**AI-Powered Intrusion Detection & Threat Prediction**

**Abstract**

As cyber threats evolve, traditional rule-based security solutions struggle to keep up with sophisticated attacks. Our project introduces an **AI-driven Intrusion Detection System (IDS)** that leverages deep learning techniques to identify and mitigate cyber threats in real time. The system is designed to adapt to new attack patterns using **sequential learning models** and **graph-based threat analysis**.

**Key Features**

**1. Data Collection & Preprocessing**

* Utilizes **CIC-IDS-2017** and other real-world datasets for model training.
* Extracts key network traffic features, including packet entropy, frequency analysis, and anomaly detection.

**2. AI-Based Threat Detection**

* Implements **LSTMs, Transformers, and Graph Neural Networks (GNNs)** for intrusion detection.
* Uses **Isolation Forests and XGBoost** to identify malicious network behavior.
* Enhances explainability using **SHAP and LIME** to interpret model decisions.

**3. Model Performance & Optimization**

* Evaluates models based on **accuracy, False Positive Rate (FPR), and False Negative Rate (FNR)**.
* Optimizes models for deployment on **edge devices** to enable low-latency threat detection.

**4. Real-Time Intrusion Detection API**

* A **Flask-based API** processes real-time network traffic and classifies it as **normal or malicious**.
* Deploys on **cloud infrastructure** for scalable and high-performance threat analysis.

**Tech Stack**

* **Programming:** Python
* **Libraries:** TensorFlow, PyTorch, Scikit-learn, XGBoost
* **Feature Engineering:** Pandas, NumPy, MinMaxScaler
* **Deployment:** Flask API, Cloud Hosting

**Conclusion**

Our AI-powered IDS provides a **dynamic and adaptable security solution** by integrating deep learning, anomaly detection, and real-time classification via a Flask API. This approach enhances cybersecurity resilience against emerging threats, ensuring **scalable and real-time protection** for modern network environments.