project

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1 Project

1.0.1 SDS322E

1.1 Enter your name and EID here

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Please submit as a python notebook file on Canvas before the due date

For all questions, include the Python commands/functions that you used to find your answer. Answers without supporting code will not receive credit.

1.1.1 Libraries

[1]:

```
import numpy as np
import matplotlib.pylab as plt
import pandas as pd
import shap
from sklearn.ensemble import RandomForestClassifier
```

1.1.2 Question 1.

[2]:

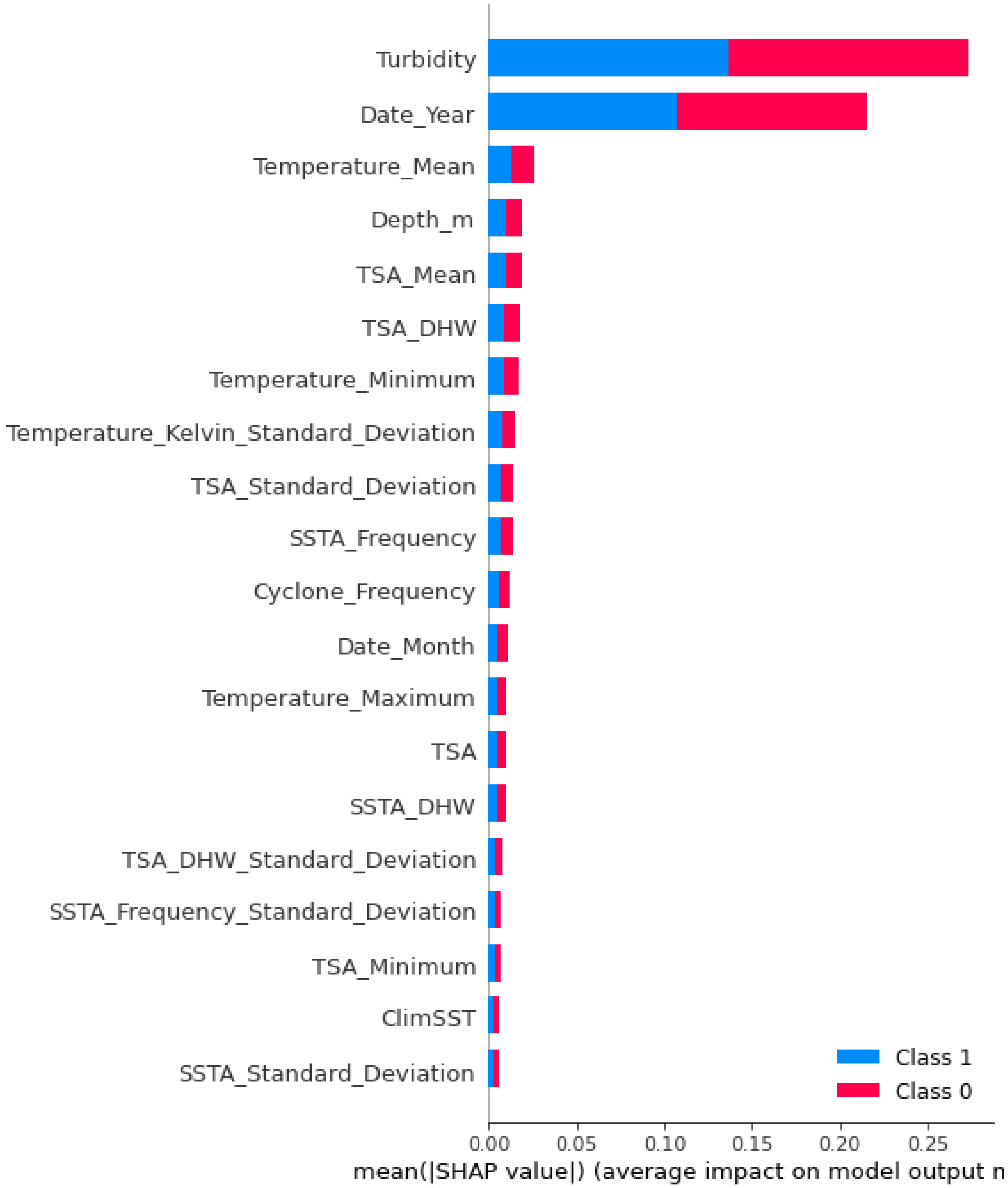
```
df = pd.read_csv('~/Data_Science/V2-global-bleaching-and-environmental-data.
 ↪csv', na_values = 'nd')

print(df.head())

print(list(df.columns))

#print(df['Bleaching_Comments'].unique())
#print(df['Exposure'])
#print(df['Substrate_Name'])
#print(df['Bleaching_Level'])

df['label'] = 1
df['label'][df['Percent_Bleaching'] < 50.0] = 0

# drop four columns from the end except label as they are character columns
```

```
df.drop(['Date', 'Site_Comments', 'Sample_Comments', 'Bleaching_Comments'],␣
 ↪axis = 1, inplace = True)

# Drop columns from Site_ID to Site_Name (i.e. from the begin of the dataframe)␣
 ↪as they are character columns
df.drop(df.loc[:, 'Site_ID':'Site_Name'], axis = 1, inplace = True)

# Drop Exposure,  Substrate_Name and Bleaching_Level since they are character␣
 ↪columns
df.drop(['Exposure', 'Substrate_Name', 'Bleaching_Level'], axis = 1, inplace =␣
 ↪True)

# Drop Percent_Bleaching as it is not needed since label is being computed from␣
 ↪Percent_Bleaching
df.drop(['Percent_Bleaching'], axis = 1, inplace = True)

# Droping all rows with NaN values
df1 = df.dropna()

X = df1.iloc[:, :-1]
y = df1['label']

clf = RandomForestClassifier(n_estimators=500, random_state=41)
clf.fit(X,y)

explainer = shap.Explainer(clf)
shap_values = explainer.shap_values(X[::200])
shap.summary_plot(shap_values, X[::200])
```

```
   Site_ID  Sample_ID Data_Source  Latitude_Degrees  Longitude_Degrees  \
0     2501   10324336      Donner            23.163           -82.5260
1     3467   10324754      Donner           -17.575          -149.7833
2     1794   10323866      Donner            18.369           -64.5640
3     8647   10328028      Donner            17.760           -64.5680
4     8648   10328029      Donner            17.769           -64.5830

  Ocean_Name Reef_ID            Realm_Name  \
0   Atlantic     NaN     Tropical Atlantic
1    Pacific     NaN  Eastern Indo-Pacific
2   Atlantic     NaN     Tropical Atlantic
3   Atlantic     NaN     Tropical Atlantic
4   Atlantic     NaN     Tropical Atlantic

                               Ecoregion_Name      Country_Name  …  \
0                     Cuba and Cayman Islands              Cuba  …
1            Society Islands French Polynesia  French Polynesia  …
2  Hispaniola Puerto Rico and Lesser Antilles    United Kingdom  …
```

```
3  Hispaniola Puerto Rico and Lesser Antilles     United States  …
4  Hispaniola Puerto Rico and Lesser Antilles     United States  …

  TSA_FrequencyMax TSA_FrequencyMean TSA_DHW  TSA_DHW_Standard_Deviation  \
0              5.0               0.0    0.00                        0.74
1              4.0               0.0    0.26                        0.67
2              7.0               0.0    0.00                        1.04
3              4.0               0.0    0.00                        0.75
4              5.0               0.0    0.00                        0.92

  TSA_DHWMax  TSA_DHWMean        Date  \
0       7.25         0.18  2005-09-15
1       4.65         0.19  1991-03-15
2      11.66         0.26  2006-01-15
3       5.64         0.20  2006-04-15
4       6.89         0.25  2006-04-15

                                       Site_Comments  \
0                                                NaN
1  The bleaching does not  appear to have gained …
2                                                NaN
3                                                NaN
4                                                NaN

                                     Sample_Comments  Bleaching_Comments
0                                                NaN                 NaN
1  The bleaching does not  appear to have gained …                 NaN
2                                                NaN                 NaN
3                                                NaN                 NaN
4                                                NaN                 NaN

[5 rows x 62 columns]
['Site_ID', 'Sample_ID', 'Data_Source', 'Latitude_Degrees', 'Longitude_Degrees',
'Ocean_Name', 'Reef_ID', 'Realm_Name', 'Ecoregion_Name', 'Country_Name',
'State_Island_Province_Name', 'City_Town_Name', 'Site_Name',
'Distance_to_Shore', 'Exposure', 'Turbidity', 'Cyclone_Frequency', 'Date_Day',
'Date_Month', 'Date_Year', 'Depth_m', 'Substrate_Name', 'Percent_Cover',
'Bleaching_Level', 'Percent_Bleaching', 'ClimSST', 'Temperature_Kelvin',
'Temperature_Mean', 'Temperature_Minimum', 'Temperature_Maximum',
'Temperature_Kelvin_Standard_Deviation', 'Windspeed', 'SSTA',
'SSTA_Standard_Deviation', 'SSTA_Mean', 'SSTA_Minimum', 'SSTA_Maximum',
'SSTA_Frequency', 'SSTA_Frequency_Standard_Deviation', 'SSTA_FrequencyMax',
'SSTA_FrequencyMean', 'SSTA_DHW', 'SSTA_DHW_Standard_Deviation', 'SSTA_DHWMax',
'SSTA_DHWMean', 'TSA', 'TSA_Standard_Deviation', 'TSA_Minimum', 'TSA_Maximum',
'TSA_Mean', 'TSA_Frequency', 'TSA_Frequency_Standard_Deviation',
'TSA_FrequencyMax', 'TSA_FrequencyMean', 'TSA_DHW',
'TSA_DHW_Standard_Deviation', 'TSA_DHWMax', 'TSA_DHWMean', 'Date',
'Site_Comments', 'Sample_Comments', 'Bleaching_Comments']
```

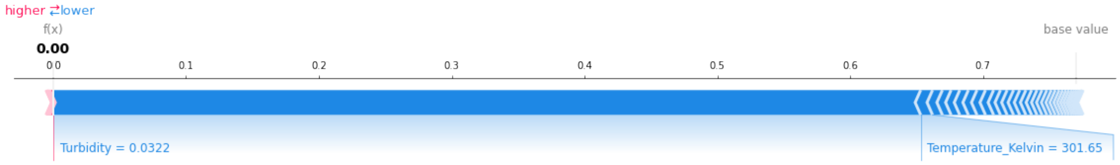
```
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
```



[3]:

```
object_i = 125
class_object_i = int(y[::200].iloc[object_i])

print('Analysis for  Object Id : ', object_i)
print('-------------------------')

print('True Class (if 1, Percent_Bleaching >= 50.0, otherwise Percent_Bleaching␣
 ↪< 50.0) : ', class_object_i)
print('Probability that this data point belong to class 0 = %0.2f'%(explainer.
 ↪expected_value[0] + sum(shap_values[0][object_i,:])))
print('Base Probability for class 0 = %0.2f'%(explainer.expected_value[0]))

shap.force_plot(explainer.expected_value[0],
                shap_values[0][object_i,:],
                X.iloc[object_i,:],
                matplotlib=True)
```

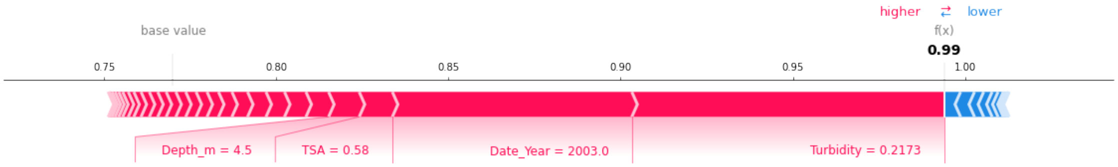
```
Analysis for  Object Id :  125
-------------------------
True Class (if 1, Percent_Bleaching >= 50.0, otherwise Percent_Bleaching < 50.0)
:  1
Probability that this data point belong to class 0 = 0.00
Base Probability for class 0 = 0.77
```



[4]:

```
object_i = 55
class_object_i = int(y[::200].iloc[object_i])

print('Analysis for  Object Id : ', object_i)
print('-------------------------')

print('True Class (if 1, Percent_Bleaching >= 50.0, otherwise Percent_Bleaching␣
 ↪< 50.0) : ', class_object_i)
print('Probability that this data point belong to class 0 = %0.2f'%(explainer.
 ↪expected_value[0] + sum(shap_values[0][object_i,:])))
print('Base Probability for class 0 = %0.2f'%(explainer.expected_value[0]))

shap.force_plot(explainer.expected_value[0],
                shap_values[0][object_i,:],
                X.iloc[object_i,:],
                matplotlib=True)
```

```
Analysis for  Object Id :  55
-------------------------
True Class (if 1, Percent_Bleaching >= 50.0, otherwise Percent_Bleaching < 50.0)
:  0
Probability that this data point belong to class 0 = 0.99
Base Probability for class 0 = 0.77
```



1.1.3 THE END