dwda-mini-project

April 5, 2025

[3]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sb
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn import metrics
from sklearn.svm import SVC
from sklearn.linear_model import LogisticRegression
from imblearn.over_sampling import RandomOverSampler

import warnings
warnings.filterwarnings('ignore')
```

[4]:
```
df = pd.read_csv('C:\\Users\\Shree\\OneDrive\\Desktop\\DWDA\\MINI_PROJECT_DS.
↪csv')
print(df.head())
```

```
   CASE_NO_PATIENT'S  A1  A2  A3  A4  A5  A6  A7  A8  A9  …  \
0                  1   0   0   0   0   0   0   1   1   0  …
1                  2   1   1   0   0   0   1   1   0   0  …
2                  3   1   0   0   0   0   0   1   1   0  …
3                  4   1   1   1   1   1   1   1   1   1  …
4                  5   1   1   0   1   1   1   1   1   1  …

   Global developmental delay/intellectual disability  \
0                                                Yes
1                                                Yes
2                                                Yes
3                                                Yes
4                                                Yes

  Social/Behavioural Issues  Childhood Autism Rating Scale  Anxiety_disorder  \
0                       Yes                             1               Yes
1                       Yes                             2               Yes
2                       Yes                             4               Yes
3                       Yes                             2               Yes
4                       Yes                             1               Yes
```

```
  Sex       Ethnicity Jaundice Family_mem_with_ASD Who_completed_the_test  \
0   F  middle eastern      Yes                  No          Family Member
1   M  White European      Yes                  No          Family Member
2   M  Middle Eastern      Yes                  No          Family Member
3   M        Hispanic       No                  No          Family Member
4   F  White European       No                  No          Family Member

  ASD_traits
0         No
1        Yes
2        Yes
3        Yes
4        Yes

[5 rows x 28 columns]
```

[5]:
```
df.shape
```

[5]:
```
(1985, 28)
```

[6]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1985 entries, 0 to 1984
Data columns (total 28 columns):
 #   Column                                              Non-Null Count  Dtype
---  ------                                              --------------  -----
 0   CASE_NO_PATIENT'S                                   1985 non-null   int64
 1   A1                                                  1985 non-null   int64
 2   A2                                                  1985 non-null   int64
 3   A3                                                  1985 non-null   int64
 4   A4                                                  1985 non-null   int64
 5   A5                                                  1985 non-null   int64
 6   A6                                                  1985 non-null   int64
 7   A7                                                  1985 non-null   int64
 8   A8                                                  1985 non-null   int64
 9   A9                                                  1985 non-null   int64
 10  A10_Autism_Spectrum_Quotient                        1985 non-null   int64
 11  Social_Responsiveness_Scale                         1982 non-null   object
 12  Age_Years                                           1985 non-null   int64
 13  Qchat_10_Score                                      1946 non-null   float64
 14  Speech Delay/Language Disorder                      1985 non-null   object
 15  Learning disorder                                   1985 non-null   object
 16  Genetic_Disorders                                   1985 non-null   object
 17  Depression                                          1984 non-null   object
 18  Global developmental delay/intellectual disability  1985 non-null   object
 19  Social/Behavioural Issues                           1971 non-null   object
```

```
 20  Childhood Autism Rating Scale                      1985 non-null   int64
 21  Anxiety_disorder                                   1985 non-null   object
 22  Sex                                                1985 non-null   object
 23  Ethnicity                                          1985 non-null   object
 24  Jaundice                                           1985 non-null   object
 25  Family_mem_with_ASD                                1985 non-null   object
 26  Who_completed_the_test                             1985 non-null   object
 27  ASD_traits                                         1985 non-null   object
dtypes: float64(1), int64(13), object(14)
memory usage: 434.3+ KB
```

[13]:
```
df.describe().T
```

[13]:

	count	mean	std	min	25%	50%	75%	max
CASE_NO_PATIENT'S	1985.0	993.000000	573.164462	1.0	497.0	993.0	1489.0	1985.0
A1	1985.0	0.299244	0.458042	0.0	0.0	0.0	1.0	1.0
A2	1985.0	0.238287	0.426143	0.0	0.0	0.0	0.0	1.0
A3	1985.0	0.213098	0.409600	0.0	0.0	0.0	0.0	1.0
A4	1985.0	0.272040	0.445123	0.0	0.0	0.0	1.0	1.0
A5	1985.0	0.278589	0.448418	0.0	0.0	0.0	1.0	1.0
A6	1985.0	0.306297	0.461071	0.0	0.0	0.0	1.0	1.0
A7	1985.0	0.345088	0.475517	0.0	0.0	0.0	1.0	1.0
A8	1985.0	0.243829	0.429499	0.0	0.0	0.0	0.0	1.0
A9	1985.0	0.259950	0.438717	0.0	0.0	0.0	1.0	1.0
A10_Autism_Spectrum_Quotient	1985.0	0.446348	0.497238	0.0	0.0	0.0	1.0	1.0
Age_Years	1985.0	9.624685	4.302416	1.0	7.0	9.0	14.0	18.0
Qchat_10_Score	1946.0	4.234841	2.898247	0.0	2.0	4.0	6.0	10.0
Childhood Autism Rating Scale	1985.0	1.701763	1.015367	1.0	1.0	1.0	2.0	4.0

[15]:
```
df['Ethnicity'].value_counts()
```

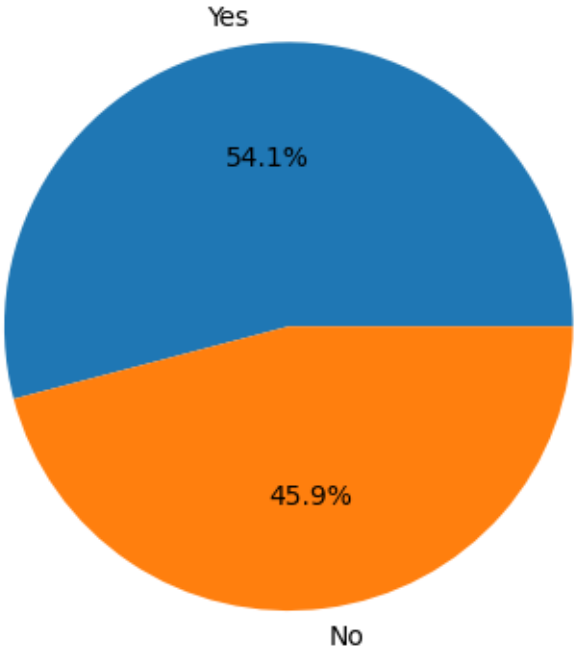
[15]:
```
Ethnicity
White European    549
Asian             392
Middle Eastern    362
asian             213
south asian       206
South Asian        49
Black              45
middle eastern     41
Hispanic           40
Others             35
Latino             26
black               8
PaciFica            8
Mixed               7
Native Indian       3
mixed               1
Name: count, dtype: int64
```

[17]:
```
df['Who_completed_the_test'].value_counts()
```

[17]:
```
Who_completed_the_test
Health Care Professional    1233
Family Member                658
Family member                 58
School and NGO                29
Self                           4
Others                         3
Name: count, dtype: int64
```

[19]:
```
df = df.replace({'yes':1, 'no':0, '?':'Others', 'others':'Others'})
```

[21]:
```
plt.pie(df['ASD_traits'].value_counts().values, labels=df['ASD_traits'].
 ↪value_counts().index, autopct='%1.1f%%')
plt.show()
```

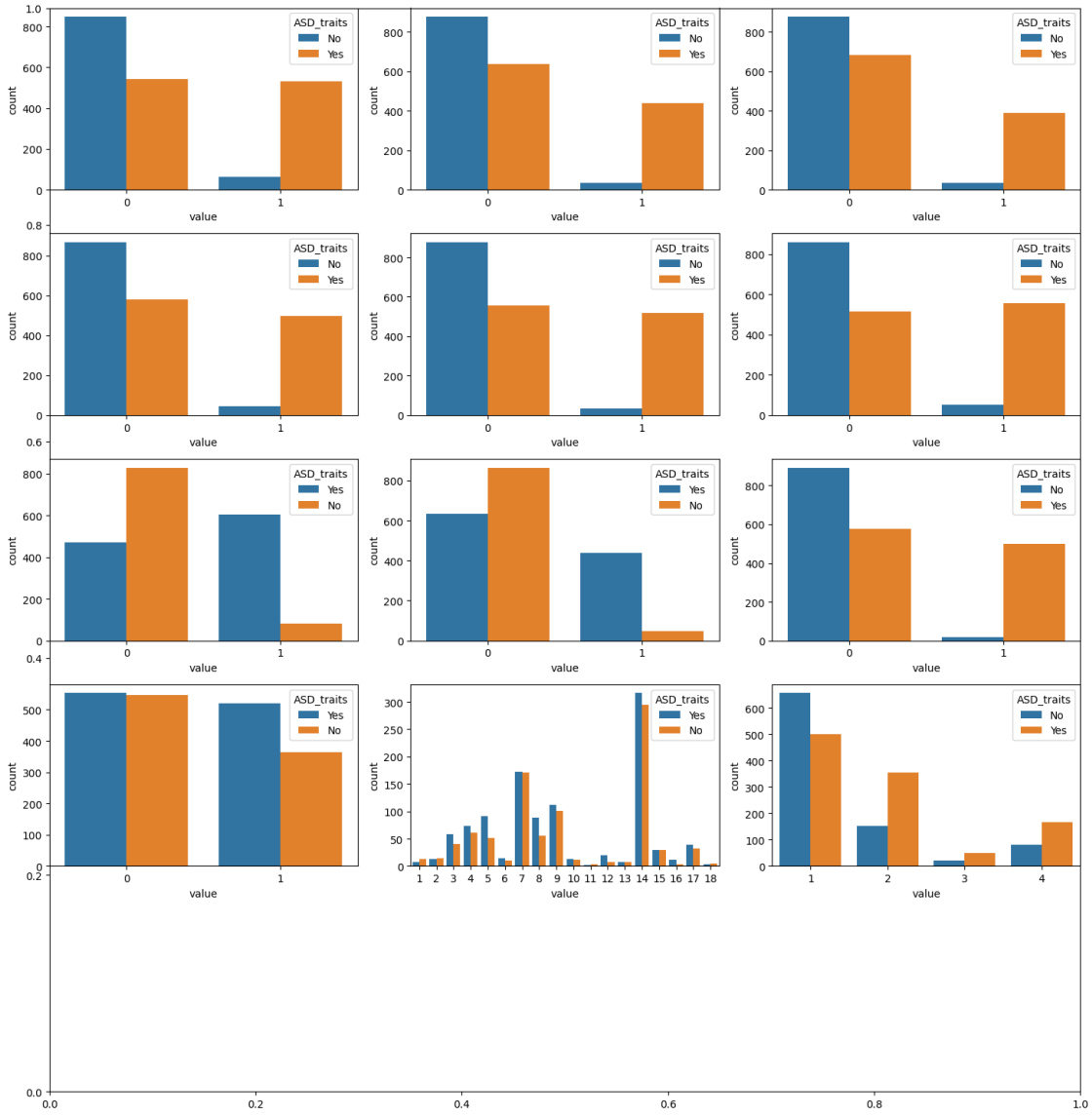


[23]:
```
ints = []
objects = []
floats = []

for col in df.columns:
    if df[col].dtype == np.int64:
        ints.append(col)
    elif df[col].dtype == object:
        objects.append(col)
    elif df[col].dtype == np.float64:
        floats.append(col)

if "CASE_NO_PATIENT'S" in ints:
    ints.remove("CASE_NO_PATIENT'S")

if 'ASD_traits' in objects:
    objects.remove('ASD_traits')

print("Ints:", ints)
print("Objects:", objects)
print("Floats:", floats)
```

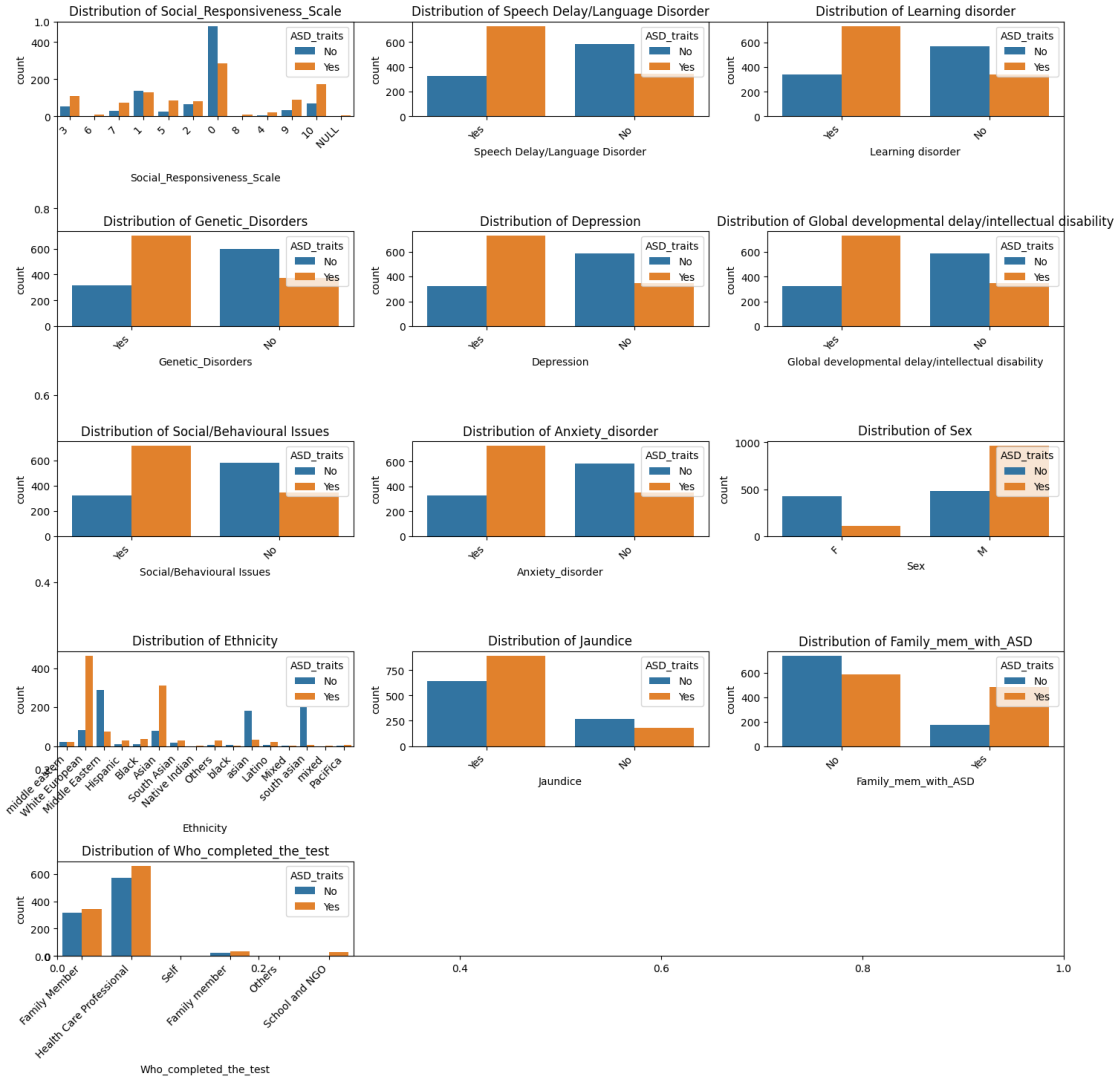
```
Ints: ['A1', 'A2', 'A3', 'A4', 'A5', 'A6', 'A7', 'A8', 'A9',
'A10_Autism_Spectrum_Quotient', 'Age_Years', 'Childhood Autism Rating Scale']
```

```
Objects: ['Social_Responsiveness_Scale', 'Speech Delay/Language Disorder',
'Learning disorder', 'Genetic_Disorders', 'Depression', 'Global developmental
delay/intellectual disability', 'Social/Behavioural Issues', 'Anxiety_disorder',
'Sex', 'Ethnicity', 'Jaundice', 'Family_mem_with_ASD', 'Who_completed_the_test']
Floats: ['Qchat_10_Score']
```

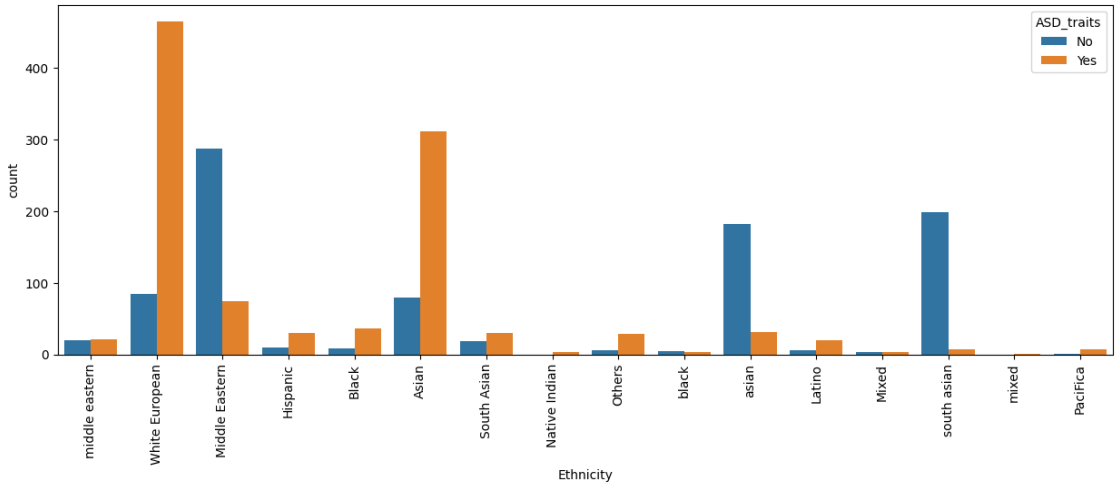
[25]:
```
# Convert the data to long-form using melt
df_melted = df.melt(id_vars=["CASE_NO_PATIENT'S", 'ASD_traits'],␣
 ↪value_vars=ints, var_name='col', value_name='value')

plt.subplots(figsize=(15,15))

for i, col in enumerate(ints):
  plt.subplot(5,3,i+1)
  # Use the melted DataFrame and specify x and hue
  sb.countplot(x='value', hue='ASD_traits', data=df_melted[df_melted['col'] ==␣
 ↪col])

plt.tight_layout()
plt.show()
```



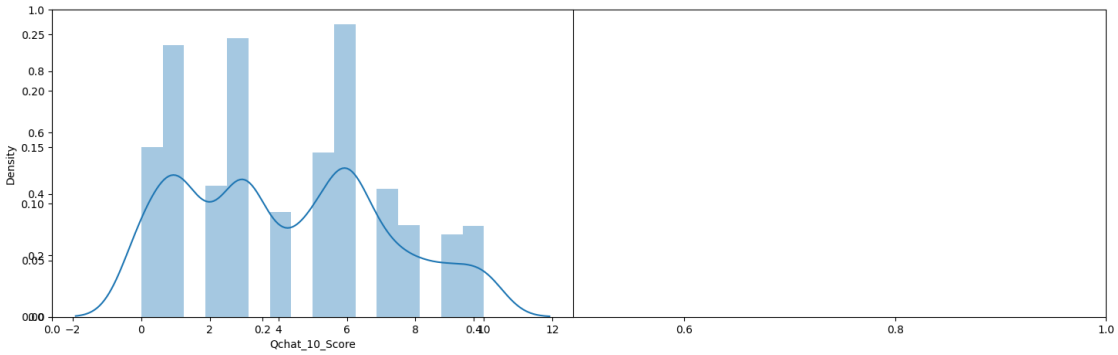
[27]:
```
plt.subplots(figsize=(15, 15))  # Adjust figure size as needed

for i, col in enumerate(objects):
    plt.subplot(5, 3, i + 1)  # Adjust subplot grid as needed
    sb.countplot(x=col, hue='ASD_traits', data=df)
    plt.title(f'Distribution of {col}')
    plt.xticks(rotation=45, ha='right') # Rotates x-axis labels for better
 ↪readability

plt.tight_layout()
plt.show()
```



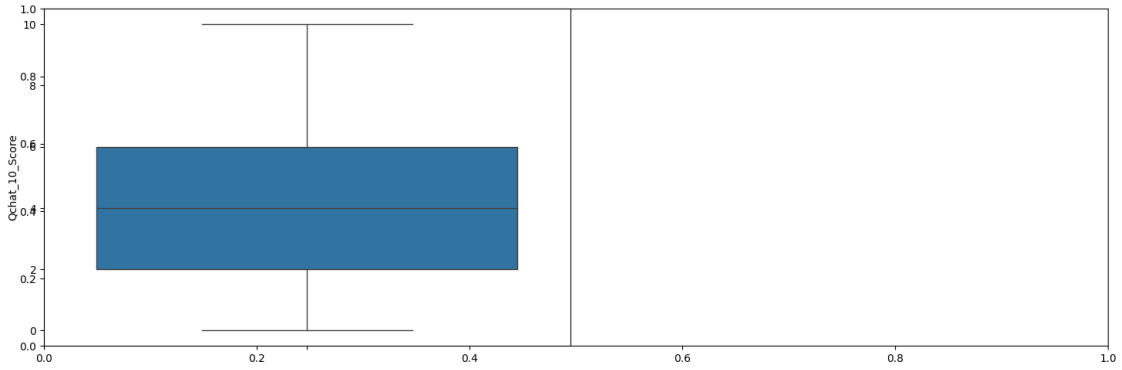
[31]:
```
plt.figure(figsize=(15,5))
sb.countplot(data=df, x='Ethnicity', hue='ASD_traits')
plt.xticks(rotation=90)
plt.show()
```



[33]:
```
plt.subplots(figsize=(15,5))

for i, col in enumerate(floats):
  plt.subplot(1,2,i+1)
  sb.distplot(df[col])
plt.tight_layout()
plt.show()
```



[35]:
```
plt.subplots(figsize=(15,5))

for i, col in enumerate(floats):
  plt.subplot(1,2,i+1)
  sb.boxplot(df[col])
plt.tight_layout()
plt.show()
```

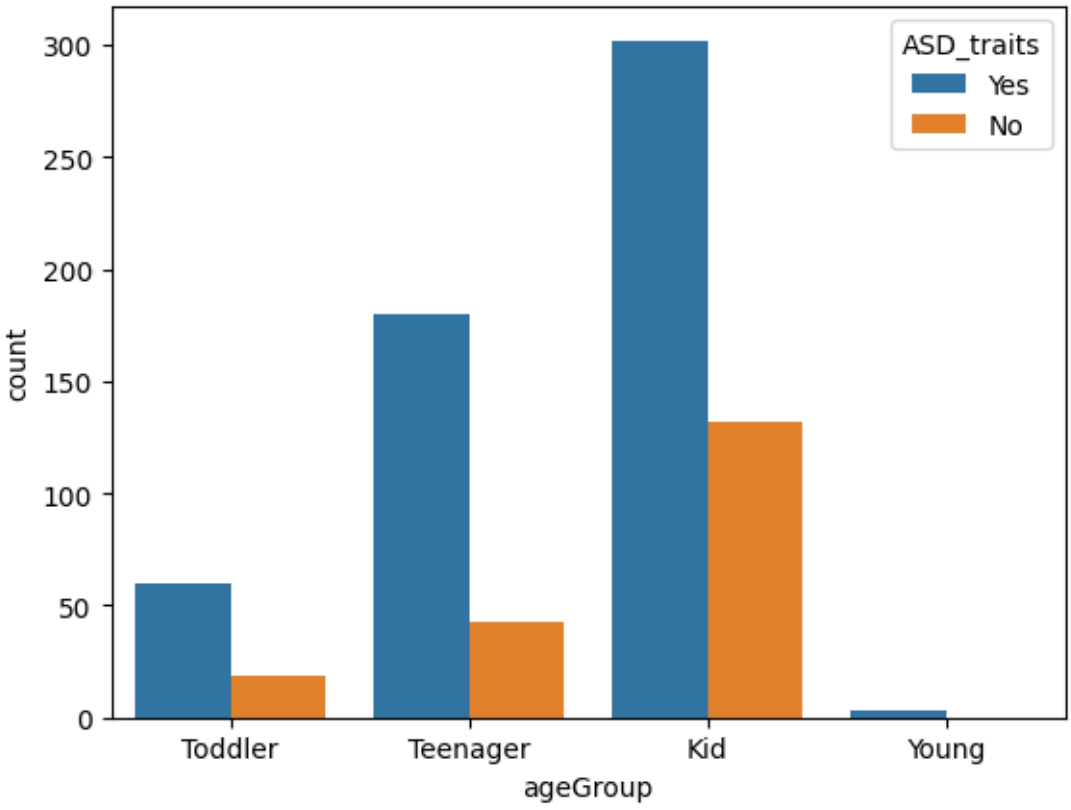


[43]:
```
df = df[df['Qchat_10_Score'] > 5]
df.shape
```

[43]: (739, 28)

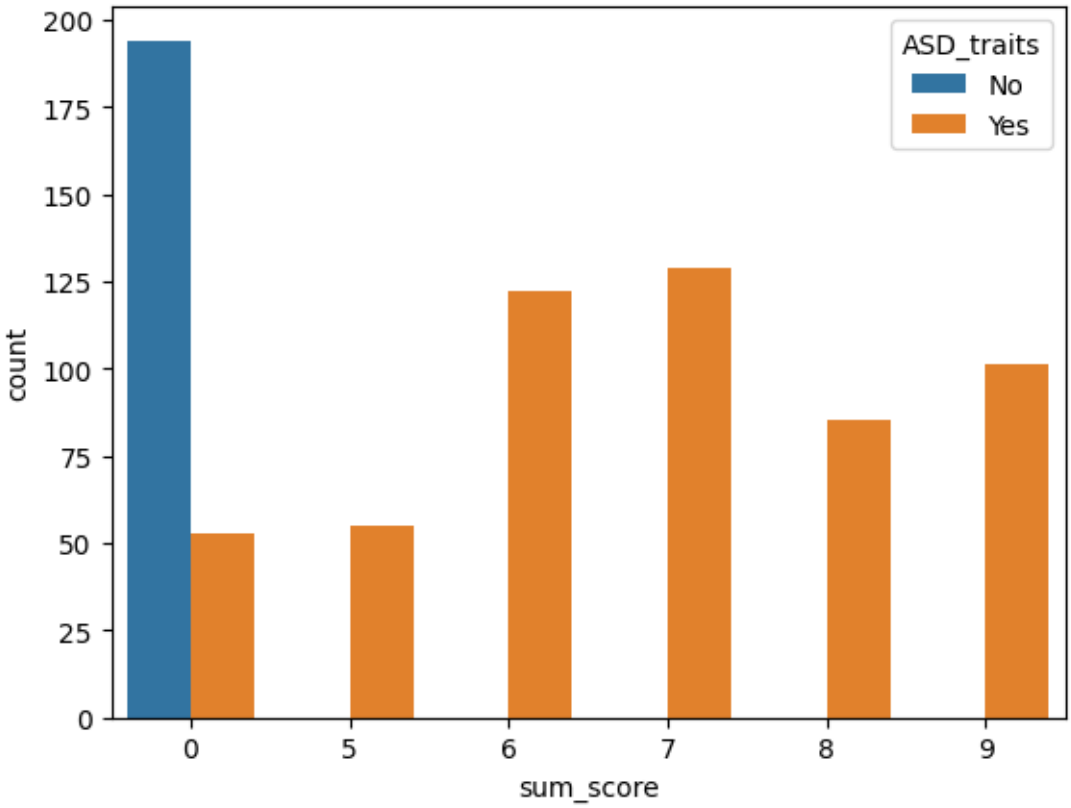
[47]:
```
def convertAge(age):
    if age < 4:
        return 'Toddler'
    elif age < 12:
        return 'Kid'
    elif age < 18:
        return 'Teenager'
    elif age < 40:
        return 'Young'
    else:
        return 'Senior'

df['ageGroup'] = df['Age_Years'].apply(convertAge)
```

[49]:
```
sb.countplot(x=df['ageGroup'], hue=df['ASD_traits'])
plt.show()
```



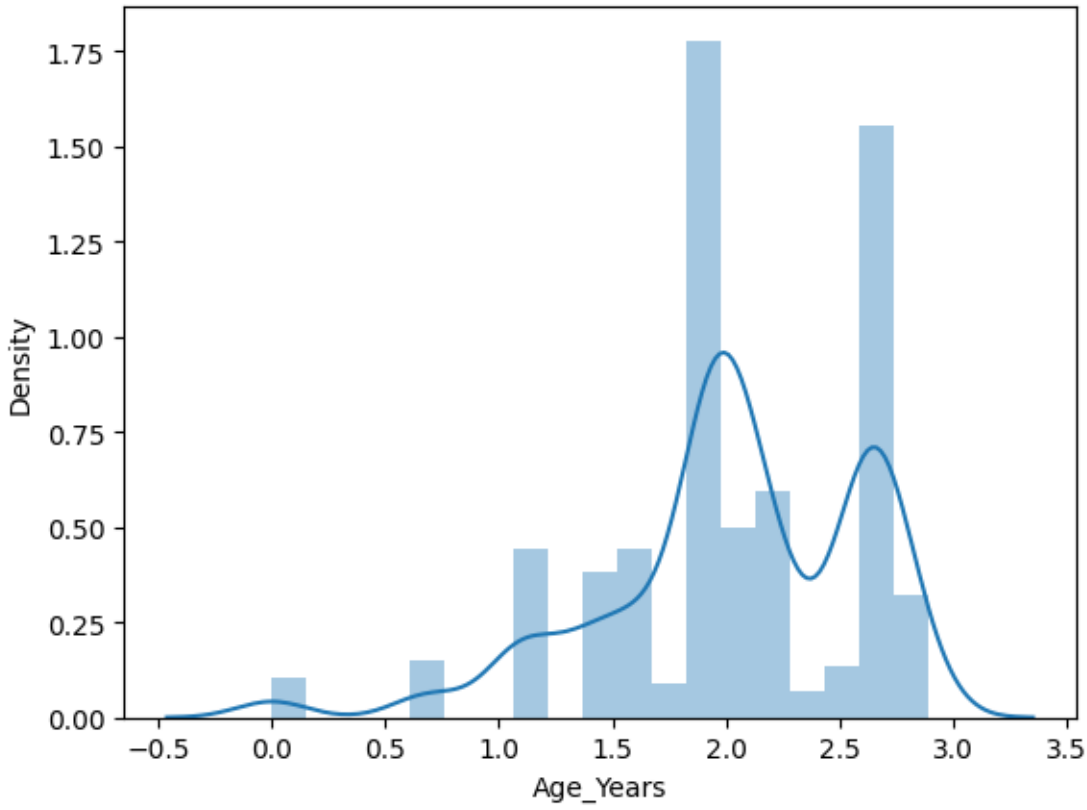
[51]:
```
def add_feature(data):
    score_columns = ['A1', 'A2', 'A3', 'A4', 'A5', 'A6', 'A7', 'A8', 'A9']

    data['sum_score'] = 0
    for col in score_columns:
        data['sum_score'] += data[col]

    data['ind'] = (
        data['Jaundice'].map({'yes': 1, 'no': 0}) +
        data['Family_mem_with_ASD'].map({'yes': 1, 'no': 0})
    )

    return data

df = add_feature(df)
```

[53]:
```
sb.countplot(x=df['sum_score'], hue=df['ASD_traits'])
plt.show()
```

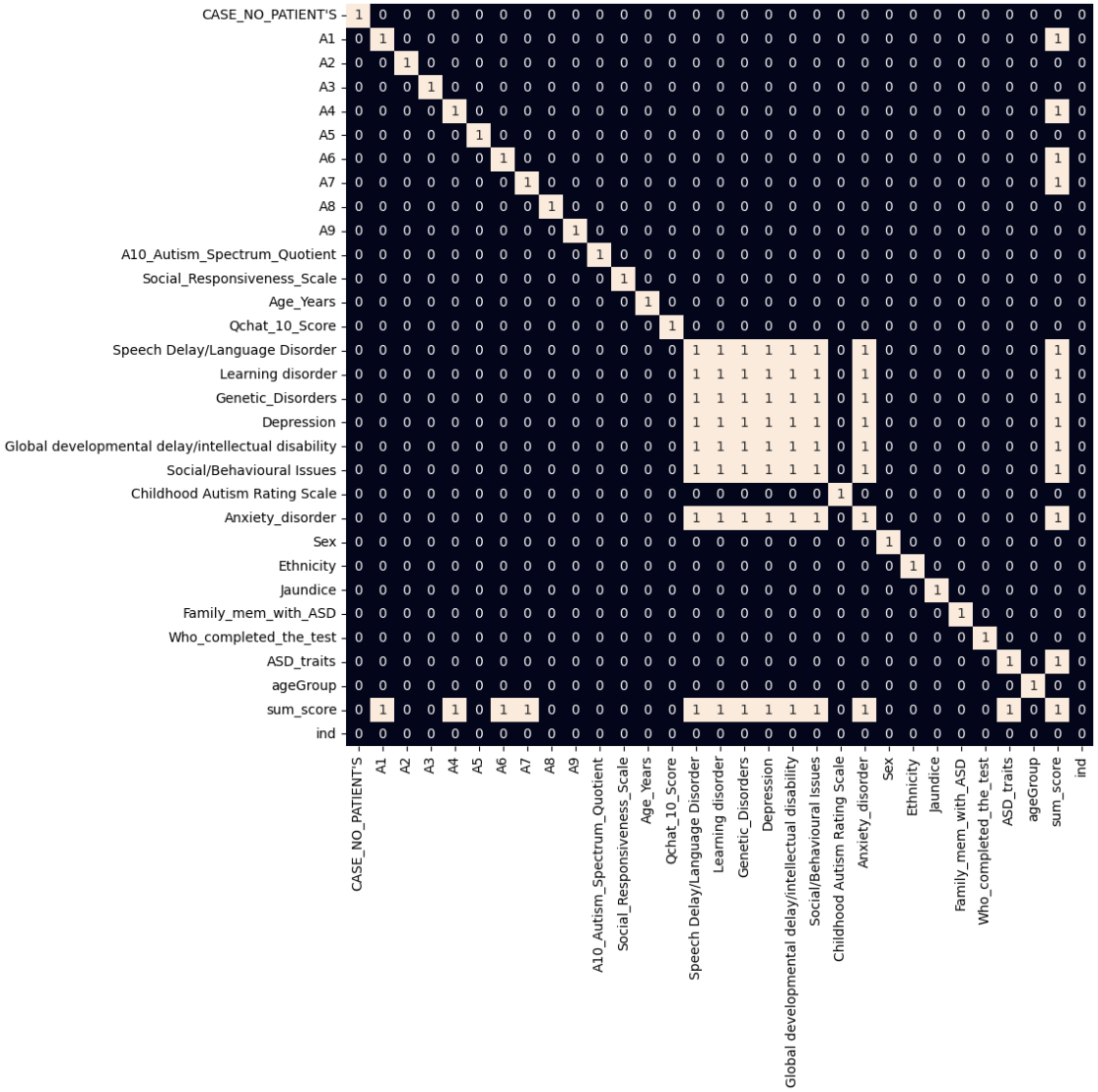


[55]:
```
df['Age_Years'] = df['Age_Years'].apply(lambda x: np.log(x))
```

[57]:
```
sb.distplot(df['Age_Years'])
plt.show()
```



[61]:
```
def encode_labels(data):
    for col in data.columns:
      if data[col].dtype == 'object':
        le = LabelEncoder()
        data[col] = le.fit_transform(data[col])

    return data

df = encode_labels(df)

plt.figure(figsize=(10,10))
sb.heatmap(df.corr() > 0.8, annot=True, cbar=False)
plt.show()
```



[65]:
```
removal = ["CASE_NO_PATIENT'S", 'ASD_traits']  # Remove ASD_traits from␣
↪features, use as target
features = df.drop(removal, axis=1)
target = df['ASD_traits']
```

[67]:
```
X_train, X_val, Y_train, Y_val = train_test_split(features, target, test_size =␣
↪0.2, random_state=10)
ros = RandomOverSampler(sampling_strategy='minority',random_state=0)
X, Y = ros.fit_resample(X_train,Y_train)
X.shape, Y.shape
```

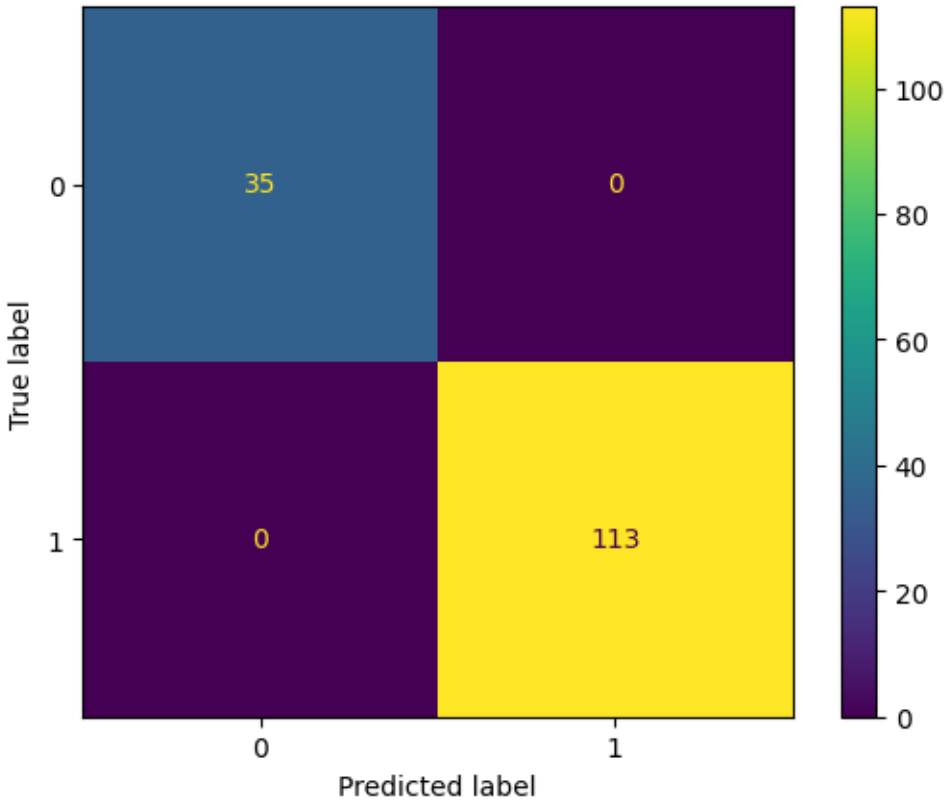
[67]: ((864, 29), (864,))

[69]:
```
scaler = StandardScaler()
X = scaler.fit_transform(X)
X_val = scaler.transform(X_val)
```

[75]:
```
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import roc_auc_score
from sklearn.model_selection import train_test_split
from imblearn.over_sampling import RandomOverSampler
import pandas as pd
import numpy as np

X_train, X_val, Y_train, Y_val = train_test_split(features, target, test_size=0.
 ↪2, random_state=10)

ros = RandomOverSampler(sampling_strategy='minority', random_state=0)
X, Y = ros.fit_resample(X_train, Y_train)
X = X.fillna(0)
X_val = X_val.fillna(0)
models = [
    LogisticRegression(),
    SVC(kernel='rbf', probability=True),
    DecisionTreeClassifier()
]
for model in models:
    model.fit(X, Y)

    print(f'{model.__class__.__name__} :')
    print('Training ROC-AUC Score:', roc_auc_score(Y, model.predict_proba(X)[:,␣
 ↪1]))
    print('Validation ROC-AUC Score:', roc_auc_score(Y_val, model.
 ↪predict_proba(X_val)[:, 1]))
    print()
```

```
LogisticRegression :
Training ROC-AUC Score: 1.0
Validation ROC-AUC Score: 1.0

SVC :
Training ROC-AUC Score: 1.0
Validation ROC-AUC Score: 1.0

DecisionTreeClassifier :
Training ROC-AUC Score: 1.0
Validation ROC-AUC Score: 1.0
```

[77]:
```
from sklearn.metrics import ConfusionMatrixDisplay

ConfusionMatrixDisplay.from_estimator(models[0], X_val, Y_val)
plt.show()
```



[ ]: