الجمهورية الشعبية الديمقراطية الجزائرية
République Algérienne Démocratique et Populaire
وزارة التعليم العالي و البحث العلمي
Ministère de l'Enseignement Supérieur et de la Recherche Scientifique
المدرسة العليا للإعلام الآلي بسيدي بلعباس
École Supérieure en Informatique
-08 Mai 1945- Sidi Bel Abbès

THESIS

To obtain the diploma of **Master**
Field: **Computer Science**
Specialty: **Ingénierie des Systèmes Informatiques (ISI)**

Theme

Next-Gen Cybersecurity: A Study on AI and Machine Learning for Enhanced Network Defense and Intrusion Detection

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Submission Date: **[Exact Date]**
In front of the jury composed of:

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Academic Year : 2023/2024

Abstract

This thesis explores how artificial intelligence (AI) can boost cybersecurity, specifically through next-generation firewalls (NGFWs) and intrusion detection systems (IDS). As cyber threats become more complex, traditional security methods struggle to keep up, highlighting the need for smarter, AI-driven solutions. The research covers the basics of cybersecurity, different types of vulnerabilities and attacks, and how machine learning and deep learning can help detect and counter these threats. By

reviewing the latest advancements in NGFWs and IDS, including AI-enhanced firewalls and anomaly detection, this study sheds light on how these technologies can improve network security. The importance of explainable AI (XAI) is also discussed, ensuring that these advanced systems remain transparent and trustworthy. The findings suggest that AI has the potential to make network security more adaptable and robust against new and evolving cyber threats.

Keywords: Cybersecurity, Next-Generation Firewalls (NGFWs), Intrusion Detection Systems (IDS), Artificial Intelligence (AI), Machine Learning, Deep Learning, Explainable AI (XAI).