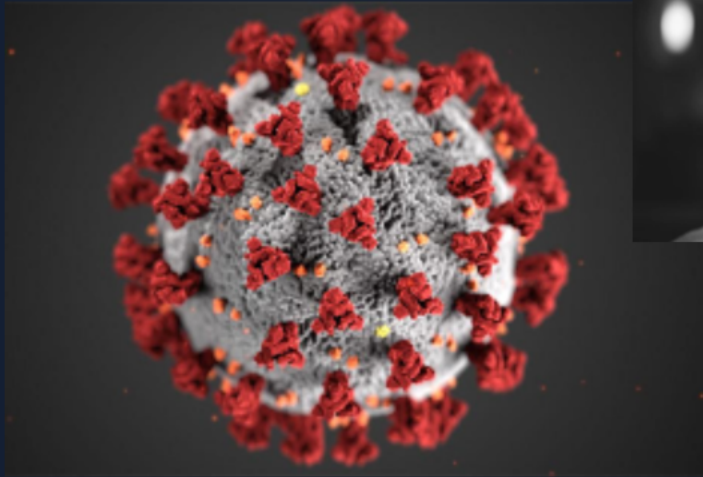# Impact of COVID-19 on U.S Job Market

Group Members:

Atharva Pandit I Rahul Jadhav I Sanjana Jairam I Shreenidhi Shetty I Shibani Dcosta

Introduction

- The COVID-19 pandemic resulted in a significant disruption of the job market worldwide.

- In the United States, the unemployment rate reached 14.7% in April 2020, which was the highest level since the Great Depression.

- Many industries were severely affected by the pandemic, leading to job losses, reduced working hours, and income uncertainty.

- The pandemic has had a disproportionate impact on certain groups, including women, people of color, and low-income workers.

COVID-19 Hits U.S. Job Market Across the Map

Seasonally adjusted state unemployment rates in the United States in March and April 2020

0-5%   5-10%   10-15%   15-20%   20%+

March 2020

April 2020
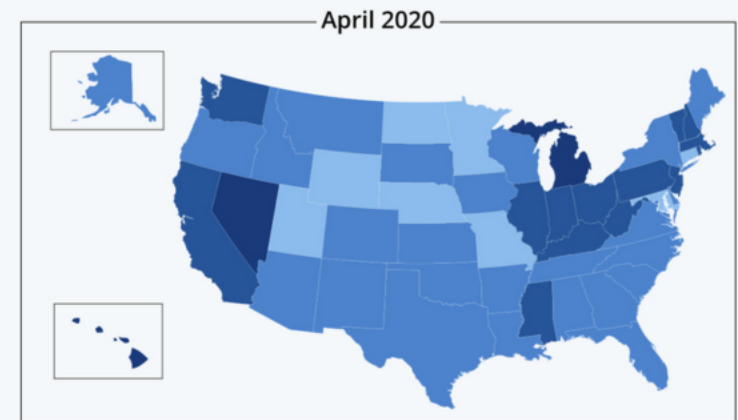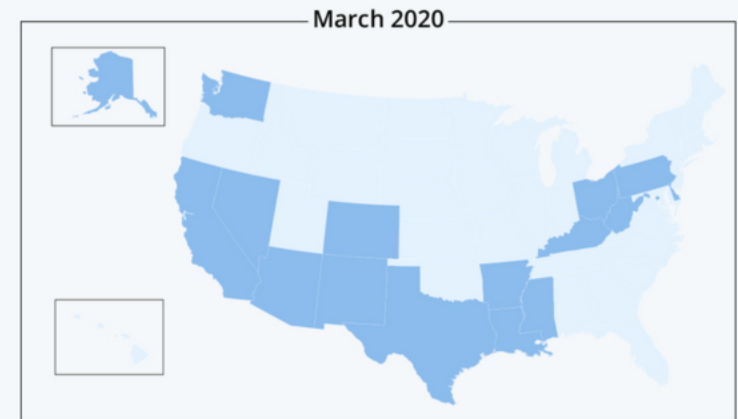
Source: U.S. Bureau of Labor Statistics

Using Machine Learning to Predict Job Layoffs

- Our objective is to use machine learning techniques to make users aware of job layoffs occurring.

- The main aim of this project is to develop a predictive model that accurately analyzes input data and makes predictions based on learned patterns.

- By analyzing data from BLS and layoffs.fyi, we can identify trends and patterns that may indicate potential job layoffs.

Layoff Trends by Industry through months
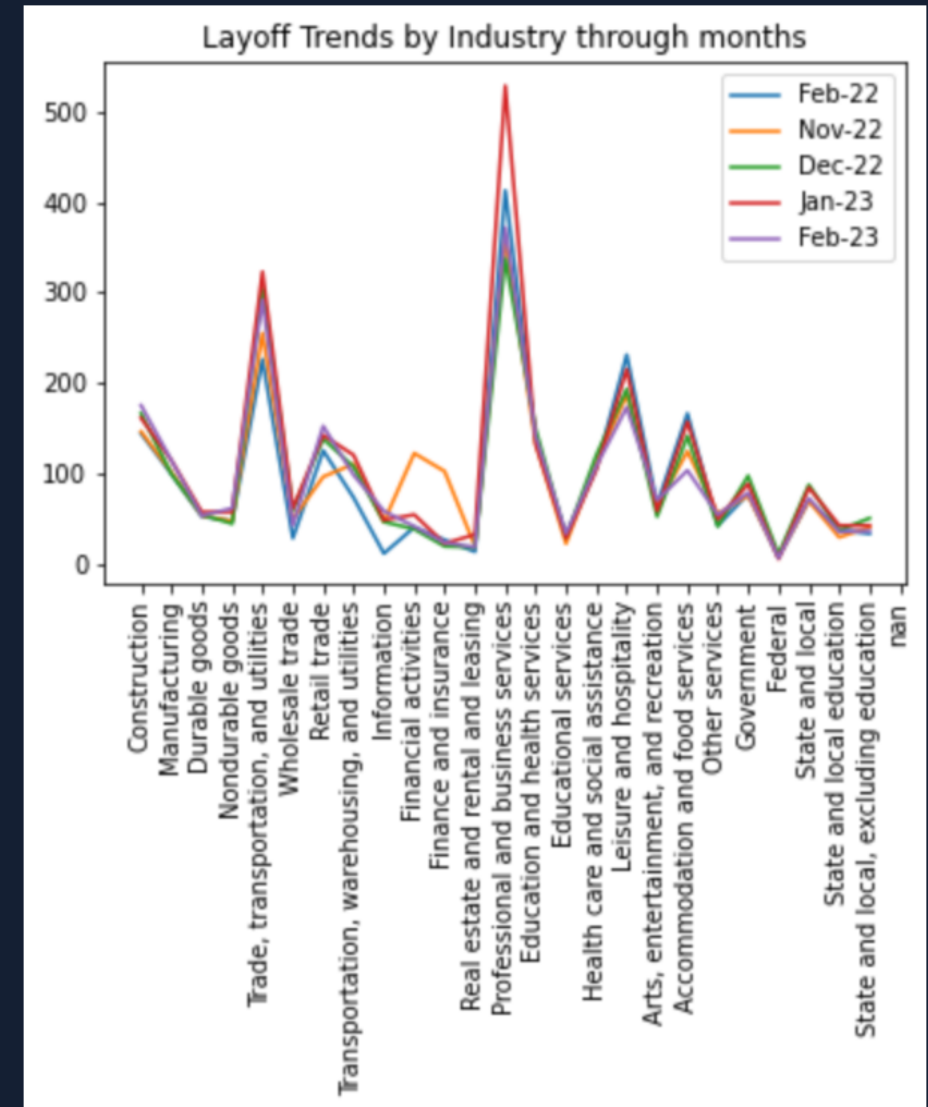
Motivation

When an economic crisis like COVID-19 hits and affects the job market what is the one SUPERPOWER you wish you had.
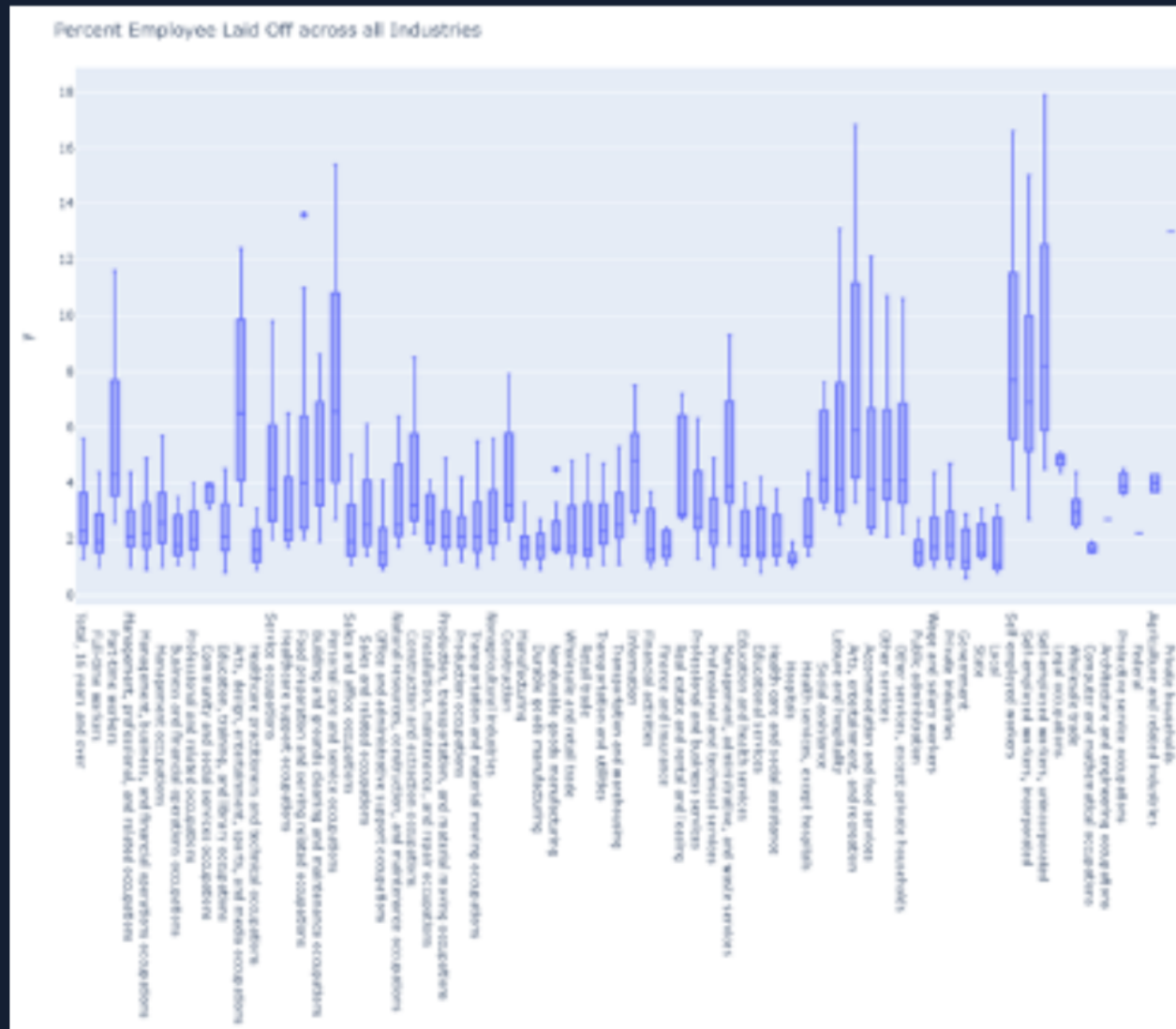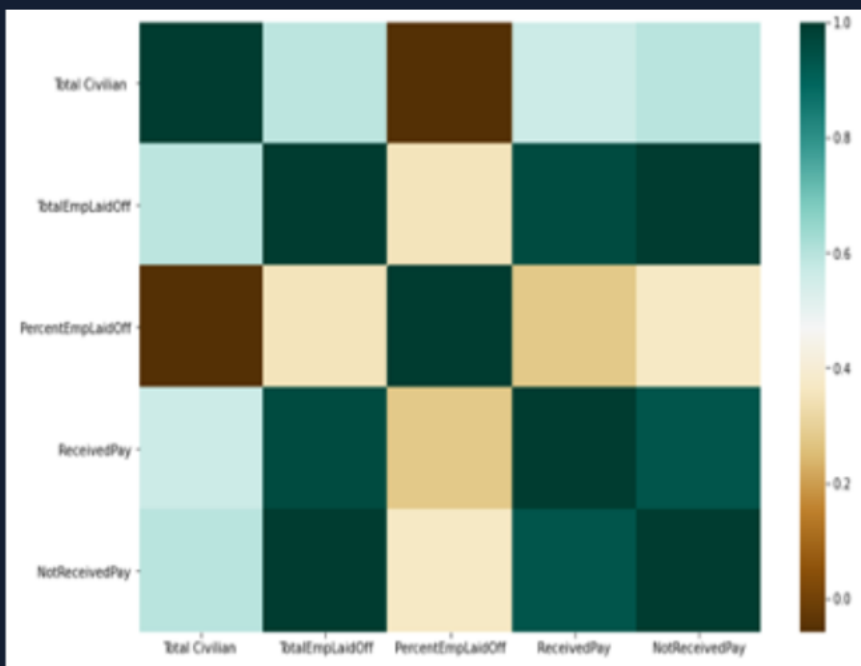
What are the chances of you being LAID OFF?

Our current solution is able to predict the number of layoffs across various job sectors and also if you are at risk of getting laid off based on your industry, stage and location of HQ.
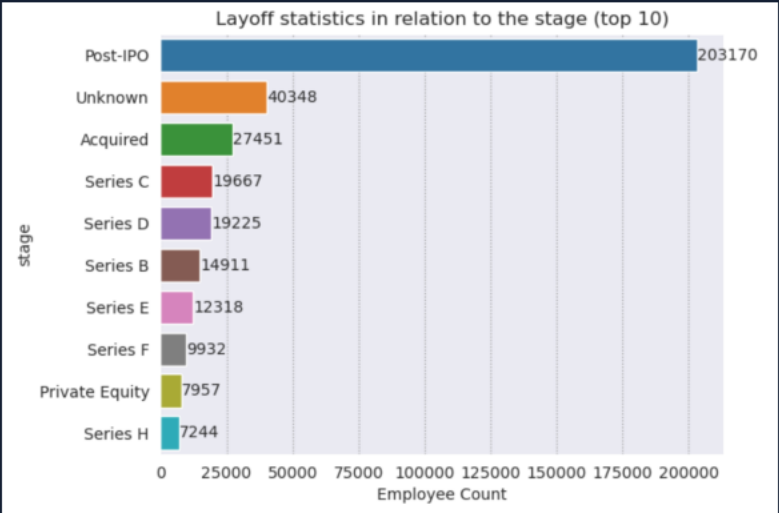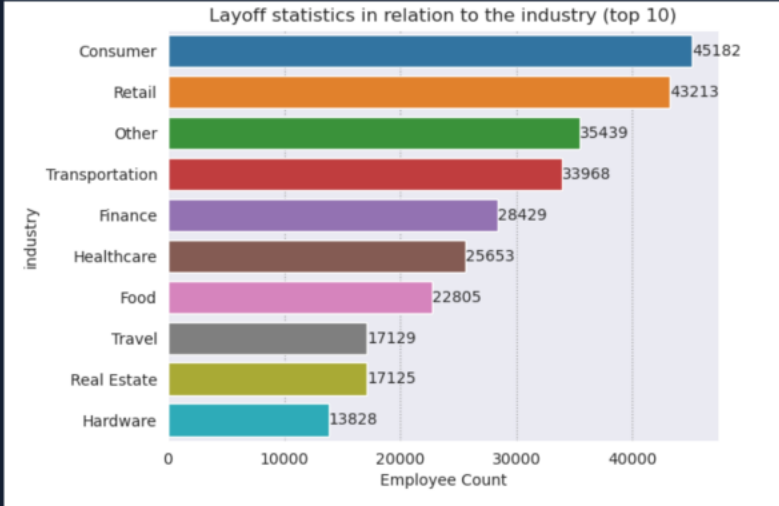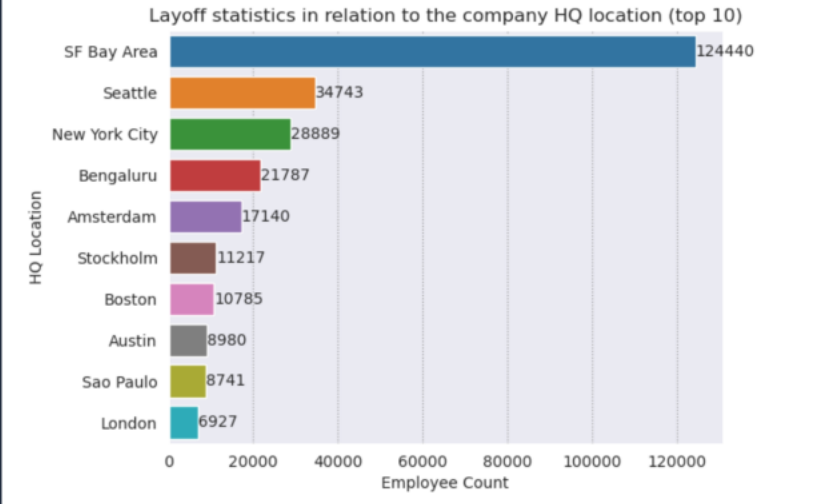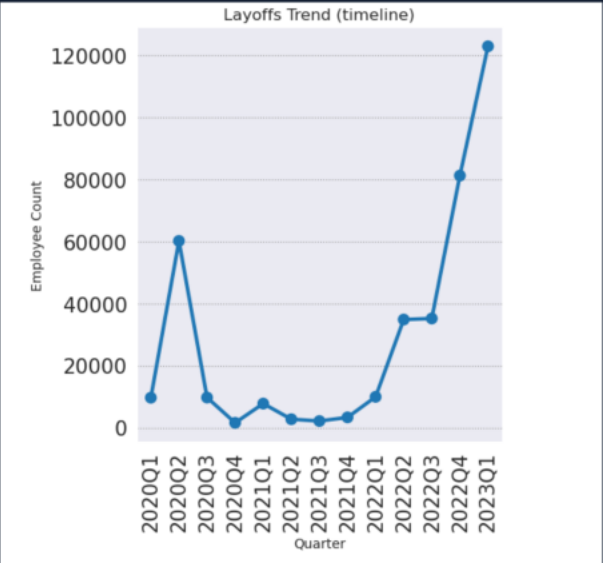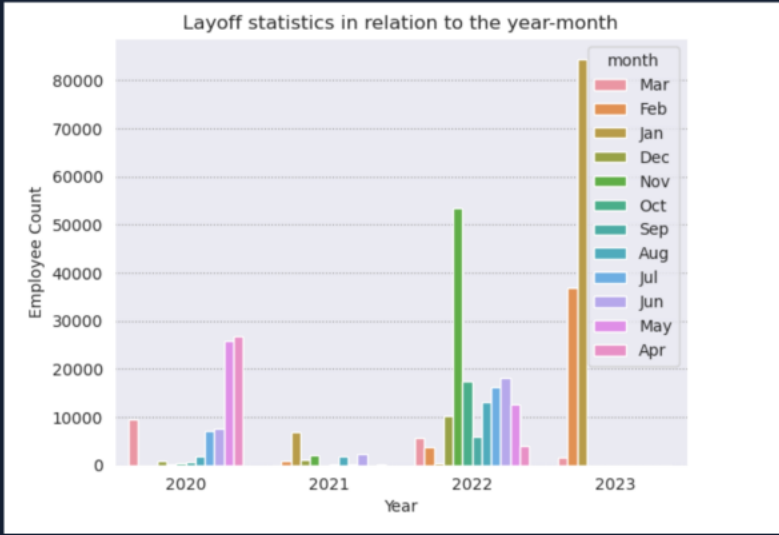
Data

Sourced Data from two public datsets:

- Bureau of Labor Statistics(BLS)

- Layoffs.fyi

EDA on BLS

EDA on Layoffs.fyi

Model Building

- The **BLS** dataset contains categorical and numerical data.

- Regression models were chosen because the target variable in the dataset, "TotalEmpLaidOff", is a continuous numerical variable.

- Different regression models applied to the dataset namely:
  - Linear regression
  - Ridge regression
  - Lasso regression
  - Decision Tree Regression
  - Random Forest Regression

Model	MSE	R2 Score
Linear Regression	333.067	0.999
Decision Tree Regressor	11305.701	0.991
Random Forest Regressor	6556.370	0.995

- Trained linear regression, decision tree, and random forest regression models using the training data, and evaluated the models using cross-validation with 5 folds.

Model Selection and Evaluation for Temporal data : Prophet

- Prophet is a time-series forecasting model developed by Facebook that can be used to make predictions on data that exhibit patterns over time.

- Prophet uses an additive model where non-linear trends are fit with yearly, weekly, and daily seasonality, plus holiday effects.

- The model also takes into account the impact of outliers and changes in trend over time.

- One of the key features of Prophet is its ability to handle missing data and anomalies, making it particularly useful for real-world data.
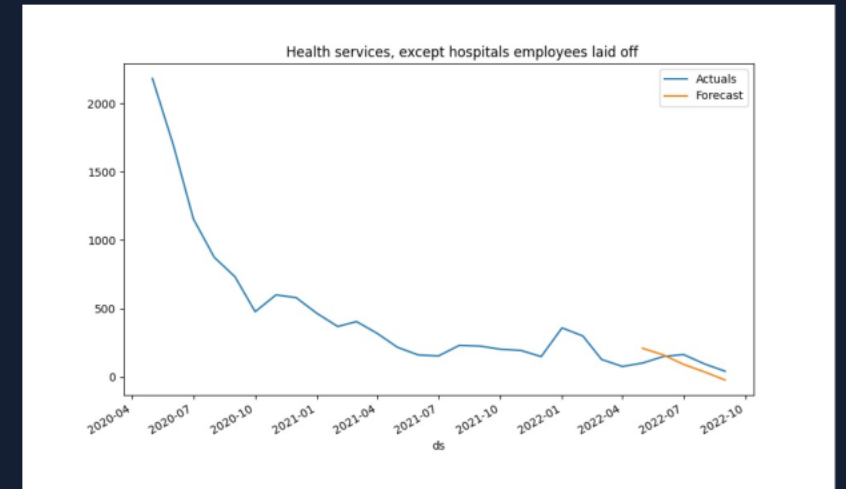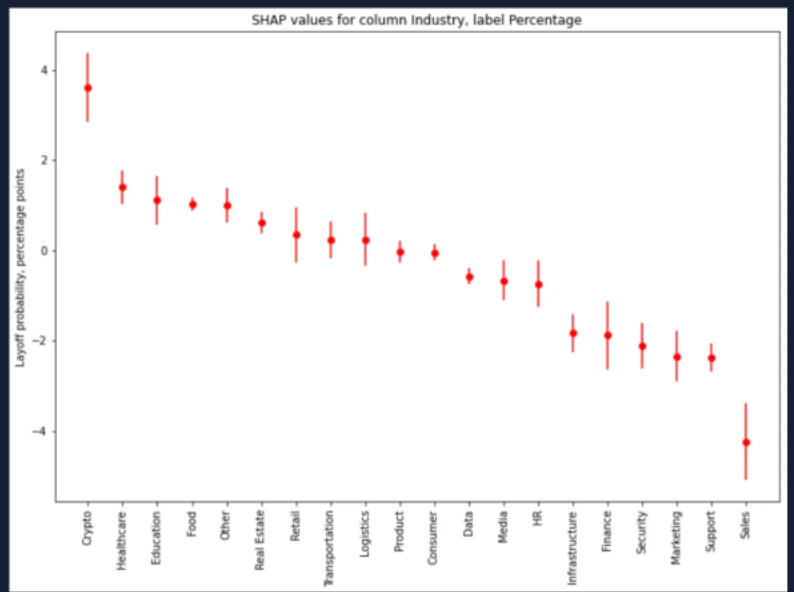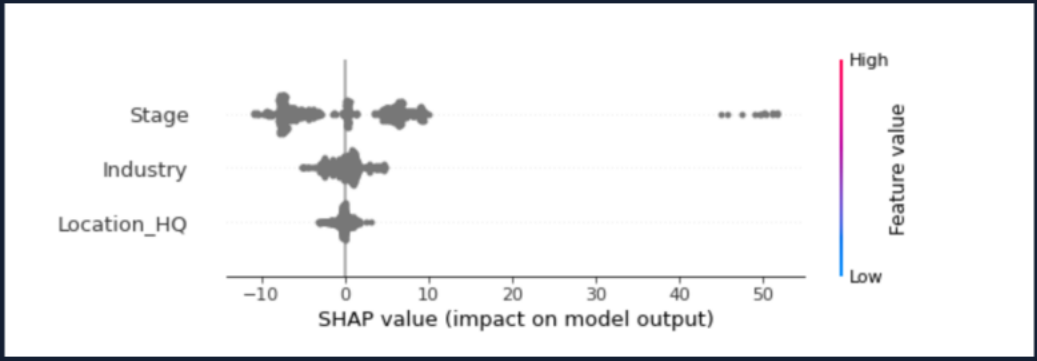
CatBoostClassifier

- We have made use of CatBoostClassifier to predict the probability of an employee getting laid off based on the features available in the dataset like Industry, Stage of Funding and Location of HQ.

- The data prepared with the previous step are randomly split between training and test samples, and modelled with the CatBoostRegressor model that explicitly takes into account categorical features.

- The root mean squared error (RMSE) of the resulting model is about 22.5 percentage points, an improvement compared to the baseline model RMSE of about 24.1 percentage apoints (assuming the same layoff probability of about 23.5% for every company presented in the dataset).

Explanation of the obtained Machine Learning model

We are using the SHapley Additive exPlanations (SHAP) method

The most important features to predict layoff probabilities for companies currently listed in layoffs.fyi are the company funding stage, industry, and headquarters location.

SHAP values for column Industry, label Percentage

SHAP values for column Stage, label Percentage

SHAP values for column Location_HQ, label Percentage

highest layoff probabilities are associated with the Crypto, Healthcare, and Education. On the other hand, the Sales and Support industries seem to be the least affected so far
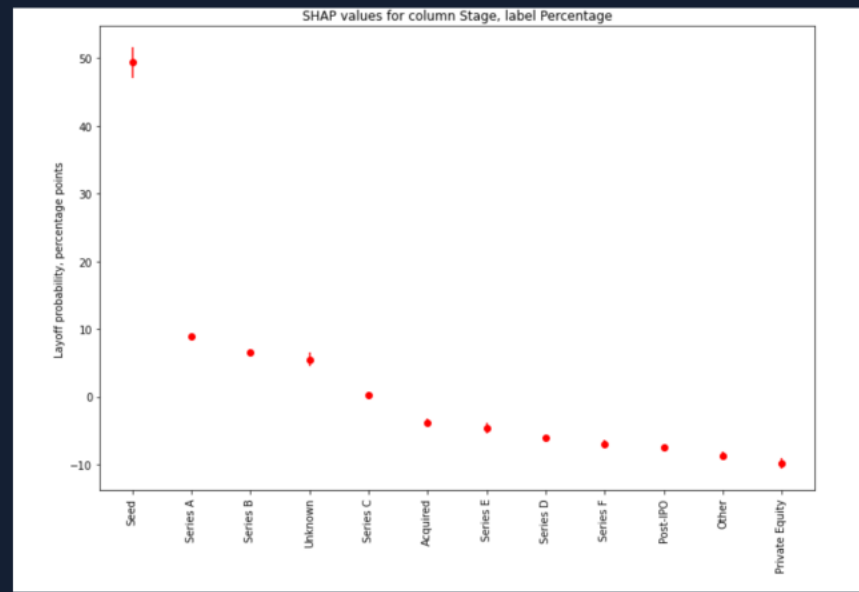
highest layoff probabilities are associated with the Seed stage, followed by Series A and Series B funding stages
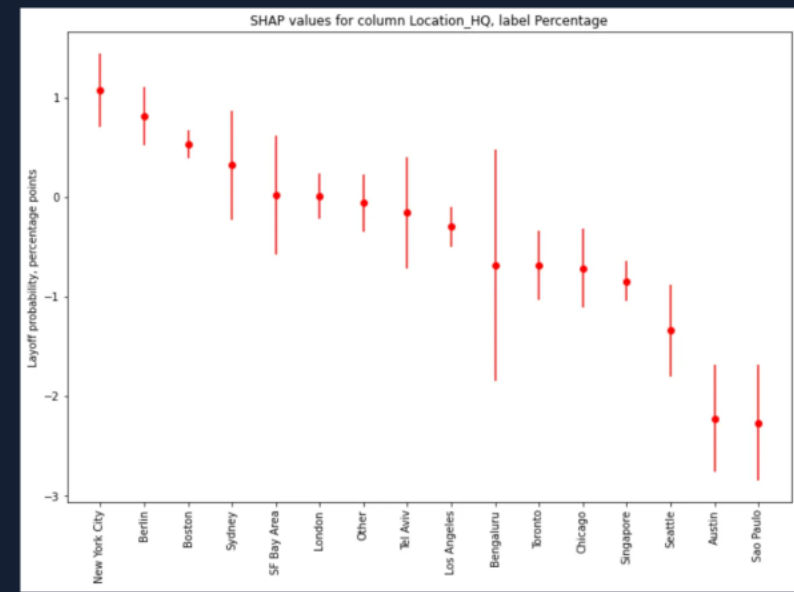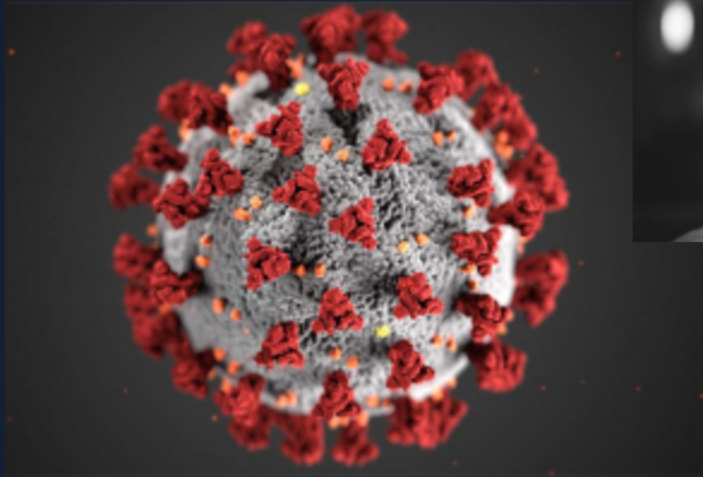
company headquarter locations, remarkably, we see that the highest layoff probabilities are associated with New York City, Berlin, and Boston:

Conclusion

- The COVID-19 pandemic has caused a significant and widespread impact on the job market.

- The job market is expected to continue evolving and adapting to the challenges and opportunities presented by the pandemic.

- There may be new job opportunities emerging in fields such as healthcare, e-commerce, and logistics due to changes in consumer behavior and demand.

- The pandemic has highlighted the need for ongoing innovation, resilience, and adaptability in the face of unforeseen challenges.

- Governments and organizations have a crucial role to play in supporting workers and industries during and after the pandemic.

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