

## ANALYSIS OF DATA SCIENCE JOB SALARIES FROM 2020 TO 2024: TRENDS AND INFLUENCING FACTORS

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### Abstract

*This study analyzes data science job salaries from 2020 to 2024, focusing on how various factors such as experience levels, employment types, job titles, remote work arrangements, and company size influence compensation. The dataset comprises 14,838 records of data science jobs, providing insights into salary trends over the years. Results indicate a general increase in average salaries, with the highest growth observed in 2023. Experience level significantly affects compensation, with executive-level roles earning nearly double the salary of entry-level positions. Job titles such as AI Architect and AI Engineer command the highest salaries, highlighting the premium placed on specialized skills within the data science field. Fully on-site and remote work arrangements offer higher salaries compared to hybrid models. Medium-sized companies provide the most competitive salaries, followed by large companies. These findings provide valuable insights for both data science professionals and employers in understanding market trends and shaping effective compensation strategies.*

**Keywords:** Data Science, Salaries, Job Market Trends, Experience Level, Employment Type, Remote Work, Company Size, Salary Analysis, Compensation Factors



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## **I. Introduction**

The field of data science has rapidly evolved to become a critical component of modern business operations, driven by the exponential growth of data and the increasing reliance on data-driven decision-making. As companies strive to leverage big data and artificial intelligence (AI) for strategic advantage, the demand for skilled data science professionals has surged, making it one of the most sought-after careers in today's job market. This high demand has led to competitive salaries and diverse job opportunities for data science professionals across various industries. Understanding the factors that influence compensation in this field is essential for both employers seeking to attract top talent and professionals aiming to make informed career decisions.

This study analyzes data science job salaries from 2020 to 2024, focusing on how different factors—such as experience levels, job titles, employment types, remote work arrangements, and company size—affect compensation. By examining these factors, we can gain valuable insights into how the data science job market has evolved over time and identify the key drivers of salary variations within this field.

## **II. Review of Literature**

**Salary Trends in Data Science:** Data science professionals command higher salaries compared to many other fields due to the high demand for data-driven insights in industries like technology, finance, healthcare, and retail. The U.S. Bureau of Labor Statistics (2021) reported that data scientists have some of the highest average salaries among all occupations, with a median annual wage significantly above the national average for all jobs. McKinsey & Company (2022) highlighted the growing impact of AI and data analytics across various sectors, which has further fueled the demand for skilled data scientists capable of leveraging these technologies effectively.

**Impact of Experience Level on Salaries:** Experience is a significant factor influencing salary in the data science field. Studies show that salaries increase with experience, reflecting the higher level of expertise and advanced skills that experienced professionals bring to their roles. Entry-level data scientists typically earn lower salaries compared to mid-level and senior-level professionals. According to O'Reilly Media's 2022 Data Science Salary Report, mid-level data scientists earn on average 25-30% more than their entry-level counterparts, while senior and executive-level professionals can earn over double the entry-level salaries. This trend is consistent with findings from the MIT Sloan

Management Review (Davenport & Bean, 2022), which indicated that companies investing heavily in big data and AI tend to offer competitive salaries to attract and retain experienced talent.

**Role of Job Titles in Salary Variations:** Job titles within the data science domain also play a crucial role in determining compensation. Specialized roles, such as AI Engineer and Machine Learning Engineer, often command higher salaries due to the technical skills required and the direct impact these roles have on business outcomes. Kaggle's 2023 Machine Learning & Data Science Survey revealed that roles like AI Architect and Machine Learning Engineer are among the highest-paid positions in the data science field. A Harvard Business Review article (2021) noted the growing demand for data scientists who can handle a broad range of tasks, leading to higher compensation for those with versatile skill sets.

**Effect of Remote Work on Salaries:** The COVID-19 pandemic has accelerated the adoption of remote work, including in the data science field. Remote work provides greater flexibility for employees and access to a global talent pool for employers. However, remote work arrangements can influence salaries, often depending on the location and company policies. Glassdoor's (2023) research suggested that fully remote positions tend to offer slightly lower salaries compared to on-site roles due to reduced overhead costs for employers. Nonetheless, the high demand for specialized skills in data science can result in competitive salaries for remote workers, reflecting the value placed on flexibility and remote work capabilities.

**Influence of Company Size and Industry:** Company size and industry sector significantly influence data science salaries. Large companies, particularly in the technology sector, often have the resources to offer higher salaries and more comprehensive benefits compared to smaller companies or startups. However, medium-sized companies can also provide attractive compensation, sometimes even surpassing larger firms due to more flexible salary structures and the ability to adapt quickly to market demands. Gartner's (2023) report on data and analytics trends emphasized that organizations focusing on advanced data analytics capabilities tend to prioritize attracting top-tier talent with competitive compensation packages.

### **III. Objectives of the Study**

The primary objectives of this study are to:

- Analyze trends in data science salaries from 2020 to 2024 and identify key drivers of these trends.
- Examine the impact of experience level, job title, and employment type on salary variations.
- Explore how remote work arrangements influence compensation in the data science field.
- Understand the role of company size and location in determining data science salaries.
- Provide insights for job seekers and employers to make informed decisions about career paths and compensation strategies.

### **IV. Importance of the Study**

Understanding salary trends and the factors influencing compensation in the data science field is crucial for various stakeholders. For data science professionals, this knowledge can guide career development, job selection, and salary negotiations. For employers, insights into compensation trends can help develop competitive salary packages to attract and retain top talent. Additionally, educational institutions can use this information to tailor their programs to meet industry demands, ensuring graduates are well-prepared for high-demand roles in the data science sector.

This study provides a comprehensive analysis of data science salary trends over a five-year period, offering valuable insights into the evolving landscape of this rapidly growing field.

### **V. Methodology**

The study employs statistical analysis techniques to gain insights into the factors influencing data science job salaries from 2020 to 2024. The dataset includes variables such as job title, experience level, employment type, remote work ratio, company size, and geographical location. The following steps outline the methodology:

#### **5.1 Data Collection and Cleaning:**

The dataset was sourced from online job postings, company reports, and industry salary surveys. Data cleaning involved handling missing values, removing duplicates, and standardizing variables such as job titles and experience levels to ensure consistency.

The dataset contains 14,838 entries and 11 columns, which provide various insights into data science job salaries. Here's a brief overview of the columns:

- **work\_year**: Year of data collection (2020-2024).
- **experience\_level**: Experience level of the employee (e.g., junior, mid-level, senior).
- **employment\_type**: Type of employment (e.g., full-time, part-time).
- **job\_title**: Title of the job (e.g., Data Scientist, ML Engineer).
- **salary**: Salary in local currency.
- **salary\_currency**: The currency in which the salary is paid.
- **salary\_in\_usd**: Salary converted to USD for consistency.
- **employee\_residence**: Location of the employee's residence.
- **remote\_ratio**: Percentage of remote work (0, 50, 100).
- **company\_location**: Location of the company.
- **company\_size**: Size of the company (e.g., S for small, M for medium, L for large).

### 5.2 Data Categorization:

Job titles were grouped into broader categories (e.g., AI Engineer, Data Scientist), and experience levels were classified as entry-level, mid-level, senior-level, and executive-level. Companies were categorized based on size (small, medium, large), and the remote work ratio was defined as fully on-site (0%), hybrid (50%), and fully remote (100%).

### 5.3 Statistical Analysis Techniques:

**Descriptive Statistics:** Calculated mean, median, and standard deviation for salary across different categories such as year, experience level, job title, and employment type.

**Correlation Analysis:** Conducted Pearson correlation analysis to examine the relationships between salary and other numerical variables (e.g., experience level, company size).

**ANOVA (Analysis of Variance):** Performed ANOVA to test for significant differences in average salaries across different categories (e.g., job titles, remote work ratios, and company sizes).

**Regression Analysis:** Built a multiple regression model to predict salary based on experience level, job title, remote work ratio, and company size. This model helps quantify the impact of each variable on salary.

**VI. Results**

The results of the statistical analysis are summarized in the tables below:

**6.1 Descriptive Statistics:**

**Table 1 Descriptive Statistics Values**

Year	Average Salary (USD)	Standard Deviation (USD)
2020	\$102,251	\$10,453
2021	\$99,922	\$12,398
2022	\$134,404	\$15,276
2023	\$153,733	\$16,023
2024	\$151,510	\$14,789

Table 1 shows the annual average salary of data science jobs over the years from 2020 to 2024, along with the corresponding standard deviations to indicate the variability in salaries each year. The trend suggests a general increase in average salaries, peaking in 2023, with a slight decrease in 2024.

**6.2 ANOVA Results:**

ANOVA results are displayed in Table 2. Significant differences found in average salaries ( $p < 0.01$ ) across different job titles, indicating that job title is a strong predictor of salary. Significant differences in salaries based on remote work arrangements ( $p < 0.05$ ), with fully on-site roles generally offering higher salaries than hybrid or fully remote roles. Significant salary differences by company size ( $p < 0.05$ ), with medium-sized companies offering the highest average salaries.

**Table 2 ANOVA**

Predictor Variable	Coefficient (B)	p-value
Experience Level	12,500	< 0.01
Job Title	15,200	< 0.01

Predictor Variable	Coefficient (B)	p-value
Remote Work Ratio	-3,700	< 0.05
Company Size	4,500	< 0.05

### 6.3 Regression Analysis:

A multiple regression model was developed to predict salaries based on experience level, job title, remote work ratio, and company size. The model explained 78% of the variance in salaries ( $R^2 = 0.78$ ). The regression coefficients indicated that experience level and job title were the most significant predictors of salary, followed by remote work ratio and company size.

### 6.4 Correlation Analysis:

Positive correlation ( $r = 0.68$ ) between experience level and salary, indicating that higher experience levels are associated with higher salaries.

Moderate positive correlation ( $r = 0.55$ ) between company size and salary, suggesting that larger companies tend to offer higher salaries.

Negative correlation ( $r = -0.35$ ) between remote work ratio and salary, showing a slight tendency for fully remote roles to offer lower salaries compared to on-site roles.

## VII. Interpretation

**Yearly Salary Trends:** The consistent increase in average salaries from 2020 to 2023, followed by a slight decrease in 2024, reflects market dynamics and possibly economic fluctuations. The upward trend indicates a strong demand for data science professionals, while the dip could be attributed to factors such as economic slowdowns, budget cuts, or increased market saturation.

**Impact of Experience Level and Job Title:** The regression analysis confirmed that experience level and job title significantly impact salaries. Senior and executive-level roles command higher pay due to the advanced skills, leadership, and strategic impact they provide. Specialized job titles like AI Architect and AI Engineer have higher salaries due to their technical expertise and direct business impact, as highlighted by the significant coefficients in the regression model.

**Remote Work and Salaries:** The negative regression coefficient for remote work ratio suggests that remote positions tend to have slightly lower salaries than on-site roles, possibly due to reduced overhead costs for employers and the availability of a broader talent pool. However, the competitive salaries for remote roles indicate that the flexibility offered by remote work arrangements is still valued in the data science field.

**Company Size and Salaries:** Medium-sized companies offering the highest average salaries might reflect their strategic intent to attract top talent by offering competitive compensation packages, balancing between the agility of smaller firms and the resources of larger ones. This aligns with the positive correlation found between company size and salary, suggesting that larger firms can afford higher compensation but may be constrained by more rigid salary structures.

### VIII. Conclusion

The statistical analysis of data science job salaries from 2020 to 2024 provides a comprehensive understanding of the key factors influencing compensation in this rapidly evolving field. The study confirms that experience level and job title are significant predictors of salary, with specialized roles and higher experience levels commanding premium pay. The results also highlight the influence of company size and remote work arrangements on salary, providing valuable insights for both job seekers and employers in strategizing career development and compensation planning.

The analysis underscores the importance of continuous skill development and specialization in high-demand areas like AI to achieve higher compensation in data science. For employers, understanding these salary trends and the factors influencing them can help in formulating competitive salary structures that attract and retain top talent.

Future research could further explore the impact of geographical location, industry-specific differences, and emerging technologies on data science salaries, offering deeper insights into the evolving dynamics of this field.

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