Project 5_exploration_analysis

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1 Data Visualization on Kaggle 2020

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1.2 Preliminary Wrangling

This dataset is the annual survey of Kaggle on data science and machine learning in 2020. It collects the information of prectitioners in a comprehensive way, from age, gender to prefered machine learning tools. I'll explore the dataset to understand the data science and machine learning practitioners with Doctoral degree.

[8]:
```
# import all packages and set plots to be embedded inline
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

%matplotlib inline
```

[2]:
```
survey_2020 = pd.read_csv('kaggle_survey_2020_responses.csv', low_memory=False,␣
↪skiprows=[1])
```

[3]:
```
survey_2020.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20036 entries, 0 to 20035
Columns: 355 entries, Time from Start to Finish (seconds) to Q35_B_OTHER
dtypes: int64(1), object(354)
memory usage: 54.3+ MB
```

[4]:
```
survey_2020.isna().sum()
```

[4]:
```
Time from Start to Finish (seconds)        0
Q1                                         0
Q2                                         0
Q3                                         0
Q4                                       467
```

```
                                        ...
Q35_B_Part_7                            19556
Q35_B_Part_8                            19190
Q35_B_Part_9                            19517
Q35_B_Part_10                           16954
Q35_B_OTHER                             19785
Length: 355, dtype: int64
```

1.2.1 What is the structure of your dataset?

It has 20036 rows and 355 colomns

1.2.2 What is/are the main feature(s) of interest in your dataset?

salary

1.2.3 What features in the dataset do you think will help support your investigation into your feature(s) of interest?

columns containing the information of education level and coding experience

1.3 Univariate Exploration

[5]:
```
columns = {'Q1': 'Age',
           'Q2': 'Gender',
           'Q3': 'Country',
           'Q4': 'Education',
           'Q5': 'Title',
           'Q6': 'Coding_exp',
           'Q8': 'Recommended_language',
           'Q15': 'ML_exp',
           'Q20': 'Company_size',
           'Q24': 'Salary'}
survey_2020.rename(columns=columns, inplace=True)
```

[6]:
```
Education = ['No formal education past high school',
             'Some college/university study without earning a bachelor's␣
 ↪degree',
             'Bachelor's degree',
             'Master's degree',
             'Doctoral degree',
             'Professional degree',
             'I prefer not to answer']
edu = pd.api.types.CategoricalDtype(categories=Education, ordered=True)
```

```
survey_2020['Education'] = survey_2020['Education'].astype(edu)
```

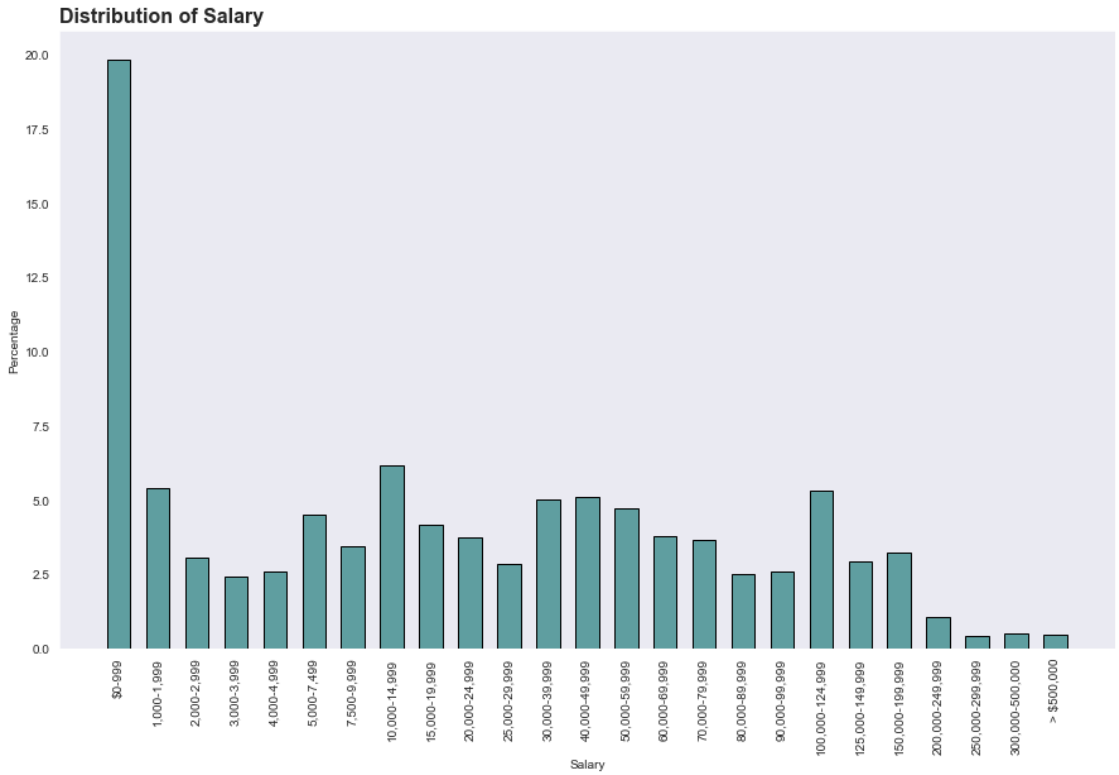
[37]:
```
survey_2020_doct = survey_2020.query('Education == "Doctoral degree"').copy()
survey_2020_other = survey_2020.query('Education != "Doctoral degree"').copy()
```

[32]:
```
edu_count = survey_2020.groupby('Education').size()
total = edu_count.sum()
edu_count = edu_count/total*100
edu_count
```

[32]:
```
Education
No formal education past high school                                1.226430
Some college/university study without earning a bachelor's degree   5.580254
Bachelor's degree                                                  35.658439
Master's degree                                                    40.160458
Doctoral degree                                                    11.763504
Professional degree                                                 3.571976
I prefer not to answer                                              2.038939
dtype: float64
```

[41]:
```
salary = ['$0-999', '1,000-1,999', '2,000-2,999', '3,000-3,999', '4,000-4,999',␣
↪'5,000-7,499', '7,500-9,999',
          '10,000-14,999', '15,000-19,999', '20,000-24,999', '25,000-29,999',␣
↪'30,000-39,999', '40,000-49,999',
          '50,000-59,999', '60,000-69,999', '70,000-79,999', '80,000-89,999',␣
↪'90,000-99,999', '100,000-124,999',
          '125,000-149,999', '150,000-199,999', '200,000-249,999',␣
↪'250,000-299,999', '300,000-500,000', '> $500,000']
salary_total = survey_2020.groupby('Salary').size()[salary]
salary_prop_total = salary_total/salary_total.sum()*100
```

[43]:
```
sns.set_style('dark')
fig, ax = plt.subplots(figsize=[15, 9])
ax.bar(salary_total.index, salary_prop_total, color='cadetblue', edgecolor=(0,␣
↪0, 0), width=0.6, label='All')
plt.xticks(rotation=90)
plt.xlabel('Salary')
plt.ylabel('Percentage')
plt.title('Distribution of Salary', fontsize=16, fontweight='bold', loc='left');
```



Majority of the respondents have annual salary lower than $1000.

Next, I'll explore the distribution of salary and coding experience.

1.3.1 Discuss the distribution(s) of your variable(s) of interest. Were there any unusual points? Did you need to perform any transformations?

Majority of the respondents have annual salary lower than \$1000, which is unusual in US. The reason might be that this is collected from worldwide, the salary is different in developed and developing country.

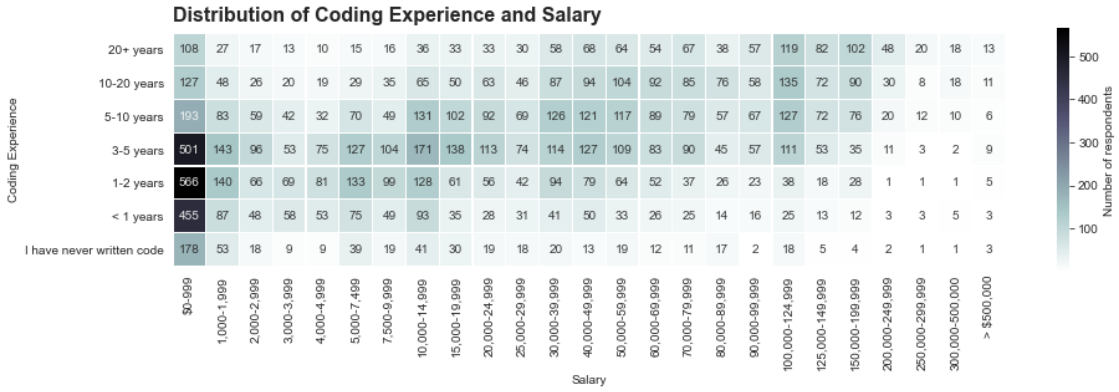
1.3.2 Of the features you investigated, were there any unusual distributions? Did you perform any operations on the data to tidy, adjust, or change the form of the data? If so, why did you do this?

No

1.4 Bivariate Exploration

[46]:
```
coding = ['I have never written code', '< 1 years', '1-2 years', '3-5 years',␣
 ↪'5-10 years', '10-20 years', '20+ years']
coding_salary = survey_2020.groupby(['Coding_exp', 'Salary']).size().
 ↪unstack()[salary].reindex(coding[::-1]).fillna(0).astype(int)
```

[48]:
```
fig, ax = plt.subplots(figsize=[15, 9])

sns.heatmap(data=coding_salary,
                    cmap='bone_r',
                    linewidths=0.2,
                    square=True,
                    annot=True,
                    fmt = 'd',
                    annot_kws={'alpha': 0.9},
                    cbar_kws={'shrink': 0.4, 'label': 'Number of respondents'})
plt.xlabel('Salary')

plt.ylabel('Coding Experience')

plt.title('Distribution of Coding Experience and Salary', fontsize=16,␣
 ↪fontweight='bold', loc='left', va='bottom');
```



There is a positive correlation between coding experience and salary. Next, I'll bring the third variable, country.

1.4.1 Talk about some of the relationships you observed in this part of the investigation. How did the feature(s) of interest vary with other features in the dataset?

Although most of the respondents have salary lower than \$1000, there is a positive correlation between salary and coding experience.

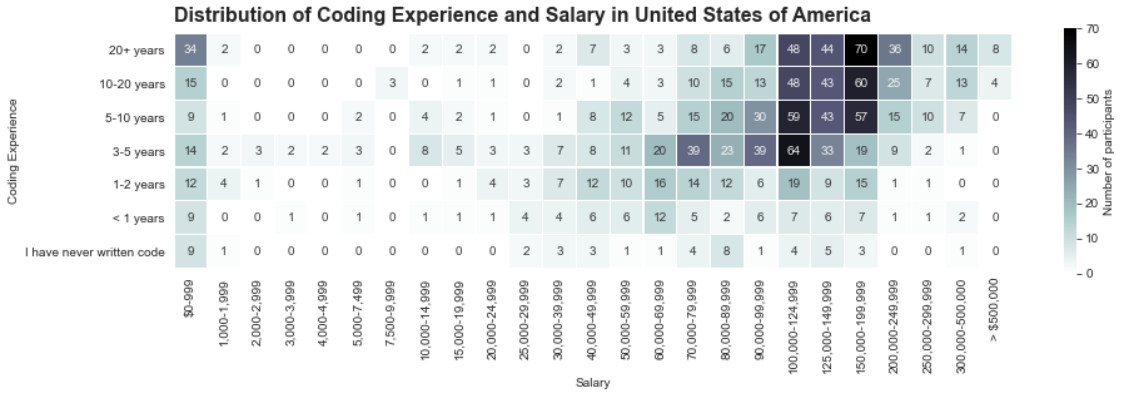
1.4.2 Did you observe any interesting relationships between the other features (not the main feature(s) of interest)?

No

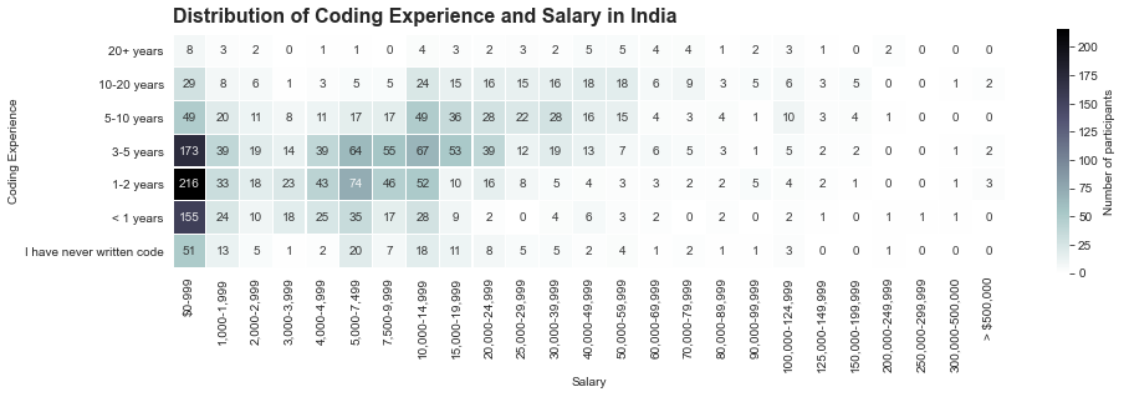
1.5 Multivariate Exploration

[51]:
```
def coding_vs_salary(country):
    survey_2020_c = survey_2020[survey_2020['Country']==country].copy()
    coding_salary_c = survey_2020_c.groupby(['Coding_exp', 'Salary']).size().
↪unstack()[salary].reindex(coding[::-1]).fillna(0).astype(int)

    fig, ax = plt.subplots(figsize=[15, 9])

    sns.heatmap(data=coding_salary_c,
                cmap='bone_r',
                linewidths=0.2,
                square=True,
                annot=True,
                fmt = 'd',
                annot_kws={'alpha': 0.9},
                cbar_kws={'shrink': 0.4, 'label': 'Number of participants'})
    plt.xlabel('Salary')
    plt.ylabel('Coding Experience')

    plt.title('Distribution of Coding Experience and Salary in {}'.
↪format(country), fontsize=16, fontweight='bold', loc='left', va='bottom');
```

[52]:
```
coding_vs_salary('United States of America')
```



[53]:
```
coding_vs_salary('India')
```



The average salary of respondents from US is much higher than those from India.

1.5.1 Talk about some of the relationships you observed in this part of the investigation. Were there features that strengthened each other in terms of looking at your feature(s) of interest?

US, representative of the developed country, showed higher salary than India, representative of the developing country, when the coding experience is the same.

1.5.2 Were there any interesting or surprising interactions between features?

There are more experienced respondents (coding experience longer than 5 years) in US.

[ ]: