the widespread implementation of AI systems. Examples of such difficulties are:

The capacity of AI systems to adjust to new circumstances is essential. If the environment changes while the model is still in use, the pre-trained version may no longer be useful. Therefore, online and unsupervised learning approaches should enable AI systems to update themselves.

Exposure to Countermeasures: Artificial intelligence systems may be susceptible to countermeasures and attacks, which can compromise their efficacy. Therefore, safeguards must be put in place to prevent and deal with AI spoofing, and AI systems must be fortified against assault.

Trust between humans and machines can be fostered through mutual comprehension of each other's thought processes. Trust in AI systems relies on humans being able to understand and interpret their actions, which is why "explainable AI" is so important.

Unethical bias in training data can cause AI systems to act in ways that humans cannot predict or influence. Ethical principles should be applied throughout the entire AI development process to avoid this.

To realize AI's full potential and guarantee its responsible and ethical use, these obstacles must be overcome.

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It appears that the Al Factory framework offers a complete method for developing and maintaining reliable Al solutions. The framework ensures that throughout the entire machine learning lifecycle, Al models are developed, validated, explained, secured, and monitored by integrating automation, MLOps solutions, and reference architectures.

Best practices in software engineering and DevSecOps inform the Al Factory's design principles, such as the emphasis on modularity and the use of MLOps solutions. By incorporating Al engineering into preexisting processes and frameworks, we can improve the likelihood that it will be carried out in a way that is secure, ethical, explainable, and performant.

By providing a scalable environment for the creation and distribution of reliable Al solutions, the Al Factory reference architecture can help the Department of Defense accomplish its goals.

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**Al Engineering: Cognitive Modules**

The building blocks of AI are cognitive modules, which are memory-efficient libraries of AI classes and functions. They were made to be a universally applicable tool for the entire Lockheed Martin enterprise. These modules have a proven track record of use in both customer-funded and internal R&D projects, as well as programs of record (PoRs), making them an excellent foundation for IRAD creation.

The cognitive modules were developed to carry out the four main tasks of artificial intelligence: analysis, prediction, decision making, and general thought. Using these methods, Lockheed Martin can create atomic AI components tailored to the company's use cases and domains. Engineers can save time and money while producing higher-quality artificial intelligence solutions by employing pre-built cognitive modules.

**Al Deployment Strategies**

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summarized version of the major subfields and career tracks in AI! For more information on the topics you raised, please see the following:

Skill in software development and familiarity with various programming languages, including Python, Java, C++, and others, are essential for creating and deploying AI systems.

Knowledge of specific domains like healthcare, finance, and transportation is crucial for creating industry-specific AI solutions.

Integrating and securing services is a critical skill for those who will be responsible for deploying and maintaining AI systems in production settings.

Training AI models and developing data-driven AI solutions require proficiency in data analysis and engineering. This includes the ability to work with large datasets, clean and preprocess data, and apply statistical analysis.

Knowledgeable in selecting, analyzing, and refining models: The ability to effectively construct AI models relies on the model developer's knowledge of algorithm selection, parameter tuning, and performance evaluation.

The ability to deploy AI models accurately and reliably calls for expertise in integrating AI systems into production workflows and in deploying models to a variety of hardware and software environments.

Building reliable AI solutions relies on the ability to validate and verify AI models to ensure they are effective, fair, and ethical.

**Job Prospects:**

Domain sensing: the application of AI to the process of gathering and analyzing data from a variety of sources in order to inform and aid decision-making in a particular field, such as medicine, economics, or transportation.

Building AI systems capable of functioning independently in challenging settings, such as those encountered by unmanned vehicles, robotics, and drones, is what is meant by "autonomy."

Creating AI systems that can work alongside humans in fields like healthcare, education, and customer service is the goal of AI collaboration.

In mission-critical settings, such as defense and emergency response, mission management entails utilizing AI to aid in decision-making and coordination.