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Automated Threat Recognition For Aviation Security Applications

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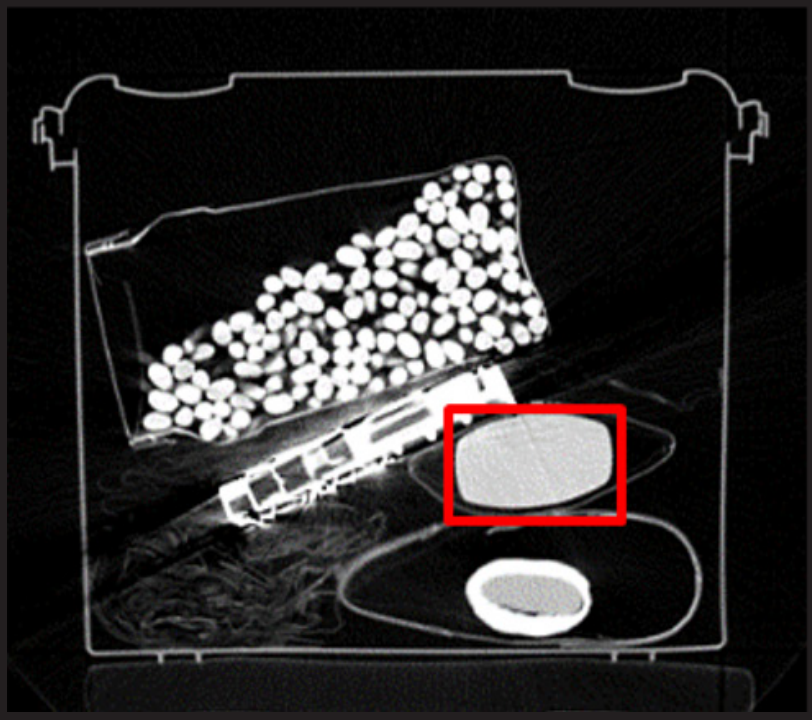
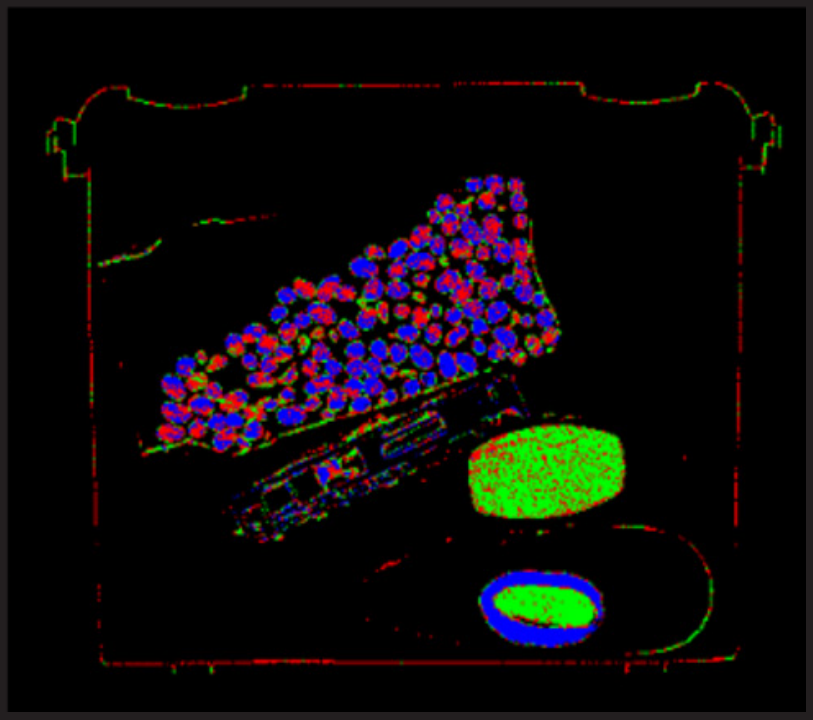
Disclaimer

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.





AUTOMATED THREAT RECOGNITION FOR AVIATION SECURITY APPLICATIONS

Summary

We have developed a framework for automated threat recognition (ATR) of explosive threat materials for both single-energy and dual-energy X-ray CT systems. Under this framework, two different types of ATR have been developed.

The first type of ATR employs supervised machine learning with statistical characterization of target materials for threat identification training. The reliance only on statistical characterization information for threat training uniquely enables this style of ATR to adapt quickly to evolving threats.

The second type of ATR employs deep learning through convolutional neural networks. Convolutional neural networks are attractive due to their human-like capacity for learning and strong ability to identify trends and patterns. Although this method is more powerful than the first type, it requires large amounts of training data and therefore is less agile.

Each ATR performs threat characterization at the voxel neighborhood level. This approach avoids the use of threat shape as a detection criterion, which is prohibited by DHS and TSA guidelines.

Applications and Commercial Potential

Our ATR framework could potentially be applied to vendor explosives detection systems (VEDS). The use of an adaptive framework that learns new threats quickly could be used to simplify the certification process for extension of current capabilities to new threats or to a dynamically changing threat assessment for currently certified threat materials. This could be leveraged to increase probability of detection or decrease false alarm rates in the field on a timescale that can keep pace with world events.

ADVANTAGES

- Adapts easily to new or changing threat assessments
- Learns and improves with additional training data
- Scales well with increasing number of threat materials
- Avoids the use of shape for explosives threat identification

INTELLECTUAL PROPERTY

N/A

TECHNOLOGY READINESS

TRL-4

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End Users

NOTE: We have additional content and users at the FOUO level

What we Need

Here is your chance to ask for resources. What would it take to significantly improve the commercial viability and/or widespread use of your technology?

- Access to data collected from additional dual-energy X-ray CT explosives detection systems. These data should include a wide variety of explosive materials along with examples of common false alarm items from either in-lab testing or stream-of-commerce scanning.
- Funding for automated algorithm training development (currently a manual process)
- Funding to develop the technology past TRL-4 so that it can be successfully transferred.

FUNDING TIMELINE

2017 TO 2020

Department of Homeland Security (DHS) – Awareness and Localization of Explosives-Related Threats (ALERT) Center of Excellence

2018 TO 2020

DHS Broad Area Announcement (BAA) 17-03 – New Tomography Techniques for the Reduction of False Alarms, DHS S&T Checked Baggage Program

2018 TO 2020

DHS BAA 17-03 – Advanced Algorithms for Reduction of False Alarms, DHS S&T Checkpoint Screening Program

2019 TO 2020

DHS TSA Accessible Property Screening System (APSS) Machine Learning. LLNL is a subcontractor for L3 Security Systems for this effort.

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