eling-and-explainability-with-shap

August 22, 2025

[1]:
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.linear_model import LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import classification_report, confusion_matrix
import joblib
```

[4]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

[5]:
```
df = pd.read_csv("C:\\Users\\HP\\Desktop\\WA_Fn-UseC_-HR-Employee-Attrition.
↪csv")
```

[6]:
```
# Encode categorical variables
df_encoded = df.copy()
for col in df.select_dtypes('object').columns:
    if col != 'Attrition':
        df_encoded[col] = LabelEncoder().fit_transform(df[col])

X = df_encoded.drop('Attrition', axis=1)
y = LabelEncoder().fit_transform(df['Attrition'])
```

[7]:
```
# Train-test split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3,␣
↪random_state=42)
```

[9]:
```
# Logistic Regression
log_model = LogisticRegression(max_iter=1000)
log_model.fit(X_train, y_train)
y_pred_log = log_model.predict(X_test)

print("Logistic Regression Report:")
print(classification_report(y_test, y_pred_log))
print(confusion_matrix(y_test, y_pred_log))
```

```
Logistic Regression Report:
              precision    recall  f1-score   support
```

```
              0       0.88      0.97      0.92       380
              1       0.48      0.16      0.24        61

       accuracy                           0.86       441
      macro avg       0.68      0.57      0.58       441
   weighted avg       0.82      0.86      0.83       441

[[369  11]
 [ 51  10]]
```

```
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\linear_model\_logistic.py:465:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. OF ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  n_iter_i = _check_optimize_result(
```

[13]:
```python
# Decision Tree
tree_model = DecisionTreeClassifier(max_depth=5)
tree_model.fit(X_train, y_train)
y_pred_tree = tree_model.predict(X_test)

print("Decision Tree Report:")
print(classification_report(y_test, y_pred_tree))
print(confusion_matrix(y_test, y_pred_tree))
```

```
Decision Tree Report:
              precision    recall  f1-score   support

           0       0.87      0.94      0.91       380
           1       0.29      0.15      0.20        61

    accuracy                           0.83       441
   macro avg       0.58      0.54      0.55       441
weighted avg       0.79      0.83      0.81       441

[[358  22]
 [ 52   9]]
```

[16]:
```python
import os
import joblib

os.makedirs("src", exist_ok=True)   # create folder if not exists
```

```
joblib.dump(tree_model, "src/best_model.joblib")
```

[16]:
```
['src/best_model.joblib']
```

[20]:
```
import joblib

# Load the saved model
loaded_model = joblib.load("src/best_model.joblib")

# Now you can use it for predictions
y_pred = loaded_model.predict(X_test)
print(y_pred[:10])   # show first 10 predictions
```

```
[0 0 1 0 0 0 0 0 0 1]
```

[22]:
```
import shap

model = joblib.load("src/best_model.joblib")
```

[24]:
```
import os

# Create 'reports' folder if it does not exist
os.makedirs("reports", exist_ok=True)

# Summary plot
shap.summary_plot(shap_values, X, show=False)

# Save the figure
plt.savefig("reports/shap_summary.png")
plt.close()
```

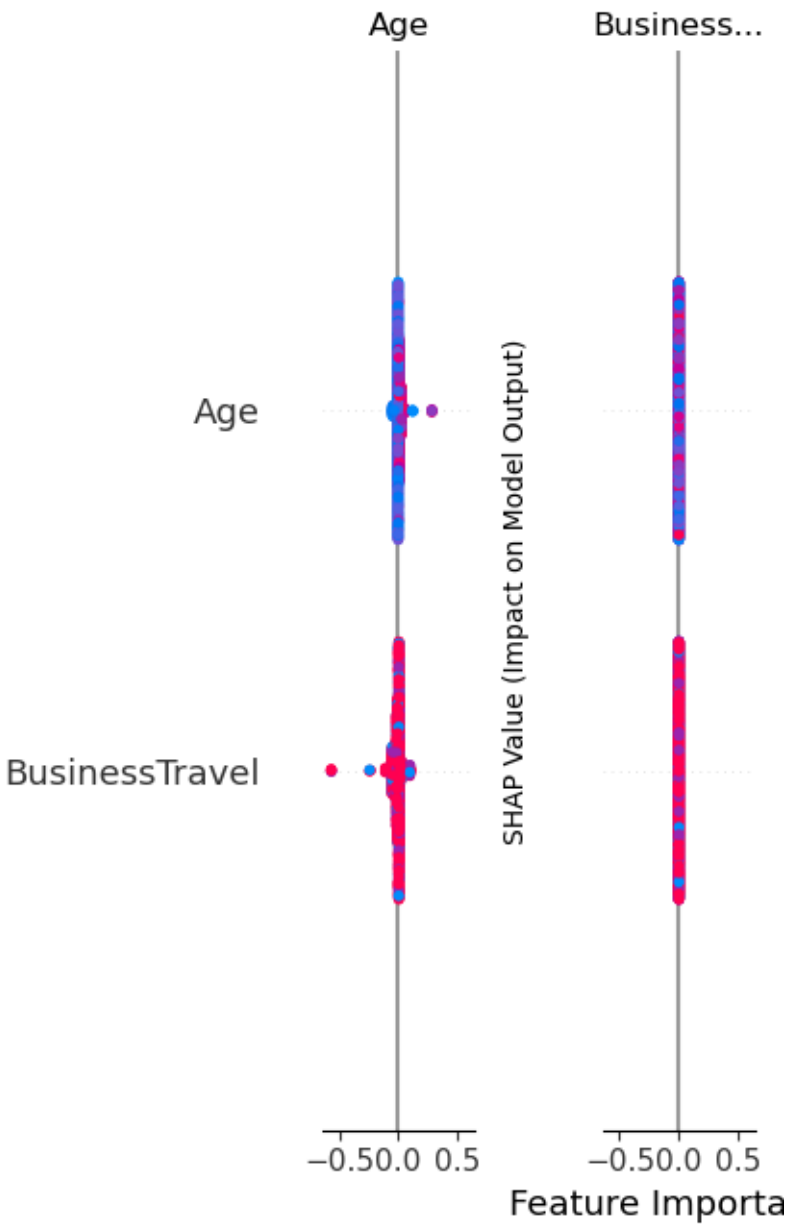
[26]:
```
import matplotlib.pyplot as plt
import shap

# Create plot
shap.summary_plot(shap_values, X, show=False, plot_size=(12,8))

# Fix cut-off labels
plt.gcf().axes[-1].set_ylabel("SHAP Value (Impact on Model Output)")
plt.gcf().axes[-1].set_xlabel("Feature Importance")

# Adjust layout so labels are not truncated
plt.tight_layout()

# Save with higher resolution
plt.savefig("reports/shap_summary_detailed.png", dpi=300, bbox_inches="tight")
plt.show()
```


Age
Business...
Age
BusinessTravel
SHAP Value (Impact on Model Output)
−0.50.0 0.5
−0.50.0 0.5
Feature Importa

[ ]: