Finding job Prediction During Pathrise Program

K Nearest Neighbor

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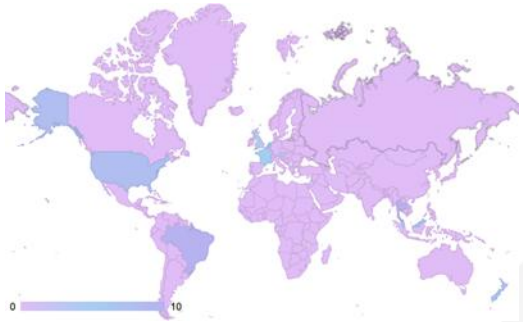
2024/2025

INTRODUCTION

In this analysis, we explore data from Pathrise, an online program aiding job seekers in the tech industry. The primary focus is to predict if a fellow will be placed at a company.

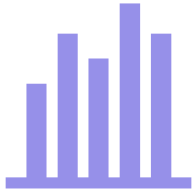
The main question that needs to be answered in this project is:

- Can we predict if candidate will be placed at Pathrise?



Dataset

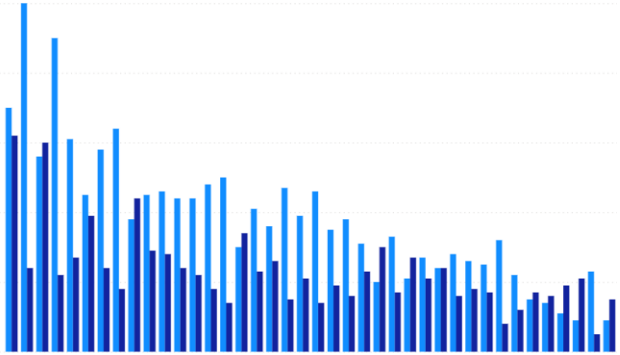
Participant information of the Pathrise program



The dataset contains information including high level of education, length of job search, professional experience, and more for 2544 individuals, and the "placed" column represents the main outcome, indicating whether a person was hired (1) or not (0) during the program

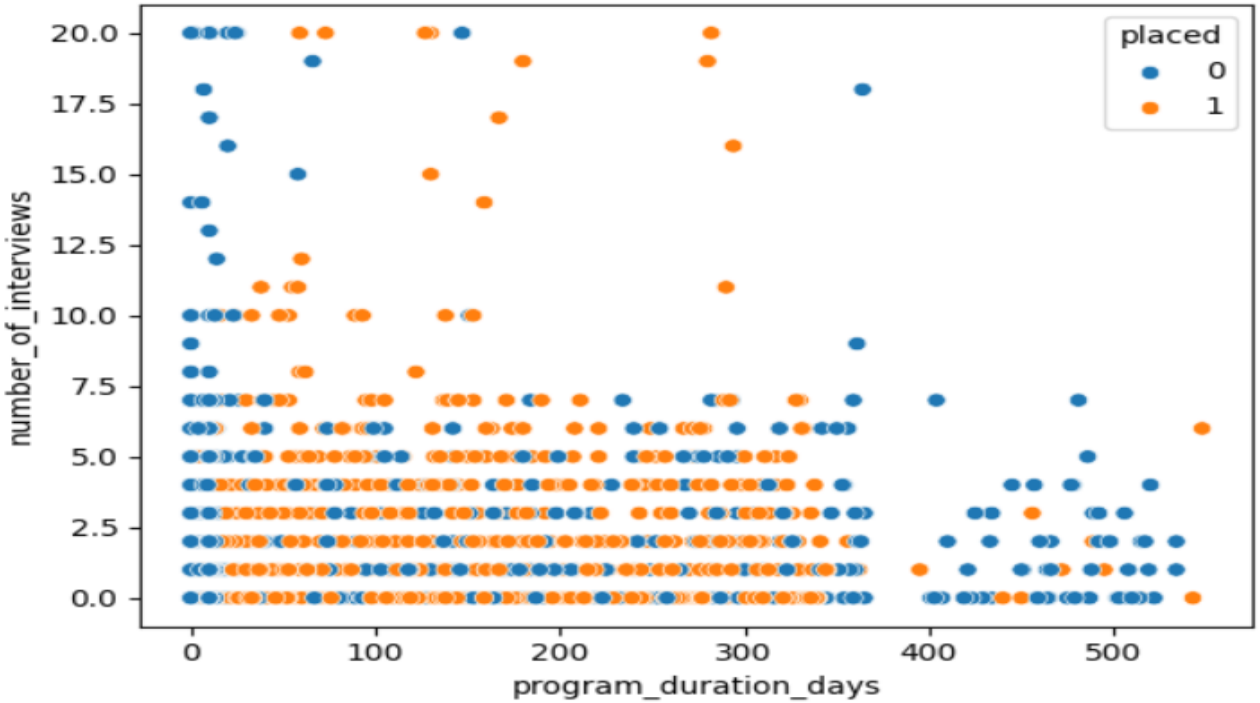
Type	Column	Row
All	17	2544
Object	11	2544
Int	4	2544
Float	2	2544

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1		id	pathrise_status	primary_track	cohort_tag	program_duration_days	placed	employment_status	highest_level_of_education	length_of_job_search	biggest_challenge_in_search	professional_experience	work_authorization_status	number_of_interviews	number_of_applications	gender	race
2	0	1	Active	SWE	OCT19A		0	Unemployed	Bachelor's Degree	3-5 months	Hearing back on my applications	3-4 years	Canada Citizen	2	900	Male	Non-Hisp
3	1	2	Active	PSO	JAN20A		0	Unemployed	Some College, No Degree	3-5 months	Getting past final round interviews	1-2 years	Citizen	6	0	Male	Non-Hisp
4	2	3	Closed Lost	Design	AUG19B	0	0	Employed Part-Time	Master's Degree	Less than one month	Figuring out which jobs to apply for	Less than one year	Citizen	0	0	Male	East Asia
5	3	4	Closed Lost	PSO	AUG19B	0	0	Contractor	Bachelor's Degree	Less than one month	Getting past final round interviews	Less than one year	Citizen	5	25	Male	Decline to
6	4	5	Placed	SWE	AUG19A	89	1	Unemployed	Bachelor's Degree	1-2 months	Hearing back on my applications	1-2 years	F1 Visa/OPT	10	100	Male	East Asia
7	5	6	Closed Lost	SWE	AUG19A	0	0	Employed Full-Time	Master's Degree	1-2 months	Technical interviewing	3-4 years	Green Card	5	100	Male	East Asia
8	6	7	Closed Lost	SWE	AUG19B	0	0	Employed Full-Time	Master's Degree	Less than one month	Getting past phone screens	3-4 years	Green Card	0	9	Male	Black, Afr
9	7	8	Withdrawn (Failed)	SWE	AUG19A	19	0	Employed Part-Time	Bachelor's Degree	Less than one month	Getting past final round interviews	1-2 years	Citizen	4	15	Female	Latino or
10	8	9	Active	SWE	AUG19B		0	Student	Master's Degree	Less than one month	Technical interviewing	1-2 years	F1 Visa/CPT	1	5	Male	East Asia
11	9	10	Withdrawn (Trial)	SWE	SEP19A	13	0	Employed Full-Time	Master's Degree	Less than one month	Getting past final round interviews	3-4 years	Citizen	0	10	Male	Black, Afr
12	10	11	Closed Lost	PSO	AUG19B	0	0	Unemployed	Master's Degree	1-2 months	Hearing back on my applications	1-2 years	Other	0	3	Male	Latino or
13	11	12	Withdrawn	Data	AUG19C	158	0	Unemployed	Master's Degree	3-5 months	Lack of relevant experience	5+ years	Citizen	5	50	Male	Decline to
14	12	13	Withdrawn (Trial)	Design	OCT19A	12	0	Contractor	Bachelor's Degree	6 months to a year	Getting past phone screens	1-2 years	Green Card	3	10	Male	Middle Ea
15	13	14	Withdrawn	PSO	OCT19A	52	0	Employed Part-Time	Bachelor's Degree	1-2 months	Lack of relevant experience	Less than one year	Citizen	4	40	Male	Non-Hisp
16	14	15	Active	PSO	DEC19A		0	Employed Full-Time	Bachelor's Degree	1-2 months	Technical skills	1-2 years	Citizen	2	35	Male	Non-Hisp
17	15	16	Active	PSO	JAN20A		0	Employed Full-Time	Bachelor's Degree	3-5 months	Getting past mid-stage interviews	Less than one year	Citizen	1	25	Male	South Asi
18	16	17	Active	PSO	FEB20A		0	Student	Bachelor's Degree	Less than one month	Getting past phone screens	3-4 years	Green Card	1	35	Male	East Asia
19	17	18	Active	SWE	JAN20A		0	Student	Bachelor's Degree	1-2 months	Lack of relevant experience	1-2 years	Green Card	5	45	Female	Middle Ea
20	18	19	Active	SWE	JAN20A		0	Unemployed	Bachelor's Degree	3-5 months	Hearing back on my applications	Less than one year	Citizen		15	Male	East Asia
21	19	20	Withdrawn (Trial)	Data	AUG19A	13	0	Employed Full-Time	Bachelor's Degree	1-2 months	Getting past final round interviews	1-2 years	Citizen	0	70	Male	Latino or
22	20	21	Active	Data	FEB20A		0	Employed Part-Time	Master's Degree	3-5 months	Technical interviewing	3-4 years	Citizen	3	30	Male	East Asia
23	21	22	Withdrawn (Trial)	SWE	NOV19A	11	0	Student	Master's Degree	3-5 months	Hearing back on my applications	3-4 years	F1 Visa/OPT	1	9	Male	Black, Afr
24	22	23	Withdrawn	SWE	AUG19A	93	0	Contractor	Bachelor's Degree	6 months to a year	Hearing back on my applications	1-2 years	Citizen	1	10	Female	East Asia
25	23	24	Placed	PSO	NOV19B	193	1	Unemployed	Master's Degree	6 months to a year	Hearing back on my applications	1-2 years	Citizen	5	4	Male	Non-Hisp
26	24	25	Closed Lost	Design	NOV19B	0	0	Contractor		1-2 months	Hearing back on my applications	3-4 years	Green Card	0	20		East Asia
27	25	26	Active	SWE	JAN20B		0	Student	Bachelor's Degree	1-2 months	Lack of relevant experience	Less than one year	F1 Visa/OPT	0	130	Male	East Asia
28	26	27	Active	SWE	FEB20B		0	Student	Bachelor's Degree	1-2 months	Figuring out which jobs to apply for	1-2 years	Citizen	2	15	Male	Latino or
29	27	28	Withdrawn (Trial)	SWE	NOV19A	12	0	Unemployed	Bachelor's Degree	3-5 months	Technical interviewing	5+ years	Citizen	0	20	Female	East Asia
30	28	29	Closed Lost	PSO	JAN20A	0	0	Employed Full-Time	Bachelor's Degree	6 months to a year	Hearing back on my applications	Less than one year	Citizen		45	Male	Non-Hisp
31	29	30	Withdrawn (Trial)	Design	JAN20B	13	0	Unemployed	Master's Degree	1-2 months	Getting past phone screens	1-2 years	F1 Visa/OPT	0	110	Female	Latino or
32	30	31	Placed	SWE	NOV19A	73	1	Student	Master's Degree	Less than one month	Figuring out which jobs to apply for	1-2 years	F1 Visa/CPT	0	1	Male	East Asia
33	31	32	Active	SWE	JAN20B		0	Student	Bachelor's Degree	3-5 months	Getting past phone screens	Less than one year	Other	5	10	Male	East Asia
34	32	33	Withdrawn	SWE	NOV19A	286	0	Student	Bachelor's Degree	1-2 months	Hearing back on my applications	1-2 years	F1 Visa/OPT	0	15	Female	East Asia
35	33	34	Active	SWE	NOV19A		0	Employed Part-Time	Master's Degree	Less than one month	Technical interviewing	Less than one year	F1 Visa/CPT	1	3	Male	Black, Afr
36	34	35	Withdrawn (Trial)	SWE	JAN20B	5	0	Student	Some College, No Degree	6 months to a year	Figuring out which jobs to apply for	5+ years	Citizen	5	30	Female	Two or M
37	35	36	Active	Design	FEB20A		0	Student	Bachelor's Degree	1-2 months	Hearing back on my applications	1-2 years	F1 Visa/OPT	2	15	Female	East Asia
38	36	37	Withdrawn (Trial)	Data	NOV19A	19	0	Student	Master's Degree	Less than one month	Behavioral interviewing	3-4 years	F1 Visa/OPT	3	9	Female	East Asia
39	37	38	Withdrawn (Trial)	Design	DEC19A	7	0	Contractor	Master's Degree	1-2 months	Hearing back on my applications	1-2 years	Citizen	6	80	Female	East Asia
40	38	39	Active	PSO	NOV19B		0	Contractor	Bachelor's Degree	1-2 months	Getting past final round interviews	5+ years		4	25	Male	East Asia
41	39	40	Placed	SWE	NOV19A	83	1	Employed Full-Time	Master's Degree	3-5 months	Getting past final round interviews	5+ years	F1 Visa/OPT		15	Male	Native Ar
42	40	41	Active	PSO	DEC19A		0	Unemployed	Master's Degree	1-2 months	Getting past mid-stage interviews	Less than one year	Citizen	20	8	Female	Black, Afr

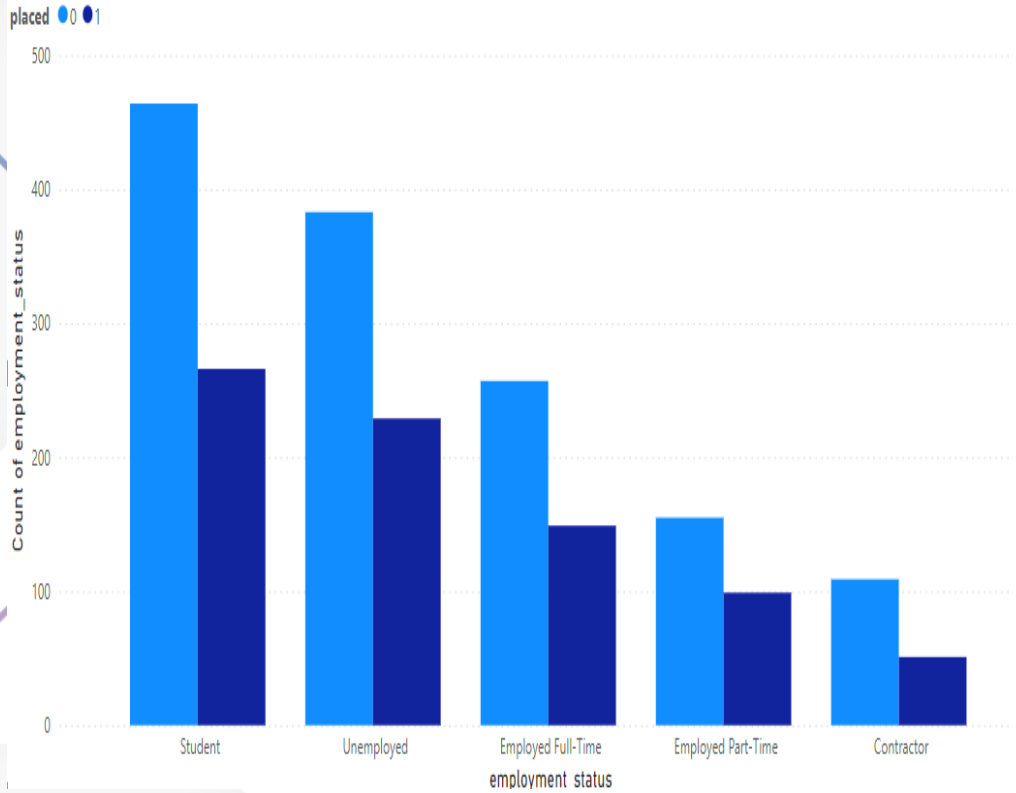


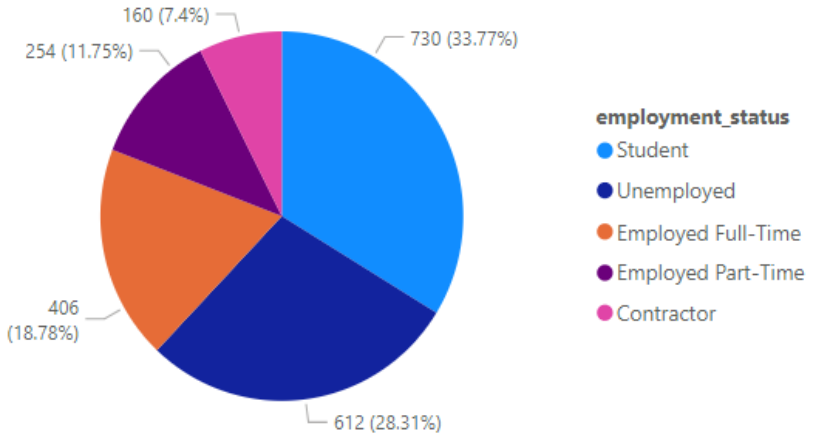
Data Overview

Scatter plot of program duration days vs number of interviews (colored by placement status)

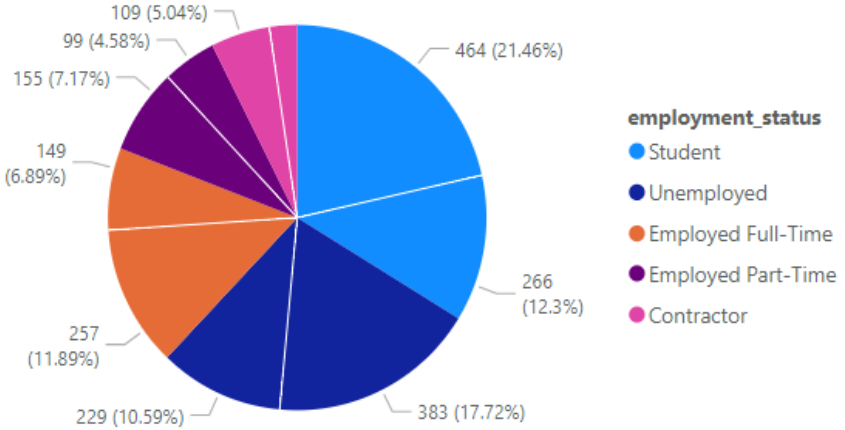


employment status

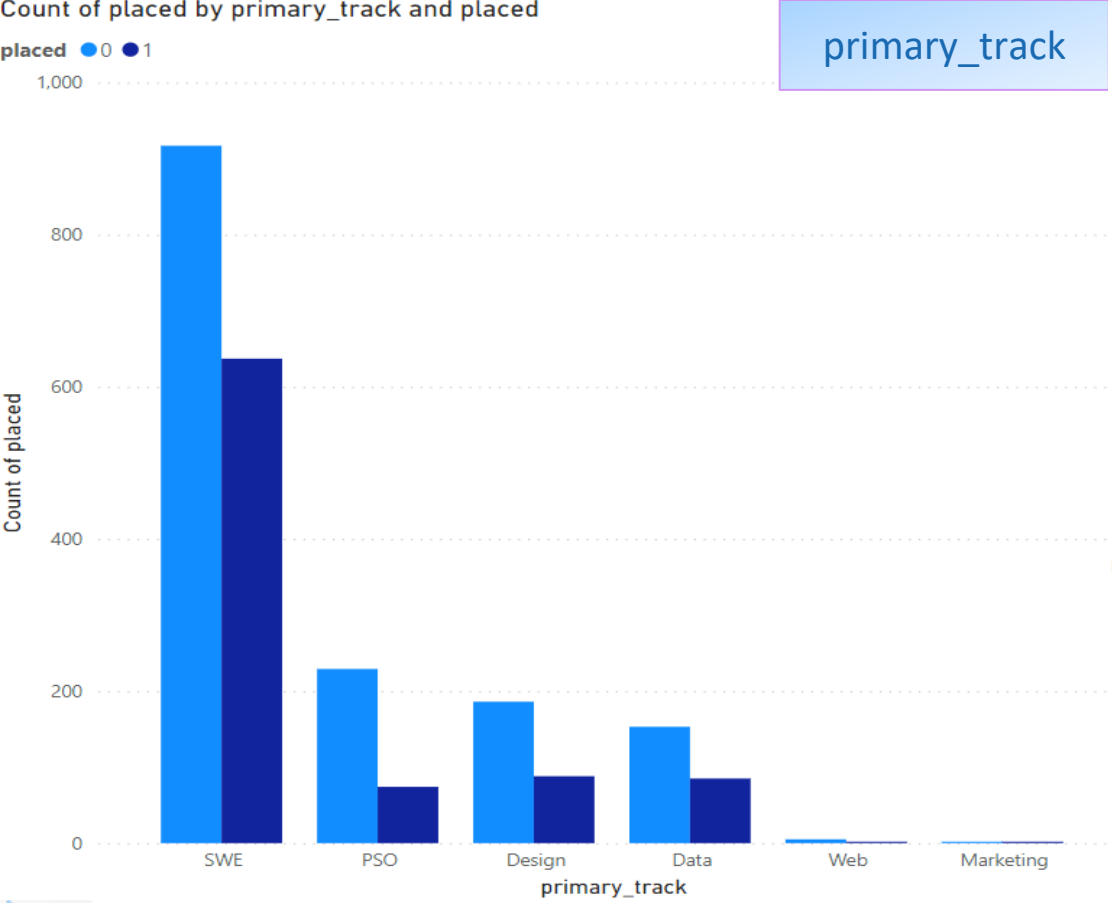


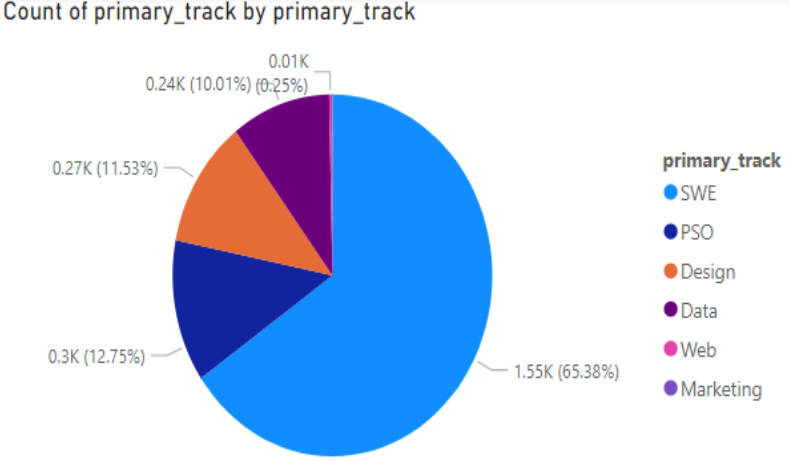


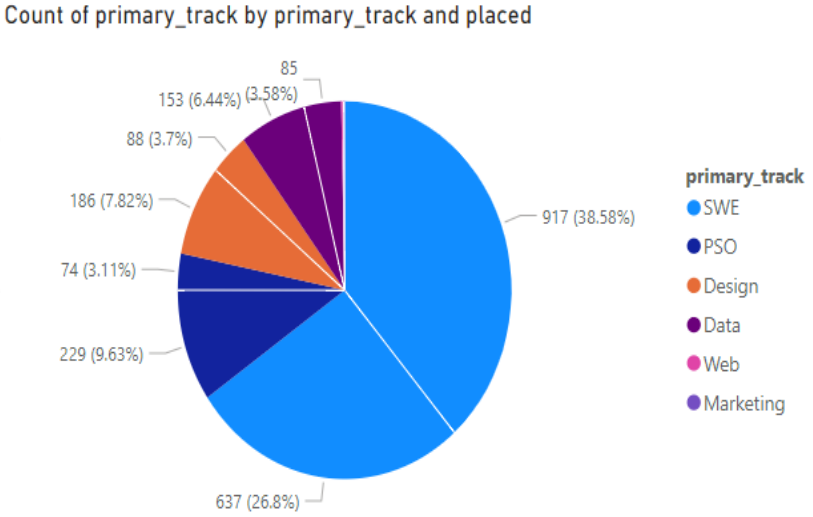
Count of employment_status by employment_status and placed



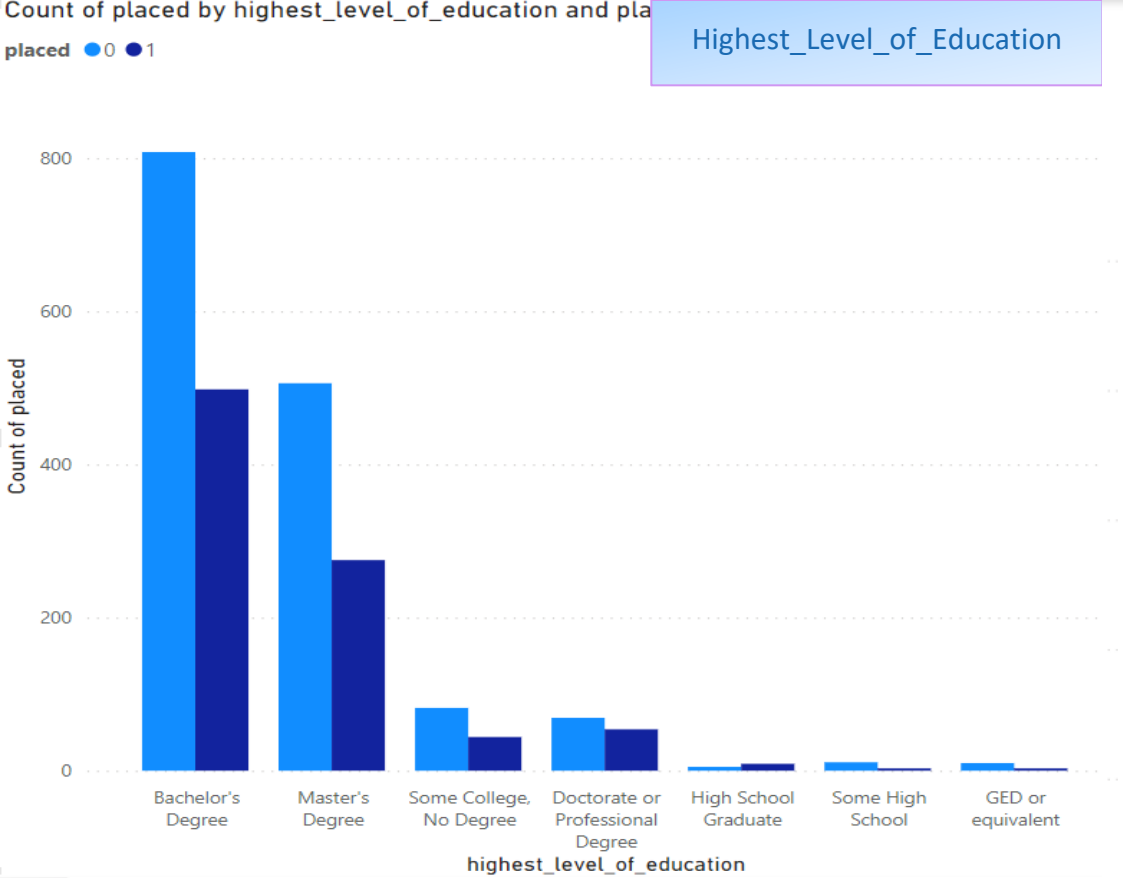
primary_track

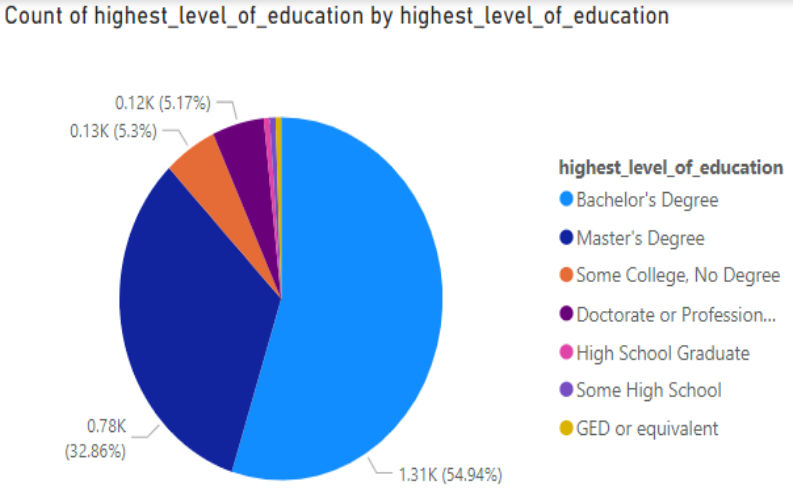


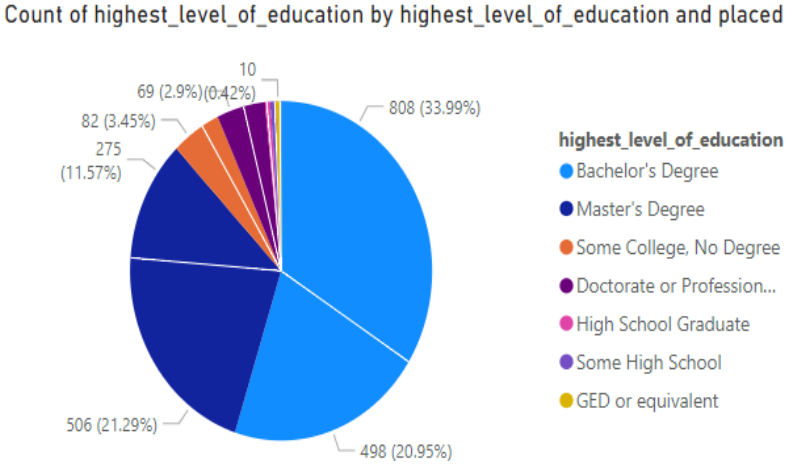




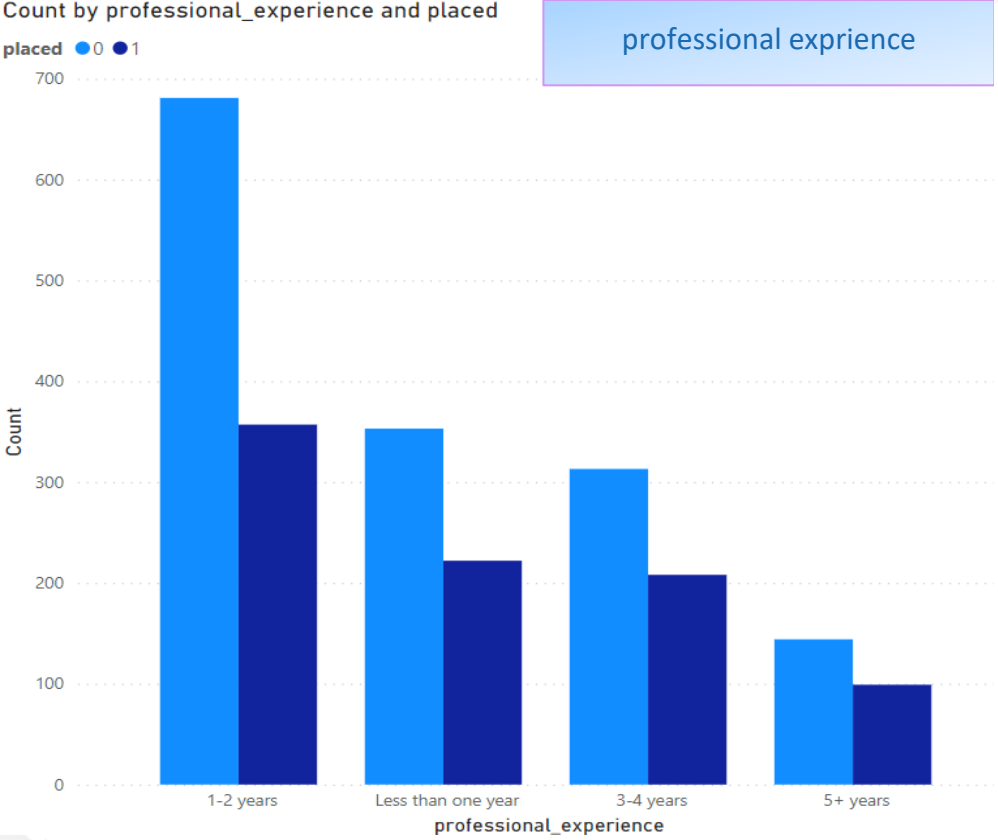
Highest_Level_of_Education

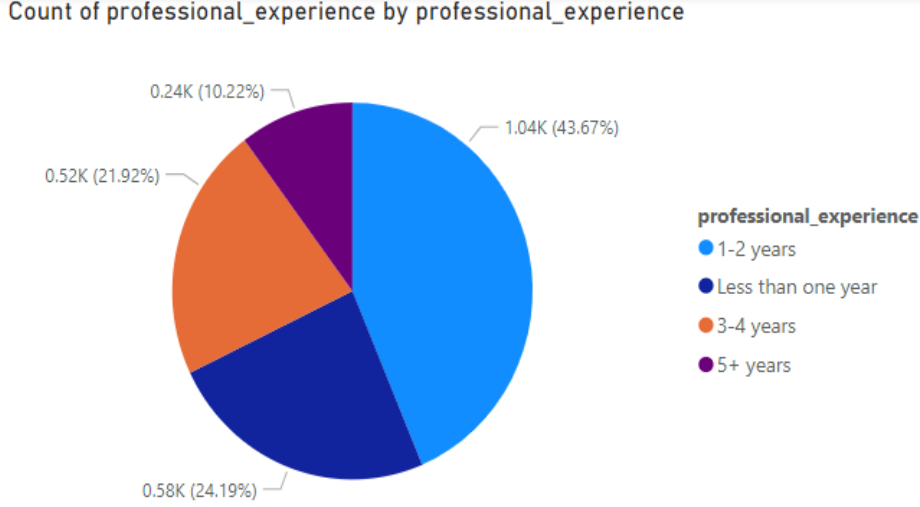


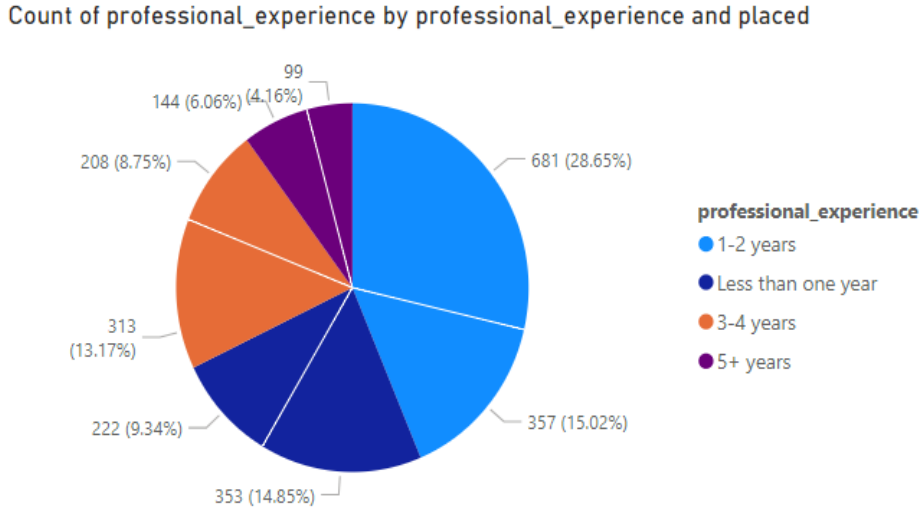




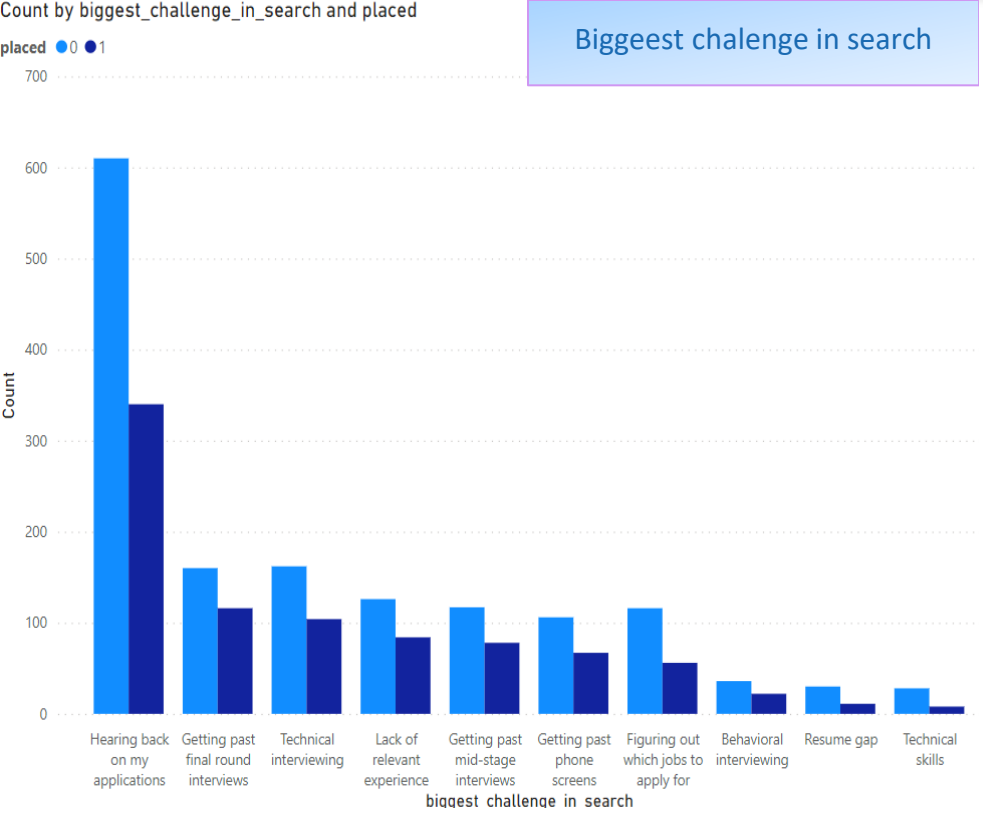
professional exprience

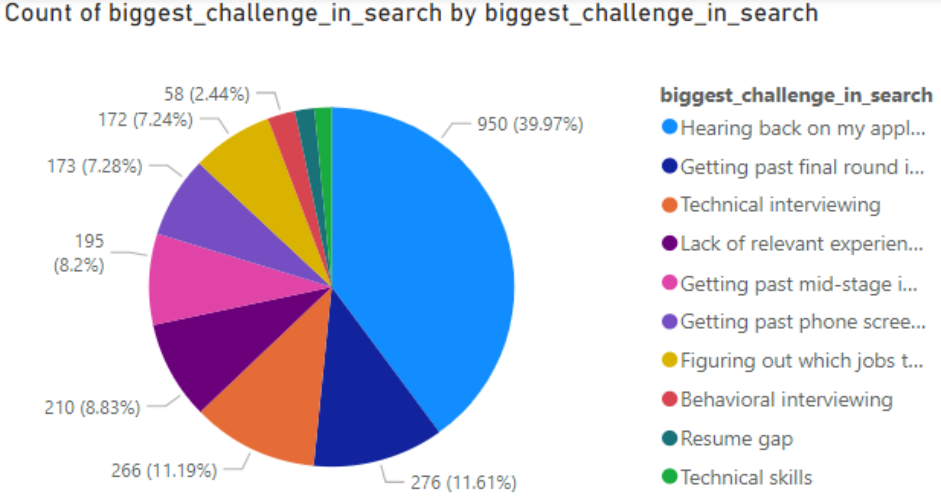


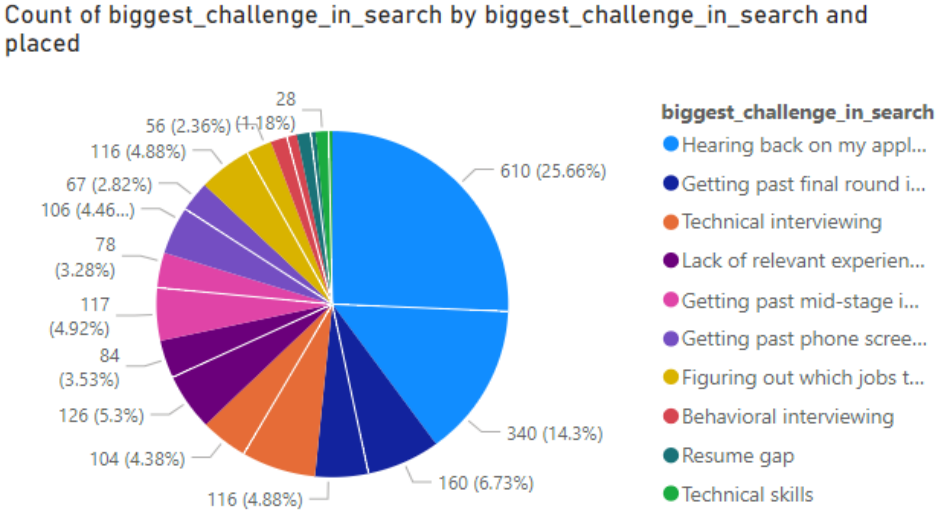




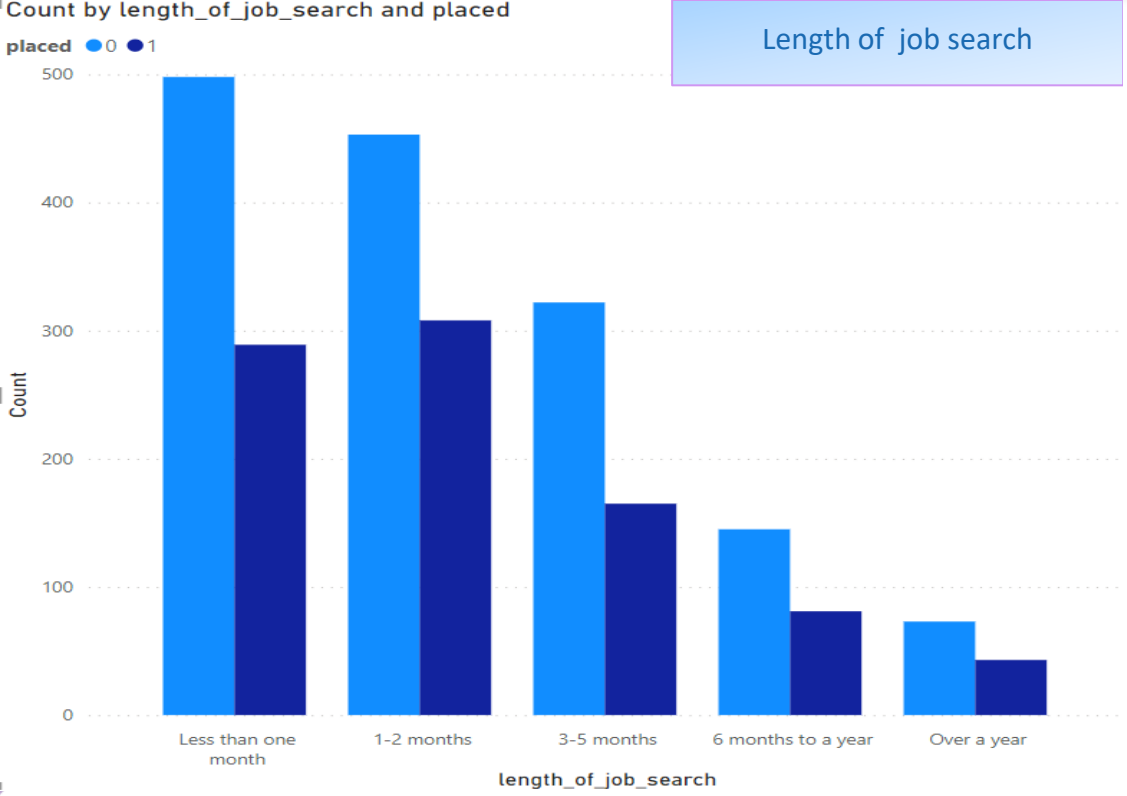
Biggeest chalenge in search

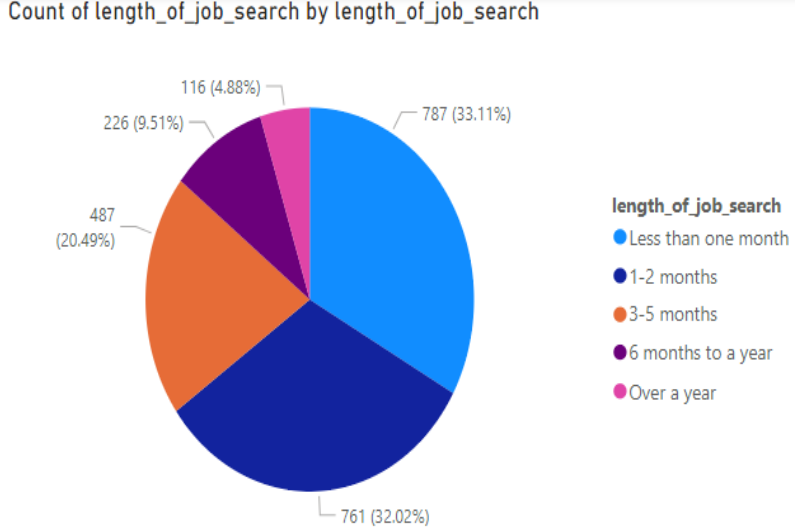


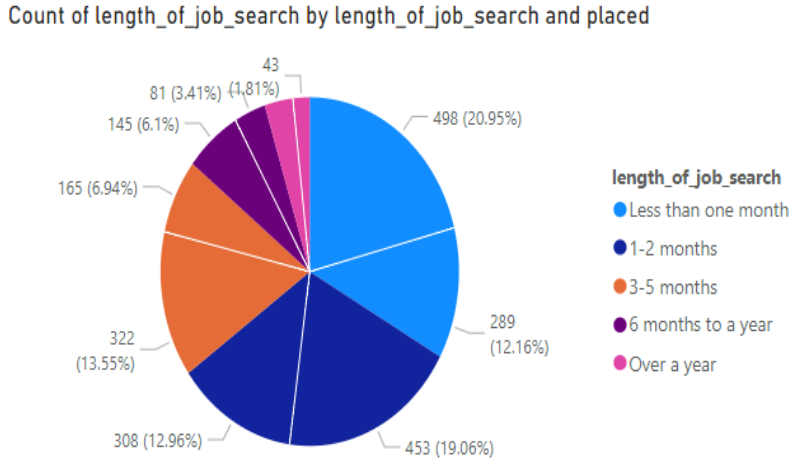


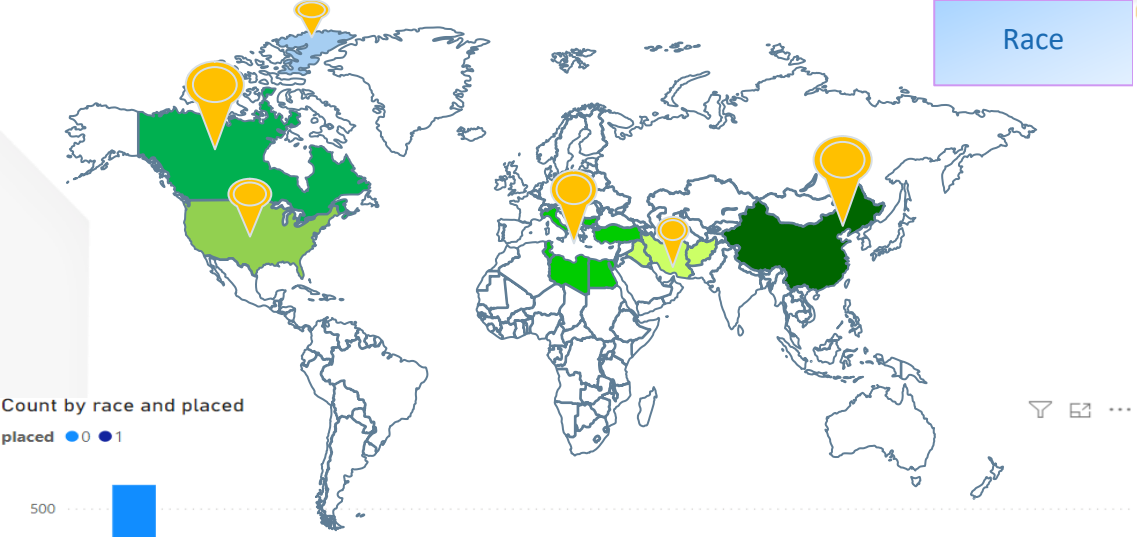


Length of job search



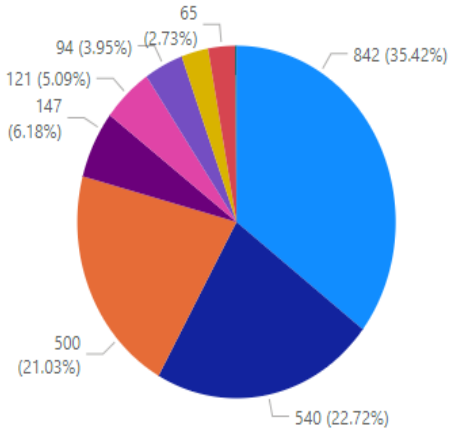






Race

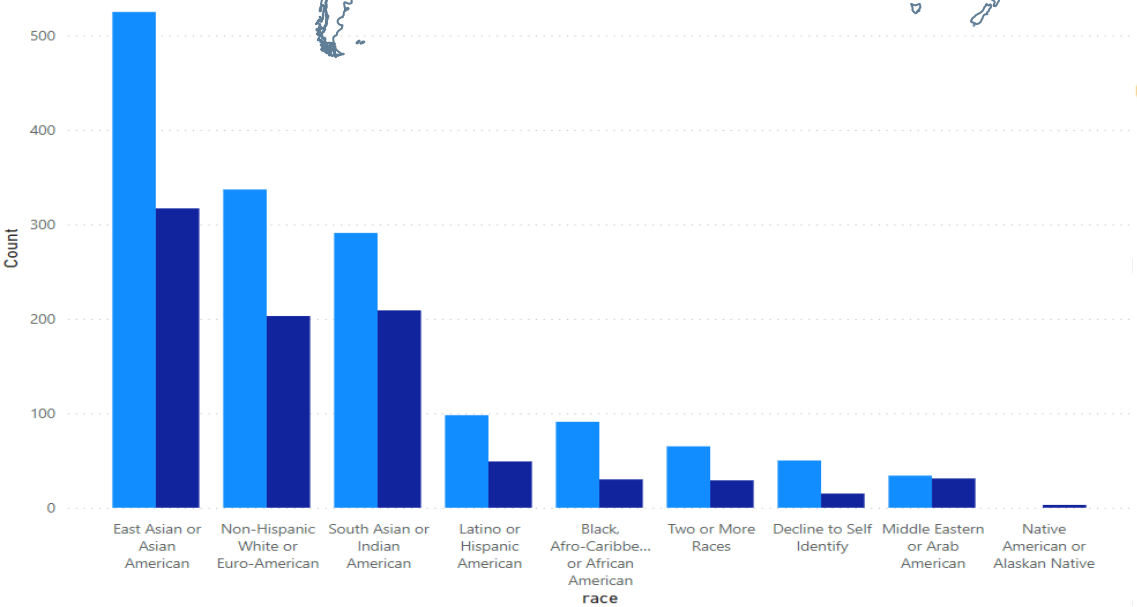
Count of race by race



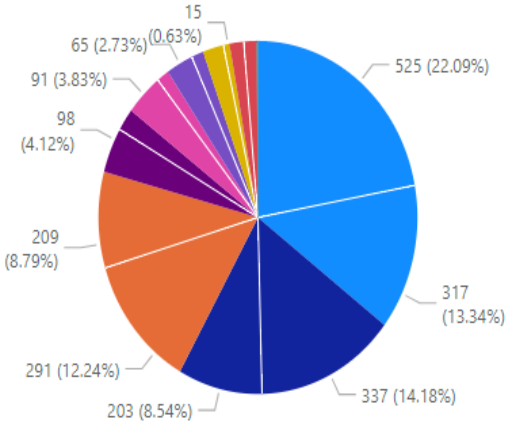
race
East Asian or Asian Am...
Non-Hispanic White or...
South Asian or Indian ...
Latino or Hispanic Ame...
Black, Afro-Caribbean, ...
Two or More Races
Decline to Self Identify
Middle Eastern or Arab...
Native American or Ala...

Count by race and placed

placed 0 1

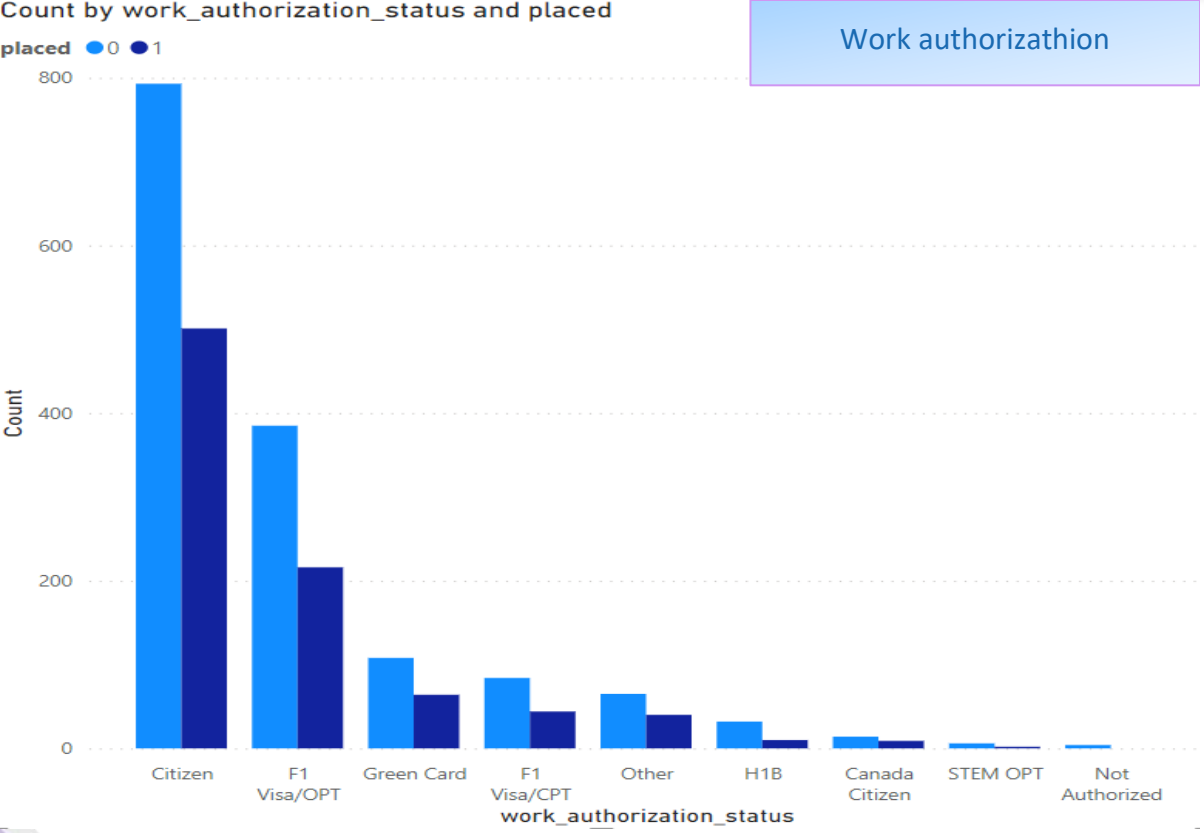


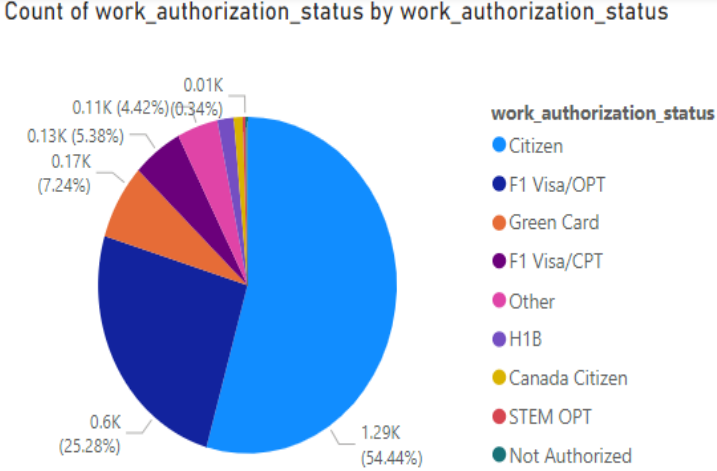
Count of race by race and placed

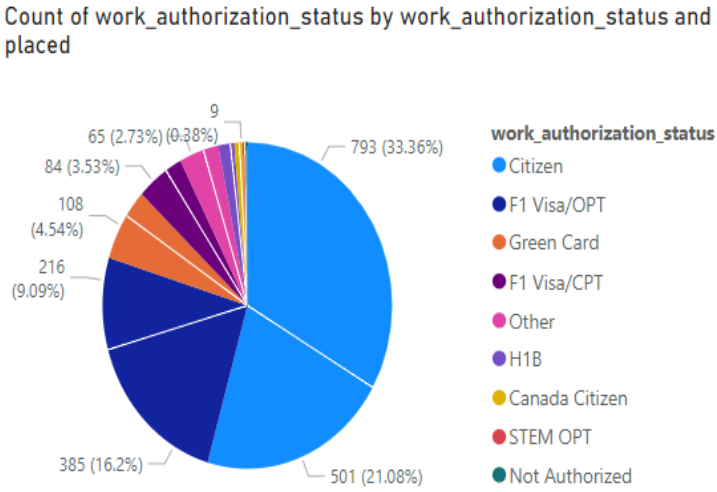


race
East Asian or Asian Am...
Non-Hispanic White or...
South Asian or Indian ...
Latino or Hispanic Ame...
Black, Afro-Caribbean, ...
Two or More Races
Decline to Self Identify
Middle Eastern or Arab...
Native American or Ala...

Work authorizathion







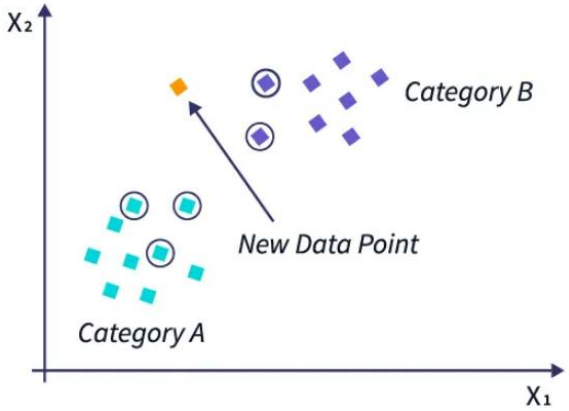
Provide Solution

For the question posed in the introduction section :

- Can we predict if candidate will be placed at Pathrise?

Leveraging Machine Learning

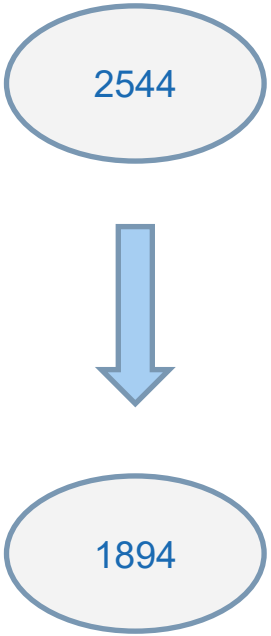
- Machine learning helps extract important information from data, leading to better decision-making.
- Machine learning models can learn from data and make decisions automatically and improve overtime.
- The KNN is a supervised learning classifier, which works well for simple classification tasks, making it ideal for small datasets.



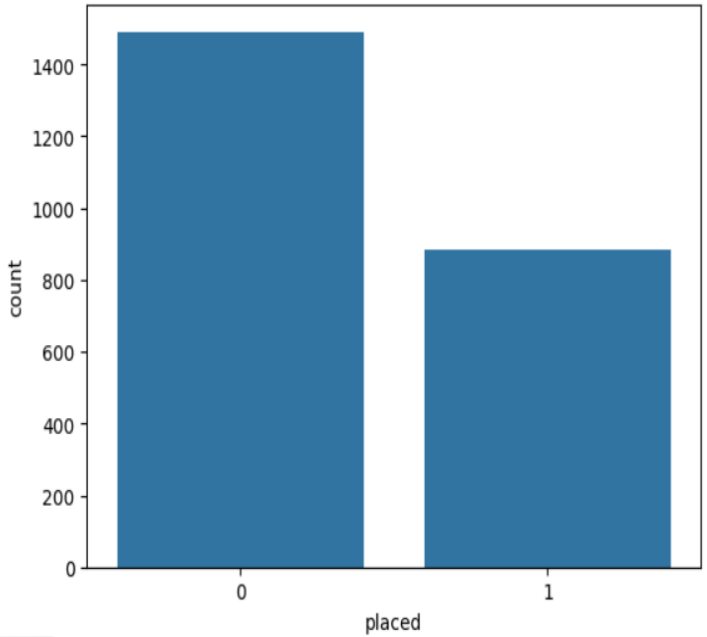
To make the dataset ready, it’s needed to do

preprocessing

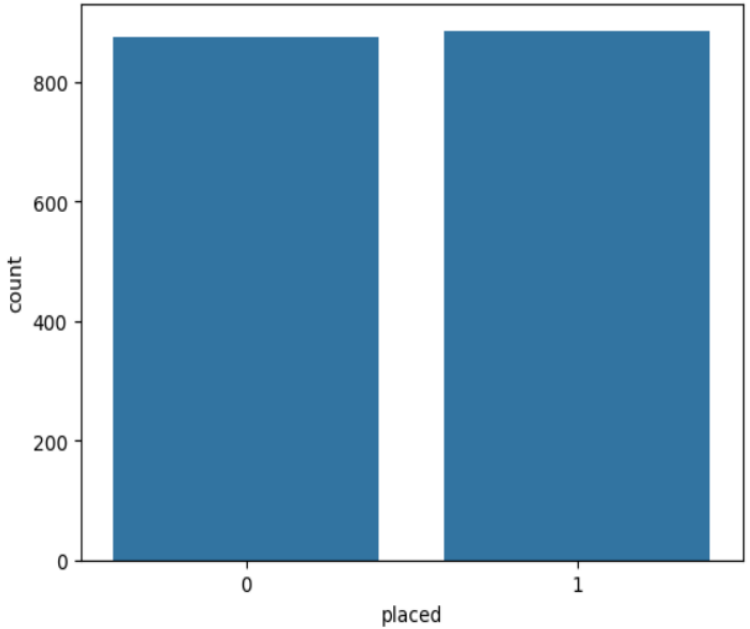
Program durations <15 days are excluded



Unballenced placed



Ballenced placed



```
[421] df.isnull().sum()
```

	0
pathrise_status	0
primary_track	0
program_duration_days	0
placed	0
employment_status	0
highest_level_of_education	0
length_of_job_search	0
biggest_challenge_in_search	0
professional_experience	0
work_authorization_status	0
number_of_interviews	0
number_of_applications	0
gender	0
race	0

dtype: int64

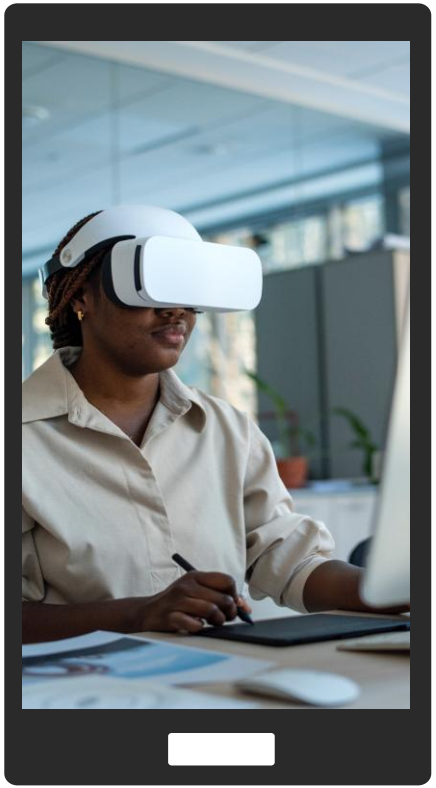
There is no Null value in the used dataset.

```
df.drop(columns=['Unnamed: 0'], inplace=True)
df.drop(columns=['id'], inplace=True)
df.drop(columns=['cohort_tag'], inplace=True)
df.drop(columns=['pathrise_status'], inplace=True)
df.drop(columns=['number_of_interviews'], inplace=True)
```

Columns cohort_tag, pathrise_status, number_of_interviews and id have no effect on our prediction so they were excluded.

As we need to have non-object values in our dataset, we converted the columns with object type to int.

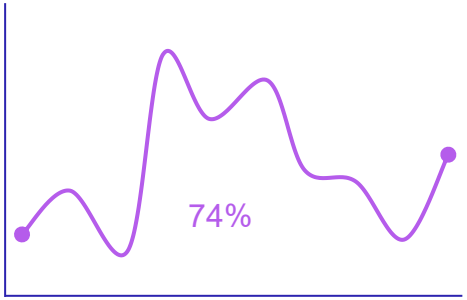
```
df=pd.get_dummies(df,columns=['employment_status ','primary_track','highest_level_of_education','length_of_job_search','gender','race','professional_experience'],dtype=int)
```



To automate tasks and gain insights from data, we need to make a machine learning

model

- KNN is easy to understand and implement, as it relies on calculating distances between data points to make predictions without requiring complex training phases.
- KNN is a non-parametric algorithm which means it doesn’t make any assume on structure of the underlying data.
- KNN memorizes training instances and uses them directly for predictions, which allows it to adapt quickly to new data but can make it slower and more memory-intensive for large datasets.



It was necessary to optimize

Hyperparameters

But what are they?

Hyperparameters necessity

In the KNN model, hyperparameters are essential settings that significantly affect the model's performance and accuracy. For example, the number of neighbors determines how many nearby points the model considers in making decisions. Choosing the right distance metric and weighting method helps the model achieve the best prediction results, especially with complex data.

- Set Prior to Training: Hyperparameters must be configured before the training process begins. They are not directly learned from the data but require manual selection and optimization.
- Control Over Model Performance: Hyperparameters play an essential role in managing the model's behavior and accuracy, helping to prevent issues like overfitting or underfitting.
- Optimization Through Trial and Error: Tuning hyperparameters is usually done through optimization techniques such as Grid Search or Random Search to achieve the best performance on a specific dataset.

which

Hyperparameters

do we used?

Used Hyperparameter

- ✓ n_neighbors: The number of neighbors in the K-Nearest Neighbors model, with values set between 1 and 10 to find the best value.

To optimize the hyperparameters, we have used

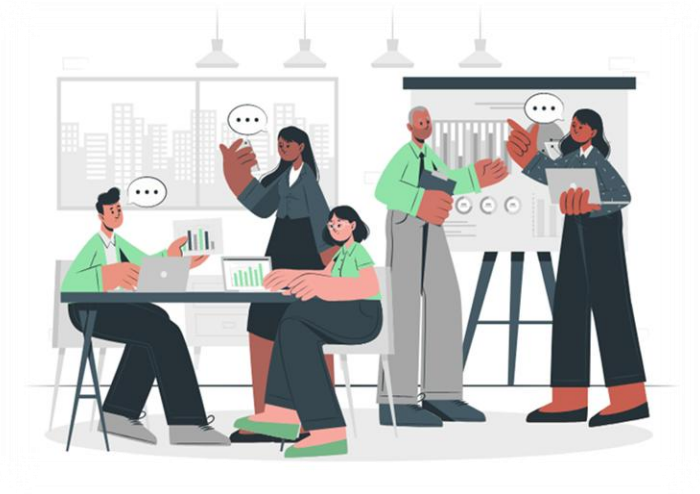
Grid Search

Grid Search

```
[242] # Allows us to test parameters of classification algorithms and find the best one
      from sklearn.model_selection import GridSearchCV
```

```
[243] parameters = {'n_neighbors': [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]}
```

```
[244] knn_cv = GridSearchCV(knn_1, parameters)
      knn_cv.fit(X_train, y_train)
```



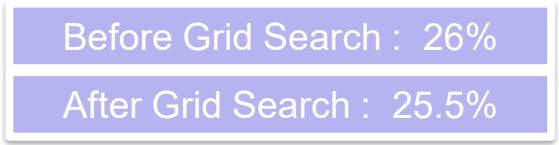
What are the

Results

that we have obtained?

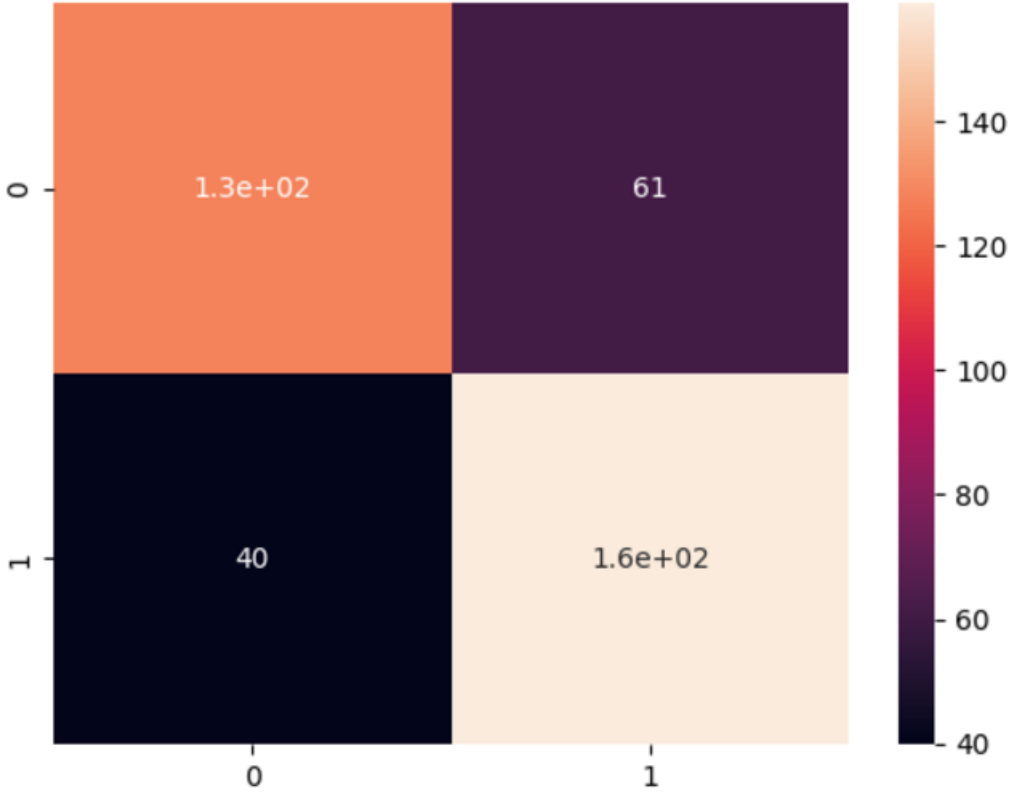
KNN Mean Absolute Error

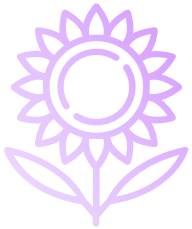
- **MAE** calculates the average absolute difference between the predicted probabilities (usually between 0 and 1) and the actual labels (0 for benign, 1 for malware)
- Hyperparameter tuning reduced the model's average error by 0.5% (MAE).



Confusion matrix

- We have used confusion matrix to visualize the performance of our classification model.
- It helps us to understand how many predictions the model got right and wrong for each class in the data.





THANKS