Tech Layoffs in the US

1. Background

The tech industry in the US has experienced rapid growth, particularly following the COVID-19 pandemic. As the world shut down and shifted online, the demand for digital solutions skyrocketed, driving a surge in tech consumption. The Federal Reserve's decision to lower interest rates provided companies with access to cheap capital, fueling aggressive expansion strategies. This environment, combined with a booming tech space and advancements in AI, attracted significant venture capital investment, leading to the rise of numerous startups. High investor confidence in the sector also drove up tech stock prices, resulting in historically high valuations for many companies. However, starting around mid-2021, a shift in the economic environment, including rising interest rates and cooling investor sentiment, prompted many companies to reassess their workforce size. This was particularly evident among firms that had pursued a "growth at all costs" strategy during the pandemic boom. As these companies faced increasing pressure to deliver profitability rather than just scale, they found that their inflated headcounts often did not translate to sustainable profits. Consequently, many began restructuring their organizations, leading to significant layoffs across the industry. This report explores the dynamics of tech layoffs, focusing on identifying patterns and understanding the factors influencing these decisions, including economic downturns, funding, industry vulnerabilities, and company stages.

2. Data Processing

For this analysis, we used data sourced from layoffs.fyi, a platform providing real-time information on layoffs in the tech industry. It compiles information from company announcements, news reports, and crowdsourced submissions, making it a trusted and up-to-date resource for analyzing tech layoffs. The data includes key columns such as company name, location, industry, company stage, funds raised, date added, total laid off, country, and the percentage of layoffs.

Initially, we attempted to scrape data directly from layoffs.fyi to ensure the most up-to-date information for our analysis. However, this process proved to be a significant challenge due to the enhanced security measures on the website that complicated the data extraction. After multiple attempts and careful consideration of time constraints, we opted to use a well-structured csv file of the dataset available on Kaggle.

Along with this file we will submit a notebook detailing the progress we have made with scraping data from layoffs.fyi.

The data was cleaned and processed through the following steps:

- **Data Cleaning:** First, we filtered the data to only companies in the US as it provides tech layoffs across the world.

The columns total_laid_off, percentage_laid_off, and funds_raised had the highest proportion of missing values. Among these, total_laid_off was the key variable for our analysis. To address its missing values, we opted to remove the affected rows. Filling with zeros was inappropriate since we knew layoffs occurred, and using the mean would have distorted insights due to the significant proportion of missing data. This approach ensured the integrity of our analysis while minimizing biases.

- **Data Transformation:**

The date column was converted to a datetime format to facilitate temporal analysis. This transformation allowed us to extract specific components such as years and quarters, which were crucial for identifying trends and patterns over time in the data.

The processed dataset was used to analyze:

- **Trend analysis over the 5yr period** (2020-2024)
- **Geographical distribution of layoffs**

We created a geographical visualization to highlight the cities most impacted by layoffs, with tech hubs predictably topping the list due to their high concentration of tech companies and workforce. To accurately plot this data, we utilized census data to obtain the coordinates for each city, ensuring a precise and insightful representation of the layoff distribution across the United States.

To merge the layoff data with geographical coordinates, we created a dictionary mapping cities to their respective states, addressing cases where multiple states share the same city name.

```
city_coords[city_coords['City'] == 'Boston']
```

✓ 0.0s

	City	State	Type	Counties	Population	Latitude	Longitude
23	Boston	MA	City	Suffolk	675647	42.359	-71.057
10929	Boston	GA	City	Thomas	1207	30.791	-83.789
19137	Boston	IN	Town	Wayne	150	39.741	-84.852

Additionally, we wrote a function to extract companies in the targeted cities and looked them up to verify whether these companies were located in the intended city-state pairs or in other states with similarly named cities. This step ensured the accuracy of our geographical analysis.

```
def search_companies(city_name, dataframe):
    """
    Parameters:
    city_name (str): The name of the city to search for.
    dataframe (pd.DataFrame): The dataframe containing the layoff data.

    Returns:
    list: A list of companies in the specified city.
    """
    companies = dataframe[dataframe['location'] == city_name]['company'].tolist()
    return companies
```

✓ 0.0s

```
# We will look up the companies in each city then use ChatGPT to confirm if they
city_name = 'Atlanta'
companies_in_city = search_companies(city_name, layoff_us)
print(companies_in_city)
```

For the San Francisco Bay Area, we manually googled the coordinates to capture its collective location. [37.8272, -122.2913]

- **Layoff trends by industry**.
- **Company stage vs. layoffs** to understand if early-stage companies experience more frequent layoffs.

For the industry and company stage impact we wrote a function that was used for both. It gets the percentage laid off for each category by getting a headcount of each category over the total headcount across all categories.

```python
def plot_horizontal_bar(data, title, xlabel, ylabel, color='thistle'):
    """
    Plots a horizontal bar chart with percentage labels.

    Parameters:
    data (pd.Series): The data to plot, with the index as the labels and values as the bar lengths.
    title (str): The title of the plot.
    xlabel (str): The label for the x-axis.
    ylabel (str): The label for the y-axis.
    color (str): The color of the bars (default is 'thistle').
    """
    # Calculate percentages
    data_pct = (data / data.sum()) * 100

    # Create horizontal bar chart
    plt.figure(figsize=(12, 6))
    bars = plt.barh(y=data.index, width=data_pct, color=color)

    # Add percentage labels
    for i, v in enumerate(data_pct):
        plt.text(v + 0.5, i, f'{v:.1f}%', va='center')

    # Customize the plot
    plt.title(title, pad=20)
    plt.xlabel(xlabel)
    plt.ylabel(ylabel)

    # Add gridlines for better readability
    plt.grid(axis='x', linestyle='--', alpha=0.7)

    plt.tight_layout()
    plt.show()
```

- **Funding raised vs. layoffs**

To explore the relationship between funds raised and layoffs, we created a scatter plot and calculated the correlation coefficient, which was approximately 0.17. This low correlation suggests a weak relationship, indicating that the amount of funds raised by companies does not strongly predict the scale of layoffs.

3. Findings

The analysis uncovered several key insights:

- **Geographical Distribution:** Cities such as San Francisco, New York, and Seattle were among the hardest-hit by layoffs. The concentration in these cities correlates with their status as tech hubs, but smaller cities with growing tech presences also experienced notable layoffs.
- **Industry Vulnerability:** Certain sectors, like consumer and retail, were more vulnerable to layoffs, likely due to economic shifts and market adjustments. In contrast, AI companies were less affected during the tech layoffs, primarily because AI adoption surged across industries, making their technologies highly valuable and essential. In fact, many AI companies experienced robust revenue growth or secured significant funding, fueled by the optimism surrounding AI's transformative potential and its critical role in shaping the future of business and technology.
- **Trend Analysis Over Time:** Q1 appears to be the most consistently affected period for layoffs, as it is a critical time for organizations to recalibrate their operations. During this quarter, companies typically conduct annual budget reviews and implement major structural changes, including workforce reductions, to align with strategic goals for the year. Q1 of 2023 marked a record high for tech layoffs, with over 120,000 employees losing their jobs. This wave of layoffs included major tech companies like Google, Microsoft, Meta, and IBM, with Amazon leading the way among global tech giants in terms of headcount reductions.
- **Company Stage and Layoffs: Company Stage and Layoffs:** From the distribution of company stages, it is evident that post-IPO companies account for the highest percentage of layoffs. This aligns with expectations, as later-stage companies and publicly traded firms typically have larger workforces and are more prone to conducting mass layoffs during economic downturns to optimize costs and maintain shareholder confidence.
- **Correlation with Funding:** Our analysis reveals no significant correlation between the amount of funds raised and the size of layoffs. This indicates that substantial fundraising may foster a false sense of stability, leading companies to overhire or expand operations excessively, only to later downsize in response to shifting market conditions. Despite having significant resources, these companies are not insulated from economic challenges or the need for organizational restructuring.

4. Conclusions

The tech industry is inherently cyclical, marked by periods of soaring growth followed by significant downturns. The industry's trajectory underscores the importance of balanced strategies. Companies need to adopt more sustainable and thoughtful approaches to expansion. Instead of focusing solely on rapid scaling, driven by external factors like cheap capital or market optimism, companies should prioritize strategies that balance growth with profitability, operational efficiency, and adaptability to market conditions. This includes making measured hiring decisions, aligning headcount with revenue potential, and investing in technologies that offer long-term value, like AI. The trajectory serves as a lesson that aggressive expansion without a strong foundation can lead to vulnerabilities when external conditions shift.

5. Future Work (Possible Extensions)

Extension of this analysis could provide further insights:

- **Predictive Modeling: Predictive Modeling:** Developing a predictive model to forecast layoffs could incorporate company revenue as a key factor, recognizing that layoffs often stem from headcount not aligning with profitability. By analyzing a company's revenue, profits, and funding, the model could assess the likelihood of layoffs. Additionally, the model could factor in technology adaptation (AI companies weren't badly hit) and employment rates, as companies with aggressive expansion strategies have faced more significant layoffs. For instance, companies like Apple, which avoided aggressive hiring during the tech boom, experienced fewer layoffs, highlighting the importance of measured growth.
- **Post-layoff Recovery:** Analyzing how companies and laid-off employees recover over time could provide a more comprehensive view of the economic impact of layoffs.