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# Artificial Intelligence and the Combat of Piracy in the Gulf of Guinea

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**Abstract**
Maritime piracy has evolved significantly in the 21st century, adapting to geopolitical, economic, and technological transformations. Nowhere is this evolution more evident than in the Gulf of Guinea (GoG), which has overtaken the Gulf of Aden as the global epicentre of piracy and armed robbery at sea. Despite a reported decrease in the number of successful pirate attacks in recent years, the region remains persistently insecure due to a combination of transnational organised crime, weak maritime governance, under-resourced navies, jurisdictional complexities, and socio-economic vulnerabilities along the West African coast. Traditional legal and naval responses, though essential, have proved insufficient in preventing sophisticated, adaptive pirate networks that employ tactics such as AIS (Automatic Identification System) spoofing, hostage-taking for ransom, and attacks on offshore installations. In this context, the international maritime community and regional actors should increasingly explore the potential of Artificial Intelligence (AI) to enhance Maritime Domain Awareness (MDA), pre-empt threats, coordinate responses, and improve evidence-gathering for legal prosecution. This article examined the role and legal implications of using AI to combat piracy in the GoG, particularly focusing on how AI technologies can support surveillance, threat detection, interdiction, and post-incident investigation. It explored the potential of AI-driven tools such as machine learning models for detecting vessel anomalies, real-time satellite imagery analysis, and predictive analytics for vessel behaviour patterns to fill existing operational and intelligence gaps. Furthermore, the article investigated whether the current legal frameworks are sufficiently equipped to accommodate the deployment of AI in counter-piracy operations. This article adopted a doctrinal legal research methodology complemented by qualitative content analysis. To find that AI technologies offer significant potential to enhance the effectiveness of anti-piracy measures in the Gulf of Guinea. Moreover, the deployment of AI introduces new legal questions concerning the admissibility of AI-generated evidence, compliance with international data protection principles, liability for algorithmic errors, and the need for transparent audit trails.
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## 1. Introduction

Piracy has remained one of the most persistent threats to maritime security since the codification of international law governing the seas. The United Nations Convention on the Law of the Sea, in Article 101, defined piracy as illegal acts of violence, detention, or depredation, committed for private ends by the crew or passengers of a private ship or aircraft, directed against another ship or aircraft on the high seas or in a place outside the jurisdiction of any state, or against persons or property on board such ship or aircraft. It also includes acts of voluntary participation in the operation of a pirate ship or aircraft and inciting or facilitating such acts.[1]

In recent decades, the locus of global maritime piracy has shifted from Southeast Asia and the Horn of Africa to the Gulf of Guinea (GoG), where piracy has taken on new and complex forms.[2] The region stretching from Senegal to Angola has witnessed an alarming escalation in incidents of armed robbery at sea, kidnapping for ransom, illegal oil bunkering, and attacks on both commercial and oil and gas infrastructure.[3] Unlike the piracy

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[1] UNCLOS 1982, art 101
[2] A A Osinowo, 'Combating Piracy in the Gulf of Guinea' (2015) 30(2) African Centre for Strategic Studies <https://www.jstor.org/stable/pdf/resrep19053.pdf> accessed 20 August 2025
[3] *Ibid*

 

observed off the coast of Somalia, which occurred largely on the high seas, piracy in the GoG often takes place within the territorial waters of sovereign states, posing unique challenges for law enforcement, jurisdiction, and inter-state cooperation.[1]

According to the International Maritime Bureau (IMB), while the total number of piracy incidents in the GoG has declined in recent years due to increased naval presence and regional collaboration, the region still accounts for the highest number of crew kidnappings globally.[2] In 2020 alone, the GoG accounted for over 95 percent of maritime kidnappings worldwide.[3] This evolution of piracy in the region reflects the growing operational sophistication of pirate networks, which are increasingly capable of evading conventional detection mechanisms through the use of GPS spoofing, disabling AIS (Automatic Identification System) devices, and launching attacks from mother ships stationed far offshore.

In response to these threats, regional actors, including Nigeria, Ghana, Togo, and Cameroon, have taken legislative and operational steps to strengthen maritime security architecture. Notable among these is Nigeria's Suppression of Piracy and Other Maritime Offences Act 2019 (SPOMO Act), which aligns the domestic legal framework with provisions of the UNCLOS and the Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation (SUA).[4] Complementing these legal initiatives are regional frameworks such as the Yaoundé Code of Conduct (2013), which establishes an inter-governmental apparatus for coordination, information-sharing, and maritime law enforcement.[5] Despite these developments, significant limitations remain in the capacity of states to detect and pre-empt piracy threats, owing to a shortage of naval assets, technological limitations, and inadequate intelligence coordination.

This limitation has created a window of opportunity for technological innovation. In particular, Artificial Intelligence (AI) and machine learning are emerging as potentially transformative tools in enhancing Maritime Domain Awareness (MDA), facilitating early-warning systems, optimising naval response times, and improving the collection and use of evidentiary data in prosecutions.[6] AI applications in the maritime security domain include real-time anomaly detection from AIS data, pattern recognition for vessel behaviour, automated satellite image analysis to track "dark" vessels, and predictive analytics for piracy risk zones.[7] Countries such as Nigeria have begun to incorporate these technologies into their national maritime strategy, most notably through the Deep Blue Project, which integrates AI-powered Command, Control, Communication, Computer, and Intelligence (C4i) centres with drones, surveillance aircraft, and maritime patrol units.[8]

However, the integration of AI into maritime security efforts in the GoG raises critical legal and normative questions. Can the deployment of AI surveillance and detection tools comply with principles of international law, particularly the jurisdictional and evidentiary requirements stipulated in UNCLOS and the SUA Convention? To what extent does the current legal framework accommodate the use of AI-generated data in criminal prosecutions? What are the implications of algorithmic decision-making for the rights of seafarers and coastal communities, particularly in relation to privacy, liability, and due process? These questions are particularly salient in the context of a region marked by weak legal harmonisation, political fragmentation, and capacity constraints.

This article critically evaluates the potential of AI as a counter-piracy tool in the Gulf of Guinea, with a dual focus on technological feasibility and legal compatibility. It argues that while AI holds considerable promise for

[1] B A. Forster, 'Modern Maritime Piracy: An Overview of Somali Piracy, Gulf of Guinea Piracy and South East Asian Piracy', *American Historical Review*
[2] Nigerian Administration and Safety Agency, 'International Maritime Bureau Confirms Piracy Decline in the Gulf of Guinea' < https://nimasa.gov.ng/international-maritime-bureau-confirms-piracy-decline-in-the-gulf-of-guinea/> accessed 20 August 2025.
[3] ICC International Maritime Bureau, 'Piracy and Armed Robbery Against Ships' ICC-IMB Piracy and Armed Robbery Against Ships Report – First Quarter 2020 < https://icc-ccs.org/reports/2020_Q1_IMB_Piracy_Report.pdf> accessed 20 August 2025
[4] Suppression of Piracy and Other Maritime Offences Act, 2019 < https://nimasa.gov.ng/wp-content/uploads/2022/12/Suppression-of-Piracy-and-Other-Maritime-Offences-Act-2019-01.pdf> accessed 20 August 2025.
[5] Yaoundé Code of Conduct Concerning the Repression of Piracy, Armed Robbery against Ships, and Illicit Maritime Activity in West and Central Africa (2013)
[6] S. Singh & F. Heymann, Machine Learning-Assisted Anomaly Detection in Maritime Navigation Using AIS Data' (2020) *IEE/ION Position Location and Navigation Symposium Conference at Portland, USA* <https://www.researchgate.net/publication/339068893_Machine_Learning-Assisted_Anomaly_Detection_in_Maritime_Navigation_Using_AIS_Data> accessed 20 August 2025
[7] *Ibid*
[8] Nigerian Maritime Administration and Safety Agency (NIMASA), 'Integrated National Security and Waterways Protection Infrastructure Deep Blue' (2020) *The Voyage* < https://nimasa.gov.ng/wp-content/uploads/2021/10/VOYAGE-2020Q4.pdf> accessed 20 August 2025

 

improving maritime security outcomes, its utility is contingent upon the existence of a coherent legal and regulatory framework that ensures its lawful, ethical, and accountable deployment. The discussion proceeds in five parts. Following this introduction, part 2 presents a literature review covering existing legal frameworks, technological solutions, and academic perspectives on AI in maritime security. Part 3 offers a contextual analysis of piracy in the GoG, identifying the nature of the threat and the institutional and legal gaps that persist. Part 4 assesses current and potential AI applications in surveillance, interdiction, and prosecution, drawing from case studies such as the Deep Blue Project. It critically examines the international and domestic legal implications of using AI, including compliance with UNCLOS, the admissibility of AI-generated evidence, and issues of inter-state cooperation. Part 5 concludes with findings and offers policy recommendations aimed at enhancing both the legal and technological capabilities of regional actors. Through this analysis, the article contributes to the evolving discourse on the intersection between law, security, and technology in international maritime governance. It makes the case for a forward-looking legal paradigm that not only recognises the utility of AI in combating piracy but also anticipates its regulatory challenges, thereby ensuring that technological advances serve the cause of maritime justice and the rule of law.

### 2.1 Maritime Piracy in the Gulf of Guinea: Trends and Threat Vectors

A significant body of literature has emerged over the past two decades examining the socio-political, economic, and criminological dimensions of piracy in the Gulf of Guinea. Scholars such as Onuoha argue that piracy in the region is fuelled by a convergence of poor governance, weak maritime law enforcement capacity, widespread youth unemployment, and entrenched criminal economies. [1] Unlike Somali piracy, which was largely opportunistic and aimed at hijacking vessels for ransom, piracy in the GoG is often linked to transnational organised crime and is characterised by targeted attacks on oil tankers, the abduction of crew members, and sophisticated evasion tactics.[2]

Murphy has noted that the proximity of pirate activities to shore, often within the territorial seas of littoral states, complicates the application of international legal instruments that traditionally focus on piracy on the high seas.[3] This has led to increased advocacy for regionally grounded solutions rather than wholesale transplanting of global counter-piracy frameworks. Empirical studies such as those by Buerger and Edmunds emphasise the hybrid nature of maritime security governance in West Africa, where state actors, international donors, and private security providers operate in overlapping jurisdictions with varying legitimacy. [4] These authors underscore the need for harmonised legal responses and advanced technological tools capable of operating in constrained, fragmented environments.

### 2.2 Legal Frameworks and Enforcement Challenges

The legal regulation of piracy is anchored in customary international law and codified principally in the United Nations Convention on the Law of the Sea (UNCLOS). Articles 100–107 define piracy as occurring on the high seas and impose a duty on all states to cooperate in its suppression.[5] However, this definition has been widely critiqued as inadequate for addressing piracy in the GoG, where most attacks occur within territorial waters and involve armed robbery rather than classical piracy *jure gentium*. Churchill and Lowe have noted that the jurisdictional limitations inherent in UNCLOS restrict its utility in high-density territorial zones, thus necessitating complementary regional and domestic legal frameworks.[6]

The Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation (SUA Convention) of 1988 and its 2005 Protocol provide an important supplementary mechanism by extending

[1] F. Onuoha, 'Piracy and Maritime Security in the Gulf of Guinea: Nigeria as a Microcosm' (2012) *Al Jazeera Centre for Studies Report* <https://studies.aljazeera.net/sites/default/files/articles/reports/documents/201261294647291734Piracy%20and%20Maritime%20Security%20in%20the%20Gulf%20of%20Guinea.pdf> accessed 20 August 2025
[2] M.N. Murphy, *Small Boats, Weak States, Dirty Money: Piracy and Maritime Terrorism in the Modern World* (Columbia University Press, 2009) 133-134
[3] *Ibid*
[4] C. Bueger and T. Edmunds, 'Blue Crime: Conceptualising Transnational Organised Crime at Sea' (2020) 95(4) Marine Policy 1-21 < https://research-information.bris.ac.uk/ws/portalfiles/portal/240115333/Bueger_and_Edmunds_2020_Blue_Crimes.pdf> accessed 20 August 2025
[5] UNCLOS 1982, Art 101-107
[6] R Churchill and A Lowe, *The Law of the Sea* (3rd edn, Manchester University Press 1999) 210–214.

 

jurisdiction over a broader range of maritime offences, including those perpetrated within national jurisdictions.[1] The convention establishes the principle of universal jurisdiction, which implies that any state party can prosecute or extradite individuals who have committed maritime offences, regardless of where the crime took place or the nationality of the offender.[2] To illustrate, in 2009, Somali pirates hijacked the MV Maersk Alabama off the coast of Somalia. The vessel's captain, Richard Phillips, was captured and taken to a different lifeboat, and a ransom of 2 million dollars was demanded.[3] U.S. Navy Seals rescued the ship's captain, and the pirates involved were prosecuted in the U.S. courts under the SUA Convention.[4] The 2005 protocol further expanded the scope of this convention to include acts of terrorism and violence against fixed platforms on the continental shelf.[5] The convention emphasises the importance of international cooperation between states to prevent and combat these unlawful maritime acts or piracy and all its related offences. The SUA Protocol primarily applies to acts of piracy on the high seas or in areas beyond national jurisdiction, potentially limiting its effectiveness in cases where piracy occurs in territorial waters.[6]

Yet, as Guilfoyle observes, implementation of the SUA Convention is often uneven, particularly in states with weak prosecutorial infrastructure.[7] In response, states like Nigeria have passed domestic laws such as the Suppression of Piracy and Other Maritime Offences Act (SPOMO) 2019, which criminalises a wide range of maritime offences and seeks to fill the jurisdictional and procedural gaps left by UNCLOS.[8] The SPOMO Act is considered a crucial step in Nigeria's efforts to combat maritime insecurity and protect its maritime domain. By providing a clear legal framework and establishing the federal High Court as the competent authority, the Act has strengthened Nigeria's ability to prosecute offenders and deter future acts of piracy and maritime crime.[9] The primary goal of the Act is to prevent and suppress piracy, armed robbery and other unlawful acts done against a ship, aircraft and other maritime craft, including a fixed or floating platform. Its application covers the territorial waters of Nigeria and also international waters. The SPOMO Act is the first domestic enactment to define piracy at sea[10] and provides the penalty for piracy as life imprisonment upon conviction and a fine of fifty million naira (N50,000), including restation to the owner or forfeiture to the federal government of Nigeria.[11]

Despite this legal evolution, effective enforcement remains constrained by practical issues such as a lack of maritime patrol capacity, inadequate inter-agency coordination, political interference, and limited use of maritime surveillance technologies. These constraints have prompted increased interest in the role of Artificial Intelligence as a force multiplier in maritime law enforcement.

### 2.3 Artificial Intelligence and Maritime Security: Potentials and Limitations

Literature on the application of AI in maritime security is still emerging but expanding rapidly. AI technologies such as machine learning, deep neural networks, and computer vision are increasingly being employed to enhance Maritime Domain Awareness (MDA). Scholarly work by Singh and Heymann demonstrates how unsupervised learning algorithms can detect vessel anomalies using Automatic Identification System (AIS) data, potentially allowing authorities to identify suspicious behaviour before an incident occurs.[12] By identifying and

[1] International Maritime Organisation, 'Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation, Protocol for the Suppression of Unlawful Acts Against the safety of Fixed Platforms Located on the Continental Shelf' < https://www.imo.org/en/about/conventions/pages/sua-treaties.aspx> accessed 21 August 2025
[2] *Ibid*
[3] K Raunek, 'The Story of Maersk Alabama Container Vessel' (September 2019 Maritime Piracy) <https://www.marineinsight.com/marine-piracy-marine/the-story-of-maersk-alabama-container-vessel/> accessed 21 August 2025.
[4] *Ibid*
[5] *Ibid*
[6] O Aaron & H Ejovwo, 'An Analysis of Piracy Provisions Under Nigeria's 2019 Suppression of Piracy Act' (2023) 2(1) Journal of Refugee Law and International Criminal Justice <https://www.researchgate.net/publication/383491747_An_Analysis_of_Piracy_Provisions_Under_Nigeria's_2019_Suppression_of_Piracy_Act> accessed 21 August 2025
[7] D Guilfoyle, *Shipping Interdiction and the Law of the Sea* (Cambridge University Press, 2009) 185–189
[8] Suppression of Piracy and Other Maritime Offences Act 2019
[9] Femi Atoyebi &Co, 'Privacy and Maritime Offences in Nigeria; Highlighting the Salient Provisions of the Suppression of Piracy and Other Maritime Offences Act, 2019' < https://femiatoyebi.com.ng/piracy-and-maritime-offences-in-nigeria-highlighting-the-salient-provisions-of-the-suppression-of-piracy-and-other-maritime-offences-act-2019/> accessed 21 August 2025
[10] SPOMO Act 2019, S 3 defined piracy as a violent attack on a ship by another ship on the high seas for personal gain.
[11] SPOMO Act 2019, S 12(1)
[12] (n 9), B. Li, X Xie & others, 'Ship Detection and Classification from optical Remote Sensing Images: A Survey' (2020) 34(3) Chinese Journal of Aeronautics

 

tracking illegal activities, the study aims to provide law enforcement and maritime authorities with the tools they need to intervene and prevent illicit activities like illegal fishing, piracy, smuggling and illegal dumping of pollutants. It puts forward the idea, which is echoed here, that AI algorithms such as Convolutional Neural Networks can be trained to identify unusual behaviour or patterns indicative of illicit activities. Although the researchers admit to environmental factors such as clouds, shadows and lighting, and lack of standardised ship classification taxonomy across datasets, methods like the RBox-CNN[1] and SHDRP[2] demonstrate high detection precision of up to 91.9% AP in some tasks.[3] Similarly, research by Lin et al. explores how satellite imagery and remote sensing data processed by AI models can be used to track 'dark' vessels that deactivate their transponders to avoid detection.[4]

On the legal front, there is growing discourse on the admissibility and reliability of AI-generated evidence. As Ziegler notes, AI-generated intelligence raises complex questions regarding data integrity, chain of custody, and compliance with fair trial rights.[5] Courts have yet to develop consistent standards for determining the probative value of such evidence, particularly in jurisdictions where judicial familiarity with technological systems are limited. Moreover, scholars such as Taddeo and Floridi have raised concerns about the ethical implications of using opaque algorithms in life-and-death decision-making contexts, including the interdiction of suspected pirate vessels.[6]

Another theme in the literature relates to regional preparedness. While AI holds promise, its successful deployment requires significant institutional investment, inter-agency collaboration, and technical training.[7] In the GoG context, where data quality is often poor, legal frameworks are fragmented, and institutional inertia is common, these prerequisites remain aspirational rather than realised. The literature thus reveals both the promise and perils of relying on AI for maritime security. There is a discernible research gap in understanding how existing legal instruments like UNCLOS, SUA, and domestic legislation like the SPOMO Act can be adapted or interpreted to regulate AI in anti-piracy operations.

### *2.4 Synthesis and Identified Gaps*

While considerable academic attention has been paid to the causes and legal dimensions of piracy in the Gulf of Guinea, the literature remains underdeveloped in three critical areas. First, there is limited analytical work exploring how AI technologies can be integrated into existing maritime legal frameworks to enhance surveillance, interdiction, and prosecution. Second, there is a paucity of doctrinal analysis on whether AI-generated data can satisfy the standards of proof required under national and international legal norms. Third, most existing studies adopt either a technological or legal lens; few adopt an interdisciplinary approach that critically engages with both dimensions.

This article seeks to address these lacunae by offering a holistic assessment of AI's utility in combating piracy in the GoG, grounded in both technological feasibility and legal soundness. It proceeds on the premise that AI can significantly enhance maritime law enforcement if its deployment is aligned with the principles of legality, accountability, and international cooperation.

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<https://www.researchgate.net/publication/346209051_Ship_detection_and_classification_from_optical_remote_sensing_images_A_survey> accessed 21 August 2025

[1] Rotated Bounding Box Convolutional Neural Network (RBox-CNN)

[2] Hip High Density Rotated Proposal (SHDRP)

[3] RBox-CNN and SHDRP are advanced convolutional neural network based methods designed for ship detection and classification in optical remote sensing images, particularly where ships exhibit arbitrary rotations, scale variations and partial occlusions.

[4] M Lin, J Xu and R Chan, 'Detecting Illicit Maritime Activity Using Satellite Imagery and AI' (2021) 14(2) Remote Sensing 225.

[5] R Ziegler, 'Artificial Intelligence and Due Process in Criminal Investigations' (2021) 18(1) *International Journal of Law and Information Technology* 33.

[6] L Floridi and M Taddeo, 'What is Data Ethics?' (2016) 374(2083) *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* <https://royalsocietypublishing.org/doi/10.1098/rsta.2016.0360> accessed 21 August 2025

[7] C Bueger and J Stockbruegger, 'Technology for Maritime Security: Challenges and Opportunities in the Gulf of Guinea' (2021) *Danish Institute for International Studies Policy Brief* <https://www.sciencedirect.com/science/article/pii/S0308597X23005092> accessed 21 August 2025.

 

## 3. Critical Analysis of Piracy in the Gulf of Guinea

### *3.1 Characterising Piracy in the Gulf of Guinea: A Distinct Threat Profile*

Piracy in the Gulf of Guinea (GoG) is uniquely shaped by the region's legal, political, and economic context. While piracy globally is understood as violent criminal acts committed at sea for private gain, its manifestation in the GoG departs in significant respects from the typologies observed in the Horn of Africa or the Strait of Malacca. The GoG threat is primarily located within the Exclusive Economic Zones (EEZs) and even territorial seas of coastal states, thereby falling outside the conventional definition of piracy under Article 101 of the United Nations Convention on the Law of the Sea (UNCLOS), which limits piracy to illegal acts occurring on the high seas or outside any state's jurisdiction.[1]

This jurisdictional distinction is not merely academic. It has real-world implications for enforcement. Unlike piracy off the Somali coast, where universal jurisdiction allowed foreign navies to interdict pirate vessels under international law, the legal authority to act against pirates in the GoG lies principally with the coastal states themselves.[2] These states often lack the naval capacity or legal infrastructure to police their maritime domains effectively. The narrow legal definition of piracy under UNCLOS, combined with a lack of harmonised regional legal frameworks, means many maritime crimes go unprosecuted or misclassified.[3]

Moreover, pirate groups in the GoG exhibit an increasing level of organisation and sophistication. Attacks are often executed by coordinated cells using speedboats launched from mother ships, operating across multiple maritime jurisdictions.[4] The primary objective is not vessel hijacking, as seen in Somali piracy, but the abduction of crew members for ransom and the theft of valuable cargo, particularly refined petroleum products.[5] This modus operandi renders vessels vulnerable not only while sailing but also during anchorage and while awaiting berthing clearance, as demonstrated by the 2021 attack on the *MV Mozart*, where 15 crew members were kidnapped some 200 nautical miles off São Tomé.[6]

### *3.2 Structural Drivers: Weak Governance, Economic Inequality, and Criminal Networks*

The persistence of piracy in the GoG is underpinned by a complex interplay of structural and institutional factors. First among these is weak state capacity. Many GoG states suffer from poor maritime domain awareness (MDA), under-resourced navies and coastguards, and endemic corruption within enforcement agencies.[7] These institutional weaknesses are often exacerbated by contested maritime boundaries and ambiguous jurisdictions, which make coordinated patrols and interdictions difficult.

Second, the socio-economic context of the Niger Delta and similar coastal regions fuels piracy as a survival strategy. [8] Widespread unemployment, environmental degradation caused by oil exploitation, and the militarisation of local economies have created a pool of disenfranchised youth easily co-opted by pirate syndicates.[9] This is compounded by the proliferation of arms and the recycling of ex-militants into maritime crime, a phenomenon seen following the demobilisation of groups under Nigeria's Presidential Amnesty Programme.[10]

Third, the GoG is a key node in transnational criminal networks engaged in illegal oil bunkering, trafficking in arms and drugs, and money laundering.[11] Pirate attacks are often facilitated or covered up by corrupt port authorities and shipping agents. The collusion between organised crime and state actors not only enables

[1] UNCLOS (n 1) art 101.
[2] M N Murphy, *Small Boats, Weak States, Dirty Money* (Hurst Publishers 2009) 152.
[3] L Ploch, C M Blanchard & others, 'Piracy off the Horn of Africa' (April 2011) Congressional Research Service <https://sgp.fas.org/crs/row/R40528.pdf> accessed 21 August 2025
[4] *Ibid*
[5] F Onuoha, 'Piracy and Maritime Security in the Gulf of Guinea' (2012) Al Jazeera Centre for Studies <https://studies.aljazeera.net/en/reports/2012/06/201261212321011333.html> accessed 21 August 2025
[6] BBC News, 'MV Mozart: Pirates Kill One and Kidnap 15 Sailors off Nigeria' (BBC, 25 January 2021) <https://www.bbc.com/news/world-africa-55785838 > accessed 21 August 2025.
[7] B B Ndibnu, 'The Legal Frameworks and Challenges in Addressing Maritime Security in the Gulf of Guinea: A Comparative Study'(2024) *United Nations – The Nippon Foundation of Japan fellowship Programme* <https://www.un.org/oceancapacity/sites/www.un.org.oceancapacity/files/2024unnf_beckley_0.pdf> accessed 21 August 2025.
[8] C Obi, 'Oil Extraction, Dispossession, Resistance, and Conflict in Nigeria's Oil-Rich Niger Delta'(2010) 30 *Canadian Journal of Development Studies* 219-236
[9] *Ibid*
[10] *Ibid*
[11] C Obi, 'Oil as the 'Curse' of Conflict in Africa: Peering Through the Smoke and Mirrors' (2010) 37(126) *Review of African Political Economy* 483-495

 

maritime insecurity but actively undermines legal accountability. As Obi notes, the region suffers from "zones of statelessness at sea" where pirates operate with near impunity.[1]

### *3.3 Legal and Jurisdictional Complexities: Fragmentation and Impunity*

The fragmented legal architecture in the GoG constitutes a major obstacle to effective counter-piracy operations. UNCLOS provides a general framework, but its definition of piracy fails to cover the full range of maritime threats occurring within national waters. Although the SUA Convention and other instruments like the Djibouti and Yaoundé Codes of Conduct extend jurisdiction to some degree, these instruments lack robust enforcement mechanisms. Most coastal states do not incorporate SUA obligations into domestic law, or do so without clear prosecutorial procedures. For instance, the Merchant Shipping Act (MSA) 2007[2] by its provision in Section 216(h) domesticated the SUA Convention, 1988 and its Protocol thereto contrary to the provision of Section 36(12) of the 1999 Constitution of Nigeria[3] which provides that no person can be convicted of a criminal offence save where an extant law provides for such offence.

Nigeria's SPOMO Act 2019 represents a commendable effort to fill these gaps. The Act criminalises a wide spectrum of maritime offences, including those occurring in territorial waters and EEZs, and establishes procedures for investigation, evidence collection, and prosecution.[4] However, the Act's enforcement has so far been inconsistent. The first successful conviction under SPOMO occurred only in 2020, more than a year after its enactment, illustrating systemic delays in judicial response.[5] The landmark conviction involved the hijacking of the Equatorial Guinean flagged vessel, MV Elobey VI, and the subsequent demand and payment of a ransom. Three individuals were found guilty of hijacking the vessel and subsequently ordered to pay a fine of N20 million each.[6] Moreover, other regional states lack equivalent legislation, creating gaps in regional enforcement and permitting perpetrators to evade justice by exploiting jurisdictional boundaries.

Coordination among regional navies and maritime agencies remains underdeveloped. While the Yaoundé Architecture for Maritime Security (YAMS) establishes a framework for inter-state cooperation and information-sharing, operational bottlenecks persist. These include poor data integration, language barriers, and bureaucratic inertia. In this context, AI-enhanced tools for vessel tracking, predictive analytics, and inter-agency coordination could address many of these weaknesses but only if they are embedded within coherent legal and operational frameworks.

### *3.4 Intelligence and Surveillance Deficits*

A final critical weakness lies in the region's poor intelligence capabilities. Most states rely on sporadic satellite coverage, manually monitored AIS data, and under-maintained radar infrastructure.[7] As a result, pirate vessels often remain undetected until an attack occurs. The inability to predict or pre-empt attacks has contributed to a reactive, rather than proactive, law enforcement culture.[8]

Furthermore, evidentiary challenges, especially the lack of reliable documentation of attacks, eyewitness accounts, and authenticated video surveillance, hinder successful prosecutions.[9] As AI tools such as pattern recognition and automated image analysis become more accessible, they could revolutionise evidence gathering and enable real-time interdiction.[10] However, these technologies are only as effective as the regulatory and infrastructural ecosystem in which they are deployed.

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[1] *Ibid*
[2] MSA 2007, S 216(h)
[3] CFRN 1999, S 36(12)
[4] V N Enebeli and D C Njoku, 'A Critical Appraisal of the Anti-Piracy Law of Nigeria', (2021) *Journal of Law, Policy and Globalisation*, 113
[5] Nigerian Maritime Administration and Safety agency (NIMASA), 'Nigeria Secures Premier Conviction Under SPOMO Act' < https://nimasa.gov.ng/antipiracy-war-nigeria-secures-premier-conviction-under-spomo-act/> accessed 21 August 2025
[6] *Ibid*
[7] J Lei, Y Sun & Ors, 'Association of AIS and Rader Data in Intelligent Navigation in Inland Waterways Based on Trajectory Characteristics' (2024) 12(6) *Journal of Marine Science and Engineering* 890
[8] *Ibid*
[9] K A Sørense, 'Maritime Surveillance Finding Dark Ships with Satellites and Artificial Intelligence', (2024) Technical University of Denmark <https://backend.orbit.dtu.dk/ws/portalfiles/portal/390125979/Maritime_Surveillance_Finding_Dark_Ships_with_Satellites_and_Artificial_Intelligence.pdf> accessed 21 August 2025.
[10] *Ibid*

 

## 4. Artificial Intelligence Applications in Combating Piracy in the Gulf of Guinea

### *4.1 Overview of AI Technologies in Maritime Security*

Artificial Intelligence (AI) refers to the simulation of human cognitive processes such as learning, reasoning, and self-correction by computer systems.[1] In the maritime security domain, AI can be employed across several applications, including vessel tracking, behavioural anomaly detection, automatic target recognition, image and signal processing, and predictive threat analytics. These technologies leverage large datasets derived from Automatic Identification Systems (AIS), satellite imaging, radar feeds, and weather data to provide real-time situational awareness and decision-making support.[2] It is estimated that more than 20% of larger ships and over 70% of smaller ships worldwide are unaccounted for, meaning they are dark ships.[3] Ships that could be involved in all kinds of nefarious activities at sea hence the need of maritime surveillance to achieve comprehensive security and safety. It's no surprise that aircraft and patrol boats are not sufficient monitoring tools for vast maritime regions like the GoG. Therefore, additional surveillance systems are required, making satellite platforms essential for effective monitoring. Given the large maritime domain and the enormous volume of data that will be generated from satellite surveillance, the use of AI for processing and analysing that data effectively is crucial for detecting and tracking dark ships and predicting future events.

Machine learning (ML), a subset of AI, is especially relevant for pattern recognition and predictive modelling. By training algorithms on historical pirate attack data, AIS traffic patterns, and environmental variables, ML systems can estimate the probability of piracy incidents across maritime zones.[4] Natural Language Processing (NLP) further allows AI systems to process and cross-reference unstructured data from news reports, naval communications, and open-source intelligence, thereby enhancing threat attribution and interdiction planning.[5]

These capabilities represent a shift from reactive law enforcement to pre-emptive security planning, enabling navies, coastguards, and inter-agency task forces to respond to piracy risks with greater precision and speed. However, their effectiveness is contingent on the quality and volume of input data, interoperability of systems, and legal authorisation for use in operational environments.

4.2 Case Study: Nigeria's Deep Blue Project

The Deep Blue Project, launched in 2017 and operationalised in 2021 by the Nigerian Maritime Administration and Safety Agency (NIMASA), is the most prominent example of AI-enabled maritime security in the Gulf of Guinea.[6] Designed as a multi-agency initiative between NIMASA and the Nigerian Navy, the project integrates air, land, and sea assets with an AI-driven Command, Control, Computer, Communication and Information (C4i) centre.[7]

The C4i centre employs machine learning algorithms to analyse data from drones, AIS transponders, and radar systems to track vessel movements and flag anomalous behaviours.[8] For instance, if a vessel abruptly turns off its AIS transponder, changes course unpredictably, or enters a high-risk zone without authorisation, the system can automatically alert patrol units or initiate drone surveillance.[9]

In 2021, shortly after the full deployment of the Deep Blue Project, the International Maritime Bureau reported a 60% decline in piracy incidents in Nigerian waters.[10] While correlation is not causation, this temporal proximity

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[1] S Singh & J Kaur, 'Artificial Intelligence: A Review of Challenges and Applications' (2024) *International Research Journal of Modernisation in Engineering Technology and Science*, <https://www.researchgate.net/publication/390300778_ARTIFICIAL_INTELLIGENCE_A_REVIEW_OF_CHALLENGES_AND_APPLICATIONS#:~:text=Abstract,and%20its%20diverse%20application%20areas.> accessed 21 August 2025; L Craig, N Laskowski & L Tucci, 'What is AI(Artificial Intelligence)? Definitions, Types, Examples & Use Cases' (2024) < https://www.techtarget.com/searchenterpriseai/definition/AI-Artificial-Intelligence> accessed 21 August 2025

[2] (n 56)

[3] *Ibid*, Dark ships - ships that do not transmit information about who or where they are.

[4] I Okafor-Yarwood, O Eastwood & Ors, 'Technology and Maritime Security in Africa: Opportunities and Challenges in the Gulf of Guinea' (2023) Marine Policy< https://research-portal.st-andrews.ac.uk/en/publications/technology-and-maritime-security-in-africa-opportunities-and-chal#:~:text=Licence:%20CC%20BY-,Fingerprint,they%20form%20a%20unique%20fingerprint.> accessed 2i August 2025.

[5] *Ibid*

[6] Nigerian Maritime Administration and Safety Agency (NIMASA), Deep Blue Project Overview (2023) <https://nimasa.gov.ng/nimasa-deep-blue-project-driven-by-competent-manpower/> accessed 21 August 2025

[7] *Ibid*

[8] Nigerian Maritime Administration and Safety Agency (NIMASA), 'Deep Blue Assets Deployed and Function- Video' < https://nimasa.gov.ng/deep-blue-assets-deployed-and-functioning/> accessed 21 August 2025.

[9] *Ibid*

[10] African Defence Forum, 'Deep Blue Project: Inside Nigeria's Maritime Security Strategy' (2023) The African Crime & Conflict Journal < https://theafricancriminologyjournal.wordpress.com/2023/01/24/deep-blue-project-inside-nigerias-

 

suggests a meaningful impact of AI-assisted surveillance. However, the project's efficacy is hindered by limited regional data sharing, logistical challenges in the maintenance of AI hardware, and inadequate legal frameworks for the admissibility of AI-derived intelligence in Nigerian courts.[1] For example, in 10-15 cases where AIS towers have been installed, international partners must provide even basic repairs, as a lack of repair culture across African countries is usually blamed for the situation.[2] Again, African governments are yet to link the towers through the internet to develop a comprehensive operating surveillance network.[3]

Moreover, the project's centralised nature raises concerns about civil liberties and data governance. The indiscriminate use of surveillance drones and automated monitoring in maritime zones must be legally constrained to ensure compatibility with privacy and due process protections under Nigerian constitutional law.[4] The need to balance national security concerns against human rights like privacy cannot be overemphasised and requires a robust legal framework. These concerns point to the need for codified rules on the use, retention, and dissemination of AI-derived maritime data.

### 4.3 Predictive Analytics and Anomaly Detection

One of the most promising AI applications in anti-piracy operations is behavioural anomaly detection**.** Pirates often engage in suspicious navigation behaviour such as loitering near shipping lanes, clustering in small craft, or switching off AIS transponders. Traditional surveillance methods are inadequate for real-time identification of such behaviour over vast maritime domains. However, AI Applications such as Seagull Surveillance and SatShipAI, among others, can be used for situational awareness and anomaly detection, as well as vessel tracking using satellite imagery.[5]

AI's capacity for predictive threat modelling represents one of its most promising applications in piracy suppression. Through the analysis of AIS data (which provides information on vessel position, speed, and identity), AI algorithms can detect anomalous behaviour such as abrupt course changes, loitering in high-risk zones, or AIS signal spoofing.[6]

Studies have shown that supervised learning models trained on labelled AIS datasets can achieve accuracy rates of over 85% in identifying vessels that deviate from normal traffic patterns, which often precede piracy events.[7] When fused with environmental data (e.g., sea state, time of day, visibility), such models become even more robust in risk prediction. In addition, neural networks can map known pirate attack zones and extrapolate risk to adjacent maritime corridors.[8] This could be particularly useful in the GoG, where attackers often operate in shifting patterns to avoid detection. The ability to forecast likely strike areas supports pre-emptive naval deployment, rather than merely reactive patrolling.

However, predictive models are only as reliable as the data they are trained on. The GoG suffers from incomplete AIS coverage, poor data sharing among states, and frequent AIS deactivation by vessels seeking to avoid customs or regulatory scrutiny.[9] Unless these data gaps are addressed, the efficacy of AI tools will remain limited.

### 4.4 Surveillance, Evidence Collection, and Prosecution Support

AI-enhanced surveillance plays a dual role of real-time interdiction and post-incident investigation. Computer vision algorithms can scan thousands of satellite images or drone video feeds to detect small vessels lacking AIS

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maritime-security-strategy/> accessed 21 August 2025

[1] A Vogel, 'Investing in Science and Technology to Meet Africa's Maritime Security Challenges' (2011) African Security Brief < https://africacenter.org/wp-content/uploads/2015/12/ACSS-Africa-Security-Brief-No.-10-EN.pdf> accessed 21 August 2025

[2] *Ibid*

[3] *Ibid*

[4] Adeola Oyinlade & Co, 'The Use of Drones for Commercial Purposes and Privacy Rights of Others' https://www.adeolaoyinlade.com/en/the-use-of-drones-for-commercial-purposes-and-privacy-rights-of-others/ accessed 21 August 2025.

[5] A Guru, 'AI in Maritime Surveillance: Uses, Risk, and Considerations'< https://www.orfonline.org/expert-speak/ai-in-maritime-surveillance-uses-risks-and-considerations accessed 21 August 2025.

[6] *Ibid*

[7] (n 58)

[8] (n 72)

[9] M Fiorelli, 'Piracy in Africa: The Case of the Gulf of Guinea' (2014) KAIPTC Occasional Paper No. 37 <https://www.kaiptc.org/wp-content/uploads/2017/03/New%20folder/FiorelliM.2014-PIRACY-IN-AFRICA-THE-CASE-OF-THE-GULF-OF-GUINEA.pdf> accessed 21 August 2025

 

transponders—commonly used by pirates. AI can also assist in automatic license plate recognition (ALPR) of vessels, identifying repeat offenders and tracing networks.[1] From a legal standpoint, AI-generated intelligence can strengthen prosecution by providing evidentiary material such as timestamped geo-located video footage, vessel trajectories, and movement logs. These are crucial under Nigeria's SPOMO Act, which requires demonstrable proof linking suspects to acts of piracy.[2]

However, the use of AI-generated evidence raises pressing due process concerns. Courts must grapple with questions such as: How was the AI model trained? What is the accuracy margin or confidence interval? Can the defence challenge the algorithm's outputs? There is a risk that opaque 'black box' systems may be used without sufficient scrutiny, potentially infringing on fair trial guarantees under both domestic and international human rights law. As Garret notes, evidentiary reliability must be assessed not only in terms of technical accuracy but also transparency, auditability, and legal admissibility.[3]

While AI tools offer significant tactical advantages, their deployment must be aligned with institutional and legal capabilities as well. Most GoG countries lack the digital infrastructure to support high-volume data transmission and storage. Skilled personnel trained in data science, AI systems, and forensic evidence processing. Legislation that defines the legal status of AI-generated intelligence, including chain-of-custody protocols and data protection safeguards. Unless these institutional barriers are resolved, the promise of AI will remain underutilised. In contrast, the European Union and the United States have begun embedding "explainability" requirements into AI governance, mandating that AI systems used in legal contexts must offer human-understandable reasoning.[4] A similar model, if adopted in the GoG, could enhance accountability and transparency in AI-aided maritime enforcement.

In a nutshell, Artificial Intelligence holds transformative potential for combating piracy in the Gulf of Guinea through improved surveillance, threat prediction, and evidentiary support. Projects like Nigeria's Deep Blue Project offer a blueprint, but their effectiveness depends on holistic integration across legal, technical, and institutional dimensions. Nevertheless, AI cannot be viewed as a substitute for weak governance or legal underdevelopment; it must complement and be constrained by the rule of law principles.

## 5. Conclusion

The persistence of piracy in the Gulf of Guinea (GoG) represents one of the most complex maritime security threats facing the global community. Unlike the piracy phenomenon off the Horn of Africa, piracy in the GoG is characterised by attacks occurring predominantly within national maritime zones, a fluid nexus between piracy and organised crime, and jurisdictional fragmentation among coastal states. While the legal and operational challenges are substantial, this paper has demonstrated that Artificial Intelligence (AI) offers transformative tools capable of enhancing surveillance, improving predictive risk assessments, supporting evidence-based prosecutions, and ultimately deterring piracy.

However, the deployment of AI in the GoG is not a panacea. As the analysis above revealed, the core challenges stem not merely from a lack of technological capability but from deeper structural weaknesses, namely, weak state capacity, limited inter-agency coordination, lack of legal harmonisation, and socio-economic instability. AI can only be effective if these underlying institutional and normative deficiencies are concurrently addressed. The current security apparatus, even when infused with advanced technologies such as those employed under Nigeria's Deep Blue Project, remains hindered by poor data governance, low technical competence, and legal ambiguity surrounding the admissibility and reliability of AI-generated outputs.

From a legal perspective, UNCLOS and related international instruments offer a skeletal framework for addressing maritime crime, but they are ill-equipped to handle the complexities introduced by AI technologies. The narrow definition of piracy under Article 101 of UNCLOS continues to restrict jurisdictional reach and impedes multinational cooperation in waters within state sovereignty. Moreover, international law has yet to adequately regulate the evidentiary, procedural, and due process implications of AI in criminal prosecutions. In this regard, states in the GoG must not only reform domestic legal instruments such as the SPOMO Act but also engage in regional legal harmonisation to ensure interoperability and accountability.

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[1] (n 72)
[2] O W Arugu, 'The Impact of the Suppression of Piracy and other Maritime Offences Act 2019 in the Fight against Piracy in Nigeria' (2024) 11(1) NAU. JCPL 145 -158
[3] B L Garrett, 'Artificial Intelligence and Procedural Due Process' (2025) *Duke Law School Public Law & Legal Theory Series No.2025.15*
[4] J Vujicic, 'Strategic Legal Frameworks for Artificial Intelligence: Why Smaller Countries Must Act Now' (2024) 12(2) *World Journal of Advanced Engineering Technology and Sciences* 953-972 <http://dx.doi.org/10.30574/wjaets.2024.12.2.0325 > accessed 21 August 2025

 

The challenges posed by AI are not purely technical or legal, they are also normative. AI's increasing role in maritime enforcement raises critical questions about human rights, transparency, explainability, and algorithmic accountability. If improperly deployed, AI could reinforce existing inequalities in enforcement, reduce transparency in judicial proceedings, and exacerbate distrust in state institutions. It is imperative, therefore, that AI applications in maritime law enforcement are guided by rule of law principles, data protection standards, and mechanisms for independent oversight.

**Recommendations**

To ensure that AI becomes a sustainable and legally compliant tool in the fight against piracy in the GoG, the following steps are recommended:

1. Regional states should incorporate comprehensive definitions of maritime crime into domestic law that go beyond the UNCLOS definition of piracy. Model laws should be developed to guide AI-evidence admissibility, clarify evidentiary standards, and protect the rights of accused persons in AI-aided prosecutions.

2. Invest in the training of law enforcement, judicial, and technical personnel on the use of AI systems, data interpretation, and evidentiary documentation. Regional training centres should be established under the auspices of ECOWAS or the Gulf of Guinea Commission.

3. Build secure, standardised, and interoperable maritime data-sharing platforms to support AI functionality. This includes expanding AIS coverage, integrating coastal radar networks, and establishing shared data repositories governed by agreed protocols.

4. Operationalise and enhance the Yaoundé Architecture for Maritime Security (YAMS) through binding protocols for data-sharing, joint patrols, and AI-enhanced threat mapping. This requires not only political will but also budgetary commitment from member states and technical support from external partners such as the EU and IMO.

5. Establish independent oversight bodies at the national and regional levels to audit AI systems, assess algorithmic fairness, and handle complaints related to AI misuse. Legislation should mandate human-in-the-loop oversight for all AI-based interdictions and prosecutions.

6. AI deployment must be part of a broader strategy that addresses the root causes of piracy, including youth unemployment, environmental degradation, and poor governance in littoral communities. Security responses must be balanced with inclusive economic development to create sustainable maritime peace.

**Final Remarks**

The future of maritime security in the Gulf of Guinea cannot be secured through naval patrols and technology alone. It demands a multidimensional strategy that aligns technological innovation with legal clarity, institutional strength, and socio-economic justice. Artificial Intelligence, if judiciously deployed and normatively grounded, can play a catalytic role in this transformation. It can help close the surveillance gaps, accelerate interdictions, and strengthen the evidentiary chain from detection to prosecution. However, without complementary reforms in law, governance, and regional cooperation, AI will merely reinforce the asymmetries already entrenched in the region's maritime security landscape. The way forward lies not in replacing human judgment with algorithmic decisions but in using AI as a force multiplier for lawful, accountable, and effective maritime governance.

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