Artificial intelligence (AI) is used in radar systems to improve accuracy, perception, and safety. AI can be used in radar systems for a variety of purposes, including:

* **Predicting future scenarios**: AI can analyse historical and real-time data to predict future events, such as traffic collisions.
* **Identifying anomalies**: AI can identify anomalies in radar operation and signal maintenance needs before failures occur.
* **Improving radar signal processing**: AI can be used for radio-frequency interference recognition, ground/sea clutter suppression, and moving target detection.
* **Improving radar imaging**: AI can be used for high-resolution target imaging via synthetic aperture radar (SAR), inverse SAR (ISAR), and multiple-input-multiple-output (MIMO) radar.
* **Improving object detection and classification**: AI can be used for intelligent object detection and classification.
* **Improving signal processing and feature extraction**: AI can be used for signal processing and feature extraction.
* **Improving real-time adaptation and decision-making**: AI can be used for real-time adaptation and decision-making.
* **Improving object tracking and trajectory prediction**: AI can be used for object tracking and trajectory prediction.

AI features in radar systems for navy applications are designed to enhance surveillance, target tracking, threat assessment, and operational efficiency. Here are some key AI-enabled features commonly used in naval radar systems:

**1. Automatic Target Recognition (ATR)**

* AI algorithms enable radars to automatically identify and classify different types of targets, such as ships, aircraft, and missiles, by analyzing their radar signatures and distinguishing between friendly and hostile contacts.

**2. Adaptive Signal Processing**

* AI helps optimize radar signal processing by dynamically adjusting parameters in real time based on environmental conditions like weather, sea state, and electromagnetic interference. This ensures clearer target detection even in cluttered or challenging conditions.

**3. Predictive Analysis**

* Machine learning models analyze historical and real-time data to predict the movement and behavior of potential threats. This enhances situational awareness and helps in early warning and threat interception.

**4. Anomaly Detection**

* AI-driven anomaly detection systems can identify unusual or unexpected patterns in radar data that may indicate new or stealth threats, like low radar cross-section vehicles or drones.

**5. Enhanced Data Fusion**

* AI combines data from multiple radar sources and other sensors (e.g., sonar, infrared) to create a comprehensive and cohesive picture of the operational area. This multi-sensor data fusion enhances decision-making for commanders.

**6. Reduced Operator Workload**

* AI-assisted automation can handle repetitive and complex tasks, reducing the cognitive load on radar operators. It provides actionable insights, alerts, and recommendations, enabling operators to focus on higher-level decision-making.

**7. Automatic Tracking and Target Prioritization**

* AI enables automatic tracking of multiple targets simultaneously and can prioritize them based on threat level, size, proximity, and speed. This allows for faster response times and more efficient resource allocation.

**8. Counter-Stealth Capabilities**

* Advanced AI algorithms help improve detection of stealth targets by analyzing subtle variations in radar returns that human operators might miss, thus improving overall detection capabilities.

**9. Enhanced Electronic Warfare (EW) Capabilities**

* AI can identify and respond to electronic jamming and countermeasures more effectively by recognizing jamming patterns and deploying adaptive counter-techniques.

**10. Training Simulations**

* AI is used to simulate various threat scenarios, helping operators train in a realistic environment that mimics potential operational challenges. This improves the readiness and response capability of naval personnel.

**11. Maintenance and Health Monitoring**

* AI-driven predictive maintenance systems assess the health of radar components in real-time, predicting failures before they occur and ensuring continuous operational capability.

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| Title/Author/  Publication Details | Description/  Hypotheses | Research Design/  Methodology | Findings | Future Scope/Recommendations |
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