EasyVisa Project

Objective

In FY 2016, the OFLC processed 775,979 employer applications for 1,699,957 positions for temporary and permanent labor certifications. This was a nine percent increase in the overall number of processed applications from the previous year. The process of reviewing every case is becoming a tedious task as the number of applicants is increasing every year.

The increasing number of applicants every year calls for a Machine Learning based solution that can help in shortlisting the candidates having higher chances of VISA approval. OFLC has hired the firm EasyVisa for data-driven solutions. You as a data scientist at EasyVisa have to analyze the data provided and, with the help of a classification model:

Facilitate the process of visa approvals. Recommend a suitable profile for the applicants for whom the visa should be certified or denied based on the drivers that significantly influence the case status.

Context

Business communities in the United States are facing high demand for human resources, but one of the constant challenges is identifying and attracting the right talent, which is perhaps the most important element in remaining competitive. Companies in the United States look for hard-working, talented, and qualified individuals both locally as well as abroad.

The Immigration and Nationality Act (INA) of the US permits foreign workers to come to the United States to work on either a temporary or permanent basis. The act also protects US workers against adverse impacts on their wages or working conditions by ensuring US employers' compliance with statutory requirements when they hire foreign workers to fill workforce shortages. The immigration programs are administered by the Office of Foreign Labor Certification (OFLC).

OFLC processes job certification applications for employers seeking to bring foreign workers into the United States and grants certifications in those cases where employers can demonstrate that there are not sufficient US workers available to perform the work at wages that meet or exceed the wage paid for the occupation in the area of intended employment.

Data Information

The data contains the different attributes of the employee and the employer. The detailed data dictionary is given below:

Variable	Description
case_id	This represent the user ID of the person visiting the website.
continent	Information of continent the employee.
education_of_employee	Information of education of the employee.
has_job_experience	Does the employee have any job experience? Y= Yes; N = No
requires_job_training	Does the employee require any job training? Y = Yes; N = No
no_of_employees	Number of employees in the employer's company.
yr_of_estab	Year in which the employer's company was established
region_of_employment	Information of foreign worker's intended region of employment in the US.
prevailing_wage	Average wage paid to similarly employed workers in a specific occupation in the area of intended employment. The purpose of the prevailing wage is to ensure that the foreign worker is not underpaid compared to other workers offering the same or similar service in the same area of employment.
unit_of_wage	Unit of prevailing wage. Values include Hourly, Weekly, Monthly, and Yearly.
full_time_position	Is the position of work full-time? Y = Full-Time Position; N = Part-Time Position
case_status	Flag indicating if the Visa was certified or denied

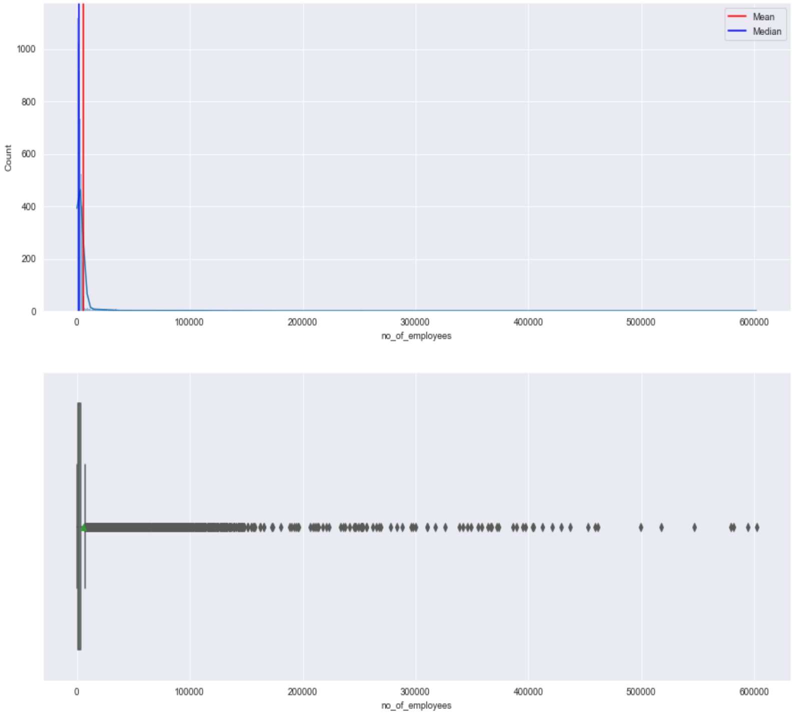
Observations	Variables
25480	12

Note:

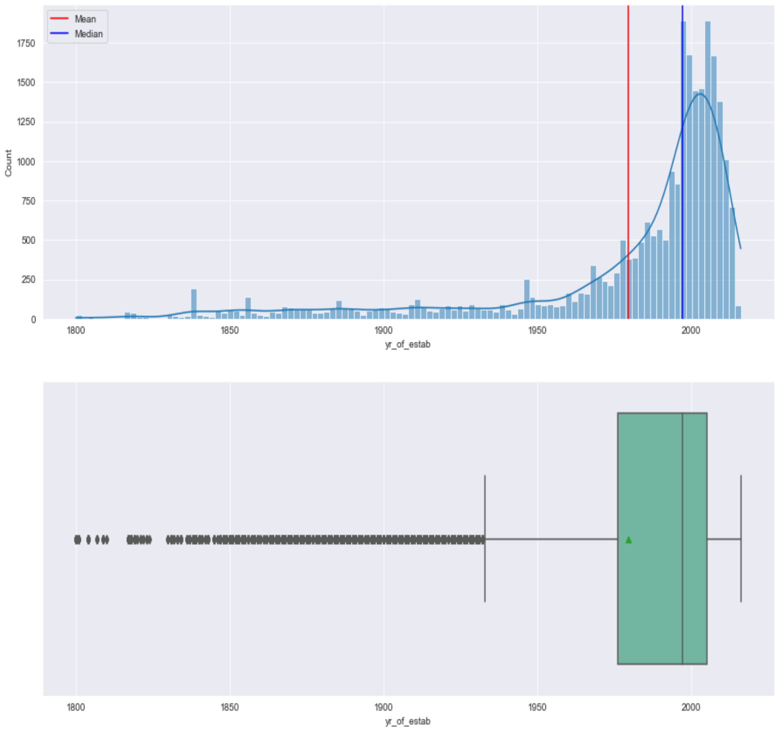
- There are no missing value in the dataset.

Exploratory Data Analysis

Histogram and Boxplot for no_of_employees



Histogram and Boxplot for yr_of_estab



Exploratory Data Analysis

Observations

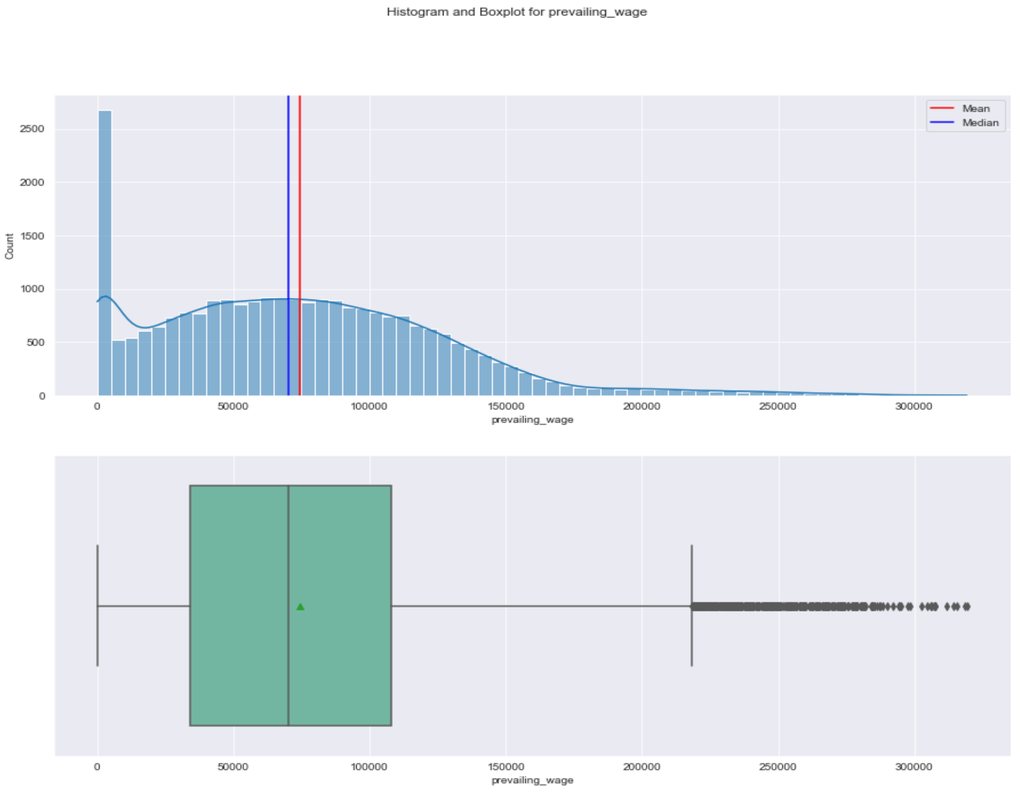
- The number_of_employees is highly right skewed data

- The mean and median fall under 100

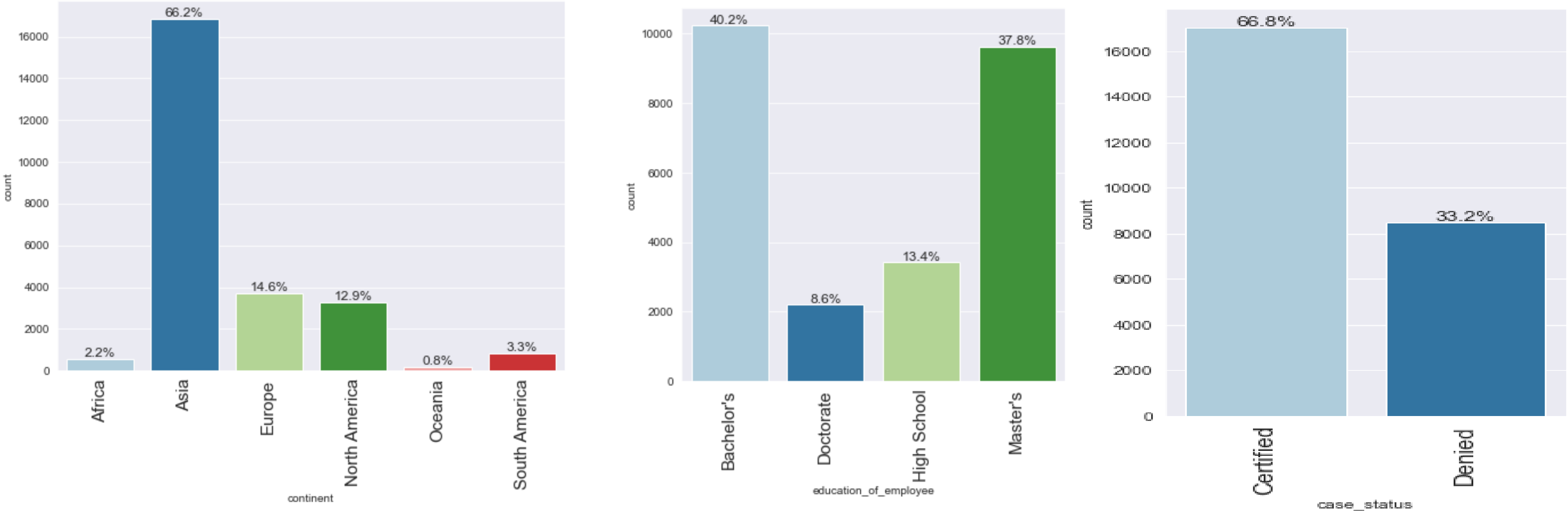
- There are a lot of outliers for number of employees

- For prevailing wages, it ranges from 0 - more than 300,000

•Mean for prevailing wages is ~75,00



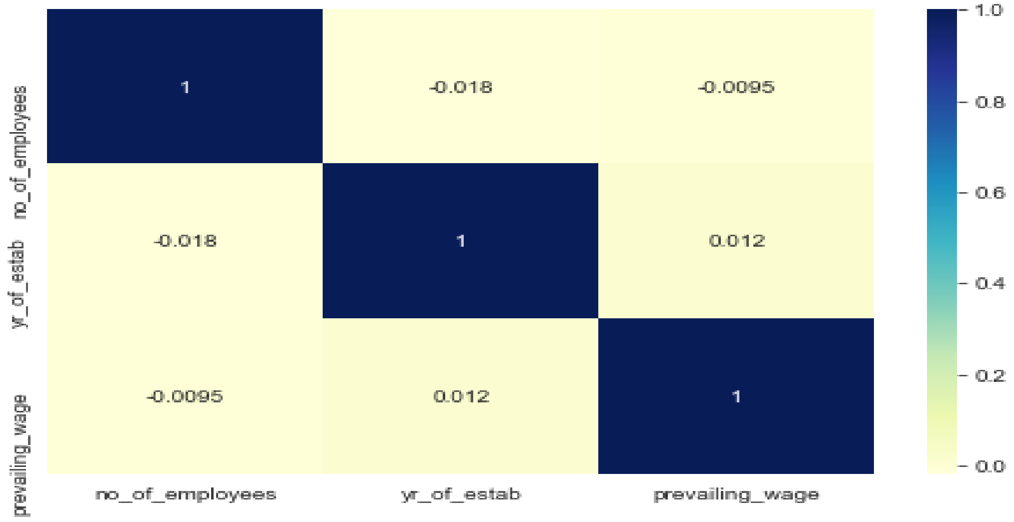
Exploratory Data Analysis – Cases by Continent, Education and Case Status



Observations

- Continent: 66% of the cases are for Asia continent, followed by 14.6% cases from Europe. Oceania has least cases with 0.8% of total.
- Education of employee: 40% of employees have Bachelor's education, followed by 37% with Masters. There are 8.6% employees who have a doctorate.

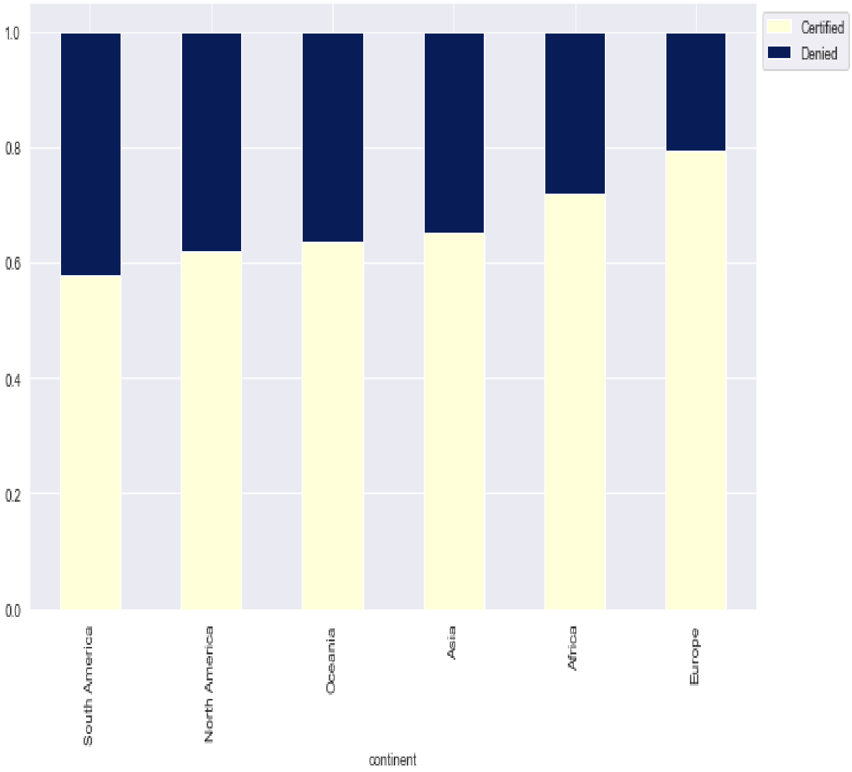
Statistical Analysis

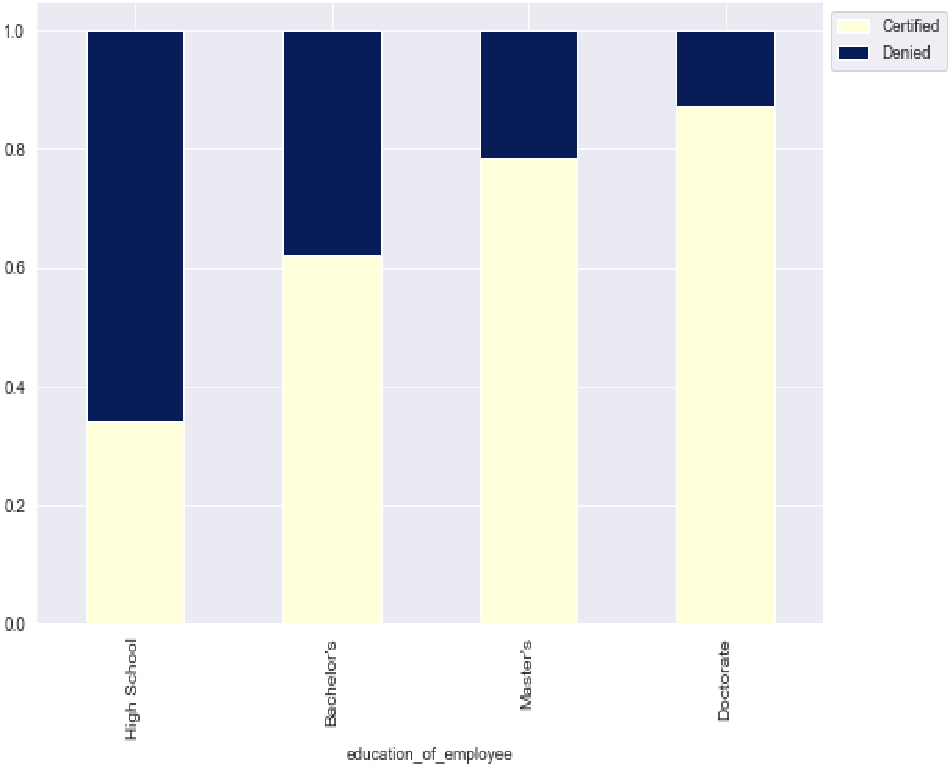


Insights;

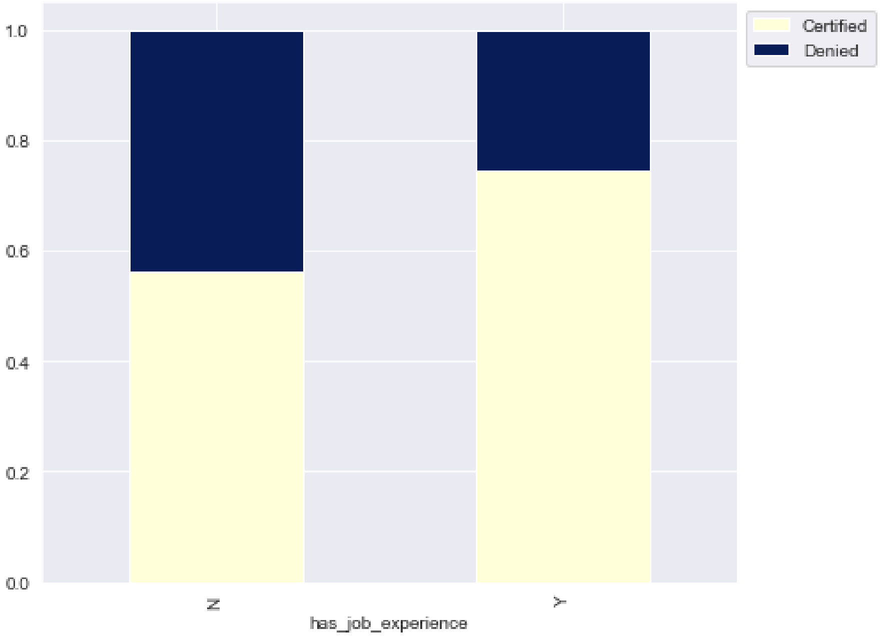
- No significant correlation

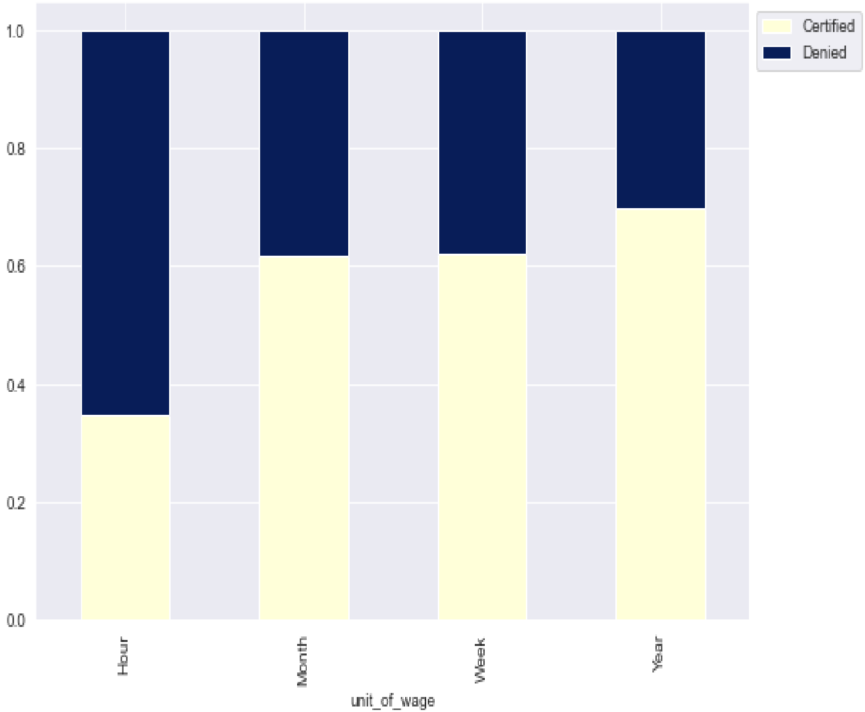
Cases based on Continent and Education



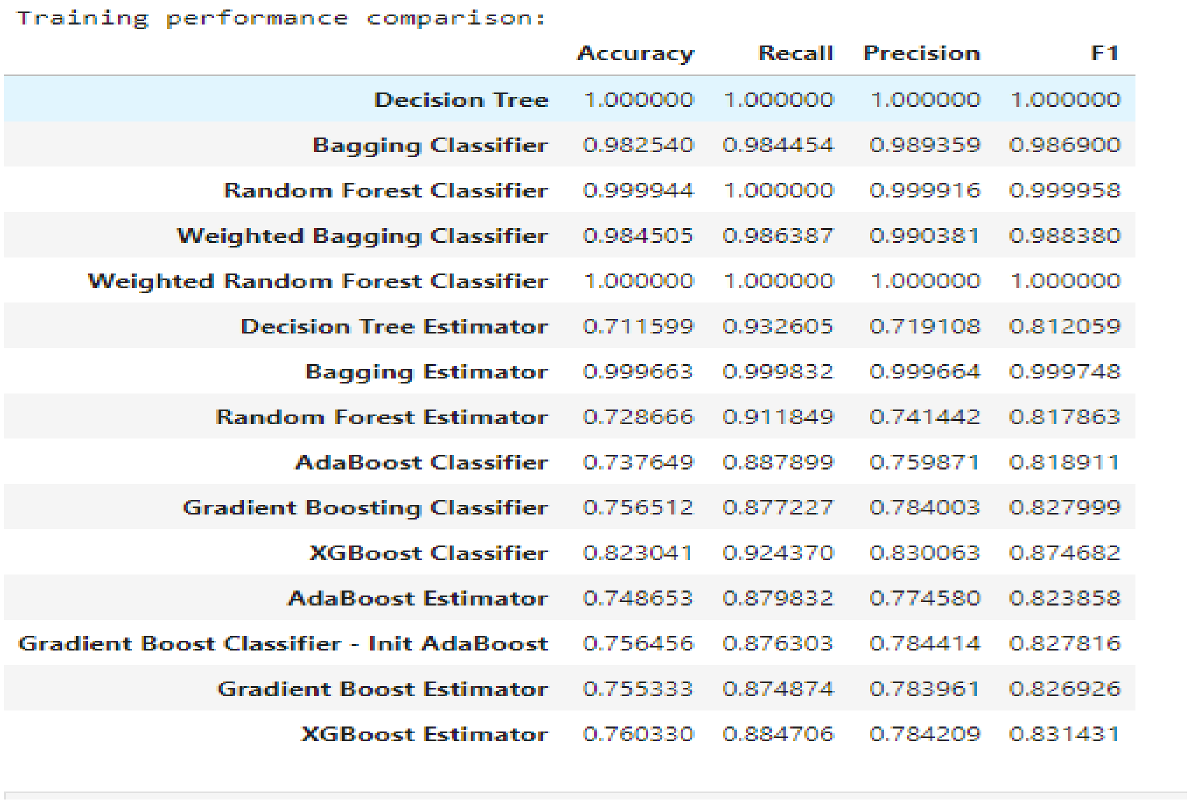


Cases based on Previous Job Experience and Wages





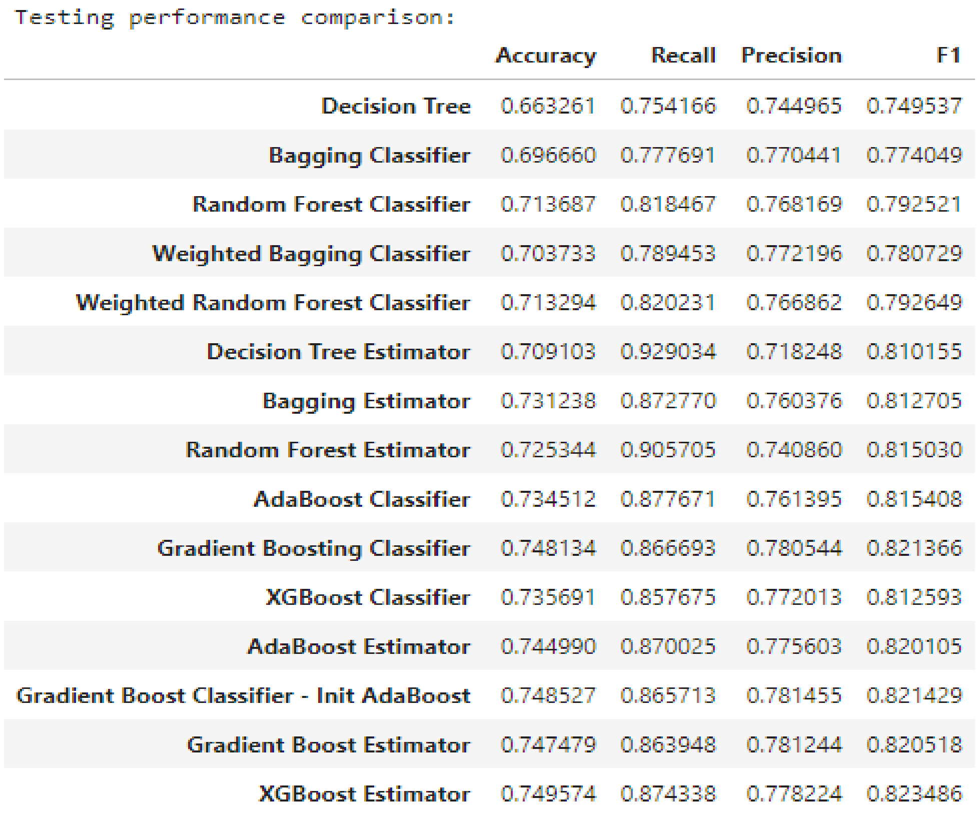
Model Performance – Training Data



Training performance comparison:

	Accuracy	Recall	Precision	F1
Decision Tree	1.000000	1.000000	1.000000	1.000000
Bagging Classifier	0.982540	0.984454	0.989359	0.986900
Random Forest Classifier	0.999944	1.000000	0.999916	0.999958
Weighted Bagging Classifier	0.984505	0.986387	0.990381	0.988380
Weighted Random Forest Classifier	1.000000	1.000000	1.000000	1.000000
Decision Tree Estimator	0.711599	0.932605	0.719108	0.812059
Bagging Estimator	0.999663	0.999832	0.999664	0.999748
Random Forest Estimator	0.728666	0.911849	0.741442	0.817863
AdaBoost Classifier	0.737649	0.887899	0.759871	0.818911
Gradient Boosting Classifier	0.756512	0.877227	0.784003	0.827999
XGBoost Classifier	0.823041	0.924370	0.830063	0.874682
AdaBoost Estimator	0.748653	0.879832	0.774580	0.823858
Gradient Boost Classifier - Init AdaBoost	0.756456	0.876303	0.784414	0.827816
Gradient Boost Estimator	0.755333	0.874874	0.783961	0.826926
XGBoost Estimator	0.760330	0.884706	0.784209	0.831431

Model Performance – Testing Data



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Testing performance comparison:
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	Accuracy	Recall	Precision	F1
Decision Tree	0.663261	0.754166	0.744965	0.749537
Bagging Classifier	0.696660	0.777691	0.770441	0.774049
Random Forest Classifier	0.713687	0.818467	0.768169	0.792521
Weighted Bagging Classifier	0.703733	0.789453	0.772196	0.780729
Weighted Random Forest Classifier	0.713294	0.820231	0.766862	0.792649
Decision Tree Estimator	0.709103	0.929034	0.718248	0.810155
Bagging Estimator	0.731238	0.872770	0.760376	0.812705
Random Forest Estimator	0.725344	0.905705	0.740860	0.815030
AdaBoost Classifier	0.734512	0.877671	0.761395	0.815408
Gradient Boosting Classifier	0.748134	0.866693	0.780544	0.821366
XGBoost Classifier	0.735691	0.857675	0.772013	0.812593
AdaBoost Estimator	0.744990	0.870025	0.775603	0.820105
Gradient Boost Classifier - Init AdaBoost	0.748527	0.865713	0.781455	0.821429
Gradient Boost Estimator	0.747479	0.863948	0.781244	0.820518
XGBoost Estimator	0.749574	0.874338	0.778224	0.823486

Conclusion

- The Decision Tree Estimator has highest recall score
- The Boosting Estimators have similar score
- Overall, the XGBoost Estimator has the best performance
- The employees with high school education have very high chances of denial
- The employees with master's and doctorate education have high chances of getting certified
- Having previous experience improves chances of getting certified
- A fair prevailing wage is important factor for getting certified

Recommendations

- EasyVisa company can use the predictive model to: a) Identify the cases that can be certified B) Identify the cases that can be denied
- The factors that affect the case denial are - Education and Previous Job Experience
- The higher the education of the employee, higher are chances of getting certified. The degree of Doctorate and Masters are highest ranking degrees
- The application for the employees with high school education need to be based on the skills they bring to the company
- Prevailing wage is the next important factor. The cases which offer fair wage based on the skill set
- EasyVisa can add the prevailing wage data for specific region and job role to this dataset. This can be used to match with each case application. This help determine case status more accurately
- The company related information like number of employees and year established have little to none impact on the result
- The continent of the employee holds more importance. Employee from Europe has highest chances to get certified.
- The region of the company has no significant impact on the result
- The company can gather more information on the employee's projects for further analysis and better prediction.
- Previous job experience is vital for the case judgement. The company can gather additional data surrounding previous job. For example - number of years, industry, technical skills, etc.

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Happy Learning !