Software Requirements Specification Document

Dark web Forensic investigation and mitigation of the data using ML model.

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1. Introduction

1.1 Purpose

The main purpose of this document is to outline the software requirements for **Arjuna**, a dark web forensic investigation tool designed to de-anonymize the uploaders of Information and mitigate the unauthorized distribution of sensitive data on the dark web. This document serves as a guide for developers, stakeholders, and users by specifying the tool's core functionalities, objectives, and legal considerations. It ensures that all parties understand the scope and goals of **Arjuna**, from development through deployment.

1.2 Project Scope

The **Arjuna** tool is designed to address the unauthorized distribution of sensitive data on the dark web by identifying and de-anonymizing the uploaders of such data. The tool will perform the following key activities:

- **Crawl the dark web** to search for relevant data linked to Personally Identifiable Information (PII) and other sensitive content.
- **Scrape and extract data** from dark web sites, focusing on personal, financial, and confidential information.
- **Verify the legitimacy** of the collected data to ensure its relevance and authenticity.
- **Deanonymize IP addresses** associated with data owners to uncover the identities of individuals responsible for uploading unauthorized data.
- **Remove unauthorized or illegal data** from the dark web to mitigate its distribution.
- **Perform final verification** to ensure the sensitive data has been successfully removed from the dark web.
- **Generate a detailed report** summarizing the collected data, the results of deanonymization, and the actions taken to remove and mitigate the risks posed by the unauthorized data.

1.3 Overview

Arjuna is a tool designed to combat dark web threats. It identifies and de-anonymizes those who upload sensitive data, removes harmful content, and provides insights for law enforcement. Key features include secure tunneling, dark web crawling, data analysis, IP de-anonymization, data removal, and report generation.

2. General Description

The objective of this project is to develop a comprehensive solution for forensic investigation and mitigation of unauthorized data distribution on the dark web, utilizing advanced machine learning algorithms. **Arjuna** encompasses the following activities:

- **Tunneling**: Establish a secure tunnel to access the dark web, ensuring all communications are encrypted and anonymous.
- **Crawling**: Crawl the dark web to search for relevant URL data, navigating through hidden sites and directories.
- **Scraping**: Extract sensitive information from the crawled data, such as personal identifiers, financial records, and confidential information.
- **Data Classification**: Classify the scraped data into predefined parameters. This classified data is then fed into a machine learning model for further processing.
- **IP De-anonymization**: Trace the IP addresses associated with the unauthorized data and attempt to de-anonymize the owner who is responsible for uploading it.
- **Data Removal**: Identify unauthorized or illegal data and take appropriate steps to remove it from the dark web.
- **Verification**: After removal, verify that the sensitive data is no longer accessible on the dark web.
- **Report Generation**: Generate a detailed report summarizing the collected data, deanonymization results, and actions taken to remove and mitigate the risks associated with the unauthorized data.

Project Phases:

1. **Data Acquisition:**
    - Implement efficient crawling and scraping techniques.
    - Develop automated bots for repetitive tasks.
2. **Data Analysis:**
    - Classify scraped data using machine learning models.
    - Employ advanced techniques for de-anonymization.
3. **Mitigation and Verification:**
    - Remove unauthorized data from the dark web.
    - Verify the effectiveness of removal efforts.

3. Functional Requirements

1. Dark Web Crawling

- **Efficient crawling:** Arjuna should be capable of efficiently crawling various dark web markets and forums, including those that use dynamic content and obfuscation techniques.
- **Customizable parameters:** The tool should allow users to specify crawling parameters such as keywords, categories, and timeframes.
- **Handling CAPTCHAs and other challenges:** Arjuna should be able to handle CAPTCHAs and other common challenges encountered during web crawling.
- **Integration with dark web directories:** The tool should be able to integrate with popular dark web directories and search engines.

2. Data Extraction

- **Extraction of relevant data:** Arjuna should be able to extract a wide range of relevant data from crawled content, including text, images, metadata, and links.
- **Support for various file formats:** The tool should support various file formats, such as PDF, DOCX, and HTML.
- **Extraction of hidden data:** Arjuna should be able to extract hidden data, such as metadata embedded within images or documents.
- **Data normalization:** The tool should normalize extracted data to ensure consistency and facilitate analysis.

3. Data Analysis

- **Machine learning algorithms:** Arjuna should leverage advanced machine learning algorithms to analyze extracted data and identify patterns, anomalies, and potential threats.
- **Natural language processing:** The tool should employ natural language processing techniques to understand and analyze textual data.
- **Data visualization:** Arjuna should provide intuitive data visualization tools to help users understand analysis results.
- **Integration with external databases:** The tool should be able to integrate with external databases and services for additional data analysis and context.

4. IP De-anonymization

- **IP address tracing:** Arjuna should be able to trace IP addresses associated with uploaded content.
- **Integration with IP intelligence databases:** The tool should integrate with IP intelligence databases to obtain additional information about IP addresses.
- **Anonymization techniques:** Arjuna should be able to identify and counter common anonymization techniques used on the dark web.
- **De-anonymization methods:** The tool should employ various de-anonymization methods, such as geolocation, historical data analysis, and social network analysis.

5. Data Removal

- **Identification of unauthorized content:** Arjuna should be able to identify unauthorized or illegal content based on predefined criteria or user-defined rules.
- **Removal requests:** The tool should allow users to submit removal requests for identified content.
- **Automated removal:** Arjuna should be capable of automatically removing content from the dark web, if possible.
- **Verification of removal:** The tool should verify that the requested content has been successfully removed.

6. Report Generation

- **Comprehensive reports:** Arjuna should generate detailed reports summarizing the results of the investigation, including extracted data, analysis findings, and actions taken.
- **Customizable templates:** The tool should allow users to customize report templates to meet specific requirements.
- **Export options:** Reports should be exportable in various formats, such as PDF, CSV, and HTML.
- **Integration with law enforcement systems:** Reports should be easily exportable to law enforcement systems for further investigation.

4. Non-Functional Requirements

1. Storage

- **Capacity:** Arjuna should have sufficient storage capacity to accommodate the vast amount of data scraped from the dark web, including text, images, and metadata.
- **Durability:** The storage solution should be reliable and resilient to data loss or corruption.
- **Accessibility:** Data should be easily accessible for analysis and processing.
- **Scalability:** The storage solution should be scalable to accommodate future growth and increased data volumes.

2. EC2 Instance

- **Compute power:** Arjuna should be deployed on an AWS EC2 instance with sufficient compute power to handle the computational demands of data analysis, machine learning, and real-time processing.
- **Memory:** The instance should have adequate memory to store data, models, and intermediate results.
- **Storage:** The instance should be configured with appropriate storage options to meet the tool's data storage needs.

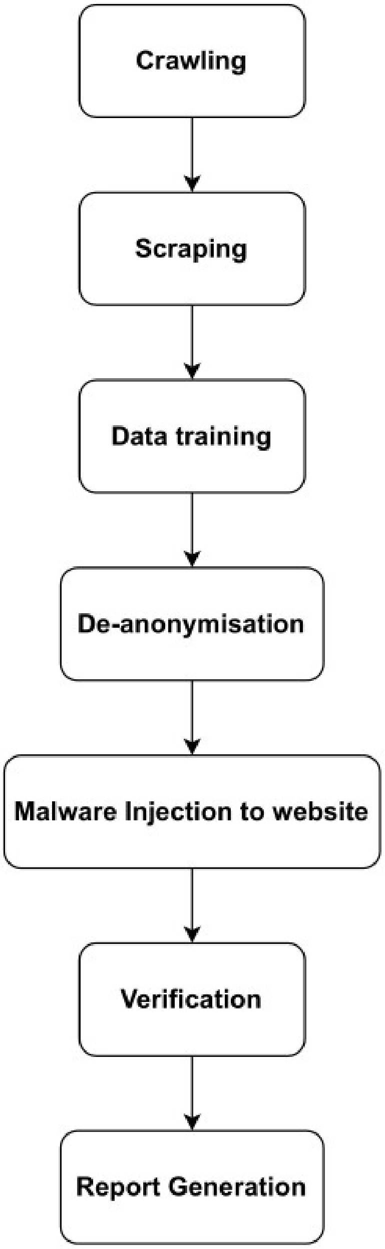
3. GPU Machine

- **Processing power:** Arjuna should leverage a high-performance GPU to accelerate machine learning training and inference, especially for tasks involving deep learning models.
- **Compatibility:** The GPU should be compatible with popular machine learning frameworks and libraries.
- **Cost-effectiveness:** The GPU should provide a good balance of performance and cost.

4. Cloud Infrastructure

- **AWS platform:** Arjuna should be deployed on the AWS cloud platform to leverage its scalability, reliability, and comprehensive suite of services.
- **Network configuration:** The cloud infrastructure should be configured to allow secure access to the dark web and external resources.
- **Cost optimization:** Strategies should be implemented to optimize resource usage and minimize costs.

5. Project Flow



6. Preliminary Schedule

Phase 1: Data Acquisition

- Task 1: Tunneling Infrastructure Setup
- Task 2: Crawler Development
- Task 3: Scraper Development

Phase 2: Data Analysis

- Task 4: Classification Model Development
- Task 5: De-anonymization Techniques Research
- Task 6: De-anonymization Tool Development

Phase 3: Threat Mitigation

- Task 7: Removal Algorithm Development
- Task 8: Verification Process Implementation

Overall Project Duration: 3 Months (1st Oct 2024 - 1st Jan 2024)

7. Appendices

References

- **CRATOR: Dark Web Crawler:** [Link] - A tool for crawling and extracting data from the dark web.
- **Cloudflare: What is Tunneling?:** [Link] - Secure tunneling methods for data transmission.
- **ACHE: Adaptive Crawler:** [Link] - Java-based crawler for hidden web content.
- **TorBot: Python-based Dark Web Crawler:** [Link] - Tool for collecting and analyzing dark web data.

8. Other Requirements

- **Data Model:** Design a robust data model to efficiently store and manage extracted data, including crawled websites, extracted information, and analysis results.
- **Indexes:** Create appropriate indexes to optimize query performance and improve data retrieval efficiency.
- **Data Security:** Implement encryption and access controls to protect sensitive data.

Legal and Ethical Considerations

- **Compliance:** Ensure compliance with relevant laws and regulations, such as data privacy laws (GDPR, CCPA) and intellectual property laws.
- **Ethical Use:** Adhere to ethical principles and avoid any harmful or malicious activities.

Reuse Objectives

- **Modularity:** Design Arjuna with a modular architecture to facilitate component reuse in other projects.
- **API Design:** Provide well-defined APIs for integration with other systems.
- **Documentation:** Create comprehensive documentation to aid in understanding and reusing Arjuna's components.

Additional Considerations

- **Scalability:** Design Arjuna to handle increasing workloads and data volumes efficiently.
- **Performance Optimization:** Implement techniques to optimize performance, such as caching, parallelization, and distributed computing.
- **Integration with Third-Party Tools:** Consider integrating with other tools or services for additional functionalities (e.g., visualization tools, threat intelligence platforms).
- **User Experience:** Focus on creating a user-friendly interface with intuitive navigation and helpful visualizations.

Appendix A: Glossary

Dark Web: A portion of the internet that is not indexed by search engines and requires specific software to access.

De-anonymization: The process of identifying an individual or entity associated with an anonymous online identity.

Machine Learning: A type of artificial intelligence that allows computers to learn from data and improve their performance over time.

Data Scraping: The process of extracting data from websites.

IP Address: A unique numerical label assigned to each device connected to the internet.

Malware: Malicious software designed to harm computer systems or steal data.

Tunneling: A technique used to create a secure connection between two networks over an insecure network.

Crawling: The process of systematically exploring the web to discover and index content.

Scraping: The process of extracting data from websites.

Data Classification: The process of categorizing data into predefined categories or labels.

De-anonymization: The process of identifying an individual or entity associated with an anonymous online identity.

Data Removal: The process of removing unauthorized or illegal content from the dark web.

Verification: The process of confirming that the desired action has been successfully completed.

Report Generation: The process of creating a detailed report summarizing the findings of an investigation.

Appendix B: Issues List

1. Data Privacy and Ethical Considerations:

- How to ensure compliance with data privacy regulations (e.g., GDPR, CCPA)?
- How to address ethical concerns related to data collection and analysis?

2. Scalability and Performance:

- How to handle large-scale data sets and ensure efficient performance?
- What strategies can be used to optimize resource utilization and minimize costs?

3. Machine Learning Model Selection:

- Which machine learning algorithms are best suited for the specific tasks involved in Arjuna?
- How to evaluate and select the optimal model for data classification and de-anonymization?

4. Data Quality and Validation:

- How to ensure the quality and accuracy of the scraped data?
- What techniques can be used to clean and preprocess the data?

5. Integration with External Systems:

- How to integrate Arjuna with law enforcement databases and other relevant systems?
- What APIs and protocols should be used for data exchange?

6. User Interface and Experience:

- How to design a user-friendly and intuitive interface?
- What visualization tools should be incorporated to help users understand the results?

7. Security and Privacy:

- How to protect sensitive data from unauthorized access and breaches?
- What security measures should be implemented to prevent malware and other threats?

8. Legal and Regulatory Compliance:

- How to ensure compliance with relevant laws and regulations, such as copyright and intellectual property laws?

9. Deployment and Maintenance:

- What deployment strategies should be used for Arjuna?
- How to ensure the tool's ongoing maintenance and updates?

10. Resource Allocation:

- How to allocate resources effectively, including hardware, software, and personnel?