anamoly-detection

June 21, 2024

```python
[18]: # Import necessary libraries
      import numpy as np
      import pandas as pd
      import seaborn as sns
      import matplotlib.pyplot as plt
      from sklearn.ensemble import IsolationForest
      from sklearn.model_selection import GridSearchCV
      from sklearn.metrics import classification_report

      # Load dataset
      df = sns.load_dataset('penguins')

      # Display the first few rows of the dataset
      print(df.head())

      # Basic EDA
      print(df.info())
      print(df.describe())

      # Feature engineering (if needed)
      # For this example, we'll use categorical features for anomaly detection
      df['species'] = df['species'].astype('category')
      df['island'] = df['island'].astype('category')

      # Isolation Forest for Anomaly Detection
      # Convert categorical features to numerical using one-hot encoding
      df_encoded = pd.get_dummies(df[['species', 'island']])

      # Hyperparameter tuning using GridSearchCV
      param_grid = {
          'n_estimators': [50, 100, 200],
          'contamination': [0.05, 0.1, 0.15]
      }

      grid_search = GridSearchCV(IsolationForest(random_state=42), param_grid, cv=5,␣
       ↪scoring='f1')
      grid_search.fit(df_encoded)
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```python
# Get the best model
best_model = grid_search.best_estimator_

# Predict outliers/anomalies
df['anomaly_score'] = best_model.predict(df_encoded)

# Classification report (evaluate model performance)
print(classification_report(np.ones(len(df)), df['anomaly_score'], labels=[1,
 ↪-1], target_names=['Normal', 'Anomaly']))

# Visualize anomalies
plt.figure(figsize=(10, 6))
plt.scatter(df.index, np.zeros(len(df)), c=df['anomaly_score'], cmap='viridis',
 ↪marker='o', edgecolors='k')
plt.colorbar(label='Anomaly Score')
plt.title('Anomaly Detection with Isolation Forest')
plt.xlabel('Index')
plt.ylabel('Anomaly Score')
plt.show()
```

```
  species      island  bill_length_mm  bill_depth_mm  flipper_length_mm  \
0  Adelie  Torgersen            39.1           18.7              181.0
1  Adelie  Torgersen            39.5           17.4              186.0
2  Adelie  Torgersen            40.3           18.0              195.0
3  Adelie  Torgersen             NaN            NaN                NaN
4  Adelie  Torgersen            36.7           19.3              193.0

   body_mass_g     sex
0       3750.0    Male
1       3800.0  Female
2       3250.0  Female
3          NaN     NaN
4       3450.0  Female
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 344 entries, 0 to 343
Data columns (total 7 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   species            344 non-null    object
 1   island             344 non-null    object
 2   bill_length_mm     342 non-null    float64
 3   bill_depth_mm      342 non-null    float64
 4   flipper_length_mm  342 non-null    float64
 5   body_mass_g        342 non-null    float64
 6   sex                333 non-null    object
dtypes: float64(4), object(3)
```

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memory usage: 18.9+ KB
None
       bill_length_mm  bill_depth_mm  flipper_length_mm  body_mass_g
count      342.000000     342.000000         342.000000   342.000000
mean        43.921930      17.151170         200.915205  4201.754386
std          5.459584       1.974793          14.061714   801.954536
min         32.100000      13.100000         172.000000  2700.000000
25%         39.225000      15.600000         190.000000  3550.000000
50%         44.450000      17.300000         197.000000  4050.000000
75%         48.500000      18.700000         213.000000  4750.000000
max         59.600000      21.500000         231.000000  6300.000000
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/usr/local/lib/python3.10/dist-packages/sklearn/model_selection/_search.py:952:
UserWarning: One or more of the test scores are non-finite: [nan nan nan nan nan
nan nan nan nan]
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/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
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  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344:
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```

	precision	recall	f1-score	support
Normal	1.00	1.00	1.00	344
Anomaly	0.00	0.00	0.00	0
micro avg	1.00	1.00	1.00	344
macro avg	0.50	0.50	0.50	344
weighted avg	1.00	1.00	1.00	344

Anomaly Detection with Isolation Forest