

Applying Machine Learning Techniques to Identify and Inspect Hazardous Cargo at US Ports

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Introduction

The number of cargo ship fires has increased over the past 5 years with devastating economic and catastrophic environmental impact. Container ship incidents **have cost more than 100 billion dollars in lost cargo and environmental damage, as well as loss of lives** due to undeclared and improperly stored hazardous material cargo. The United States Coast Guard (USCG) Sector New York (NY) intends to improve the safe transport of hazardous cargo by implementing an inspection process that will efficiently and effectively identify with high-probability, high-risk containers for review. Sector NY currently inspects 2,400 containers annually, however, the Port of NY/NJ sees more than 7.4 million containers in imports alone each year. This demonstrates the **need for an inspection system that can catch a higher percentage of dangerous cargo**. A team of students attending Stevens Institute of Technology are collaborating with USCG Sector NY cargo inspectors to apply new techniques, including machine learning, to better identify and target hazardous material cargo for inspection.

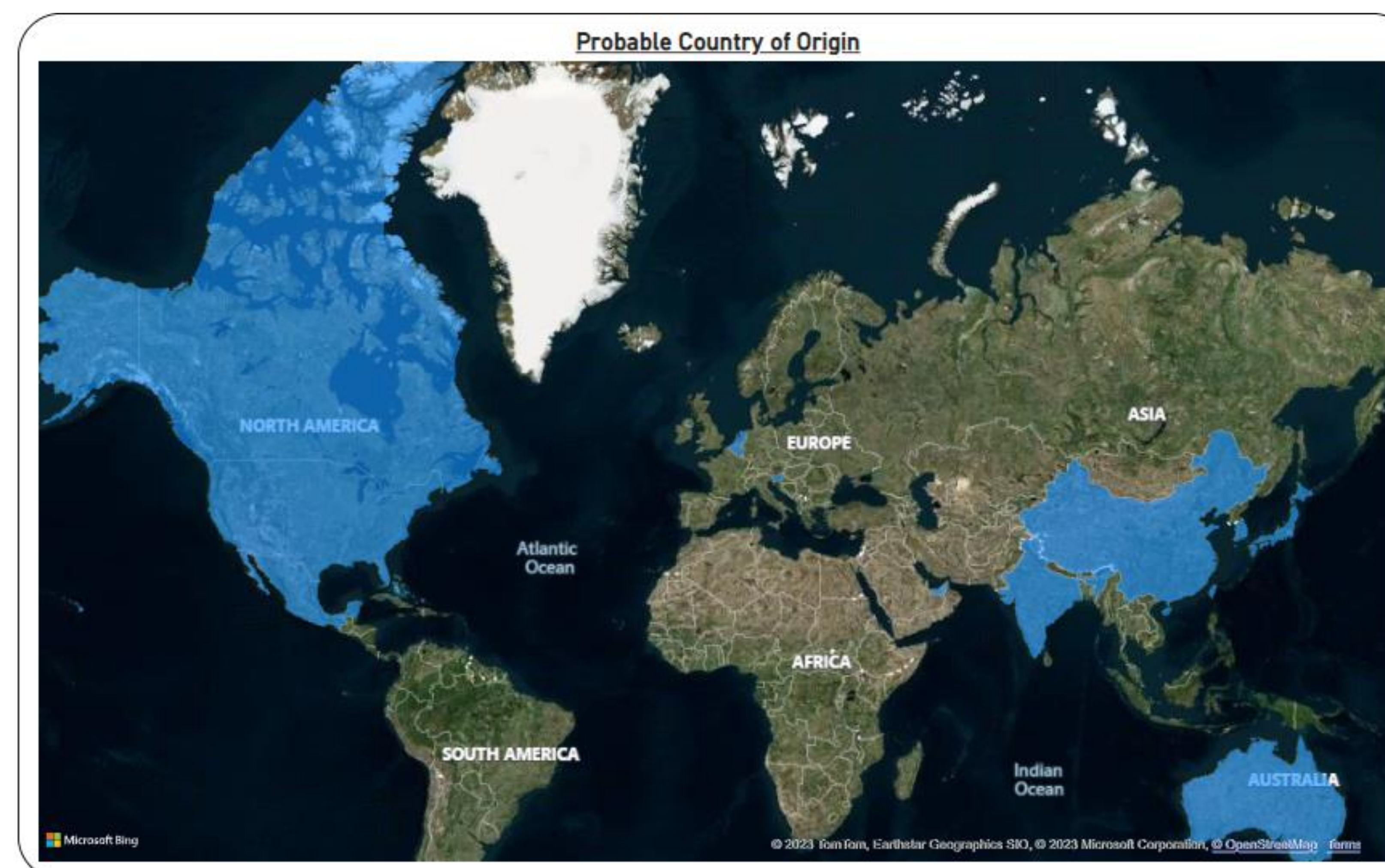


Figure 1: Example PowerBI Visualization

Methodology

This project intends to use historical **Coast Guard inspection** data and machine learning to **develop an algorithm to enhance the targeting of hazardous material cargo for inspection**. It will be able to process input parameters, such as hazard class, to identify the risk associated with each container. The software system has 3 major components, each with their own purposes.

- **User-friendly interface** to upload necessary files into the algorithm. (Figure 4)
- **Python-based machine learning algorithm** to process information and the random selection of containers for inspection
- **PowerBI dashboard** to visualize all aspects of the cargo manifest data (Figure 1)



Figure 2: X-Press Pearl Fire

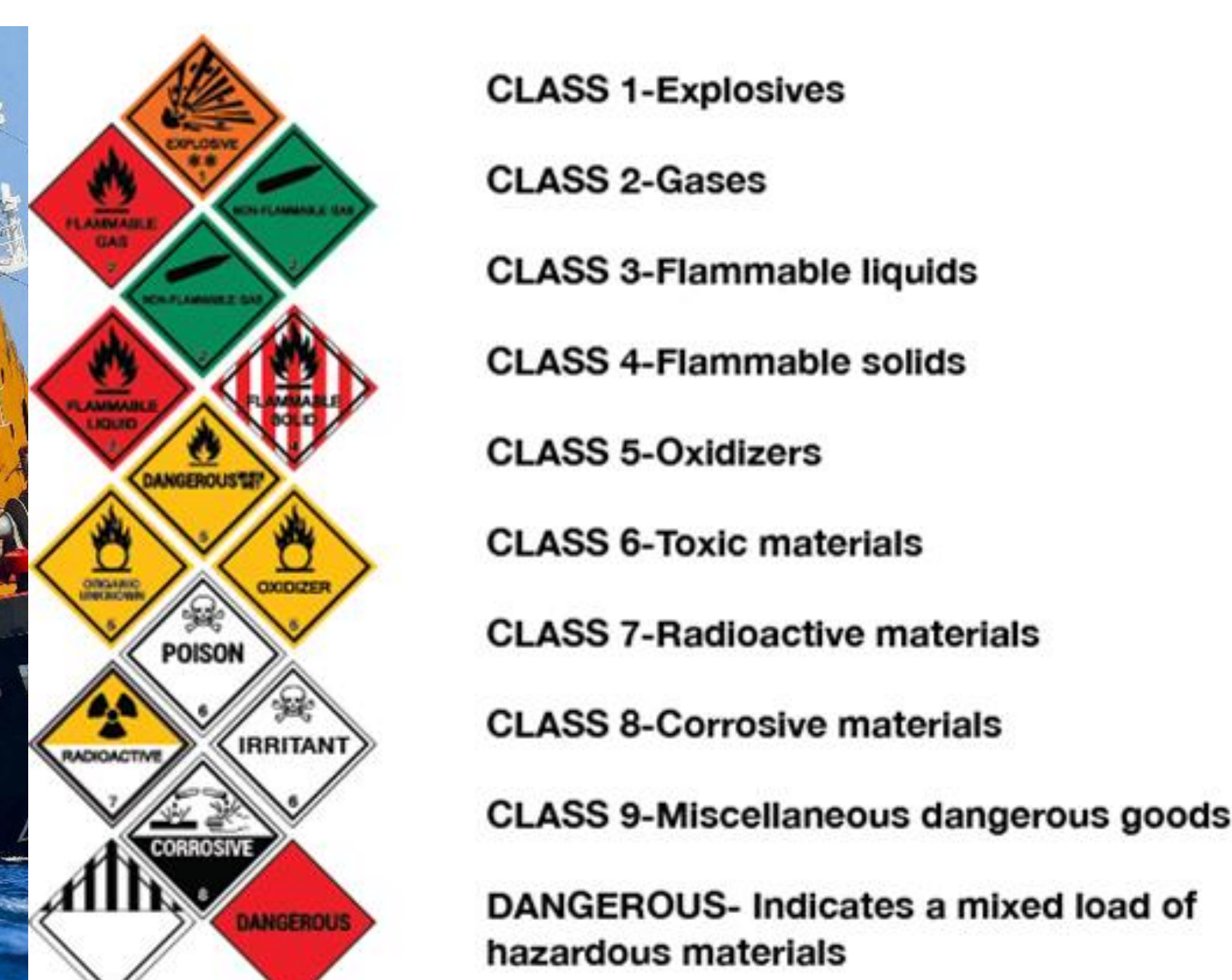


Figure 3: Hazard Class Diagram

Next Steps

There are improvements to be made to the Coast Guard's container inspection method following the implementation of this software-based system.

- Develop a data set of containers that have been inspected by the USCG and passed inspection to continue to train the machine learning algorithm
- Establish standardizations for how shippers report the contents of their containers such as a separate column for hazard class
- Begin rolling out this software system to other CG Sectors



Figure 4: Partial Interface