

Anti-Blackbeard AI

An Analysis of the AI Defending Cargo Ships Against Modern Maritime Pirates

Megdalia Bromhal
Computer Science
UNC Wilmington
Wilmington, NC, U.S.A.
mb2710@uncw.com

Yang Song
Computer Science
UNC Wilmington
Wilmington, NC, U.S.A.
songy@uncw.com

ABSTRACT

From 1714 to 1718, piracy thrived in the Caribbean. Notorious figures like Blackbeard plundered European vessels transporting goods, gold, and slaves headed to colonial America. Today, 310 years later, pirates still roam the seas — only now, instead of commanding striking vessels with black sails and cannons, pirates attack from inconspicuous fishing boats. Due to the smaller size of these boats, maritime pirates often escape detection and hijack vessels legally transporting cargo, wreaking havoc upon international trade routes. However, in recent years, scientists have begun training artificial intelligence (AI) models to predict which vessels are most likely captained by pirates. So far, public case studies demonstrate AI's accuracy and assistance in the field of maritime security. Although this implementation of AI is still being developed, a growing number of shipping companies are depending on AI to secure their ships and cargo, and thus artificial intelligence is becoming ingrained with maritime security and transforming how cargo ships deter pirates.

1 Introduction

With tens of thousands of merchant ships on the seas at any given time, authorities are simply unable to adequately protect the cargo and crews traveling around high-risk areas, such as West Africa and the Red Sea. Roughly 4 years have passed since AI was introduced into this sector of industry, but has this technology succeeded in deterring pirates from cargo ships? In this report, I will analyze the different AI models both previously and currently implemented in maritime security, as well as evaluate them on effectiveness.

2 AI Onboard Merchant Ships

One of the main reasons maritime pirates can take control of a merchant ship is because the vessel's security is mainly human-powered. In one study that analyzes the causes of pirate attacks, it was found that just under 50% of pirate attacks occur between midnight and 6 a.m., when it is most difficult for human sentries to see through the dark and fog [1]. Often, the crew of a ship will not see the pirates before they have been boarded by them [2]. Additionally, pirates often use fishing boats, which makes distinguishing between fishermen and pirates problematic, and AI can help with this. As Beng from ST Engineering explains, fishing boats "making sudden movements, high speed headings, or

dubiously moving back and forth around the ship" trigger an alert that pirates are close by, differentiating from false alarms like buoys [2].

The AI technologies available for purchase rely heavily on behavioral analysis to determine an abnormal speed or trajectory of a ship and whether it warrants an alarm. In the case study of Windward's AI technology, this behavioral analysis led to one of the biggest narcotics captures in the history of AI security.

2.1 Windward vs the NATALIA

In one of the most popular case studies of using AI to prevent maritime pirate attacks, a company named Windward, based in Israel, used AI to determine the NATALIA had become a pirated ship. According to Windward, their proprietary AI models "evaluate [sic.] each vessel in context to its previous patterns and behaviors to detect when suspicious events emerge in real-time" [3]. Specifically, Windward's AI models took note that the NATALIA's flag had changed midtrip from one high-risk country to another, so when Windward's "risk models detected anomalous loitering," Windward alerted local authorities [3]. Stored in the vessel, authorities found "\$470 million" worth of illegal narcotics [3][4].

2.2 AgilTrack MAPS by ST Engineering

The AgilTrack Maritime Anti-Piracy System, or AgilTrack MAPS, is an AI algorithm developed by ST Engineering to "deliver fully automated piracy alerts to ocean-going vessels," specifically in the waters near Somalia and Southern China [5]. This implementation of AI for maritime security "uses a proprietary Track-Before-Detect technology" that tracks vessels and logs behavioral data to determine discrepancies, reducing the number of false alarms [5]. Yet, even once pirates have been detected, this technology offers only an "early warning against an attack," taking no active steps itself [5].

2.3 ZIMGuard

Yet another AI security technology available for purchase is ZIMGuard from ZIM, an international shipping industry. ZIMGuard is a system that "scans shippers' cargo declarations...and flags potential cases of wrongly declared cargo" [6]. ZIMGuard AI includes "Natural Language Processing (NLP) capabilities and Machine Learning," which is used to "analyze documentation and alert operations personnel of

occurrences of omission, concealment or erroneous declaration of hazardous cargo” [6]. This means that, while this technology is used mainly in shipping ports and processing locations, it can prevent pirates from overtaking a vessel and attempting to ship illegal cargo that has been wrongly labeled. Indeed, the fight against maritime pirates extends from the high seas onto land, as well as even the sky.

2.4 AI in Salty Skies: UAV’s

The most notable company building UAVs (Unmanned Aerial Vehicles) to track maritime pirates and secure shipping routes is Schiebel, which is known for its CAMCOPTER S-100 UAS (Unmanned Air System) and S-300 version of the CAMCOPTER UAS [7]. According to Naval News writer Martin Manaranche, Schiebel’s UAVs “play a critical role in enhancing maritime defenses,” and can be used for “surveillance and reconnaissance...to detect and track pirate vessels” [8]. The S-100, particularly, is extremely versatile and useful in detecting pirate vessels in “adverse weather conditions” and capable of detecting objects of interest “out to 200 km,” or about 124 miles [7]. While the CAMCOPTER provides “real-time situational awareness” for the vessel’s crew, it does not take any preemptive steps to deter pirates trying to board a cargo ship.

2.5 AI’s Active Defense

These AI models and algorithms, while they do detect pirates and warn the crew of an impending hijacking, do not proactively prevent pirates from attacking. Planned security upgrades to these AI models include adding “surveillance cameras, search beams, and long-range acoustic devices...to automatically deter the hostile vessel [and] collect video evidence for follow-up enforcement action” [2]. This is groundbreaking, as security in the shipping industry has previously taken a more passive approach. With this innovative technology, pirates could be deterred from boarding the vessel entirely, keeping the crew and cargo even more safe.

2.6 Bayesian Networks

According to one study that analyzed maritime piracy data from Southeast Asia, a Bayesian Network “can capture the causal relationships between piracy and influencing factors,” which means this algorithm can handle more data and consider the relationships between different data types, thus making better evaluations and decisions [9]. Specifically, this network takes into consideration the ship type, location of the ship, external environmental conditions, the presence or absence of anti-piracy defenses onboard, and numerous other conditions to predict whether a ship is especially susceptible to pirate hijacking [9].

While this technology has yet to be implemented in a cargo ship’s security system, at least to public knowledge, this type of research can lead to more robust and effective AI models and algorithms that can be, eventually, used onboard vessels to deter pirates.

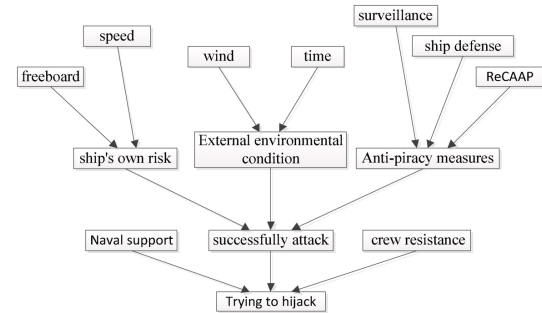


Figure 1: Bayesian Network Diagram used in Jiang & Lu, 2020.

3 Conclusion

In summary, although AI security systems onboard shipping vessels are relatively new, this field of study expands every year. As researchers construct better AI models and algorithms, such as Bayesian Networks, industry companies implement them. In terms of maritime security, Windward and ST Engineering have developed AI models that deter pirates while onboard cargo ships, publishing case studies with encouraging results. ZIM and Schiebel also provide AI responses to the threat of piracy, tackling the problem on land and in the air. With this technology, merchant ships are notified if pirates are in the waters, and companies can predict which ships pirates will attempt to hijack. Developers have yet to release an AI security system that proactively protects the ship with defensive deterrents. Overall, AI is making great strides in the sector of maritime security, improving the trade industry and continually reinforcing a vessel’s protection against pirates.

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