

Exploring Pivotal Dynamics of the Technological Job Market Through Data Analysis

Harini Anand
Bengaluru, India
harini.anand@gmail.com

Aishwarya Srinivasan
Bay Area, USA
aishgrt@gmail.com

Abstract—The job market has been changing ever so drastically, with the steady influx of AI, post-pandemic trends, and a refined shift in the skill sets required in the current industry. This white paper explores these dynamics through the analysis of a dataset with 3.5L entries, provided by GrepSr. We had access to study the various relationships across features such as Job Title, Job Location, Company Name, Ratings, Reviews and Benefits, giving us a holistic view of the job market dynamics. We also list out skill sets that are in demand for the most coveted jobs and analyse the trend shift in this evolving market.

Index Terms—Job market, Technological advancements, Post-pandemic trends, Skill sets, Data analysis, Job titles, Geographical shifts, Company ratings, Benefits, Salary distribution

I. INTRODUCTION

The job market has been changing ever so drastically, with the steady influx of AI, post-pandemic trends, and a refined shift in the skill sets required in the current industry. We are using a dataset with 3.5L entries, provided by GrepSr. We had access to study the various relationships across features such as Job Title, Job Location, Company Name, Ratings, Reviews, and Benefits, giving us a holistic view of the job market dynamics.

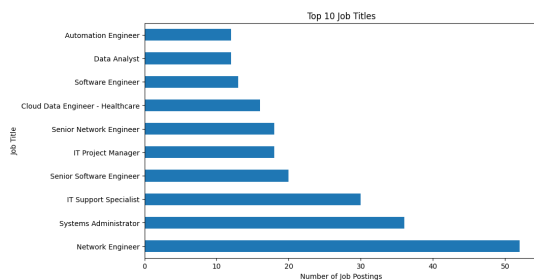


Fig. 1. Graph showing top job titles in the dataset

Historically, certain kind of job roles have been the backbone of many industries. Network Engineers, System Administrators, and similar positions have long been essential for maintaining IT infrastructure. However, the rise of artificial intelligence (AI) and automation is reshaping these roles. Companies now seek professionals with expertise in cloud computing, data analysis, and machine learning to leverage the benefits of AI technologies.

The COVID-19 pandemic has accelerated these transformations, pushing companies to adopt remote work models at an

unprecedented rate. This shift has led to a rise in demand for roles such as remote software developers, cybersecurity specialists, and digital marketers.

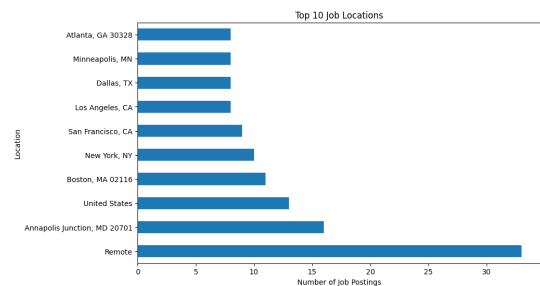


Fig. 2. Graph showing top job locations in the dataset

Moreover, industries across the board are undergoing digitalization, creating a demand for cross-functional skill sets. Proficiency in data science, AI, and cloud computing has become not just important but crucial for businesses striving to stay competitive in today's market. Consequently, individuals are required to adapt and upskill rapidly to meet the evolving demands of the job market.

Through our analysis, we aim to delve deeper into these trends, providing insights into the changing job landscape, the pivotal skill requirements, and the increasing digitization of industries. Understanding these dynamics helps both job seekers and employers as they navigate the changing tides of the job market.

II. PROPOSED APPROACH

III. TOP JOB ROLES

We begin our analysis by examining the top job titles in the dataset. We gain insight into the current job market demands by identifying the most prevalent roles. The top 10 job titles are based on the number of job postings, which directly indicates the demand for the kind of roles in the market. Network Engineers and System Administrators have the most number of job postings followed by roles such as Cloud Data Engineer and Data Analysts as seen in the word cloud in Figure 4.

We observe a growing demand for roles such as:

- Machine Learning Engineers

Algorithm 1 Proposed Approach for Job Market Analysis

- 1: **Input:** Dataset containing job market information
- 2: **Output:** Insights into job market dynamics
- 3: **Step 1:** Load the dataset
- 4: Read the dataset from `dataset.csv`
- 5: **Step 2:** Job Title Analysis
- 6: Identify the most prevalent job titles
Output: List of top job titles
- 7: **Step 3:** Geographical Shifts in Job Opportunities
- 8: Analyze job locations to identify geographical trends
Output: Trends in job locations and new hotspots
- 9: **Step 4:** Impact on Skill Sets
- 10: Extract and analyze required skill sets from job descriptions
Output: List of in-demand skills and their trends
- 11: **Step 5:** Company Ratings and Benefits Analysis
- 12: Calculate and analyze average company ratings and benefits
Output: Distribution of company ratings and list of top benefits
- 13: **Step 6:** Salary Distribution Across Locations
- 14: Perform salary analysis across different locations
Output: Salary distribution across locations and comparison charts

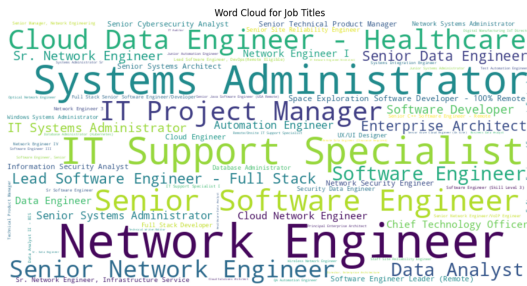


Fig. 3. Word Cloud showing top job titles

- Data Scientists
- AI Engineers
- Cloud Architects

These roles are indicative of the increasing digitalization of industries, as seen in Figure 1.

IV. GEOGRAPHICAL SHIFTS IN JOB OPPORTUNITIES

Analysis of job locations reveals geographical shifts in job opportunities. We observe a trend of job market expansion in certain regions, driven by factors such as economic growth, industry specialization, and remote work trends. The location of jobs plays a vital role in mapping out the tech ecosystem in the country. The earlier top hotspot was San Francisco, popularly known as the Silicon Valley of the world. However, there is an emerging shift in the rise of remote roles and places like Boston and Annapolis Junction as seen from the graph Figure 2.

V. SKILL SETS AND EXPERIENCE

As the job titles in the market shift, there is a domino effect on the skillsets expected, quite naturally. From the various job descriptions listed, experience is highly coveted, which one could build using opportunities like attending hackathons, building projects with use cases, and pursuing internships, as depicted in Figure 2



Fig. 4. Word Cloud showing top job generalist set of skills required

A. Machine Learning Engineers

ML jobs continue to be among the most coveted due to their critical role in driving innovation and technological advancements. This chart showcases the companies leading the way in seeking out ML talent. The data reveals that leading tech giants and innovative firms are at the forefront of hiring, underscoring the competitive landscape for skilled ML Engineers. This trend reflects the growing importance of machine learning in various sectors and emphasizes the robust opportunities available for professionals in this dynamic field. The top companies identified in the chart are key players shaping the future of technology, making them attractive destinations for aspiring ML engineers.

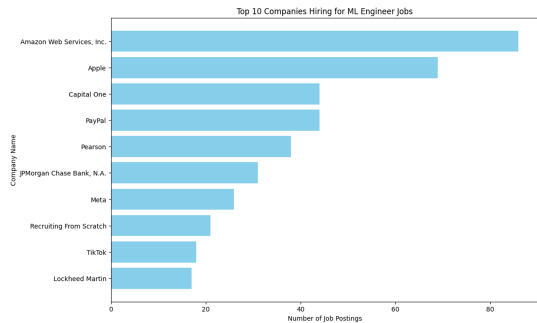


Fig. 5. Bar Graph of top companies hiring MLEs

B. Other Top Roles

After Machine Learning (ML) roles, the next set of top roles based on company ratings encompass a diverse array of positions. As demonstrated by the accompanying graphs, companies renowned for their excellence in hiring ML Engineers also prioritize recruiting for roles such as Software Engineers. These companies, known for their exemplary company ratings, extend their commitment to excellence across various technical

domains. Moreover, the graphs depict how these top-rated companies value non-technical roles, as evidenced by the inclusion of positions like Technical Content Writers. This highlights shown in the holistic approach adopted by leading organizations in building high-performing teams comprising both technical and non-technical professionals. By showcasing the prominence of these roles at esteemed companies, as plotted in Figure 6 and 7 the graphs depict the breadth of opportunities available and the emphasis placed on diverse skill sets in today’s job market.

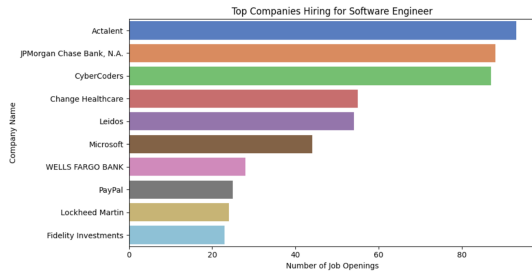


Fig. 6. Top Companies hiring for Software Engineers

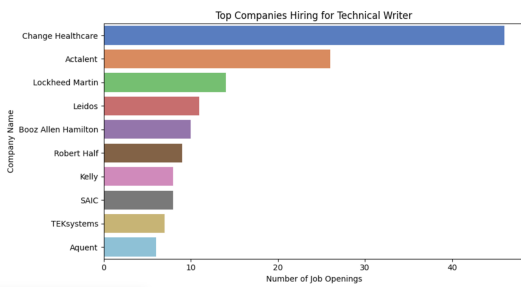


Fig. 7. Top Companies hiring for Content Writers

VI. COMPANY RATINGS AND BENEFITS

Using the above visualization, we explored what industries and companies are hiring for the most sought-after jobs, in relevance to the skillset in demand as shown in Figure 8. The companies with the highest ratings have been plotted in the bar graphs along with the most in demand kind of jobs they hire for. We see the correlation in software engineering industry is highly rated in 2022, with the slow and steady onset of Machine Learning with emphasis on Generative AI shifting the trend in the year 2023.

The average company rating on a scale of 5 was 3.67. The net percentage of job postings with a company rating above 4 was 11.57. The company rating is influenced by a plethora of factors, like employee satisfaction, career development opportunities, and perks/benefits. We notice the top companies in Figure 9 and 10 and how they’ve maintained stability of having a net consistent rating throughout the years, indicating job security in these respective companies, which is truly crucial for an employee.

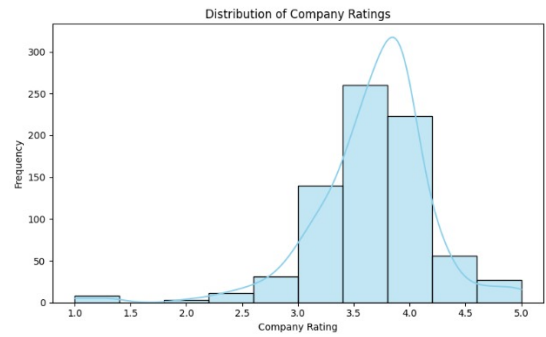


Fig. 8. Distribution of Company Ratings

A. Top Benefits

The top 5 benefits from the dataset are as follows:

- **Flexible schedule** - 95.3% : This is the most common benefit.
- **Health insurance**: A very important benefit for managing medical expenses.
- **Paid time off**: Allows employees to take breaks with pay.
- **Multiple benefits grouped** - 22% : These lines show combinations of benefits offered, likely by some employers. They include 401(k), dental insurance, vision insurance, etc.

Comparing industry ratings between 2022 and 2023 would allow us to identify any notable changes or trends. By examining shifts in industry perception over time, we can gain a deeper understanding of evolving market dynamics and potentially uncover areas of growth, where we notice a growing demand for roles such as Software Engineers and Data Analysts at top companies with high ratings, as observed in Figures 11 and 12.

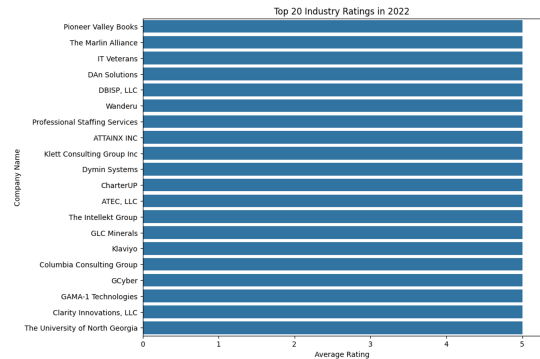


Fig. 9. Top 20 Industry Ratings in 2022

VII. SALARY DISTRIBUTION

The salary distribution across different locations is a crucial aspect of understanding the job market landscape. To provide a comprehensive view of salary dynamics, we highlight the significant variation in salaries across different locations, emphasizing the importance of geographical factors in job compensation. Notably, tech-centric areas like San Francisco

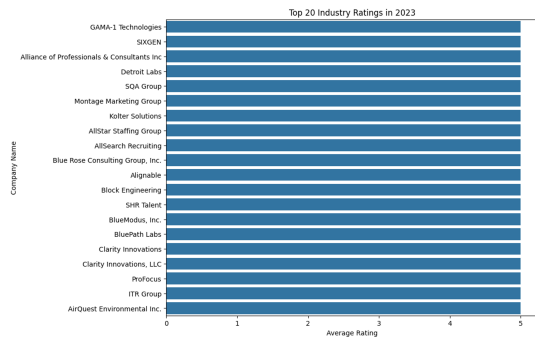


Fig. 10. Top 20 Industry Ratings in 2023

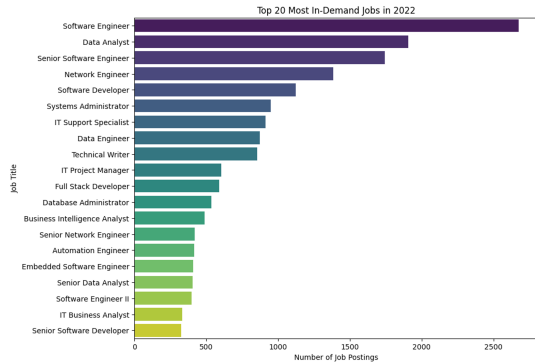


Fig. 11. Top 20 Most in Demand Jobs in 2022 based on Top Company Ratings

and New York stand out with the highest average salaries. For instance, San Francisco, CA leads with an impressive average salary of \$192,000, followed by San Francisco, CA at \$175,000. These figures reflect the high demand for specialized skills and the elevated cost of living in these regions. Other notable locations include Rutherford, NJ, and Dallas, TX, each offering competitive average salaries of around \$170,000. To illustrate these trends, here is a box plot showing salary distributions across different locations and a Pareto chart depicting both the average and highest salaries for the top 10 locations as seen in Figures 13 and 14:

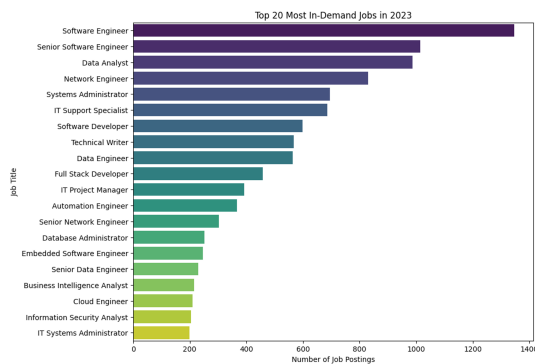


Fig. 12. Top 20 Most in Demand Jobs in 2022 based on Top Company Ratings

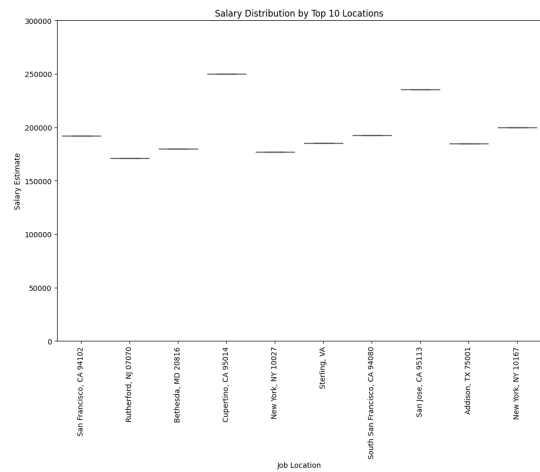


Fig. 13. Salary Distribution in the top 10 Locations

VIII. INSIGHTS ON JOB ROLES

Based on the frequency of job postings and benefits, places like San Francisco and New York are the top locations to work at. They also offer a higher salary package, proportionate to the quality of life and inflation at such hot-spots. Here are some insights on upcoming job roles with a technical and non-technical skill set focus:

A. Technical Roles

- **Artificial Intelligence (AI) and Machine Learning (ML):** These fields are booming, with roles like AI Engineer, ML Engineer, and Data Scientist in high demand.
- **Cybersecurity:** With the increasing reliance on technology, cybersecurity professionals are crucial. Roles like Security Analyst, Penetration Tester, and Security Engineer are on the rise.
- **Cloud Computing:** Cloud adoption is accelerating, creating demand for Cloud Architects, Cloud Engineers, and DevOps Engineers.
- **Full Stack Development:** Businesses need skilled developers who can handle both front-end and back-end development.

B. Non-Technical Roles

- **Digital Marketing:** As companies move online, roles like Social Media Manager, Content Marketing Specialist, and Search Engine Optimization (SEO) Specialists are becoming increasingly important.
- **Business Development:** Finding new clients and business opportunities is essential. Business Development Managers and Sales Representatives are in demand.
- **Human Resources (HR):** HR professionals play a vital role in employee recruitment, training, and development. Roles like HR Specialist, Talent Acquisition Specialist, and HR Manager are important.

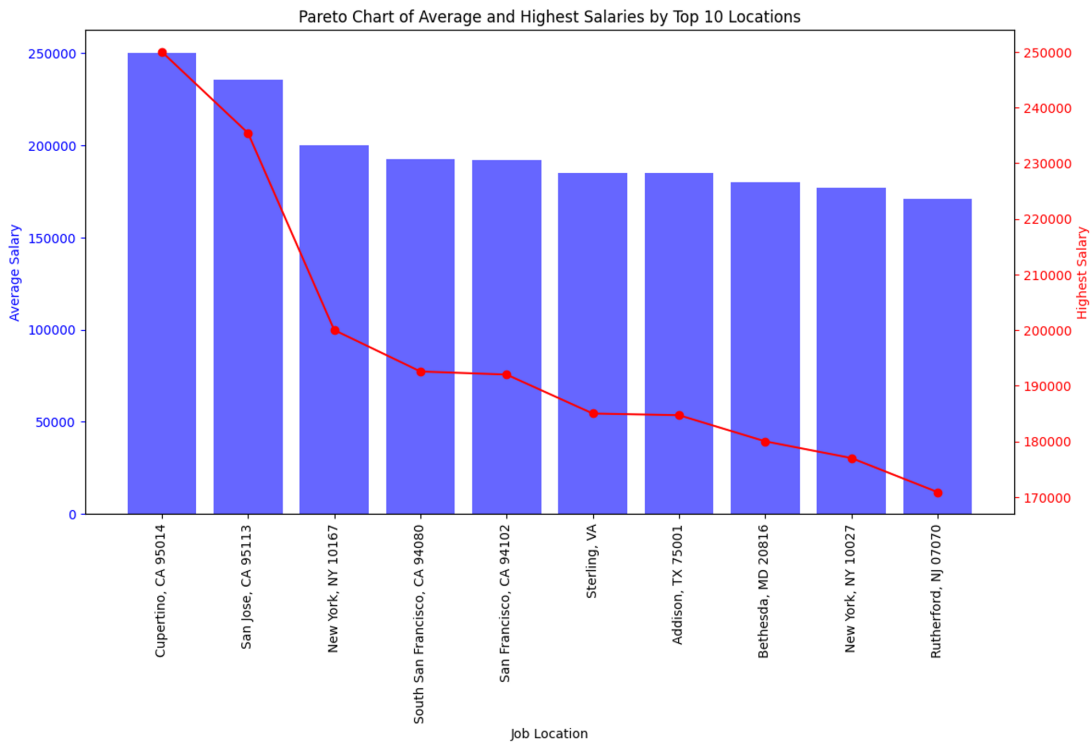


Fig. 14. Highest and Average Salary Distribution in the top 10 Locations

IX. SKILLS FOR TECHNICAL ROLES

The upcoming technical roles often require strong analytical and problem-solving skills, which can be honed by having a strong grasp on foundational skills. Here is a detailed overview that can help one in perfecting their skillset:

A. AI Engineer

- Expertise in building, deploying, and maintaining AI models.
- Experience with cloud platforms like AWS, Azure, or GCP.
- Software development skills for integrating AI models into applications.

B. Machine Learning Engineer

- Deep understanding of machine learning algorithms and their applications.
- Experience with data pre-processing, model training, and evaluation techniques.
- Ability to optimize and tune models for performance.

C. Data Scientist

- Strong data analysis skills using tools like Pandas and NumPy.
- Proficiency in data visualization libraries like Matplotlib or Seaborn.
- Experience with data wrangling, cleaning, and feature engineering.

- Ability to communicate insights effectively to technical and non-technical audiences.

D. Bonus Skills

- Deep Learning: Knowledge of deep learning frameworks like TensorFlow, PyTorch, or Keras is a valuable asset.
- Big Data Tools: Familiarity with tools like Hadoop, Spark, or Kafka can be helpful for handling large datasets and parallel processing multiple pipelines in critical workflows.
- Domain Knowledge: Understanding the specific industry or application area where you want to work using AI/ML can give you an edge.

E. Learning Resources

- Online courses from platforms like Coursera, Udacity, or edX.
- Kaggle competitions: Gain practical experience by participating in data science and machine learning challenges.
- Reading the latest research and familiarizing oneself with the SOTA helps in keeping up with the rapid advancements in the industry.
- Building portfolio projects, and making written documentation in the form of blogs and newsletters further shows the quality of skill set one possess and significantly improves the learning curve.
- Open-source libraries and frameworks: Explore and contribute to open-source projects to deepen your knowledge.

X. SKILLS FOR NON-TECHNICAL ROLES

Non-technical roles may also benefit from flexible schedules, particularly those requiring creativity and communication, as it allows for adaptability to different work styles.

A. Digital Marketing

- **Content Marketing:**
 - Excellent writing and editing skills to craft compelling content (blogs, social media posts, etc.)
 - Understanding of Search Engine Optimization (SEO) principles to improve online visibility.
 - Knowledge of content marketing platforms and tools.
- **Social Media Marketing:**
 - Ability to develop and execute engaging social media campaigns.
 - Understanding of different social media platforms and their target audiences.
 - Strong analytical skills to track and measure social media performance.
- **Paid Advertising (PPC):**
 - Knowledge of paid advertising platforms like Google Ads and Facebook Ads.
 - Skills in creating and managing effective pay-per-click (PPC) campaigns.

B. Content Creation

- **Writing & Editing:**
 - Strong command of grammar, punctuation, and writing style.
 - Ability to tailor content to different audiences and platforms.
 - Experience with copy writing, storytelling, and persuasive writing techniques.
- **Content Strategy:**
 - Understanding of different content formats (text, video, infographics, etc.)
 - Ability to develop a content calendar and plan strategically.
- **Visual Communication:**
 - Basic design skills for creating visuals like images and presentations.
 - Knowledge of video editing tools (if video content creation is involved).
- **SEO Optimization:**
 - Understanding of basic SEO principles to optimize content for search engines.
- **Content Management Systems (CMS):**
 - Familiarity with popular CMS platforms like WordPress or Drupal can be beneficial.

C. Human Resources (HR)

- **Recruitment & Talent Acquisition:**
 - Understanding of the recruitment process, from job postings to candidate selection.

- Skills in conducting interviews and evaluating candidates.
- Knowledge of employment law and regulations.

- **Human Resources Management:**

- Strong communication and interpersonal skills to build relationships with employees.
- Ability to handle employee relations issues, including conflict resolution.
- Knowledge of HR policies and procedures.

- **Benefits & Compensation:**

- Understanding of employee benefits packages and compensation structures.
- Ability to administer and manage employee benefits programs.

Important Note: This is not an exhaustive list, and specific skill requirements will vary depending on the job role.

XI. CONCLUSION

Our analysis highlights how the job market constantly changes, with job titles, company ratings, locations, and job types evolving over time. This information is essential for job seekers, employers, and policymakers, as it helps them strategically make informed decisions and plan. Exploring various job types sheds light on changes in the nature of job roles. We find a rising demand for remote and flexible work arrangements, alongside a growing emphasis on specialized skill sets and cross-functional roles.

XII. ACKNOWLEDGMENT

We would like to express our gratitude to Grepsr for providing the dataset used in this analysis. Grepsr gets you high-quality and instantly actionable data tailored to fit your needs. Their powerful web scraping services have been instrumental in driving insightful decisions for companies, ranging from budding startups to Fortune 500 companies. With simple, customizable solutions and a quick turnaround time, they aim to encourage data-driven decisions in various industries.