MileStone_1_Raghuwanshi_Prashant_DSC550

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Assignment: 6.3 Project Milestone 1

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Course: DSC550-T301 Data Mining (2221-1)

Analyze data to predict the traits to detect Autistics disease amoung the toddlers Data Source : https://www.kaggle.com/fabdelja/autism-screening-for-toddlers?select=Toddler+Autism+dataset+July+2018.csv

Description about Dataset:

The dataset was developed by Dr Fadi Fayez Thabtah (fadifayez.com) using a mobile app called ASDTests (ASDtests.com) to screen autism in toddlers.we can use it to estimate the predictive power of machine learning techniques in detecting autistic traits

Abstract: Autistic Spectrum Disorder (ASD) is a neurodevelopmental condition associated with significant healthcare costs, and early diagnosis can significantly reduce these. Unfortunately, waiting times for an ASD diagnosis are lengthy and procedures are not cost effective. The economic impact of autism and the increase in the number of ASD cases across the world reveals an urgent need for the development of easily implemented and effective screening methods. Therefore, a time-efficient and accessible ASD screening is imminent to help health professionals and inform individuals whether they should pursue formal clinical diagnosis. The rapid growth in the number of ASD cases worldwide necessitates datasets related to behaviour traits

[1]:
```
# Import library
import pandas as pd
import yellowbrick
import matplotlib.pyplot as plt
import numpy as np
```

```
C:\ProgramData\Anaconda3\lib\site-packages\sklearn\utils\deprecation.py:144:
FutureWarning: The sklearn.metrics.classification module is  deprecated in
version 0.22 and will be removed in version 0.24. The corresponding classes /
functions should instead be imported from sklearn.metrics. Anything that cannot
be imported from sklearn.metrics is now part of the private API.
  warnings.warn(message, FutureWarning)
```

Columns Details : Features collected and their descriptions Feature Type Description Variable in Dataset Corresponding Q-chat-10-Toddler Features A1 Does your child look at you when you call his/her name? A2 How easy is it for you to get eye contact with your child? A3 Does your child point to indicate that s/he wants something? (e.g. a toy that is out of reach) A4 Does your child point to share interest with you? (e.g. poin9ng at an interes9ng sight) A5 Does your child pretend? (e.g. care for dolls, talk on a toy phone) A6 Does your child follow where you're looking? A7 If you or someone else in the family is visibly upset, does your child show signs of wan9ng to comfort them? (e.g. stroking hair, hugging them) A8 Would you describe your child's first words as: A9 Does your child use simple gestures? (e.g. wave goodbye) A10 Does your child stare at nothing with no apparent purpose? Age Number Toddlers (months) Score by Q-chat-10 Number 1-10 (Less that or equal 3 no ASD traits; > 3 ASD traits Sex Character Male or Female Ethnicity String List of common ethnicities in text format Born with jaundice Boolean (yes or no) Whether the case was born with jaundice Family member with ASD history Boolean (yes or no) Whether any immediate family member has a PDD Who is completing the test String Parent, self, caregiver, medical staff, clinician ,etc. Why_are_you_taken_the_screening String Use input textbox Class variable String ASD traits or No ASD traits (automatically assigned by the ASDTests app). (Yes / No)

[2]:
```
# 1.        Load the data from the "Toddler Autism dataset July 2018.csv" file␣
 ↪into a DataFrame.
addr1 = "D:/MS_DataScience/DSC550/Milestone-1/Toddler Autism dataset July 2018.
 ↪csv"
df_todd = pd.read_csv(addr1)
df_todd.head()
```

[2]:

	Case_No	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	Age_Mons	Qchat-10-Score	Sex	Ethnicity	Jaundice	Family_mem_with_ASD	Who completed the test	ASD_Traits
0	1	0	0	0	0	0	0	1	1	0	1	28	3	f	middle eastern	yes	no	family member	No
1	2	1	1	0	0	0	1	1	0	0	0	36	4	m	White European	yes	no	family member	Yes
2	3	1	0	0	0	0	0	1	1	0	1	36	4	m	middle eastern	yes	no	family member	Yes
3	4	1	1	1	1	1	1	1	1	1	1	24	10	m	Hispanic	no	no	family member	Yes
4	5	1	1	0	1	1	1	1	1	1	1	20	9	f	White European	no	yes	family member	Yes

[3]:
```
df_todd.isnull().sum() # find out the missing values in the dataset's for all␣
 ↪variables
```

[3]:
```
Case_No                    0
A1                         0
A2                         0
A3                         0
A4                         0
A5                         0
A6                         0
A7                         0
A8                         0
A9                         0
A10                        0
Age_Mons                   0
Qchat-10-Score             0
Sex                        0
Ethnicity                  0
Jaundice                   0
Family_mem_with_ASD        0
Who completed the test     0
ASD_Traits                 0
dtype: int64
```

[4]:
```
df_todd.info() # find out the datatype for each columns
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1054 entries, 0 to 1053
Data columns (total 19 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   Case_No                 1054 non-null   int64
 1   A1                      1054 non-null   int64
 2   A2                      1054 non-null   int64
 3   A3                      1054 non-null   int64
 4   A4                      1054 non-null   int64
 5   A5                      1054 non-null   int64
 6   A6                      1054 non-null   int64
 7   A7                      1054 non-null   int64
 8   A8                      1054 non-null   int64
 9   A9                      1054 non-null   int64
 10  A10                     1054 non-null   int64
 11  Age_Mons                1054 non-null   int64
 12  Qchat-10-Score          1054 non-null   int64
 13  Sex                     1054 non-null   object
 14  Ethnicity               1054 non-null   object
 15  Jaundice                1054 non-null   object
 16  Family_mem_with_ASD     1054 non-null   object
 17  Who completed the test  1054 non-null   object
 18  ASD_Traits              1054 non-null   object
dtypes: int64(13), object(6)
```

```
memory usage: 156.6+ KB
```

[5]:
```
#5.        Look at summary information about your data (total, mean, min, max,␣
 ↪freq, unique, etc.)  Does this present any more questions for you?  Does it␣
 ↪lead you to a conclusion yet?
print("\nDescribe Data\n")
print(df_todd.describe())
```

```
Describe Data

           Case_No           A1           A2           A3           A4  \
count  1054.000000  1054.000000  1054.000000  1054.000000  1054.000000
mean    527.500000     0.563567     0.448767     0.401328     0.512334
std     304.407895     0.496178     0.497604     0.490400     0.500085
min       1.000000     0.000000     0.000000     0.000000     0.000000
25%     264.250000     0.000000     0.000000     0.000000     0.000000
50%     527.500000     1.000000     0.000000     0.000000     1.000000
75%     790.750000     1.000000     1.000000     1.000000     1.000000
max    1054.000000     1.000000     1.000000     1.000000     1.000000

                A5           A6           A7           A8           A9  \
count  1054.000000  1054.000000  1054.000000  1054.000000  1054.000000
mean      0.524668     0.576850     0.649905     0.459203     0.489564
std       0.499628     0.494293     0.477226     0.498569     0.500128
min       0.000000     0.000000     0.000000     0.000000     0.000000
25%       0.000000     0.000000     0.000000     0.000000     0.000000
50%       1.000000     1.000000     1.000000     0.000000     0.000000
75%       1.000000     1.000000     1.000000     1.000000     1.000000
max       1.000000     1.000000     1.000000     1.000000     1.000000

               A10     Age_Mons  Qchat-10-Score
count  1054.000000  1054.000000     1054.000000
mean      0.586338    27.867173        5.212524
std       0.492723     7.980354        2.907304
min       0.000000    12.000000        0.000000
25%       0.000000    23.000000        3.000000
50%       1.000000    30.000000        5.000000
75%       1.000000    36.000000        8.000000
max       1.000000    36.000000       10.000000
```

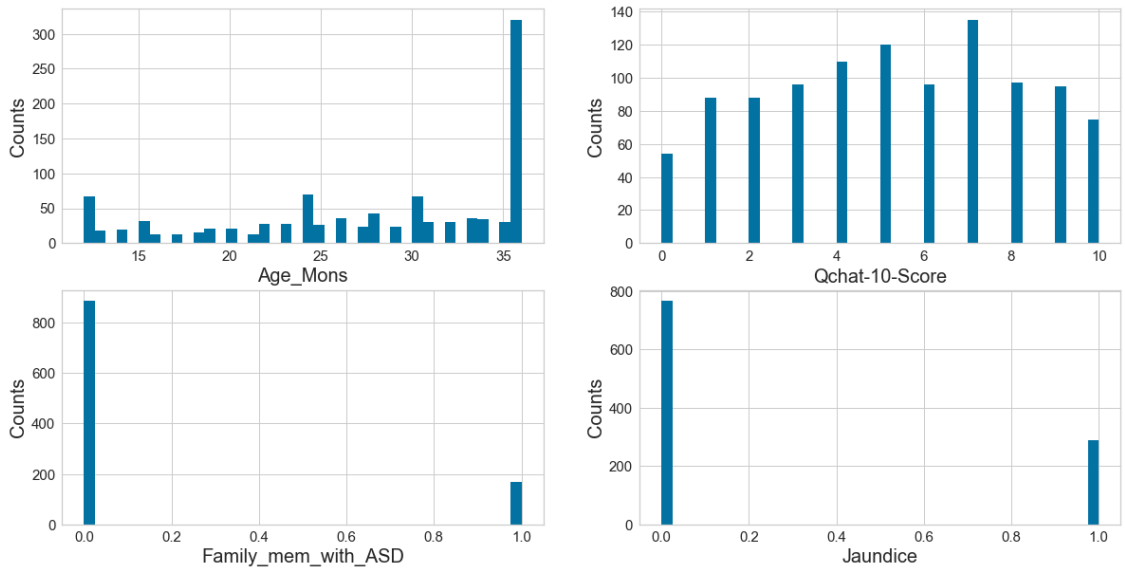
[6]:
```
print("\nSummarized Data\n")
print(df_todd.describe(include=['O']))
```

```
Summarized Data

         Sex       Ethnicity Jaundice Family_mem_with_ASD  \
count   1054            1054     1054                1054
```

```
unique      2              11        2                   2
top         m  White European       no                  no
freq      735             334      766                 884

       Who completed the test ASD_Traits
count                    1054       1054
unique                      5          2
top             family member        Yes
freq                     1018        728
```

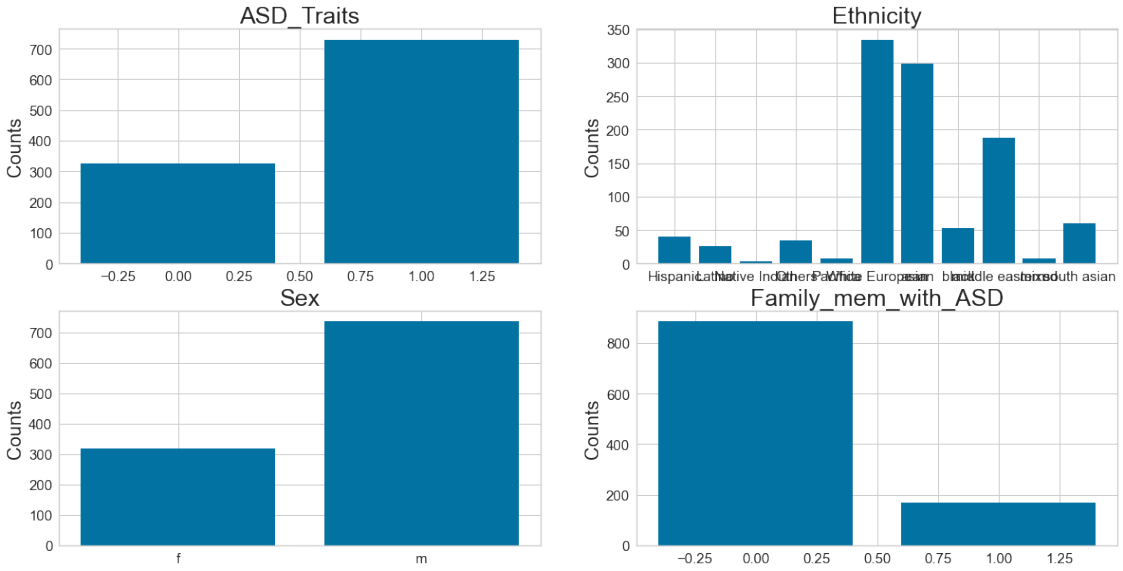
[7]:
```
# convert categorical data to numbers
#get the categorical data
df_todd['ASD_Traits'] = df_todd['ASD_Traits'].replace(['Yes', 'No'],[1, 0])
df_todd['Jaundice'] = df_todd['Jaundice'].replace(['yes', 'no'],[1, 0])
df_todd['Family_mem_with_ASD'] = df_todd['Family_mem_with_ASD'].replace(['yes',␣
↪'no'],[1, 0])
```

[8]:
```
#6.        Make some histograms of your data ("A picture is worth a thousand␣
↪words!")
# Specify the features of interest
num_features = ['Age_Mons', 'Qchat-10-Score', 'Family_mem_with_ASD', 'Jaundice']
xaxes = num_features
yaxes = ['Counts', 'Counts', 'Counts', 'Counts']
# set up the figure size
plt.rcParams['figure.figsize'] = (20, 10)
# make subplots
fig, axes = plt.subplots(nrows = 2, ncols = 2)
# draw histograms
axes = axes.ravel()
for idx, ax in enumerate(axes):
    ax.hist(df_todd[num_features[idx]].dropna(), bins=40)
    ax.set_xlabel(xaxes[idx], fontsize=20)
    ax.set_ylabel(yaxes[idx], fontsize=20)
    ax.tick_params(axis='both', labelsize=15)
plt.show()
```



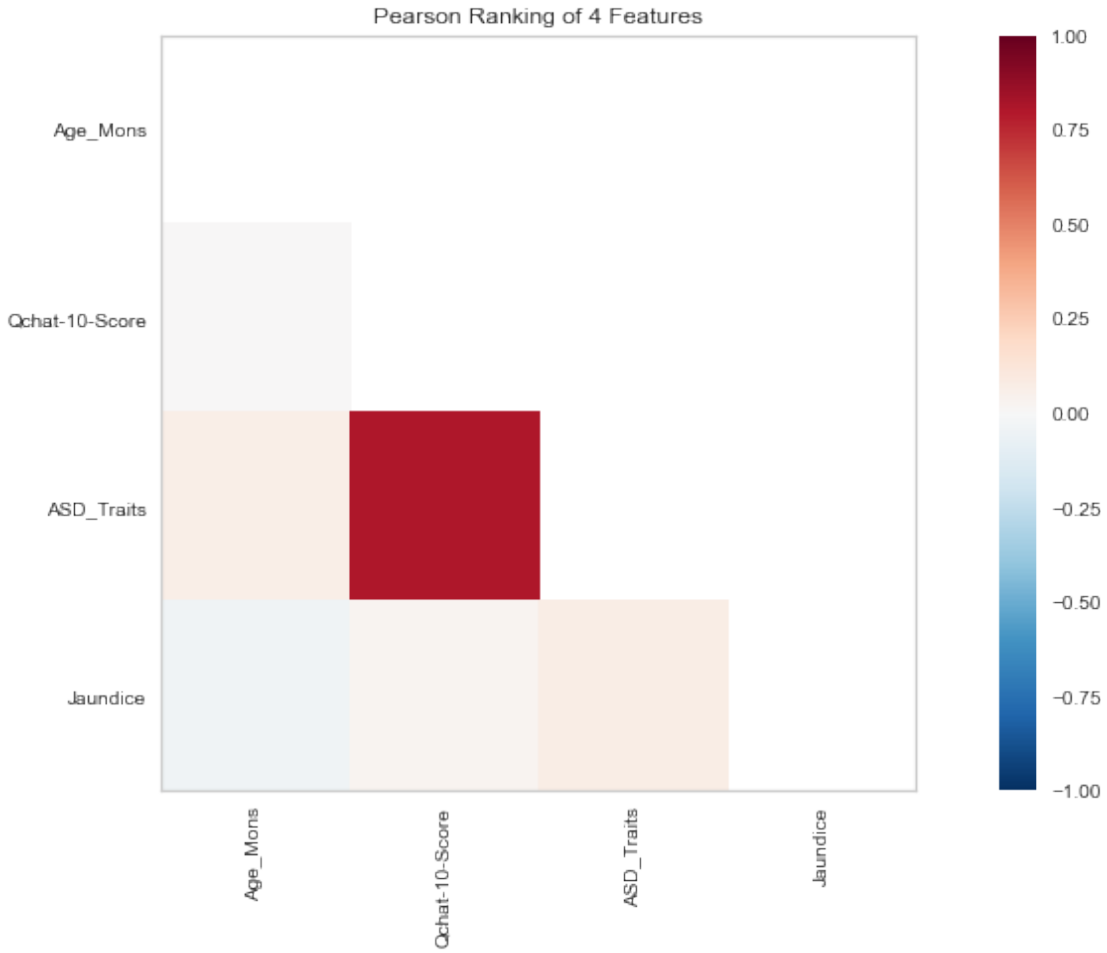
[9]:
```
#7:  Barcharts: set up the figure size
%matplotlib inline
plt.rcParams['figure.figsize'] = (20, 10)

# make subplots
fig, axes = plt.subplots(nrows = 2, ncols = 2)

# make the data read to feed into the visulizer
X_ASD_Traits = df_todd.groupby('ASD_Traits').size().
 ↪reset_index(name='Counts')['ASD_Traits']
Y_ASD_Traits = df_todd.groupby('ASD_Traits').size().
 ↪reset_index(name='Counts')['Counts']
# make the bar plot
axes[0, 0].bar(X_ASD_Traits, Y_ASD_Traits)
axes[0, 0].set_title('ASD_Traits', fontsize=25)
axes[0, 0].set_ylabel('Counts', fontsize=20)
axes[0, 0].tick_params(axis='both', labelsize=15)

# make the data read to feed into the visulizer
X_Ethnicity = df_todd.groupby('Ethnicity').size().
 ↪reset_index(name='Counts')['Ethnicity']
Y_Ethnicity = df_todd.groupby('Ethnicity').size().
 ↪reset_index(name='Counts')['Counts']
# make the bar plot
axes[0, 1].bar(X_Ethnicity, Y_Ethnicity)
axes[0, 1].set_title('Ethnicity', fontsize=25)
axes[0, 1].set_ylabel('Counts', fontsize=20)
axes[0, 1].tick_params(axis='both', labelsize=15)
```

```
# make the data read to feed into the visulizer
X_Sex = df_todd.groupby('Sex').size().reset_index(name='Counts')['Sex']
Y_Sex = df_todd.groupby('Sex').size().reset_index(name='Counts')['Counts']
# make the bar plot
axes[1, 0].bar(X_Sex, Y_Sex)
axes[1, 0].set_title('Sex', fontsize=25)
axes[1, 0].set_ylabel('Counts', fontsize=20)
axes[1, 0].tick_params(axis='both', labelsize=15)

# make the data read to feed into the visualizer
X_Family_mem_with_ASD = df_todd.groupby('Family_mem_with_ASD').size().
 ↪reset_index(name='Counts')['Family_mem_with_ASD']
Y_Family_mem_with_ASD = df_todd.groupby('Family_mem_with_ASD').size().
 ↪reset_index(name='Counts')['Counts']
# make the bar plot
axes[1, 1].bar(X_Family_mem_with_ASD, Y_Family_mem_with_ASD)
axes[1, 1].set_title('Family_mem_with_ASD', fontsize=25)
axes[1, 1].set_ylabel('Counts', fontsize=20)
axes[1, 1].tick_params(axis='both', labelsize=15)
plt.show()
```

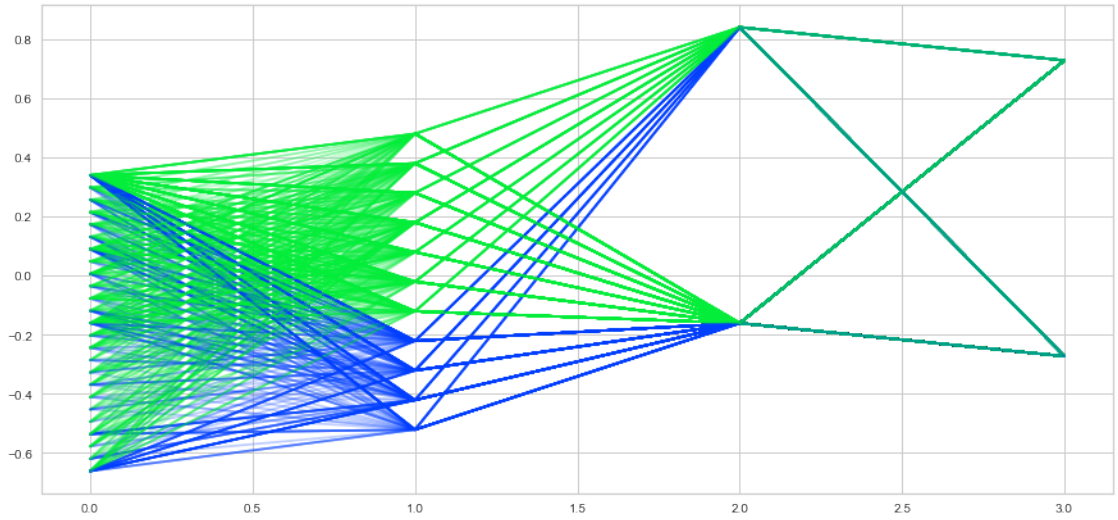


[10]:
```
# The correlation between the variables is low (1 or -1 is high positive or␣
 ↪high negative, 0 is low or no correlation)
# These results show there is  positive correlation between 'ASD_Traits' &␣
 ↪'Qchat-10-Score', but it's not a high correlation amoung other variables.

#Step 8: Pearson Ranking
```

```
#set up the figure size
#%matplotlib inline
plt.rcParams['figure.figsize'] = (15, 7)

# import the package for visulization of the correlation
from yellowbrick.features import Rank2D
num_features = ['Age_Mons', 'Qchat-10-Score', 'ASD_Traits', 'Jaundice']
# Define features to test for correlation
# extract the numpy arrays from the data frame
X = df_todd[num_features].to_numpy()

# instantiate the visualizer with the Covariance ranking algorithm
visualizer = Rank2D(features=num_features, algorithm='pearson')
visualizer.fit(X)                # Fit the data to the visualizer
visualizer.transform(X)             # Transform the data
visualizer.poof(outpath="pcoords1.png") # Draw/show/poof the data
plt.show()
```



[11]:
```
# Use Parallel Coordinates visualization to compare the distributions of␣
 ↪numerical variables between
# toddlers that ASD_Trait  and those that did not have ASD_Trait.
# toddlers with Family_mem_with_ASD & having the lower Qchat-10-Score have␣
 ↪agreater chance of ASD , however Joundice is not contibuting factor for AsD␣
 ↪infections


# Step 9:  Compare variables against ASD_Traits_YES and ASD_Traits_No
#set up the figure size
#%matplotlib inline
plt.rcParams['figure.figsize'] = (15, 7)
plt.rcParams['font.size'] = 50

# setup the color for yellowbrick visulizer
from yellowbrick.style import set_palette
set_palette('sns_bright')

# import packages
from yellowbrick.features import ParallelCoordinates
# Specify the features of interest and the classes of the target
classes = ['ASD_Traits_YES', 'ASD_Traits_NO']
num_features = ['Age_Mons', 'Qchat-10-Score', 'Family_mem_with_ASD', 'Jaundice']
# copy data to a new dataframe
data_norm = df_todd.copy()
# normalize data to 0-1 range
for feature in num_features:
    data_norm[feature] = (df_todd[feature] - df_todd[feature].
 ↪mean(skipna=True)) / (df_todd[feature].max(skipna=True) - df_todd[feature].
 ↪min(skipna=True))

# Extract the numpy arrays from the data frame
X = data_norm[num_features].to_numpy()
y = df_todd.ASD_Traits.to_numpy()

# Instantiate the visualizer

visualizer = ParallelCoordinates(classes=classes, features=num_features)


visualizer.fit(X, y)       # Fit the data to the visualizer
visualizer.transform(X)    # Transform the data
#visualizer.poof(outpath="d://pcoords2.png") # Draw/show/poof the data
plt.show();
```

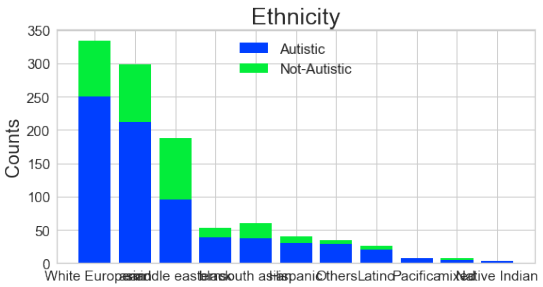


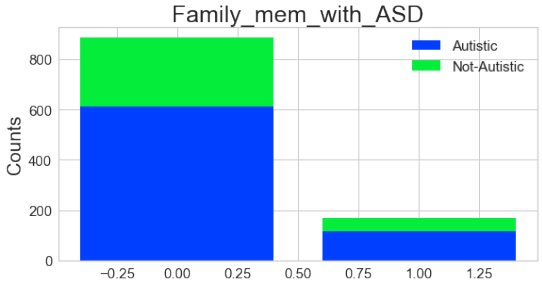
[12]:
```
# Use Stack Bar Charts to compare toddlers who is having ASD &  who didn't have␣
 ↪ASD based on the other variables.
# less females have ASD as compared to MEN, white europian is having more rate␣
 ↪for insfaction from ASD,
# Family with ASD history and with Non ASD history, in  both toddlers have ASD


# Step 10 - stacked bar charts to compare autistic/not autistic
#set up the figure size
#%matplotlib inline
plt.rcParams['figure.figsize'] = (20, 10)

# make subplots
fig, axes = plt.subplots(nrows = 2, ncols = 2)

# make the data read to feed into the visulizer
Sex_autism = df_todd[df_todd['ASD_Traits']==1]['Sex'].value_counts()
Sex_not_autism = df_todd[df_todd['ASD_Traits']==0]['Sex'].value_counts()
Sex_not_autism = Sex_not_autism.reindex(index = Sex_autism.index)
# make the bar plot
p1 = axes[0, 0].bar(Sex_autism.index, Sex_autism.values)
p2 = axes[0, 0].bar(Sex_not_autism, Sex_not_autism.values, bottom=Sex_autism.
 ↪values)
axes[0, 0].set_title('Sex', fontsize=25)
axes[0, 0].set_ylabel('Counts', fontsize=20)
axes[0, 0].tick_params(axis='both', labelsize=15)
axes[0, 0].legend((p1[0], p2[0]), ('Autistic', 'Not-Autistic'), fontsize = 15)

# make the data read to feed into the visualizer
```

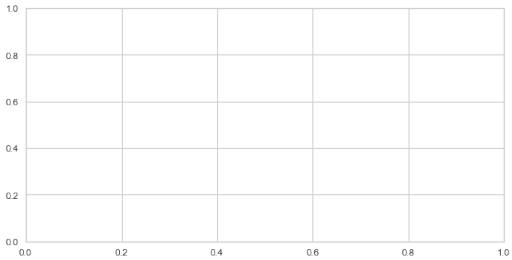
```
ethnicity_autism = df_todd[df_todd['ASD_Traits']==1]['Ethnicity'].value_counts()
ethnicity_not_autism = df_todd[df_todd['ASD_Traits']==0]['Ethnicity'].
 ↪value_counts()
ethnicity_not_autism = ethnicity_not_autism.reindex(index = ethnicity_autism.
 ↪index)
# make the bar plot
p3 = axes[0, 1].bar(ethnicity_autism.index, ethnicity_autism.values)
p4 = axes[0, 1].bar(ethnicity_not_autism.index, ethnicity_not_autism.values,␣
 ↪bottom=ethnicity_autism.values)
axes[0, 1].set_title('Ethnicity', fontsize=25)
axes[0, 1].set_ylabel('Counts', fontsize=20)
axes[0, 1].tick_params(axis='both', labelsize=15)
axes[0, 1].legend((p3[0], p4[0]), ('Autistic', 'Not-Autistic'), fontsize = 15)

# make the data read to feed into the visualizer
ASD_autism = df_todd[df_todd['ASD_Traits']==1]['Family_mem_with_ASD'].
 ↪value_counts()
ASD_not_autism = df_todd[df_todd['ASD_Traits']==0]['Family_mem_with_ASD'].
 ↪value_counts()
ASD_not_autism = ASD_not_autism.reindex(index = ASD_autism.index)

# make the bar plot
p5 = axes[1, 0].bar(ASD_autism.index, ASD_autism.values)
p6 = axes[1, 0].bar(ASD_not_autism.index, ASD_not_autism.values,␣
 ↪bottom=ASD_autism.values)
axes[1, 0].set_title('Family_mem_with_ASD', fontsize=25)
axes[1, 0].set_ylabel('Counts', fontsize=20)
axes[1, 0].tick_params(axis='both', labelsize=15)
axes[1, 0].legend((p5[0], p6[0]), ('Autistic', 'Not-Autistic'), fontsize = 15)
```

[12]: <matplotlib.legend.Legend at 0x1c8e61ced30>


Sex
Autistic
Not-Autistic
Counts
m
f


Ethnicity
Autistic
Not-Autistic
Counts
White European
Others
Latino
Pacifica
Native Indian


Family_mem_with_ASD
Autistic
Not-Autistic
Counts



[ ]: