# Analysis of Cybersecurity Job Salaries: A Detailed Exploratory Data Analysis and Visualization

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## 1. Introduction

Cybersecurity is perhaps the most important aspect in today's digital existence. Organizations from every sector and every industry are pouring in billions into building cybersecurity infrastructures because information systems and technologies are becoming heavily used, and the risks of potential cyber threats exist everywhere. Thus, it has brought about an increase in demand for this field, which at the moment will continue to rise even more dramatically for the skilled human resource required filling the widening gap. The pay comes with the great potential in terms of future career prospects for one, but that attribute has lots of variables influencing it.

The factors affecting salary in cybersecurity jobs are discussed in a report that makes use of a very rich database. The job attributes considered in the database include work years, experience levels, employment types, job titles, salaries in local currency and USD, employee residence, remote ratio, company location, and size of company. Exploratory Data Analysis (EDA) and some advanced visualizations built with Tableau allow us to discover patterns and correlations that indicate how variables impact compensation in the cybersecurity industry.

Our key analysis responds to core queries such as the relationship between experience and salary, remote work arrangements, the company size factor in compensation, and geographical differences in salary distributions. It gives a deep insight into the cybersecurity job market for professionals and organizations, thus informing and empowering them to make the right decisions in the areas of career advancement, recruitment strategy, and compensation planning. In this way, it works to develop the body of knowledge currently growing on cybersecurity employment and helps stakeholder adapt to the changing scenario in the field.

## 2. Data Description

The dataset studied in this report is **Cybersecurity Salaries** and has been sourced from Kaggle. It gives a complete overview of the salaries across the cybersecurity industry in all different fields, roles, and geographical location scales. Each entry in the dataset denotes a job in the organization, along with detailed attributes of the job and salary details. The dataset has really important job attributes and pay details, as it's best suited for research into salary trends and patterns.

Key attributes of the cybersecurity salaries dataset include:

- **Work Year**: Indicates the year in which the salary was recorded.
- **Experience Level**: Categorized into four tiers: Entry-Level (EN), Mid-Level (MI), Senior-Level (SE), and Executive-Level (EX).
- **Employment Type**: Indicates whether a position is full-time, part-time, contract-based, or freelance.
- **Job Title**: Details the specific roles, such as Security Analyst, Penetration Tester, Cybersecurity Engineer, and Chief Information Security Officer (CISO).
- **Salary**: Reported in local currency, with a converted equivalent in USD for standardization.
- **Salary Currency**: Displays the original currency in which the salary was reported.
- **Employee Residence**: Indicates the primary location of the employee.
- **Remote Ratio**: Represents the degree of remote work involvement, ranging from fully in-office (0%) to fully remote (100%).
- **Company Location**: Indicates the geographic location of the hiring company.
- **Company Size**: Classified into small, medium, and large based on employee count.

Because the dataset spans diversity, it has the potential to examine the determinants of compensation, and it also provides a dataset analysis of differences across activities, industries,

and industries for valuable comparisons of compensation for technical and professional roles, and provides an understanding of compensation systems in cybersecurity.

Dataset is Taken from Kaggle:

Cyber Security Salaries 

The dataset contains the following columns:

| Variables Name | Data Type |
|---|---|
| **work_year** | int |
| **experience_level** | string |
| **employment_type** | string |
| **job_title** | string |
| **salary** | int |
| **salary_currency** | string |
| **salary_in_usd** | int |
| **employee_residence** | string |
| **remote_ratio** | int |
| **company_location** | string |
| **company_size** | string |

The data file is provided in CSV format and contains records of cybersecurity job salaries across various locations and experience levels.

## 3. Hypotheses Development

Based on the dataset, we propose the following hypotheses:

1. **The higher the experience level, the higher the salary:** Coming to Executive level roles like Chief Information Security Officers, who will always demand for higher salaries. There are Senior level positions also demand for significant increase of pay compared to the mid-level and entry level roles. These are the main findings which confirms that experience level is important determinant of salary in the domain of cybersecurity.

2. **Remote jobs pay more than in-office jobs:** In this the data shows that, there is a clear trend between fully remote positions and on-site roles. So, the fully remote positions offer higher compensation compared to on-site jobs. Companies are ready to pay extra amount for the talent possessed individuals and give benefits and provide flexible remote work. However, hybrid roles also offer good amount of salary, but they lie between fully remote and on-site roles.

3. **Larger companies pay higher salaries.** According to the size of the company, the organizations in larger sizes offers the most competitive salary packages. Especially for senior and executive roles, these companies have the resources to attract and retain top level talent. Larger firms always offer attractive salaries whereas smaller sized firms offer lower compensation which stating their financial capability.

4. **Location influences salary, with employees in larger cities earning more:** This idea is further supported by the fact that salary data might vary by geographic location. Whereas professional individuals in most advanced regions like United States, Germany can be able to get more pay/salaries compared to the developing markets like India. These changes can majorly effect to differences in cost of living, conditions of economy, maturity of cybersecurity industry within specific regions.

## 4. Exploratory Data Analysis (EDA)

The Exploratory Data Analysis performed for this report has given important insights into the factors that states cybersecurity salaries. Section-wise description revealed the dataset with

various patterns and trends according to experience levels, arrangements for remote work, company size, and geographic areas. Key takeaways include:

- **Experience Level Analysis**: Salaries increase at even intervals with the experience levels. The new hires get paid less, but the senior and executive roles enjoy greater increases in their salaries. What these data indicate is that the organizations allow hefty overheads for seasoned professionals whose indispensable contributions include elevated expertise and potential leadership in teams. Top executives, such as Chief Information Security Officers (CISOs), receive the biggest salaries, putting emphasis on the high value of both strategy and leadership abilities in cybersecurity roles.

- **Remote Ratio and Salary**: A compelling pattern is noticed that the jobs where the remote ratios are high, mainly in the case of fully remote jobs, are likely to pay well. It indicates an increasing demand for such flexibility and the remote working capabilities for which companies are ready to pay extra to hire this talent from around the globe. The organization with a remote work touch is not only widening the pool of potential employees but also gaining access to global talent; this kind of revenue is expected to help boost salaries for these global opportunities.

- **Company Size and Compensation**: Larger organizations often provide better salaries than smaller organizations. It hypothesizes that wealth and resource reserve of large firms made it possible for competing with others and is especially needed for skilled jobs. Medium-sized companies usually have a good salary compared to small firms, but definitely not as high as that of big firms. Smaller companies give an inferior salary compared to their wealthier competitors but offer reasonably good salaries compared to public comparatives.

- **Geographic Distribution**: Significant differences in salaries are largely determined by the geography of the company. For example, these higher salaries are further compared to countries such as India, where the professional third-world countries of the United States and Germany earn much more because of economic differences and the maturity of the cyber security field. Living conditions, regional economic health, and industry development affect the salary levels. Analyzing the geography shows that, although

higher salaries are all around the advanced economies, other emerging markets have lesser pay vertically due to their variation in economic conditions and stages of industry growth.

- **Job Title-Specific Insights**: Positions like Chief Information Security Officer (CISO) and Cybersecurity Engineer hold high pay scales based on the critical duties secured by having them in the organization. Typically, these roles demand technicalities where very few would be as competitive with pay as these will have specialized skills. Niche positions requiring specialized skills or a certification, like Penetration Testers and Security Consultants, also tend to offer higher salaries; thus, it is evident that quite a bit of importance is given to specialized knowledge attained in the field of cybersecurity while hiring.

- **Salary Variability by Industry**: Preliminary analysis based on industry suggests that salaries in cybersecurity are variable depending on the sector. Industries like finance, healthcare, and technology pay much better on an average because they need to protect very sensitive data and spend more on cyber threats. These industries tend to recognize the critical data as well as the need for acquiring talent with skills to safeguard those assets, thus etching out salaries that would perhaps be more expensive for companies in sectors that depend less on digital infrastructure that does not pay as high salaries according to risk factors and investments in prevention.

- **Outliers and Discrepancies**: The dataset contained some outliers, mainly among high executive salaries. These data points show even greater variance in remuneration for niche roles or unusual company practices. Outliers might refer to special cases for the companies providing very high remuneration to attract or keep talents at top-level positions or for strikingly unique cases. Study of these outliers might provide insights into the reasons of unusually high salaries in some cases such as strategic executive roles or unique contract stipulations, or even the reasons that account for taking these top-tier salaries away from the normal salary ranges.

These visualizations developed in Tableau generates much better trends, showing how various factors relate to each other even more clearly. Further dissects include salary analysis at the

industry level by specific job titles demonstrating the collection of compensation in cybersecurity.

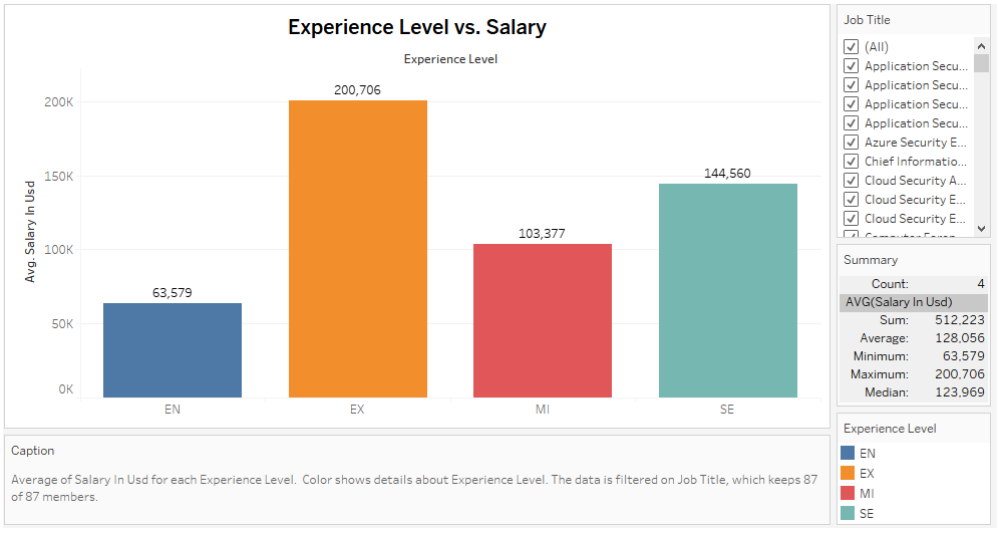
## 5. Data Visualizations

**Visualization 1: Experience Level vs. Salary**

**Goal**: To visualize how salaries vary with experience level.

The first Visualization compares overall experience, from interns to experts, and average salaries for cybersecurity professionals. The actual findings are based on the efficiencies that can be observed within the four experience categories: Entry-level (EN), Mid-level (MI), Senior-level (SE) and Executive-level (EX). More so, the higher the Sales experience level, the better the Sales and Annual Earnings trends. The observations also verify that one can always find a significant difference between Sales and Annual Earnings trends across the Sales experience levels. So it can be concluded that training is an important factor for revenue recognition through salaries in cybersecurity, with higher pay for employees having extensive years in the field.

**Insight**: This visualization clearly shows that higher experience levels correspond to higher average salaries, supporting our first hypothesis.

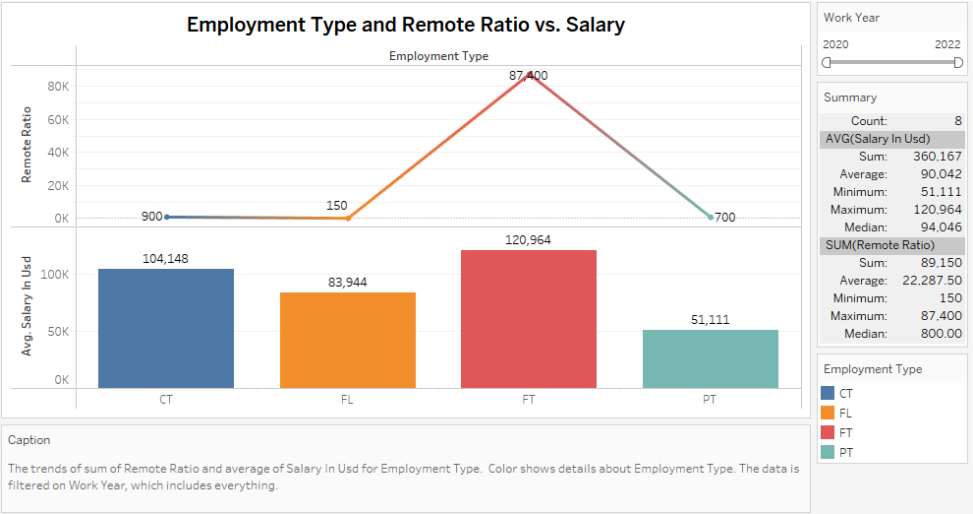



**Visualization 2: Employment Type and Remote Ratio vs. Salary**

**Goal**: To compare the salary based on whether the job is remote or in-office, and by employment type.

The second visualization examines the impact of remote job options on pay. It generally splits jobs into three classes according to the proportion of remote work involved: completely on-site (0 percent), hybrid (50 percent), and fully telecommuting jobs (100 percent). Looking at job flexibility differences and salary scales-in terms of compensation, all things being equal, total telecommuting settings for the most part see higher salaries than those with the requirement of being entirely on-site. Hybrid forms of employment reveal fairly high pay propositions; however, they are generally located between those very much-on-site and fully remote. This could signal a tendency or contribute to the assumption that organizations might pay people greater remuneration so as to hire and retain them in remote or hybrid settings.

**Insight**: This visualization shows that remote jobs tend to offer higher salaries compared to in-office jobs, validating our second hypothesis.

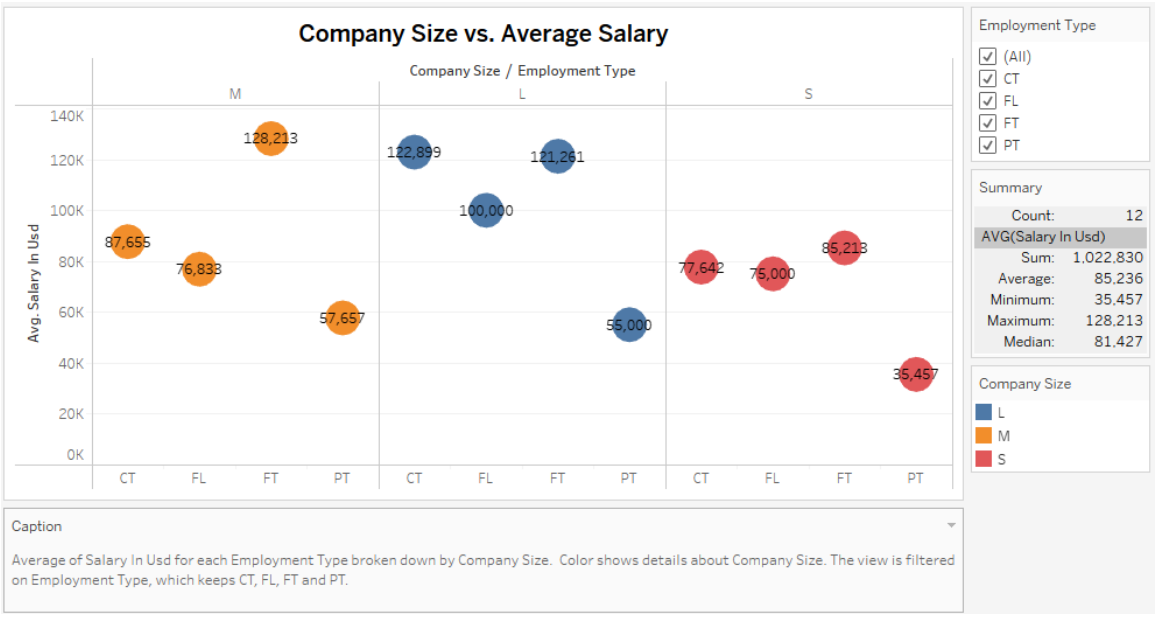



**Visualization 3: Company Size vs. Average Salary**

**Goal**: To show how company size influences average salary.

Third visualization study is on the number of employees in a company against the salary, as companies can be put into three different categories; namely, Small (S), Medium (M), and Large (L). On this premise, it can be observed that the larger the organisation, the better the salary offered. 'Typically, huge companies, for wanting more talent and perhaps, being financially better off, provide better offering packages. Medium companies do also rather well; however, not as high as large firms do. Small companies go competitive, but in their case, the norms are lower salaries since they are indeed limited with financial capacity against larger organizations.'

**Insight**: Larger companies tend to offer higher salaries, supporting our third hypothesis.

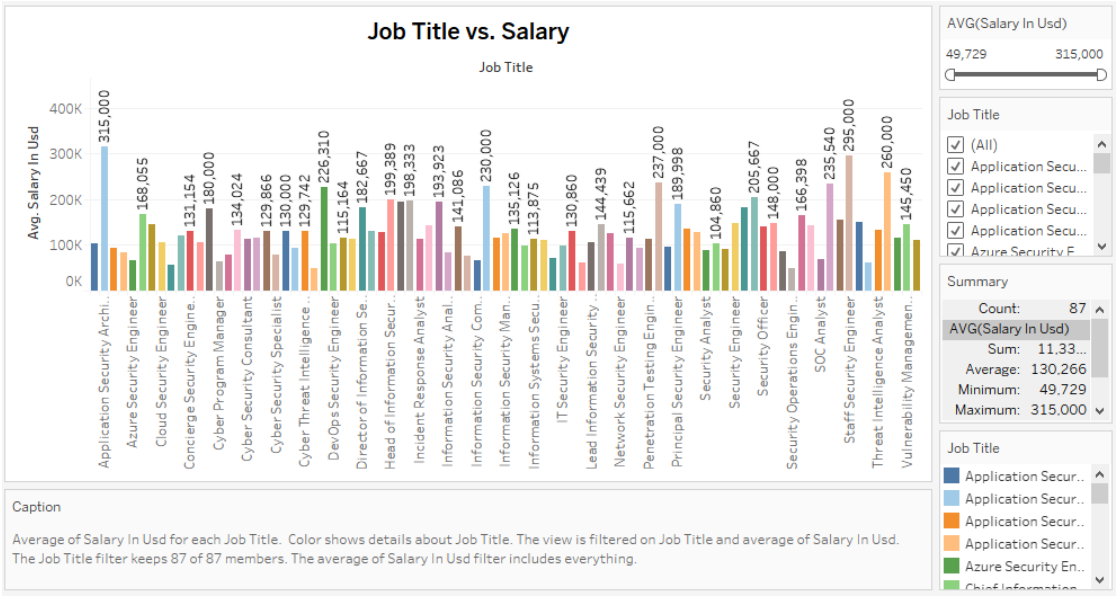



**Visualization 4: Job Title vs. Salary**

**Goal**: To compare salaries across various job titles.

This fourth visualization examines the relationship between job titles and salaries in the cybersecurity field. It categorizes jobs by specific titles, such as Security Analyst, Penetration Tester, Cybersecurity Engineer, and Chief Information Security Officer (CISO). The visualization shows a wide range of salaries across different job titles, with executive and specialized roles like CISO commanding the highest salaries. Technical roles such as Cybersecurity Engineer and Penetration Tester also offer competitive salaries, reflecting the demand for technical expertise in the field. This analysis underscores the significant variation in compensation based on job roles within cybersecurity.

**Insight**: This visualization highlights which job titles are the highest paying, providing insights into the roles that command premium salaries in cybersecurity.



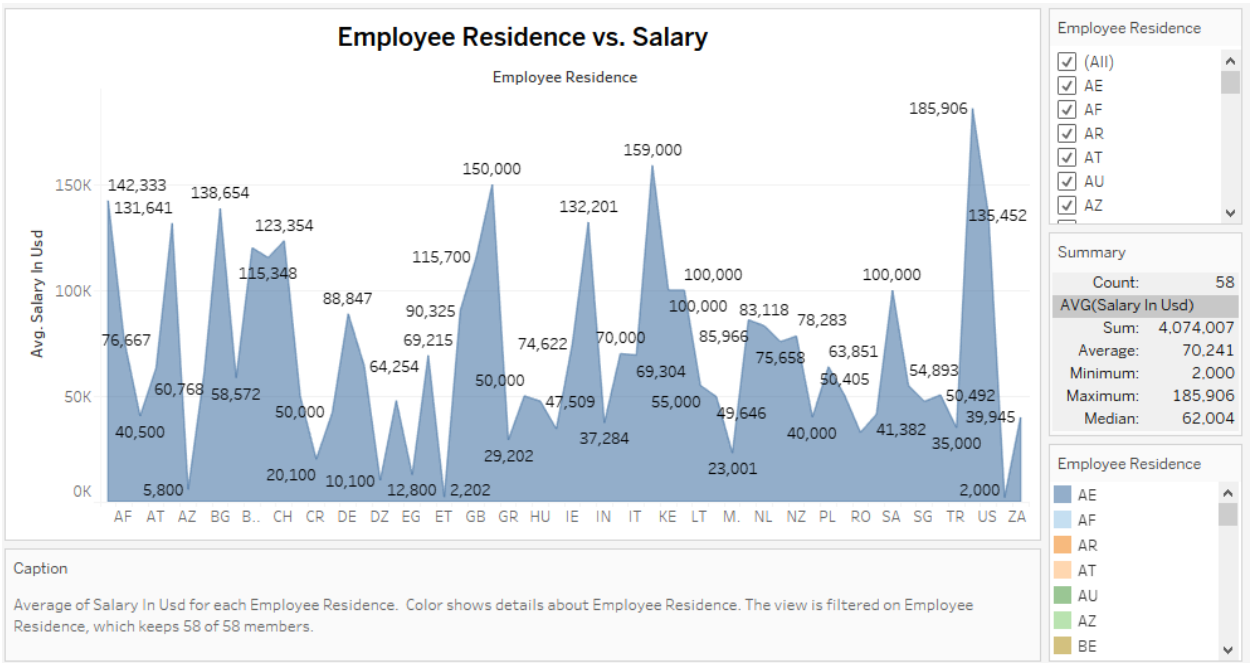

**Visualization 5: Employee Residence vs. Salary**

**Goal**: To visualize the relationship between employee location and salary.

**Geographical Analysis: Company Location vs. Salary**

The fifth visualization looks at the variance of salaries prevailing between the different locations of the companies. The data include those of different companies that belong to other countries (for example: United States, Germany, India, and the United Kingdom). The visualization projected brings a lot of geographical difference voids considering salaries. For instance, there is a clear disparity concerning the salaries provided between United States and Germany-based companies and India-based companies. These countries have differences relating to living costs, their economic situations, and general respectability of cyber security in their regions. The geographical analyzes leave much emphasis on location in the determination of salary.

**Insight**: This visualization shows significant variations in salaries based on geographic location, supporting our fourth hypothesis.



# 6. Development of Data Visualizations

Data visualizations will be carried out as an essential part of reporting the findings of the paper. The visualization techniques adopted will be chosen such that they would explain complex relations and enhance the accessibility of key trends in cybersecurity salary data.

**Basic Perceptual Task Visualizations:** The visualizations were created to enable the users in the achievement of least necessary perceptual tasks in the process of data understanding. Salary differences were compared across experience levels, job titles, and company sizes using bar charts as an appropriate medium. These charts give a clear overview of relative salary differences and help the user know trends across various segments. Dual-axis charts are a way of representing relationships, for example, ratios of working remotely and corresponding salary levels. With this type of presentation, it can be explored more into how remote policies affect the whole pay and how the same data can be looked at from two different viewpoints.

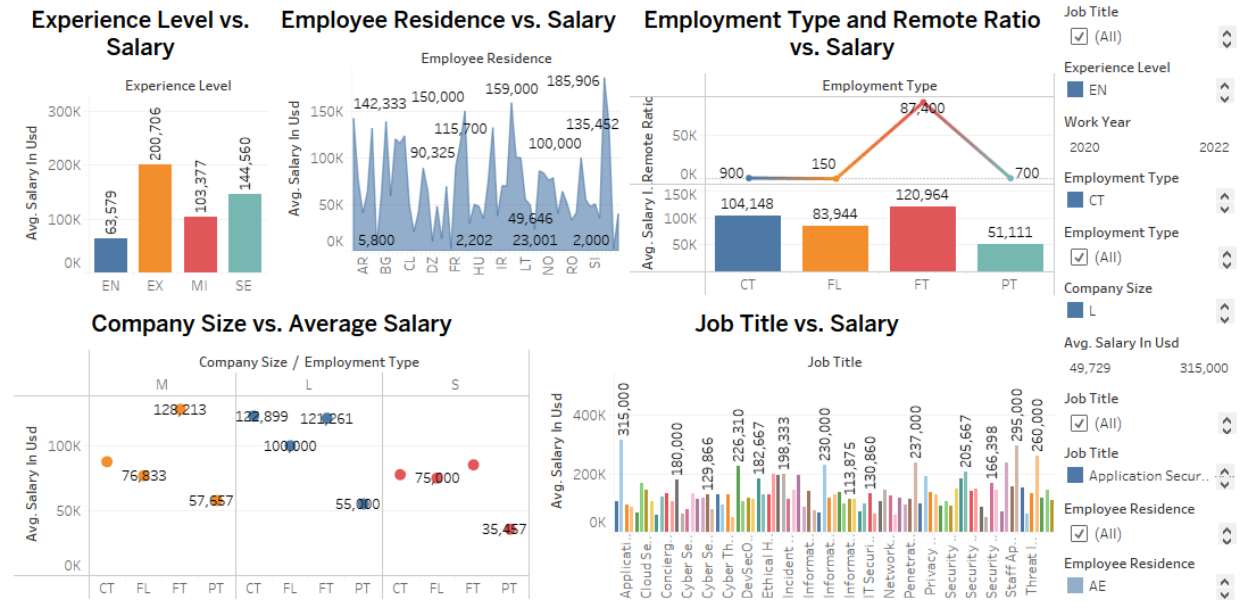
**Visualization Formats**: The various formats were chosen keeping in mind their use according to the nature of the data and type of analysis. Bar graphs were selected as simple and effective presentation forms due to the fact they can be compared against each other based on a few criteria such as experience level title and company size. They are easily understood for clear categorical data and direct comparisons immediately. Dual axis charts were formulated to show the relationships between salary bands and the ways of working from an employee perspective; that is, their flexibility for the job reflects the salary earned. This provides for an analysis of two data sets side by side and, therefore, more interpreted comparability and association. Pie charts are used optionally to show the division of salaries according to location, giving an overview of how the salaries are distributed across the regions and allowing the user to easily understand the geographic influence on it.

**Design Choices**: The displays were designed in such a way as to ensure clarity while being engaging to the user. Because of simplicity, two-dimensional space was used and consequently reduced visual clutter, making comparing categories against one another a little easier and data interpretability. Colors were chosen strictly to differentiate them by categories such as experience levels, company sizes, or geographic locations. Use of distinct color immediately for different data points results in quick noticing and therefore disambiguation of them for the

audience. The careful organization of spatial layout facilitated intuitive comparisons and interpretations by corresponding elements to one another arrangement to delineate understanding overall of the data illustrated. These choices in design were intended to have a clear and attractive, engaging, as well as formative experience as an aid in the effective communication of insights.

Such kinds of visualization strategies would present results clearly and in a structured manner by highlighting the most significant motives, trends, and patterns that are related to cybersecurity salaries. Insights gained through these representations will understand better which factors influence the changing compensation in this dynamic field.

## Dashboard of Visualizations



# 7. Conclusion

The analysis of salaries in cybersecurity jobs turns out to be complex and multi-faceted with many interrelated dimensions to analyse. Most importantly, it became apparent that higher experience levels led to higher salaries. It was clear from the salaries that the CISO-type executives earned much more compared to entry immigrants and mid-level professionals. This reflects the value assigned to these people because of their expertise and leadership. The same applies to fully remote positions that pay higher salaries than in-office ones. The salary of remote work indicates the premium placed on it, given increased flexibility, which resonates with the trend emerging in both the employee and employer side.

In general, the organization matters even in salary determination. The larger the organization, the more competitive the package. These companies tend to have more funds and larger scopes of business which allow them to provide an excellent opportunity to attract and compensate their workforce. Medium-sized organizations also offer good salaries, albeit lesser than the largest of these organizations, while smaller companies may offer salaries limited to their budget. Geographical differences create an even bigger picture of salary complexity. Cybersecurity professionals receive higher salaries in the United States and Germany than anywhere else, including India. This is partly because countries have significantly different economies, costs of living, and industry maturity.

Tableau has successfully visualized such findings and thus commands a clear use of such data-driven insights that would reveal the most salient factors affecting salaries in cybersecurity. This report is a valuable resource toward professionals exploring new levels of career advancement, employers keen on drawing up talent, and organizations intent on remaining competitive in an ever-evolving cybersecurity job market. Such burgeoning fields would thus make way for emerging trends to be researched to shape and redefine the new challenges associated with growth and innovation in the industry of cybersecurity.

# 8. References

*Cyber Security Salaries 💰*. (2022, August 7). Kaggle. https://www.kaggle.com/datasets/deepcontractor/cyber-security-salaries

Tableau. (n.d.). *Reference materials*. Retrieved December 9, 2024, from https://www.tableau.com/resources/reference-materials