Practice Project - Matplotlib based Data Visualization in Python

- #### Heat Maps using Matplotlib
- #### Confusion Matrix using Matplotlib

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Problem Statement:

```
Using Matplotlib generate Heat Map & Confusion Matrix
```

1. Heat Maps using Matplotlib

In [ ]:
```
%pylab inline
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
```

```
Populating the interactive namespace from numpy and matplotlib
```

Populating the interactive namespace from numpy and matplotlib

In [ ]:
```
helix = pd.read_csv('data/helix_parameters.csv')
helix.head() # just seeing that data was imported properly by outputing first 5 cells
```

Out[ ]:

	job_n	Energy	n_helices	r0_A	r0_B	r0_C	omega0	delta_omega0_A	delta_omega0_B	delta_omega0_C	...	invert_B	invert_C	z1_offset_A	z1_offset_I
0	36019	-387.167	3	6.0	6.0	6.0	0	0	120	240	...	1	0	0	0.(
1	36022	-402.606	3	6.0	6.0	6.0	0	0	120	240	...	1	0	0	0.(
2	36020	-395.944	3	6.0	6.0	6.0	0	0	120	240	...	1	0	0	0.(

	job_n	Energy	n_helices	r0_A	r0_B	r0_C	omega0	delta_omega0_A	delta_omega0_B	delta_omega0_C	...	invert_B	invert_C	z1_offset_A	z1_offset_I
3	36002	-389.788	3	6.0	6.0	6.0	0	0	120	240	...	1	0	0	-3.(
4	36005	-388.016	3	6.0	6.0	6.0	0	0	120	240	...	1	0	0	-3.(

5 rows × 27 columns

In [ ]:
```
# shape of the dataframe
helix.shape
```

Out[ ]:
```
(47475, 27)
```

In [ ]:
```
# checking what the columns are
helix.columns
```

Out[ ]:
```
Index(['job_n', 'Energy', 'n_helices', 'r0_A', 'r0_B', 'r0_C', 'omega0',
       'delta_omega0_A', 'delta_omega0_B', 'delta_omega0_C', 'z0_offset_A',
       'z0_offset_B', 'z0_offset_C', 'helix1 phase', 'helix 2 phase',
       'helix3 phase', 'invert_A', 'invert_B', 'invert_C', 'z1_offset_A',
       'z1_offset_B', 'z1_offset_C', 'delta_t_A', 'delta_t_B', 'delta_t_C',
       'omega1', 'z1'],
      dtype='object')
```

Selecting Columns (by different methods)

In [ ]:
```
# selecting a couple columns
couple_columns = helix[['Energy','helix 2 phase', 'helix1 phase']]
couple_columns.head()
```

Out[ ]:

	Energy	helix 2 phase	helix1 phase
0	-387.167	0	0
1	-402.606	0	0
2	-395.944	0	0
3	-389.788	0	0

	Energy	helix 2 phase	helix1 phase
4	-388.016	0	0

Heat Map Generation

In [ ]:
```
# this is essentially would be taking the average of each unique combination.
# one important mention is notice how little the data varies from eachother.
phase_1_2 = couple_columns.groupby(['helix1 phase', 'helix 2 phase']).mean()
print (phase_1_2.shape)
phase_1_2.head(10)
```

```
(100, 1)
```

Out[ ]:

		Energy
helix1 phase	**helix 2 phase**	
0	**0**	-392.419841
	20	-389.622691
	40	-390.318620
	60	-392.198537
	80	-393.661624
	100	-392.226253
	120	-390.955112
	140	-394.319969
	160	-392.594862
	180	-389.254009

In [ ]:
```
phase_1_2 = phase_1_2.reset_index()
phase_1_2.head()
```

Out[ ]:

	helix1 phase	helix 2 phase	Energy
0	0	0	-392.419841
1	0	20	-389.622691
2	0	40	-390.318620
3	0	60	-392.198537
4	0	80	-393.661624

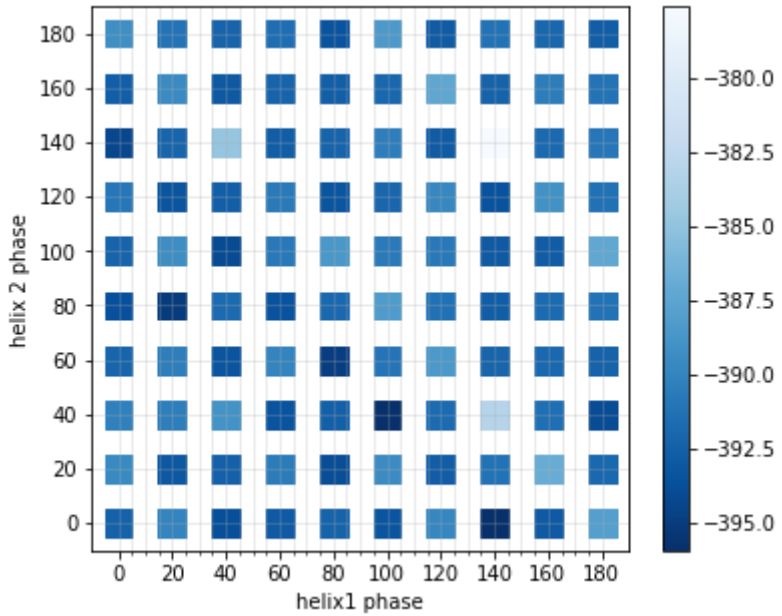
In [ ]:

```
major_ticks = np.arange(0, 200, 20)
minor_ticks = np.arange(0, 180, 5)

fig = plt.figure(figsize = (6,5))
ax = fig.add_subplot(1,1,1)
s = ax.scatter('helix1 phase', 'helix 2 phase', c = 'Energy',data = phase_1_2, cmap = 'Blues_r', marker = 's',s = 190)
ax.axis([phase_1_2['helix1 phase'].min()-10, phase_1_2['helix1 phase'].max()+10, phase_1_2['helix 2 phase'].min()-10, phase_1_2['h
ax.set_xticks(major_ticks)
ax.set_xticks(minor_ticks, minor=True)
ax.set_yticks(major_ticks)
ax.grid(which='both', alpha = 0.3)
ax.grid(which='major', alpha=0.3)
ax.set_xlabel('helix1 phase', fontsize=10);
ax.set_ylabel('helix 2 phase', fontsize=10);

# http://stackoverflow.com/questions/13943217/how-to-add-colorbars-to-scatterplots-created-like-this
cbar = plt.colorbar(mappable = s,ax = ax)

plt.show()
```



---

2. Confusion Matrix using Matplotlib

Let's import all the dependencies first.

In [ ]:
```
# primary data structure library
import pandas as pd

# primary plotting libraries
import matplotlib.pyplot as plt
import seaborn as sns

# using the inline backend
%matplotlib inline
```

Now we'll create the DataFrame.

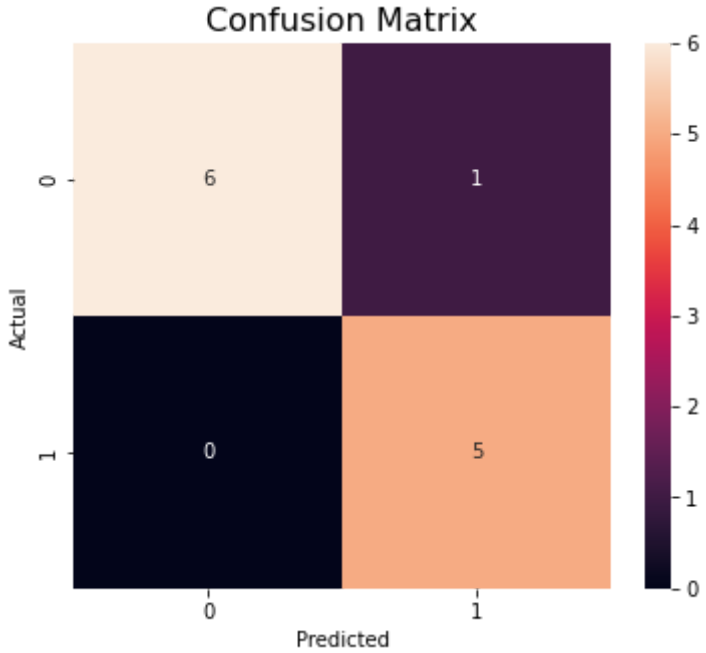
In [ ]:
```
data = {'Actual':    [1, 0, 0, 1, 0, 1, 0, 0, 1, 0, 1, 0],
        'Predicted': [1, 1, 0, 1, 0, 1, 0, 0, 1, 0, 1, 0]
```

```
        }
df = pd.DataFrame(data, columns=['Actual','Predicted'])
```

Let's plot the confusion matrix.

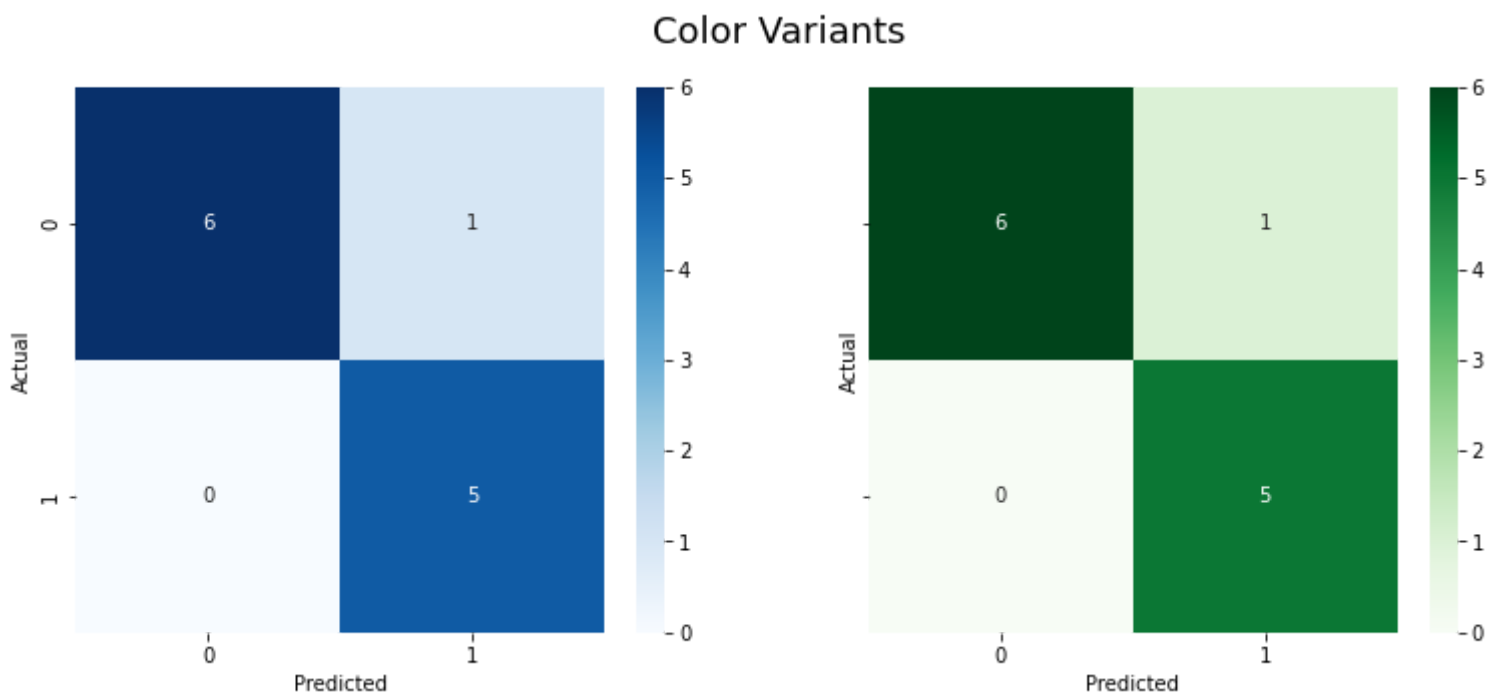
In [ ]:
```
confusion_matrix = pd.crosstab(df['Actual'], df['Predicted'], rownames=['Actual'], colnames=['Predicted'])
```

In [ ]:
```
plt.figure(figsize=(6,5))
sns.heatmap(confusion_matrix, annot=True)
plt.title("Confusion Matrix", fontsize=16)
plt.show()
```



Didn't like the color theme? you can change it as shown below.

In [ ]:
```
fig, axes = plt.subplots(1, 2, figsize=(13, 5), sharey=True)
fig.suptitle("Color Variants", fontsize=18)
sns.heatmap(confusion_matrix, annot=True, ax=axes[0], cmap="Blues")
sns.heatmap(confusion_matrix, annot=True, ax=axes[1], cmap="Greens")
plt.show()
```


Color Variants
Actual
Predicted
6
1
0
5
0
1
0
1
0
1
2
3
4
5
6