Project Number: 21

Project Title: Code-Enhanced Vulnerability Intelligence Alignment

Project Clients: Jiaojiao Jiang

Project specializations: Artificial Intelligence (Machine/Deep Learning, NLP);Security/Cyber Security;Computer Science and Algorithms;

Number of groups: 2 group

Main contact: Jiaojiao Jiang

Background:

Vulnerability intelligence is crucial for cybersecurity, but current databases struggle with fragmented and inconsistent information. This project proposes enhancing vulnerability alignment by combining code-level analysis with traditional text-based reports. By integrating semantic data from code commits, patches, and snippets with vulnerability metadata (like affected products, attack vectors, and impacts), the framework aims to enable more accurate vulnerability intelligence consolidation and improved risk assessment.

Requirements and Scope:

This project will build a system that combines code analysis with vulnerability reports. The system will extract key vulnerability aspects from text-based reports using state-of-the-art language models and will simultaneously analyze related vulnerable code snippets (PoC) using a code-aware model. These dual data streams will be constructed into a multi-relational knowledge graph. A graph neural network-based alignment module will then be used to accurately align vulnerability entries across heterogeneous sources to support dynamic risk assessments and tailored patch prioritisation recommendations.

Required Knowledge and skills:

Extract code semantics to analyze vulnerability-related commits, patches, and code snippets.

Build a multi-relational knowledge graph by combining text-based vulnerability data with code semantic embeddings.

Implement a GNN-based alignment system for accurate vulnerability matching and dynamic risk assessment.

Expected outcomes/deliverables:

A working prototype system that integrates code-level semantic analysis with text-based vulnerability intelligence for robust alignment.

Source Code thorough documentation and a user guide.