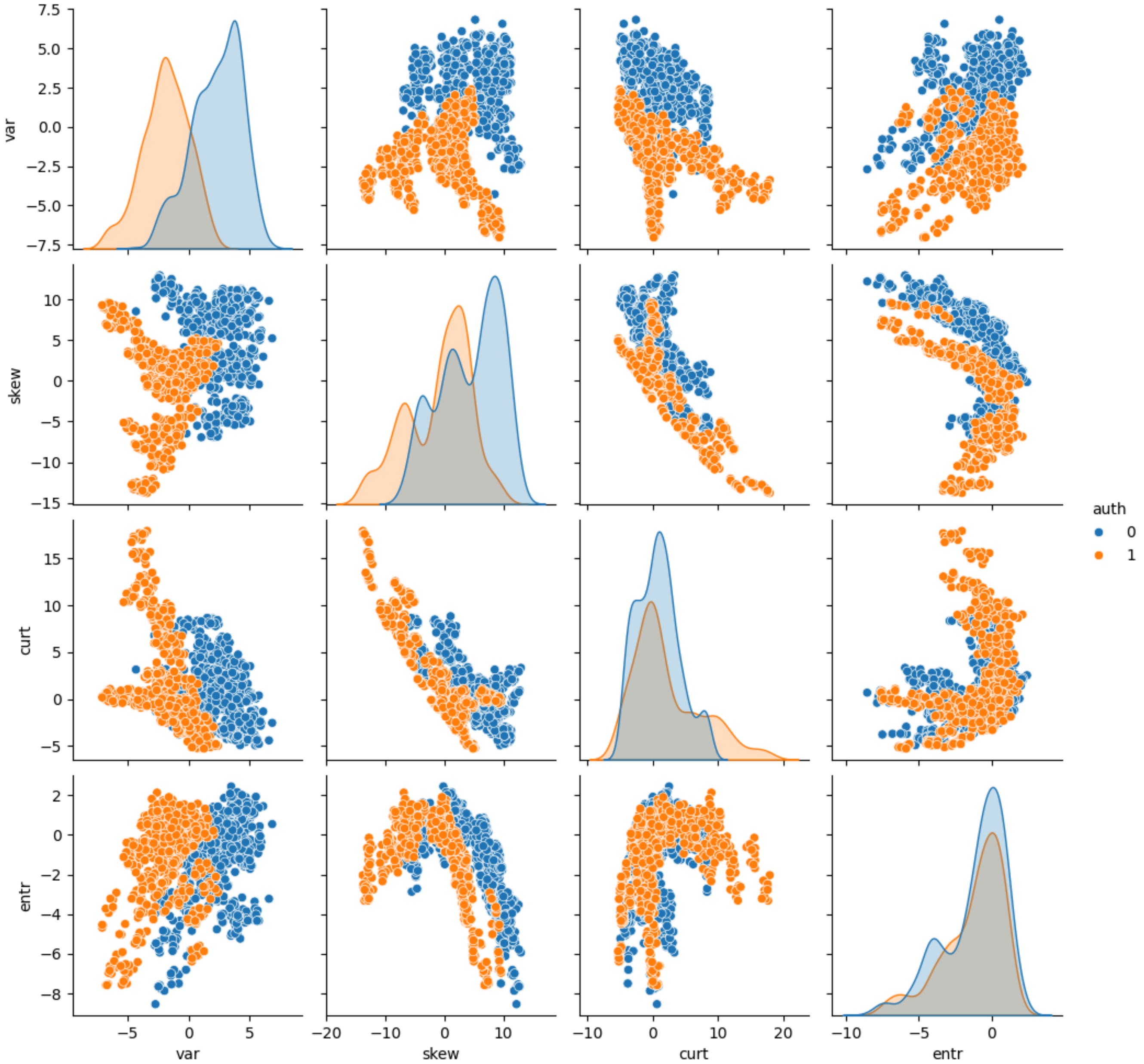
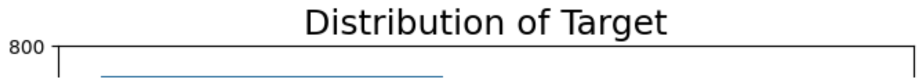
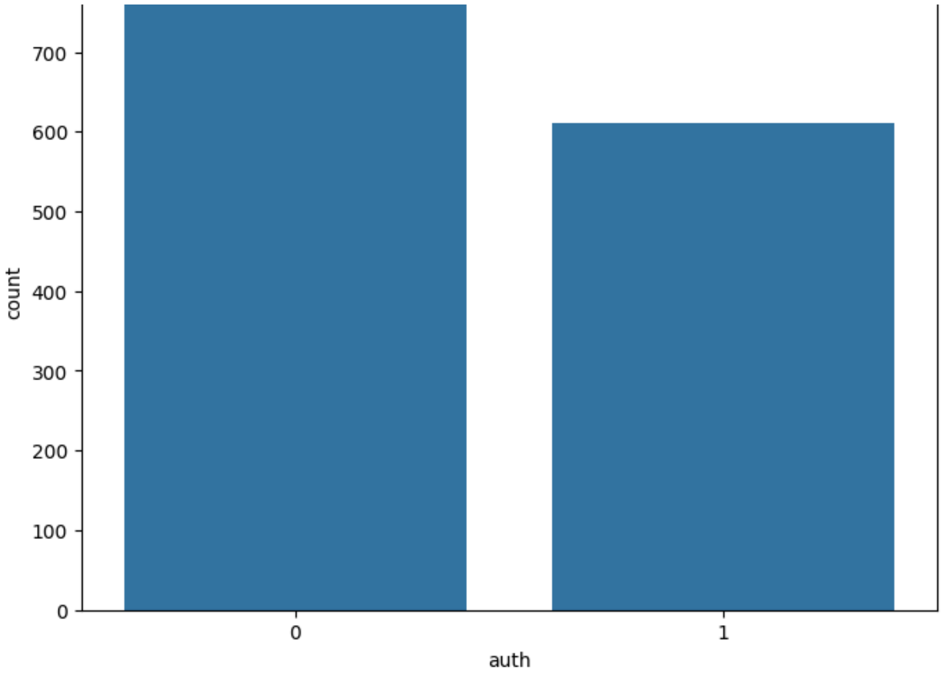
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix
data = pd.read_csv('/content/fakecurrency.txt', header=None)
data.columns = ['var', 'skew', 'curt', 'entr', 'auth']
print(data.head())
print(data.info)
sns.pairplot(data, hue='auth')
plt.show()
plt.figure(figsize=(8,6))
plt.title('Distribution of Target', size=18)
sns.countplot(x=data['auth'])
target_count = data.auth.value_counts()
plt.annotate(s=target_count[0], xy=(-0.04,10+target_count[0]), size=14)
plt.annotate(s=target_count[1], xy=(0.96,10+target_count[1]), size=14)
plt.ylim(0,900)
plt.show()
nb_to_delete = target_count[0] - target_count[1]
data = data.sample(frac=1, random_state=42).sort_values(by='auth')
data = data[nb_to_delete:]
print(data['auth'].value_counts())
x = data.loc[:, data.columns != 'auth']
y = data.loc[:, data.columns == 'auth']
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.3, random_state=42)
scalar = StandardScaler()
scalar.fit(x_train)
x_train = scalar.transform(x_train)
x_test = scalar.transform(x_test)
clf = LogisticRegression(solver='lbfgs', random_state=42, multi_class='auto')
clf.fit(x_train, y_train.values.ravel())
y_pred = np.array(clf.predict(x_test))
conf_mat = pd.DataFrame(confusion_matrix(y_test, y_pred),
                        columns=["Pred.Negative", "Pred.Positive"],
                        index=['Act.Negative', "Act.Positive"])
tn, fp, fn, tp = confusion_matrix(y_test, y_pred).ravel()
accuracy = round((tn+tp)/(tn+fp+fn+tp), 4)
print(conf_mat)
print(f'\n Accuracy = {round(100*accuracy, 2)}%')
new_banknote = np.array([4.5, -8.1, 2.4, 1.4], ndmin=2)
new_banknote = scalar.transform(new_banknote)
print(f'Prediction:  Class{clf.predict(new_banknote)[0]}')
print(f'Probability [0/1]:  {clf.predict_proba(new_banknote)[0]}')
```

```
       var    skew    curt     entr  auth
0  3.62160  8.6661 -2.8073 -0.44699     0
1  4.54590  8.1674 -2.4586 -1.46210     0
2  3.86600 -2.6383  1.9242  0.10645     0
3  3.45660  9.5228 -4.0112 -3.59440     0
4  0.32924 -4.4552  4.5718 -0.98880     0
<bound method DataFrame.info of           var      skew     curt     entr  auth
0     3.62160   8.66610  -2.8073 -0.44699     0
1     4.54590   8.16740  -2.4586 -1.46210     0
2     3.86600  -2.63830   1.9242  0.10645     0
3     3.45660   9.52280  -4.0112 -3.59440     0
4     0.32924  -4.45520   4.5718 -0.98880     0
...       ...       ...      ...      ...   ...
1367  0.40614   1.34920  -1.4501 -0.55949     1
1368 -1.38870  -4.87730   6.4774  0.34179     1
1369 -3.75030 -13.45860  17.5932 -2.77710     1
1370 -3.56370  -8.38270  12.3930 -1.28230     1
1371 -2.54190  -0.65804   2.6842  1.19520     1

[1372 rows x 5 columns]>
```



```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-5-3446614338> in <cell line: 0>()
     17 sns.countplot(x=data['auth'])
     18 target_count = data.auth.value_counts()
---> 19 plt.annotate(s=target_count[0], xy=(-0.04,10+target_count[0]), size=14)
     20 plt.annotate(s=target_count[1], xy=(0.96,10+target_count[1]), size=14)
     21 plt.ylim(0,900)

TypeError: annotate() missing 1 required positional argument: 'text'
```





```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix, classification_report

# Read the data
data = pd.read_csv('/content/fakecurrency.txt', header=None)
data.columns = ['var', 'skew', 'curt', 'entr', 'auth']

print("First 5 rows of the dataset:")
print(data.head())
print("\nDataset Info:")
print(data.info())

# Create pairplot
print("\nCreating pairplot...")
sns.pairplot(data, hue='auth')
plt.show()

# Distribution of target variable
plt.figure(figsize=(8,6))
plt.title('Distribution of Target', size=18)
sns.countplot(x=data['auth'])
target_count = data.auth.value_counts()

# Fixed annotation - use 'text' parameter instead of 's'
plt.annotate(text=str(target_count[0]), xy=(-0.04, 10+target_count[0]), size=14)
plt.annotate(text=str(target_count[1]), xy=(0.96, 10+target_count[1]), size=14)
plt.ylim(0,900)
plt.show()

print(f"\nOriginal class distribution:")
print(target_count)

# Balance the dataset by removing excess samples from majority class
nb_to_delete = target_count[0] - target_count[1]
data = data.sample(frac=1, random_state=42).sort_values(by='auth')
data = data[nb_to_delete:]

print(f"\nBalanced class distribution:")
print(data['auth'].value_counts())

# Prepare features and target
x = data.loc[:, data.columns != 'auth']
y = data.loc[:, data.columns == 'auth']
```

```
# Split the data
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.3, random_state=42)

# Scale the features
scaler = StandardScaler()  # Fixed typo: 'scalar' -> 'scaler'
scaler.fit(x_train)
x_train_scaled = scaler.transform(x_train)
x_test_scaled = scaler.transform(x_test)

# Train logistic regression model
clf = LogisticRegression(solver='lbfgs', random_state=42, multi_class='auto')
clf.fit(x_train_scaled, y_train.values.ravel())

# Make predictions
y_pred = clf.predict(x_test_scaled)

# Create confusion matrix
conf_mat = pd.DataFrame(confusion_matrix(y_test, y_pred),
                        columns=["Pred.Negative", "Pred.Positive"],
                        index=['Act.Negative', "Act.Positive"])

# Calculate accuracy
tn, fp, fn, tp = confusion_matrix(y_test, y_pred).ravel()
accuracy = round((tn+tp)/(tn+fp+fn+tp), 4)

print(f"\nConfusion Matrix:")
print(conf_mat)
print(f'\nAccuracy = {round(100*accuracy, 2)}%')

# Print additional metrics
print(f"\nClassification Report:")
print(classification_report(y_test, y_pred))

# Test with new banknote
new_banknote = np.array([4.5, -8.1, 2.4, 1.4], ndmin=2)
new_banknote_scaled = scaler.transform(new_banknote)

prediction = clf.predict(new_banknote_scaled)[0]
probabilities = clf.predict_proba(new_banknote_scaled)[0]

print(f'\nNew Banknote Prediction:')
print(f'Prediction: Class {prediction}')
print(f'Probability [Fake/Authentic]: {probabilities}')

if prediction == 0:
    print("The banknote is predicted to be FAKE")
else:
    print("The banknote is predicted to be AUTHENTIC")
```