ML-lab / 1BM22CS286_Lab_10_PCA.ipynb

sonalkolekar Add files via upload 1e859e8 · 7 hours ago History

Preview Code Blame 415 lines (415 loc) · 49.9 KB Raw

Lab-10

Implement Dimensionality reduction using Principle Component Analysis (PCA) method.

In [1]:
```
from google.colab import files
uploaded=files.upload()
```

Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

```
Saving heart.csv to heart.csv
```

To Do: Implementation – PCA

Write Python code to implement the following. Consider dataset files as “heart.csv”

Convert text columns to numbers using label encoding and one hot encoding

Apply scaling

Build a classification model using various methods (SVM, logistic regression, random forest) and check which model gives you the best accuracy

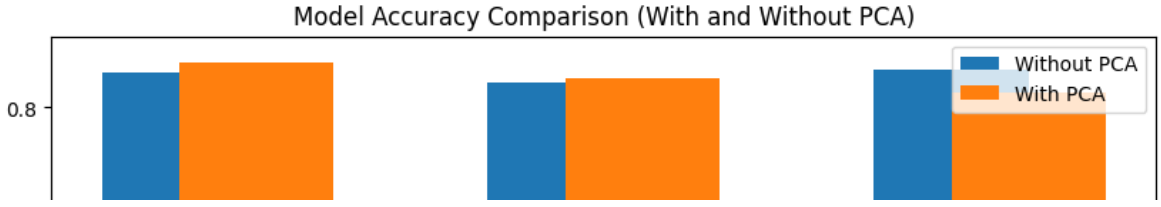
Now use PCA to reduce dimensions, retrain your model and see what impact it has on your model in terms of accuracy. Keep in mind that many times doing PCA reduces the accuracy but computation is much lighter and that's the trade off you need to consider while building models in real life.

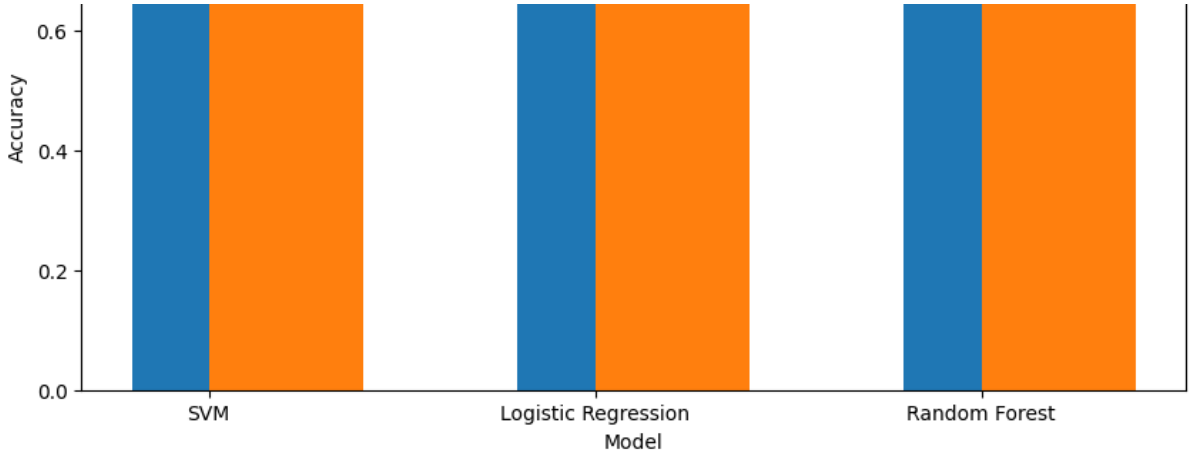
In [4]:
```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn.svm import SVC
from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import RandomForestClassifier
from sklearn.decomposition import PCA
from sklearn.metrics import accuracy_score
```

```
from sklearn.metrics import accuracy_score
import matplotlib.pyplot as plt

# Load the dataset (replace with your own file path)
data = pd.read_csv("heart.csv")

# Display first few rows to understand the dataset structure
print(data.head())

# Encode categorical columns using Label Encoding
label_encoder = LabelEncoder()

# Label Encoding for 'Sex', 'RestingECG', 'ExerciseAngina', and 'ST_Slope'
data['Sex'] = label_encoder.fit_transform(data['Sex'])
data['RestingECG'] = label_encoder.fit_transform(data['RestingECG'])
data['ExerciseAngina'] = label_encoder.fit_transform(data['ExerciseAngina'
data['ST_Slope'] = label_encoder.fit_transform(data['ST_Slope'])

# One Hot Encoding for 'ChestPainType' (if necessary, based on dataset)
data = pd.get_dummies(data, columns=['ChestPainType'], drop_first=True)

# Split data into features and target
X = data.drop("HeartDisease", axis=1)  # Features
y = data["HeartDisease"]  # Target

# Train-test split (80-20 split)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, r

# Apply scaling using StandardScaler
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)

# Build and evaluate the models: SVM, Logistic Regression, and Random Fore
models = {
    "SVM": SVC(),
    "Logistic Regression": LogisticRegression(),
    "Random Forest": RandomForestClassifier()
}

# Train and evaluate models without PCA
for model_name, model in models.items():
    model.fit(X_train_scaled, y_train)
    y_pred = model.predict(X_test_scaled)
    accuracy = accuracy_score(y_test, y_pred)
    print(f"{model_name} Accuracy without PCA: {accuracy:.4f}")

# Apply PCA for dimensionality reduction
pca = PCA(n_components=0.95)
X_train_pca = pca.fit_transform(X_train_scaled)
X_test_pca = pca.transform(X_test_scaled)

# Train and evaluate models with PCA
for model_name, model in models.items():
    model.fit(X_train_pca, y_train)
    y_pred = model.predict(X_test_pca)
    accuracy = accuracy_score(y_test, y_pred)
    print(f"{model_name} Accuracy with PCA: {accuracy:.4f}")
```

```
# Plotting the accuracy comparison (without PCA vs with PCA)
accuracies_without_pca = []
accuracies_with_pca = []

for model_name, model in models.items():
    model.fit(X_train_scaled, y_train)
    y_pred = model.predict(X_test_scaled)
    accuracies_without_pca.append(accuracy_score(y_test, y_pred))

    model.fit(X_train_pca, y_train)
    y_pred = model.predict(X_test_pca)
    accuracies_with_pca.append(accuracy_score(y_test, y_pred))

# Bar plot comparison
labels = list(models.keys())
x = range(len(models))

plt.figure(figsize=(10, 5))
plt.bar(x, accuracies_without_pca, width=0.4, label='Without PCA', align='
plt.bar(x, accuracies_with_pca, width=0.4, label='With PCA', align='edge')
plt.xlabel("Model")
plt.ylabel("Accuracy")
plt.title("Model Accuracy Comparison (With and Without PCA)")
plt.xticks(x, labels)
plt.legend()
plt.show()
```

```
   Age Sex ChestPainType  RestingBP  Cholesterol  FastingBS RestingECG  MaxH
R  \
0   40   M           ATA        140          289          0     Normal    17
2
1   49   F           NAP        160          180          0     Normal    15
6
2   37   M           ATA        130          283          0         ST     9
8
3   48   F           ASY        138          214          0     Normal    10
8
4   54   M           NAP        150          195          0     Normal    12
2

  ExerciseAngina  Oldpeak ST_Slope  HeartDisease
0              N      0.0       Up             0
1              N      1.0     Flat             1
2              N      0.0       Up             0
3              Y      1.5     Flat             1
4              N      0.0       Up             0
SVM Accuracy without PCA: 0.8587
Logistic Regression Accuracy without PCA: 0.8424
Random Forest Accuracy without PCA: 0.8641
SVM Accuracy with PCA: 0.8750
Logistic Regression Accuracy with PCA: 0.8478
Random Forest Accuracy with PCA: 0.8424
```




0.6
0.4
0.2
0.0
Accuracy
SVM
Logistic Regression
Random Forest
Model