

Analysis of the Information Security Job Landscape in Austria

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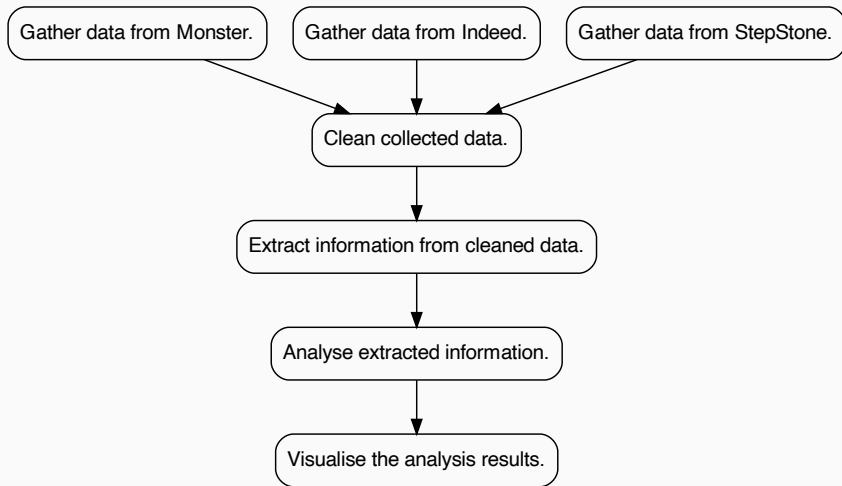
Outline

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- Overview of the Project Workflow
- Evaluation of Scraping Tools
- Implementation
 - Scraping
 - Natural Language Processing
 - Data Analysis
- Findings
- Conclusion & Future Work

- information security becoming an essential area of expertise
- same understanding of the required skills by both companies and prospective employees
- get an overview of the current situation and trends regarding the information security job landscape

- scraping of three popular job search websites: Monster, Indeed and StepStone
- cleaning of scraped data
- extraction of information from cleaned data
- analysis of extracted information

Overview of the Project Workflow



Evaluation of Scraping Tools: OctoParse

- desktop application for scraping
- free tier allows scraping unlimited pages on unlimited computers
- two concurrent scraping jobs
- allows configuring 10 different crawler configurations
- only supported on Windows

Evaluation of Scraping Tools: ScrapingBot

- does not provide an application at all
- similar to using a proxy server
- HTTP request responds with the contents including any rendered JavaScript
- free plan only includes 100 API calls per month

Evaluation of Scraping Tools: ScrapeStorm

- desktop application for scraping
- works on Linux, macOS as well as Windows
- free plan allows 10 different crawler configurations
- 1 concurrent local run
- allows 100 exported rows per day

Evaluation of Scraping Tools: ScrapeStorm Trial

- scrape Monster detail page
- content included in nested `iframe` element
- major problem: extracted content empty
- cannot extract nested `iframe` element

Evaluation of Scraping Tools: Selenium & Firefox

- supports all of the major web browsers
- only thing needed is the so called “webdriver”
- can be used with a wide array of programming languages
- most importantly: can extract nested `iframe` elements

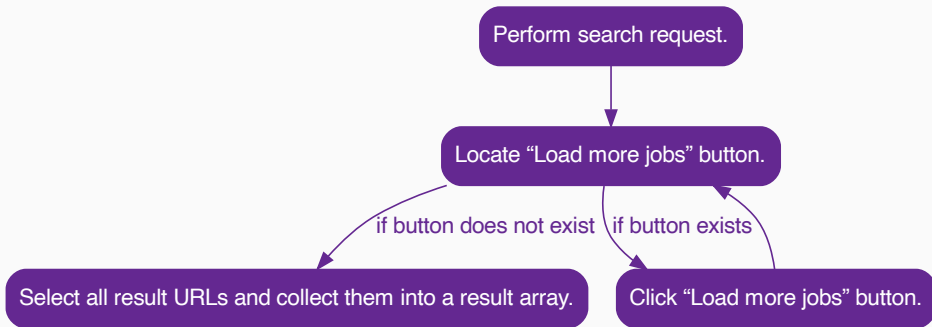
Implementation

- Scraping
- Natural Language Processing
- Data Analysis

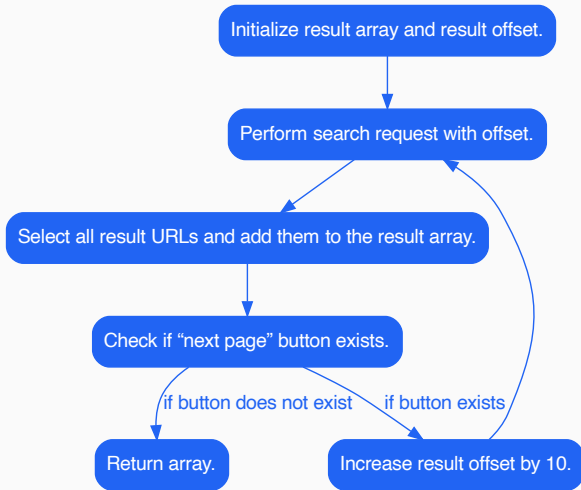
Implementation: Data Scraping

- implemented in Ruby using Rake and Selenium with Firefox
- scraping each website consists of two main steps
 - perform search request and gather URLs for detail pages
 - scrape data from detail page

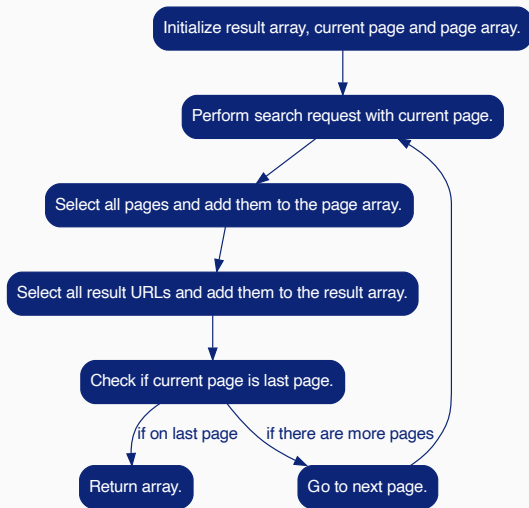
Implementation: Data Scraping - Monster URLs



Implementation: Data Scrapping - Indeed URLs



Implementation: Data Scrapping - StepStone URLs



Implementation: Data Scraping - Detail Page

- title
- metadata: location, contract type
- body content on Monster:
 - find nested `iframe` element
 - use `switch_to` function to switch to the `iframe` element
- body content on Indeed and StepStone:
 - no nested `iframe` element
 - extracted the same way as all other fields

Implementation: Natural Language Processing

- implemented in Python
- tokenisation using NLTK (Natural Language Toolkit)
- Austrian cities database from simplemaps.com

Implementation: Natural Language Processing - Extracted Data

- average salary
- location (including mapping cities to states)
- employment type (full-time vs. part-time and permanent vs. temporary)
- required education (Matura, bachelor's degree, master's degree etc.)
- required certifications

Implementation: Natural Language Processing - Example Salary

43,595 Euros	EUR 2.600,00	65,000 €
30k Euros	70.000 €	€60,000
3,100.00 EUR	€ 4.209,-	€85k
EUR 2.800,-	€ 3.933,0	€3.007,20
EUR 50k	€ 55.000,-	80.000 Euro
EUR 5700	€ 65.000,—	60000 €

- needed to be normalised to XXXXX.XX € format
- extracted using 2-grams with number and € symbol

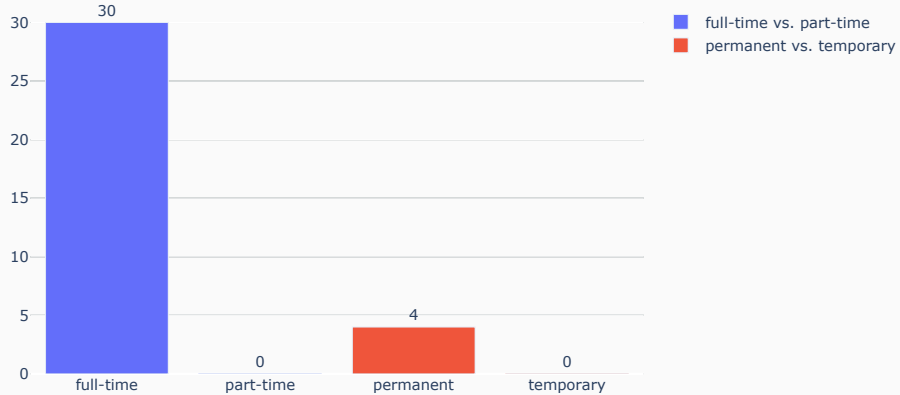
Implementation: Data Analysis

- Jupyter Notebook (interactive Python environment)
 - very useful for quickly iterating over revisions
 - graphs are displayed in the same environment as the code
- pandas framework for manipulating data
- Plotly for generating graphs

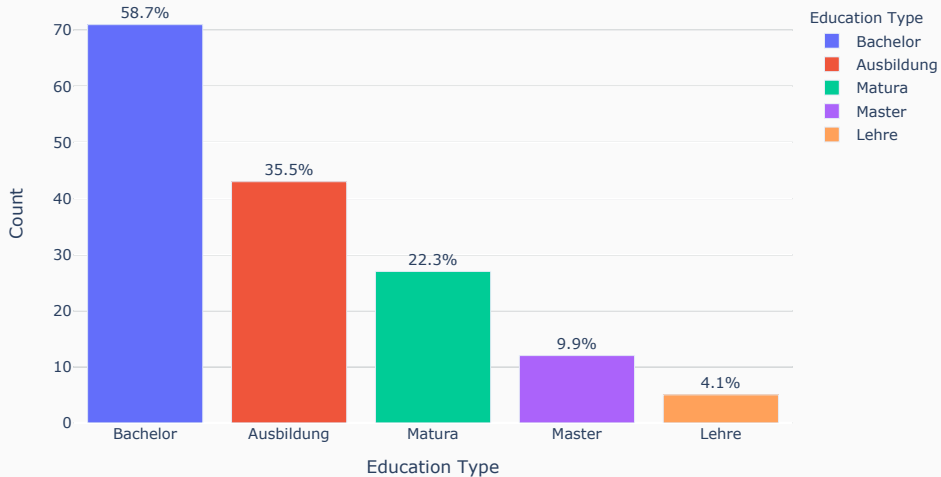
Findings

- search term “information security”
- 1538 scraped jobs in total
 - 993 from Monster
 - 282 from Indeed
 - 263 from StepStone
- 121 actual information security jobs
 - filtered according to job title

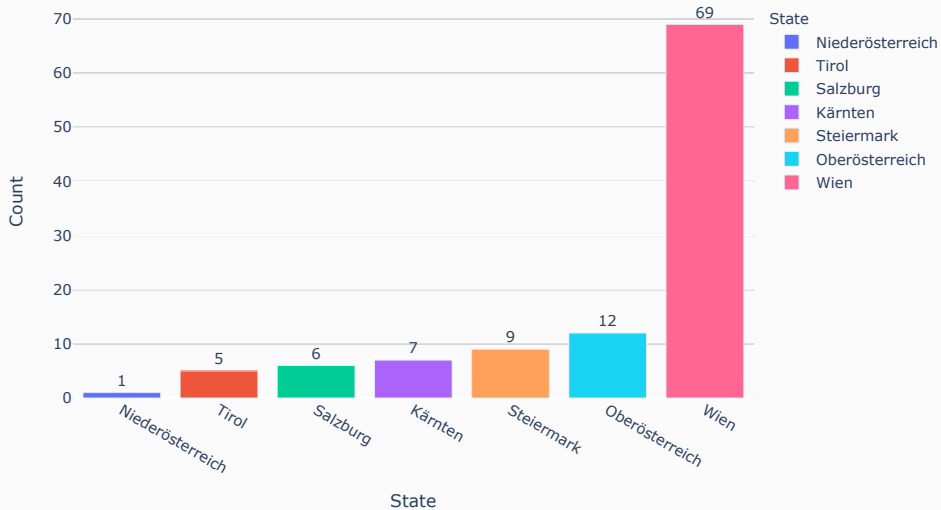
Findings: Employment Type



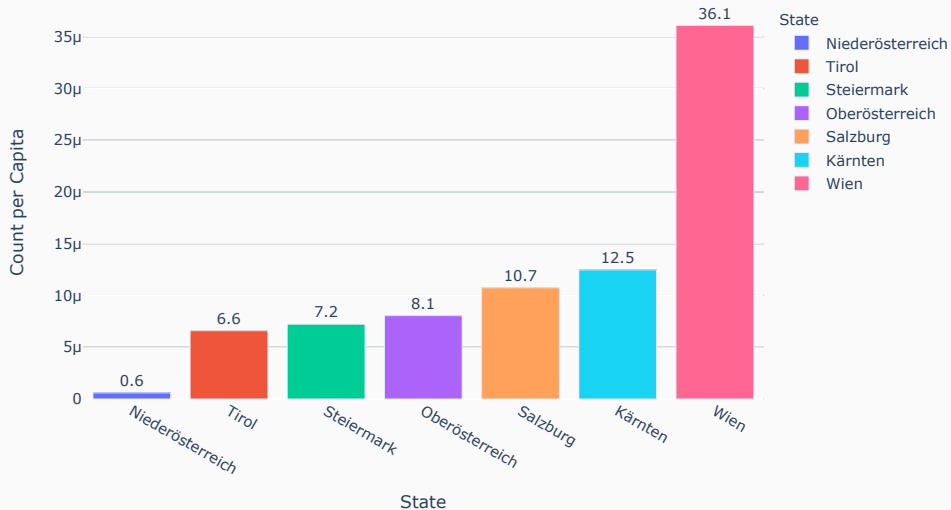
Findings: Education Type



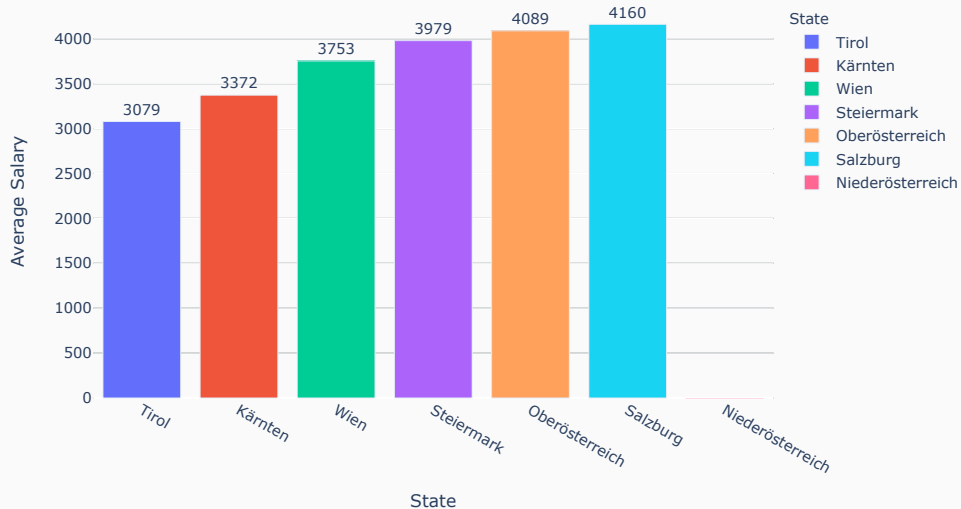
Findings: Location



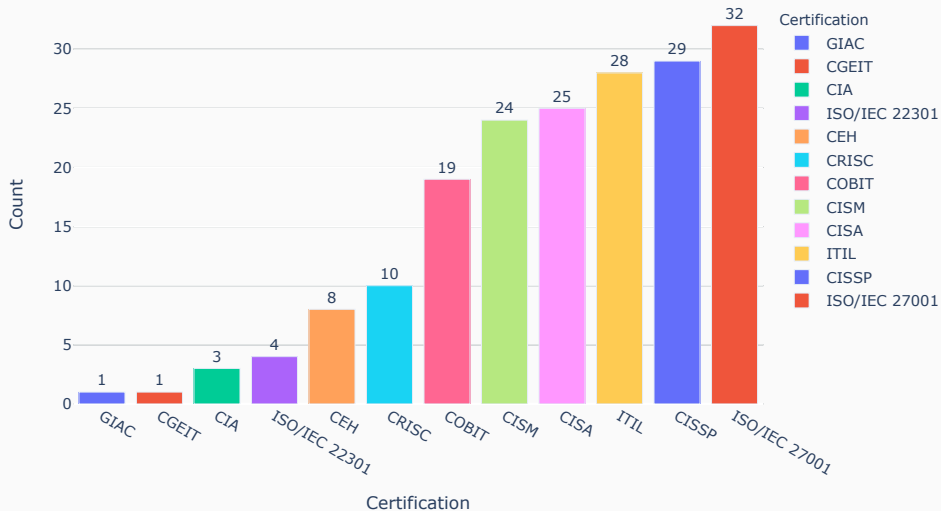
Findings: Location per Capita



Findings: Average Salary



Findings: Certifications



Conclusion & Future Work

- compared multiple scraping tools
- developed a program for scraping and analysing data from three job search sites
- more data points could be implemented in a future revision of this survey
- survey could be conducted again within a longer time span
- survey could be conducted again with additional job search websites