

## A254-018: Novel AI Techniques for Insights in Various Environments (NATIVE)

### ADDITIONAL INFORMATION

N/A

### TECHNOLOGY AREAS:

Information Systems

### MODERNIZATION PRIORITIES:

Advanced Computing and Software | Trusted AI and Autonomy

### KEYWORDS:

Self Supervised Vision Transformer Models; Foundational Models; Visual Search; Generative Models; Retrieval-augmented generation

### OBJECTIVE:

Organizations across various sectors are increasingly inundated with vast amounts of data, making it challenging to identify and analyze anomalies and patterns effectively. Traditional methods often fall short in handling the scale and complexity of modern datasets, leading to missed opportunities and potential risks.

### DESCRIPTION:

In today's data-driven world, organizations, including the Army, face the challenge of managing and making sense of vast amounts of diverse data. This data comes from various sources, such as sensors, communication systems, operational logs, and more. The sheer volume and complexity of this data make it difficult to identify critical anomalies and patterns that could impact decision-making and operational effectiveness.

The desired outcome of this topic is to develop and implement innovative AI technologies that can efficiently process and analyze terabytes of data, including imagery, text, and signals, to detect anomalies and uncover patterns. Anomalies are deviations from the norm that could indicate potential issues, threats, or opportunities. This effort will also involve detecting biases and deficiencies within the datasets, ensuring that relevant data is identified for labeling, so that the AI models built from the SBIRs are not only accurate but also fair and reliable.

By leveraging advanced AI techniques, such as machine learning, deep learning, and natural language processing, we aim to create AI models that can automatically and accurately identify these anomalies and patterns.

**IMPORTANT: A prize competition, xTechIgnite, will be used to identify small business concerns that meet the criteria for award for this topic. Winners selected from the xTechIgnite prize competition will be the only firms eligible to submit a SBIR proposal under this topic. All other proposals will not be evaluated. See the full xTechIgnite competition details here: <https://www.xtech.army.mil/competition/xttechignite/>.**

### PHASE I:

This topic is accepting Direct to Phase II proposals for a cost up to \$2,000,000 for an 18-month period of performance.

Proposers interested in submitting a DP2 proposal must provide documentation to substantiate that the scientific and technical merit and feasibility equivalent to a Phase I project has been met. Documentation can include data, reports, specific measurements, success criteria of a prototype, etc.

### PHASE II:

During Phase II, firms should expect to engage in a research and development effort focused on refining and validating their AI capabilities for identifying and analyzing anomalies and patterns in large datasets. The goal is to develop a robust, scalable, and secure prototype that can be packaged and transition to Project Linchpin's model marketplace. This phase will involve extensive testing and iteration to ensure the AI models meet performance, accuracy, and security standards. Firms will also collaborate closely with Project Linchpin to access operational

data at the and onboard their solutions onto the Impact Level 5 (IL5) environment. By the end of Phase II, the expectation is to deliver a well-defined, functional prototype that demonstrates the AI technology's effectiveness.

### **PHASE III DUAL USE APPLICATIONS:**

The AI technologies being developed for anomaly detection and pattern recognition have numerous commercial applications across a wide range of industries. In financial services, they can be used for fraud detection, risk management, and compliance monitoring, helping to prevent financial losses and reputational damage. Healthcare institutions can employ them for real-time patient monitoring, disease outbreak detection, and personalized medicine, leading to improved patient outcomes and more efficient resource allocation. Retailers can benefit from improved inventory management, customer behavior analysis, and demand forecasting, enabling them to optimize supply chains and enhance the customer experience. Manufacturers can utilize AI for predictive maintenance, quality control, and supply chain optimization, reducing downtime and improving overall efficiency. Cybersecurity firms can enhance intrusion detection, threat intelligence, and incident response, helping to protect against increasingly sophisticated cyber threats. Transportation and logistics companies can optimize routes, vehicle maintenance, and cargo management, reducing costs and improving delivery times. Energy companies can manage grids, forecast demand, and optimize energy distribution, leading to a more sustainable and reliable energy supply. Additionally, AI-powered anomaly detection and pattern recognition can be applied in various other industries, such as:

1. Media and entertainment: content recommendation, audience analysis, and piracy detection
  2. Education: personalized learning, student performance analysis, and academic integrity monitoring
  3. Real estate: property valuation, market trend analysis, and predictive maintenance
  4. Environmental monitoring: climate modeling, air quality monitoring, and wildlife conservation
- These applications demonstrate the broad impact of AI in enhancing operational efficiency, decision-making, and innovation across various industries, ultimately leading to increased productivity, competitiveness, and economic growth.

### **REFERENCES:**

1. <https://dinov2.metademolab.com/>
2. <https://huggingface.co/models>

### **TOPIC POINT OF CONTACT (TPOC):**

TPOC-1: David Charles Codrington

PHONE: N/A

EMAIL: david.charlescodrington.civ@army.mil