Homeland Security Challenge

Strengthen the overall security posture of the nation by better preparing the current and future cybersecurity workforce.

Motivation & Goal

Inconsistencies related to job posting requirements have made it difficult to identify specific skills necessary to fulfill the needs across the cybersecurity domain. Additionally, a recent revision to the NICE Framework has prompted a need to map new knowledge, skills, abilities, and tasks (KSATs) to current job posting requirements. Finally, recent national security issues has potentially revealed a gap between what KSATs have been identified by the government and what is currently needed.

The major research questions are what are the new KSATs required for current and future cybersecurity professionals and how can we identify them?

Approach / Methodology

Utilizing the Python programming language (specifically the libraries: BeautifulSoup (bs4), nltk, pandas, requests, scikit-learn, sikit3, and TextBlob (textblob)), this project was able to collect and conduct initial text analysis on a large collection of postings and related metadata. This analysis allows us to identify prevalent topics in the job descriptions, as well as collect requirements, education, certification, and company profiles and extract parallel KSATs from these areas.

Topics
- ability to work, excessive ir, related model, digital media, skills required, possess ability
- software, tools, etc., related to information security
- Internet, cloud technology, enterprise systems, incident handling, incident clearance, cloud/clouds
- cyber defense, design information security, cloud computing, credit required, information credit required
- incident handling, network systems, industry recognized, similar industry, experience preferred, overall experience
- security, response, containment, security technologies, experience

Outcomes / Results

Using exploratory and text analytics techniques, this project identified key KSATs for each job description, as defined by the NICE Framework. Additionally, utilizing Negative Matrix Factorization (NMF) topic extraction techniques allowed this project to identify possible unidentified KSATs, as well as common topics that may exist amongst the variety of job descriptions we were drawn from.

Further, the outcomes of the project will provide opportunities for additional workforce studies in other interdisciplinary fields. In the case of the NMF extraction techniques, this will allow future projects to potentially identify new and/or critical skills for training and/or cybersecurity strategy.

Below is an example of the output for the aggregated Security Analyst job postings data, after it had been cleaned, processed, and analyzed.

1.1 SECURITY TECHNICIAN SPECIALIST

- design, test, configure, and maintain security controls for systems and networks
- define systems against unauthorized access, modification, and/or destruction
- perform vulnerability testing, risk analysis, and security assessments
- identify system and network abnormalities and report violations
- respond immediately to security incidents and provide post incident analysis, etc.

Identified KSATs:
- Category: Operation and Maintenance
- Specialty Area: installs, configures, troubleshoots, and provides maintenance and training in response to customer requirements or inquiries (e.g., network-level customer support). Typically provides initial incident information to the Incident Response (IR) Specialist.

Discussions

This project attempts to predict future workforce needs and fill the shortage of qualified cybersecurity professionals through the alignment of cybersecurity job demands with workforce supply. Additionally, it will provide important tools that continuously update the structure and common understanding of cybersecurity job components, their relationships, and career pathways.

This project provides broad impacts in several ways at different levels. For job candidates and professionals expanding their career paths, it gives a better understanding of the emerging KSATs needed for continued development. For individuals wanting to enter the field it outlines the KSATs necessary for positions and allows for better preparation regarding education and training.

Selected References


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