```
# Install libraries if needed
!pip install pandas numpy scikit-learn matplotlib seaborn

# Import libraries
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 LabelEncoder, StandardScaler
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import classification_report, confusion_matrix
```

```
Requirement already satisfied: pandas in
/usr/local/lib/python3.11/dist-packages (2.2.2)
Requirement already satisfied: numpy in
/usr/local/lib/python3.11/dist-packages (1.26.4)
Requirement already satisfied: scikit-learn in
/usr/local/lib/python3.11/dist-packages (1.6.1)
Requirement already satisfied: matplotlib in
/usr/local/lib/python3.11/dist-packages (3.10.0)
Requirement already satisfied: seaborn in
/usr/local/lib/python3.11/dist-packages (0.13.2)
Requirement already satisfied: python-dateutil>=2.8.2 in
/usr/local/lib/python3.11/dist-packages (from pandas) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in
/usr/local/lib/python3.11/dist-packages (from pandas) (2024.2)
Requirement already satisfied: tzdata>=2022.7 in
/usr/local/lib/python3.11/dist-packages (from pandas) (2025.1)
Requirement already satisfied: scipy>=1.6.0 in
/usr/local/lib/python3.11/dist-packages (from scikit-learn) (1.13.1)
Requirement already satisfied: joblib>=1.2.0 in
/usr/local/lib/python3.11/dist-packages (from scikit-learn) (1.4.2)
Requirement already satisfied: threadpoolctl>=3.1.0 in
/usr/local/lib/python3.11/dist-packages (from scikit-learn) (3.5.0)
Requirement already satisfied: contourpy>=1.0.1 in
/usr/local/lib/python3.11/dist-packages (from matplotlib) (1.3.1)
Requirement already satisfied: cycler>=0.10 in
/usr/local/lib/python3.11/dist-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in
/usr/local/lib/python3.11/dist-packages (from matplotlib) (4.55.7)
Requirement already satisfied: kiwisolver>=1.3.1 in
/usr/local/lib/python3.11/dist-packages (from matplotlib) (1.4.8)
Requirement already satisfied: packaging>=20.0 in
/usr/local/lib/python3.11/dist-packages (from matplotlib) (24.2)
Requirement already satisfied: pillow>=8 in
/usr/local/lib/python3.11/dist-packages (from matplotlib) (11.1.0)
Requirement already satisfied: pyparsing>=2.3.1 in
/usr/local/lib/python3.11/dist-packages (from matplotlib) (3.2.1)
Requirement already satisfied: six>=1.5 in
```

```
/usr/local/lib/python3.11/dist-packages (from python-dateutil>=2.8.2->pandas) (1.17.0)
```

```
df=pd.read_csv('traffic_accidents.csv')
print(df)
```

```
                    crash_date traffic_control_device
weather_condition  \
0       07/29/2023 01:00:00 PM         TRAFFIC SIGNAL
CLEAR
1       08/13/2023 12:11:00 AM         TRAFFIC SIGNAL
CLEAR
2       12/09/2021 10:30:00 AM         TRAFFIC SIGNAL
CLEAR
3       08/09/2023 07:55:00 PM         TRAFFIC SIGNAL
CLEAR
4       08/19/2023 02:55:00 PM         TRAFFIC SIGNAL
CLEAR
...                        ...                    ...                ..
.
120257  01/11/2023 08:12:00 AM         TRAFFIC SIGNAL
CLEAR
120258  07/16/2018 07:58:00 AM            NO CONTROLS
CLEAR
120259  10/17/2023 03:33:00 PM         TRAFFIC SIGNAL
CLEAR
120260  10/19/2020 08:47:00 PM         TRAFFIC SIGNAL
RAIN
120261  09/28/2019 04:50:00 PM         TRAFFIC SIGNAL
CLEAR

            lighting_condition first_crash_type  \
0                    DAYLIGHT          TURNING
1       DARKNESS, LIGHTED ROAD          TURNING
2                    DAYLIGHT         REAR END
3                    DAYLIGHT            ANGLE
4                    DAYLIGHT         REAR END
...                       ...              ...
120257               DAYLIGHT          TURNING
120258               DAYLIGHT          TURNING
120259               DAYLIGHT          TURNING
120260  DARKNESS, LIGHTED ROAD         REAR END
120261               DAYLIGHT          TURNING

                        trafficway_type           alignment  \
0                           NOT DIVIDED  STRAIGHT AND LEVEL
1                              FOUR WAY  STRAIGHT AND LEVEL
2                          T-INTERSECTION  STRAIGHT AND LEVEL
3                              FOUR WAY  STRAIGHT AND LEVEL
4                          T-INTERSECTION  STRAIGHT AND LEVEL
```

```
...                                  ...                   ...
120257                          FOUR WAY  STRAIGHT AND LEVEL
120258  DIVIDED - W/MEDIAN (NOT RAISED)  STRAIGHT AND LEVEL
120259                      NOT DIVIDED  STRAIGHT AND LEVEL
120260                      NOT DIVIDED  STRAIGHT AND LEVEL
120261       DIVIDED - W/MEDIAN BARRIER  STRAIGHT AND LEVEL

       roadway_surface_cond road_defect
crash_type  \
0                   UNKNOWN     UNKNOWN             NO INJURY / DRIVE
AWAY
1                       DRY  NO DEFECTS             NO INJURY / DRIVE
AWAY
2                       DRY  NO DEFECTS             NO INJURY / DRIVE
AWAY
3                       DRY  NO DEFECTS  INJURY AND / OR TOW DUE TO
CRASH
4                   UNKNOWN     UNKNOWN             NO INJURY / DRIVE
AWAY
...                     ...         ...
...
120257                  DRY  NO DEFECTS  INJURY AND / OR TOW DUE TO
CRASH
120258                  DRY  NO DEFECTS  INJURY AND / OR TOW DUE TO
CRASH
120259                  DRY  NO DEFECTS             NO INJURY / DRIVE
AWAY
120260                  WET     UNKNOWN             NO INJURY / DRIVE
AWAY
120261                  DRY  NO DEFECTS  INJURY AND / OR TOW DUE TO
CRASH

        ...        most_severe_injury injuries_total injuries_fatal  \
0       ...   NO INDICATION OF INJURY            0.0            0.0
1       ...   NO INDICATION OF INJURY            0.0            0.0
2       ...   NO INDICATION OF INJURY            0.0            0.0
3       ...  NONINCAPACITATING INJURY            5.0            0.0
4       ...   NO INDICATION OF INJURY            0.0            0.0
...     ...                       ...            ...            ...
120257  ...  NONINCAPACITATING INJURY            1.0            0.0
120258  ...   NO INDICATION OF INJURY            0.0            0.0
120259  ...   NO INDICATION OF INJURY            0.0            0.0
120260  ...   NO INDICATION OF INJURY            0.0            0.0
120261  ...                 NO INDICA            NaN            NaN

        injuries_incapacitating injuries_non_incapacitating  \
0                           0.0                          0.0
1                           0.0                          0.0
2                           0.0                          0.0
3                           0.0                          5.0
```

```
4                            0.0                            0.0
...                          ...                            ...
120257                       0.0                            1.0
120258                       0.0                            0.0
120259                       0.0                            0.0
120260                       0.0                            0.0
120261                       NaN                            NaN

        injuries_reported_not_evident  injuries_no_indication
crash_hour  \
0                                 0.0                     3.0
13.0
1                                 0.0                     2.0
0.0
2                                 0.0                     3.0
10.0
3                                 0.0                     0.0
19.0
4                                 0.0                     3.0
14.0
...                               ...                     ...
...
120257                            0.0                     2.0
8.0
120258                            0.0                     2.0
7.0
120259                            0.0                     2.0
15.0
120260                            0.0                     3.0
20.0
120261                            NaN                     NaN
NaN

        crash_day_of_week  crash_month
0                     7.0          7.0
1                     1.0          8.0
2                     5.0         12.0
3                     4.0          8.0
4                     7.0          8.0
...                   ...          ...
120257                4.0          1.0
120258                2.0          7.0
120259                3.0         10.0
120260                2.0         10.0
120261                NaN          NaN

[120262 rows x 24 columns]
```

```
print(df.columns)
```

```
Index(['crash_date', 'traffic_control_device', 'weather_condition',
       'lighting_condition', 'first_crash_type', 'trafficway_type',
       'alignment', 'roadway_surface_cond', 'road_defect',
'crash_type',
       'intersection_related_i', 'damage', 'prim_contributory_cause',
       'num_units', 'most_severe_injury', 'injuries_total',
'injuries_fatal',
       'injuries_incapacitating', 'injuries_non_incapacitating',
       'injuries_reported_not_evident', 'injuries_no_indication',
'crash_hour',
       'crash_day_of_week', 'crash_month'],
      dtype='object')
```

```python
# Check for missing values
print(df.isnull().sum())

# Fill or drop missing values (example: filling with mode for
categorical columns)
for col in df.select_dtypes(include='object').columns:
    df[col].fillna(df[col].mode()[0], inplace=True)

# Fill numeric columns with median
for col in df.select_dtypes(include='number').columns:
    df[col].fillna(df[col].median(), inplace=True)

# Encode categorical variables
label_encoders = {}
for col in df.select_dtypes(include='object').columns:
    le = LabelEncoder()
    df[col] = le.fit_transform(df[col])
    label_encoders[col] = le

# Display cleaned data
df.info()
```

```
crash_date                      0
traffic_control_device          0
weather_condition               0
lighting_condition              0
first_crash_type                0
trafficway_type                 0
alignment                       0
roadway_surface_cond            0
road_defect                     0
crash_type                      0
intersection_related_i          0
damage                          0
prim_contributory_cause         0
num_units                       0
most_severe_injury              0
```

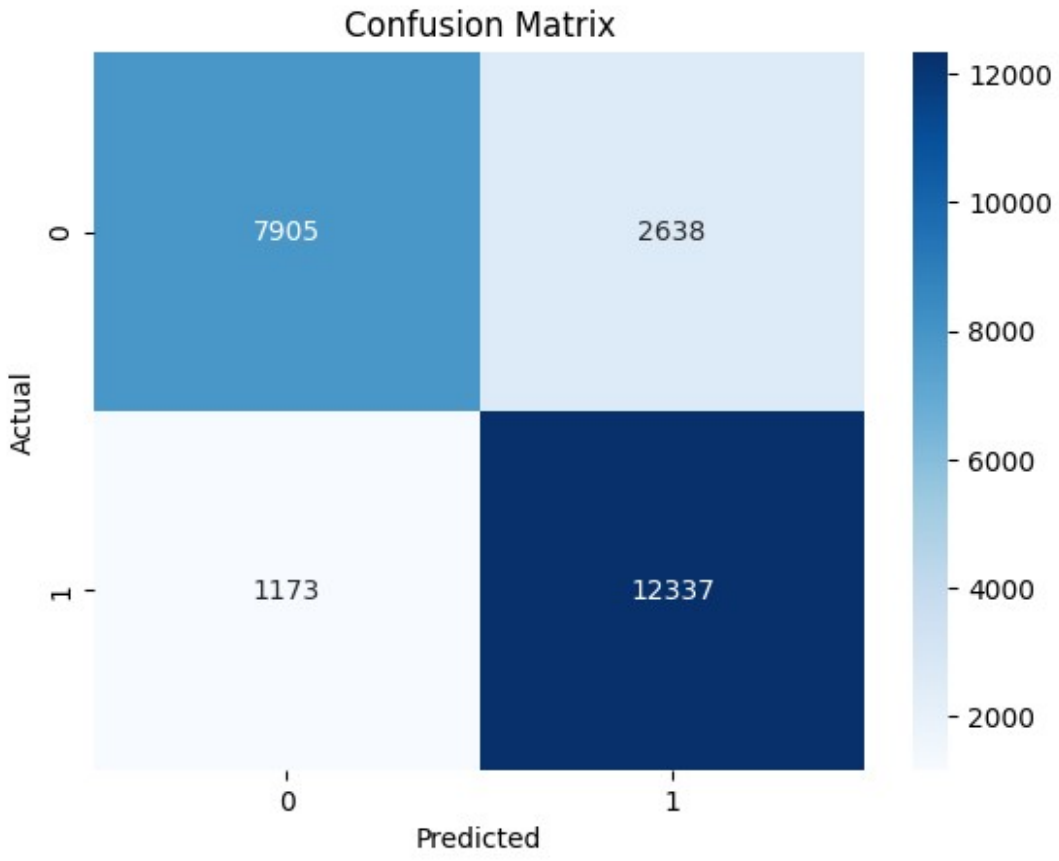
```
injuries_total                    1
injuries_fatal                    1
injuries_incapacitating           1
injuries_non_incapacitating       1
injuries_reported_not_evident     1
injuries_no_indication            1
crash_hour                        1
crash_day_of_week                 1
crash_month                       1
dtype: int64

<ipython-input-10-61791cad35b5>:6: FutureWarning: A value is trying to
be set on a copy of a DataFrame or Series through chained assignment
using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never
work because the intermediate object on which we are setting values
always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try
using 'df.method({col: value}, inplace=True)' or df[col] =
df[col].method(value) instead, to perform the operation inplace on the
original object.


  df[col].fillna(df[col].mode()[0], inplace=True)
<ipython-input-10-61791cad35b5>:10: FutureWarning: A value is trying
to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never
work because the intermediate object on which we are setting values
always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try
using 'df.method({col: value}, inplace=True)' or df[col] =
df[col].method(value) instead, to perform the operation inplace on the
original object.


  df[col].fillna(df[col].median(), inplace=True)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 120262 entries, 0 to 120261
Data columns (total 24 columns):
 #   Column                          Non-Null Count   Dtype
---  ------                          --------------   -----
 0   crash_date                      120262 non-null  int64
 1   traffic_control_device          120262 non-null  int64
 2   weather_condition               120262 non-null  int64
 3   lighting_condition              120262 non-null  int64
 4   first_crash_type                120262 non-null  int64
```

```
 5   trafficway_type                120262 non-null  int64
 6   alignment                      120262 non-null  int64
 7   roadway_surface_cond           120262 non-null  int64
 8   road_defect                    120262 non-null  int64
 9   crash_type                     120262 non-null  int64
 10  intersection_related_i         120262 non-null  int64
 11  damage                         120262 non-null  int64
 12  prim_contributory_cause        120262 non-null  int64
 13  num_units                      120262 non-null  int64
 14  most_severe_injury             120262 non-null  int64
 15  injuries_total                 120262 non-null  float64
 16  injuries_fatal                 120262 non-null  float64
 17  injuries_incapacitating        120262 non-null  float64
 18  injuries_non_incapacitating    120262 non-null  float64
 19  injuries_reported_not_evident  120262 non-null  float64
 20  injuries_no_indication         120262 non-null  float64
 21  crash_hour                     120262 non-null  float64
 22  crash_day_of_week              120262 non-null  float64
 23  crash_month                    120262 non-null  float64
dtypes: float64(9), int64(15)
memory usage: 22.0 MB
```

```
# Define features and target
X = df.drop(['crash_type'], axis=1)  # Replace 'crash_type' if using
another target
y = df['crash_type']

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)

# Initialize and train model
model = RandomForestClassifier(n_estimators=100, random_state=42)
model.fit(X_train, y_train)

# Make predictions
y_pred = model.predict(X_test)

# Classification report
print(classification_report(y_test, y_pred))

# Confusion matrix
conf_matrix = confusion_matrix(y_test, y_pred)
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues')
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.show()
```

```
              precision    recall  f1-score   support
```

```
              0       0.87      0.75      0.81     10543
              1       0.82      0.91      0.87     13510

       accuracy                           0.84     24053
      macro avg       0.85      0.83      0.84     24053
   weighted avg       0.84      0.84      0.84     24053
```



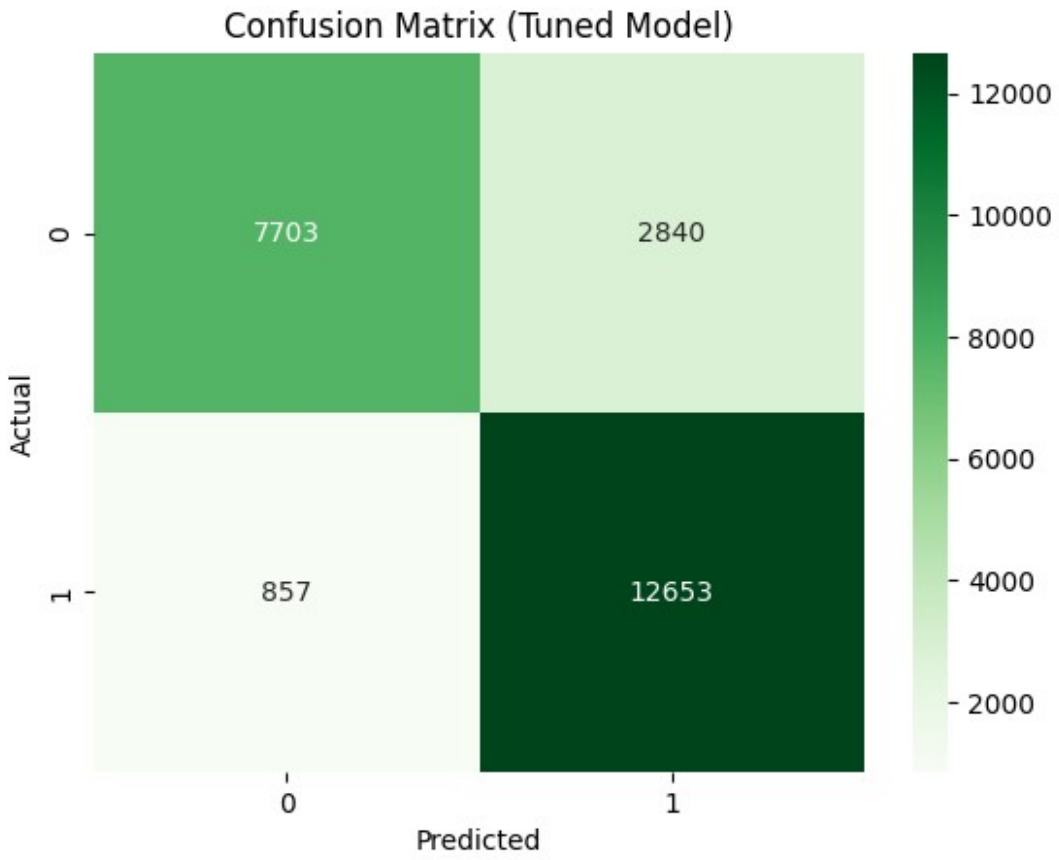

```python
from sklearn.model_selection import GridSearchCV

# Define parameter grid for tuning
param_grid = {
    'n_estimators': [50, 100, 150],
    'max_depth': [None, 10, 20, 30],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4]
}

# Initialize GridSearchCV
grid_search =
GridSearchCV(estimator=RandomForestClassifier(random_state=42),
                           param_grid=param_grid,
                           cv=3,
```

```
                           n_jobs=-1,
                           verbose=2)

# Fit model to training data
grid_search.fit(X_train, y_train)

# Display best parameters
print(f"Best Parameters: {grid_search.best_params_}")
```

```
Fitting 3 folds for each of 108 candidates, totalling 324 fits
Best Parameters: {'max_depth': None, 'min_samples_leaf': 4,
'min_samples_split': 2, 'n_estimators': 100}
```

```
# Use the best estimator found by GridSearchCV
best_model = grid_search.best_estimator_

# Predict using the tuned model
y_pred_tuned = best_model.predict(X_test)

# Evaluate performance
from sklearn.metrics import classification_report, confusion_matrix

print(classification_report(y_test, y_pred_tuned))

# Confusion matrix
conf_matrix_tuned = confusion_matrix(y_test, y_pred_tuned)
sns.heatmap(conf_matrix_tuned, annot=True, fmt='d', cmap='Greens')
plt.title('Confusion Matrix (Tuned Model)')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.show()
```

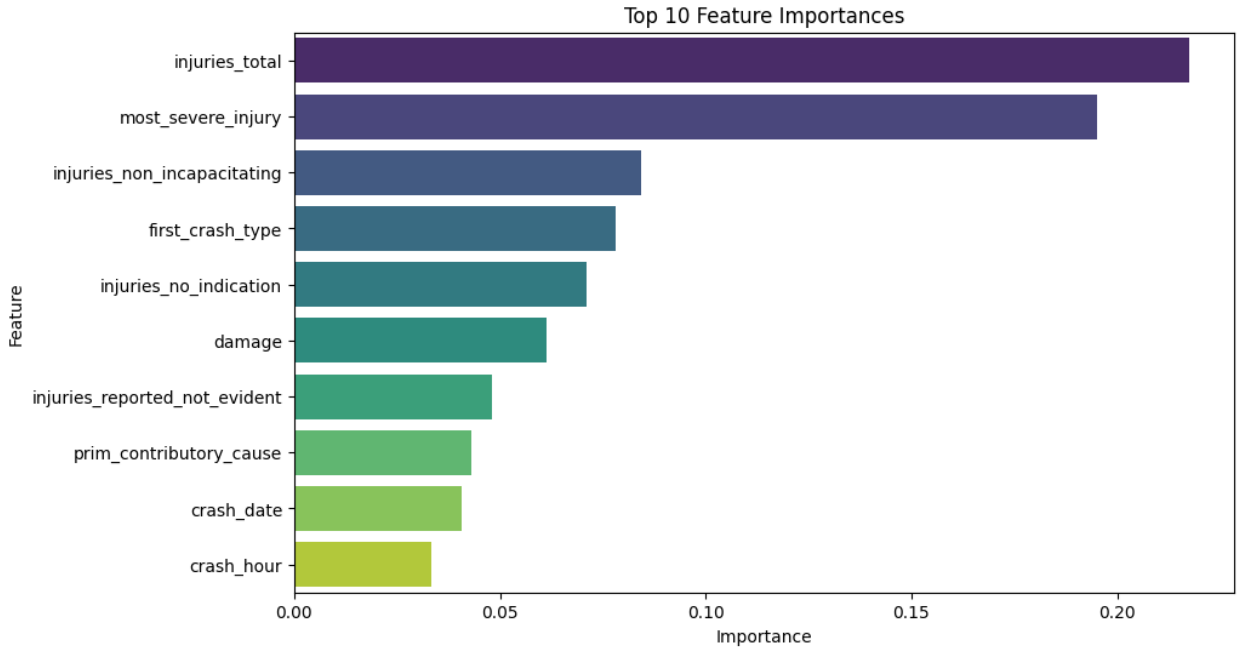
```
              precision    recall  f1-score   support

           0       0.90      0.73      0.81     10543
           1       0.82      0.94      0.87     13510

    accuracy                           0.85     24053
   macro avg       0.86      0.83      0.84     24053
weighted avg       0.85      0.85      0.84     24053
```




```
# Get feature importances from the model
importances = best_model.feature_importances_
features = X.columns

# Create DataFrame for visualization
feature_importances_df = pd.DataFrame({'Feature': features,
'Importance': importances})
feature_importances_df =
feature_importances_df.sort_values(by='Importance', ascending=False)

# Display top features
print(feature_importances_df.head(10))

# Plot feature importances
plt.figure(figsize=(10, 6))
sns.barplot(x='Importance', y='Feature',
data=feature_importances_df.head(10), palette='viridis')
plt.title('Top 10 Feature Importances')
plt.show()
```

```
                        Feature  Importance
14               injuries_total    0.217534
13           most_severe_injury    0.195029
```

```
17    injuries_non_incapacitating    0.084180
4                first_crash_type    0.078058
19         injuries_no_indication    0.070962
10                         damage    0.061369
18  injuries_reported_not_evident    0.047949
11        prim_contributory_cause    0.043100
0                     crash_date    0.040668
20                    crash_hour    0.033366

<ipython-input-18-67c2ae666497>:14: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be
removed in v0.14.0. Assign the `y` variable to `hue` and set
`legend=False` for the same effect.

  sns.barplot(x='Importance', y='Feature',
data=feature_importances_df.head(10), palette='viridis')
```




```
import joblib

# Save the model
joblib.dump(best_model, 'accident_prediction_model.pkl')

['accident_prediction_model.pkl']

# Load model
model = joblib.load('accident_prediction_model.pkl')

# Get the feature names used during training
training_features = model.feature_names_in_
```

```python
# Example input (replace with user input from chatbot)
# Ensure all features used during training are included and in the
correct order
user_input = pd.DataFrame({
    feature: [0] for feature in training_features  # Initialize all
features to 0
})

# Update user input with actual values (replace with user input from
chatbot)
user_input['weather_condition'] = [1]  # Example encoded value
user_input['lighting_condition'] = [2]
user_input['roadway_surface_cond'] = [0]
user_input['crash_hour'] = [14]
user_input['traffic_control_device'] = [3]
# ... Add other necessary features here ...


# Predict
prediction = model.predict(user_input)
print(f'Predicted Crash Type: {prediction[0]}')
```

```
Predicted Crash Type: 1
```

```
pip install streamlit
```

```
Collecting streamlit
  Downloading streamlit-1.41.1-py2.py3-none-any.whl.metadata (8.5 kB)
Requirement already satisfied: altair<6,>=4.0 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (5.5.0)
Requirement already satisfied: blinker<2,>=1.0.0 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (1.9.0)
Requirement already satisfied: cachetools<6,>=4.0 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (5.5.1)
Requirement already satisfied: click<9,>=7.0 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (8.1.8)
Requirement already satisfied: numpy<3,>=1.23 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (1.26.4)
Requirement already satisfied: packaging<25,>=20 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (24.2)
Requirement already satisfied: pandas<3,>=1.4.0 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (2.2.2)
Requirement already satisfied: pillow<12,>=7.1.0 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (11.1.0)
Requirement already satisfied: protobuf<6,>=3.20 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (4.25.6)
Requirement already satisfied: pyarrow>=7.0 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (17.0.0)
Requirement already satisfied: requests<3,>=2.27 in
```

```
/usr/local/lib/python3.11/dist-packages (from streamlit) (2.32.3)
Requirement already satisfied: rich<14,>=10.14.0 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (13.9.4)
Requirement already satisfied: tenacity<10,>=8.1.0 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (9.0.0)
Requirement already satisfied: toml<2,>=0.10.1 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (0.10.2)
Requirement already satisfied: typing-extensions<5,>=4.3.0 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (4.12.2)
Collecting watchdog<7,>=2.1.5 (from streamlit)
  Downloading watchdog-6.0.0-py3-none-
manylinux2014_x86_64.whl.metadata (44 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 44.3/44.3 kB 2.4 MB/s eta
0:00:00
ent already satisfied: gitpython!=3.1.19,<4,>=3.0.7 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (3.1.44)
Collecting pydeck<1,>=0.8.0b4 (from streamlit)
  Downloading pydeck-0.9.1-py2.py3-none-any.whl.metadata (4.1 kB)
Requirement already satisfied: tornado<7,>=6.0.3 in
/usr/local/lib/python3.11/dist-packages (from streamlit) (6.4.2)
Requirement already satisfied: jinja2 in
/usr/local/lib/python3.11/dist-packages (from altair<6,>=4.0-
>streamlit) (3.1.5)
Requirement already satisfied: jsonschema>=3.0 in
/usr/local/lib/python3.11/dist-packages (from altair<6,>=4.0-
>streamlit) (4.23.0)
Requirement already satisfied: narwhals>=1.14.2 in
/usr/local/lib/python3.11/dist-packages (from altair<6,>=4.0-
>streamlit) (1.24.1)
Requirement already satisfied: gitdb<5,>=4.0.1 in
/usr/local/lib/python3.11/dist-packages (from gitpython!
=3.1.19,<4,>=3.0.7->streamlit) (4.0.12)
Requirement already satisfied: python-dateutil>=2.8.2 in
/usr/local/lib/python3.11/dist-packages (from pandas<3,>=1.4.0-
>streamlit) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in
/usr/local/lib/python3.11/dist-packages (from pandas<3,>=1.4.0-
>streamlit) (2024.2)
Requirement already satisfied: tzdata>=2022.7 in
/usr/local/lib/python3.11/dist-packages (from pandas<3,>=1.4.0-
>streamlit) (2025.1)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27-
>streamlit) (3.4.1)
Requirement already satisfied: idna<4,>=2.5 in
/usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27-
>streamlit) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27-
```

```
>streamlit) (2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27-
>streamlit) (2024.12.14)
Requirement already satisfied: markdown-it-py>=2.2.0 in
/usr/local/lib/python3.11/dist-packages (from rich<14,>=10.14.0-
>streamlit) (3.0.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in
/usr/local/lib/python3.11/dist-packages (from rich<14,>=10.14.0-
>streamlit) (2.18.0)
Requirement already satisfied: smmap<6,>=3.0.1 in
/usr/local/lib/python3.11/dist-packages (from gitdb<5,>=4.0.1-
>gitpython!=3.1.19,<4,>=3.0.7->streamlit) (5.0.2)
Requirement already satisfied: MarkupSafe>=2.0 in
/usr/local/lib/python3.11/dist-packages (from jinja2->altair<6,>=4.0-
>streamlit) (3.0.2)
Requirement already satisfied: attrs>=22.2.0 in
/usr/local/lib/python3.11/dist-packages (from jsonschema>=3.0-
>altair<6,>=4.0->streamlit) (25.1.0)
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in
/usr/local/lib/python3.11/dist-packages (from jsonschema>=3.0-
>altair<6,>=4.0->streamlit) (2024.10.1)
Requirement already satisfied: referencing>=0.28.4 in
/usr/local/lib/python3.11/dist-packages (from jsonschema>=3.0-
>altair<6,>=4.0->streamlit) (0.36.2)
Requirement already satisfied: rpds-py>=0.7.1 in
/usr/local/lib/python3.11/dist-packages (from jsonschema>=3.0-
>altair<6,>=4.0->streamlit) (0.22.3)
Requirement already satisfied: mdurl~=0.1 in
/usr/local/lib/python3.11/dist-packages (from markdown-it-py>=2.2.0-
>rich<14,>=10.14.0->streamlit) (0.1.2)
Requirement already satisfied: six>=1.5 in
/usr/local/lib/python3.11/dist-packages (from python-dateutil>=2.8.2-
>pandas<3,>=1.4.0->streamlit) (1.17.0)
Downloading streamlit-1.41.1-py2.py3-none-any.whl (9.1 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 9.1/9.1 MB 51.8 MB/s eta
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anylinux2014_x86_64.whl (79 kB)
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0:00:00
lit
Successfully installed pydeck-0.9.1 streamlit-1.41.1 watchdog-6.0.0
```

```
# List of features used during training
print(list(X.columns))
```

```
['crash_date', 'traffic_control_device', 'weather_condition',
'lighting_condition', 'first_crash_type', 'trafficway_type',
```

```
'alignment', 'roadway_surface_cond', 'road_defect',
'intersection_related_i', 'damage', 'prim_contributory_cause',
'num_units', 'most_severe_injury', 'injuries_total', 'injuries_fatal',
'injuries_incapacitating', 'injuries_non_incapacitating',
'injuries_reported_not_evident', 'injuries_no_indication',
'crash_hour', 'crash_day_of_week', 'crash_month']

# Before training the model
X = X.drop(['crash_date'], axis=1)

from sklearn.ensemble import RandomForestClassifier

model = RandomForestClassifier()
model.fit(X, y)

# Save the retrained model
import joblib
joblib.dump(model, 'accident_prediction_model.pkl')

['accident_prediction_model.pkl']

# Load the saved model
import joblib
import pandas as pd

model = joblib.load('accident_prediction_model.pkl')

# Simple chatbot function
def accident_prediction_chatbot():
    print("Welcome to the Accident Prediction Chatbot!")
    print("Please provide the following information:\n")

    # User inputs
    weather_condition = int(input("Weather Condition (0=Clear, 1=Rain,
2=Snow, etc.): "))
    lighting_condition = int(input("Lighting Condition (0=Daylight,
1=Dark, etc.): "))
    roadway_surface_cond = int(input("Road Surface Condition (0=Dry,
1=Wet, etc.): "))
    crash_hour = int(input("Crash Hour (0-23): "))
    traffic_control_device = int(input("Traffic Control Device
(0=None, 1=Stop Sign, etc.): "))
    first_crash_type = int(input("First Crash Type (0=Rear-end,
1=Angle, etc.): "))
    alignment = int(input("Alignment (0=Straight, 1=Curve, etc.): "))
    prim_contributory_cause = int(input("Primary Cause (0=Speeding,
1=Distracted Driving, etc.): "))
    most_severe_injury = int(input("Most Severe Injury (0=None,
1=Minor, 2=Severe, 3=Fatal): "))

    # Default values for missing features
```

```
    crash_date = '2025-01-01'  # Placeholder date
    crash_day_of_week = 4       # Assuming Thursday (adjust as needed)
    crash_month = 1             # January
    damage = 0                  # No damage (adjust based on dataset
encoding)
    num_units = 1               # Assuming a single vehicle
    intersection_related_i = 0  # Not at intersection
    injuries_total = 0
    injuries_fatal = 0
    injuries_incapacitating = 0
    injuries_non_incapacitating = 0
    injuries_reported_not_evident = 0
    injuries_no_indication = 0
    road_defect = 0             # Assuming no defect
    trafficway_type = 0         # Default trafficway type

    # Create DataFrame with all required features
    user_data = pd.DataFrame({
    'weather_condition': [weather_condition],
    'lighting_condition': [lighting_condition],
    'roadway_surface_cond': [roadway_surface_cond],
    'crash_hour': [crash_hour],
    'traffic_control_device': [traffic_control_device],
    'first_crash_type': [first_crash_type],
    'alignment': [alignment],
    'prim_contributory_cause': [prim_contributory_cause],
    'most_severe_injury': [most_severe_injury],
    'crash_day_of_week': [crash_day_of_week],
    'crash_month': [crash_month],
    'damage': [damage],
    'num_units': [num_units],
    'intersection_related_i': [intersection_related_i],
    'injuries_total': [injuries_total],
    'injuries_fatal': [injuries_fatal],
    'injuries_incapacitating': [injuries_incapacitating],
    'injuries_non_incapacitating': [injuries_non_incapacitating],
    'injuries_reported_not_evident': [injuries_reported_not_evident],
    'injuries_no_indication': [injuries_no_indication],
    'road_defect': [road_defect],
    'trafficway_type': [trafficway_type]
})

    # Ensure feature order matches the model's expectations
    user_data = user_data[X.columns]

    # Make prediction
    prediction = model.predict(user_data)
    print(f"\nPrediction: The predicted crash type is
{prediction[0]}.")
```

```
# Run the chatbot
accident_prediction_chatbot()

Welcome to the Accident Prediction Chatbot!
Please provide the following information:

Weather Condition (0=Clear, 1=Rain, 2=Snow, etc.): 0
Lighting Condition (0=Daylight, 1=Dark, etc.): 0
Road Surface Condition (0=Dry, 1=Wet, etc.): 0
Crash Hour (0-23): 3
Traffic Control Device (0=None, 1=Stop Sign, etc.): 1
First Crash Type (0=Rear-end, 1=Angle, etc.): 0
Alignment (0=Straight, 1=Curve, etc.): 1
Primary Cause (0=Speeding, 1=Distracted Driving, etc.): 1
Most Severe Injury (0=None, 1=Minor, 2=Severe, 3=Fatal): 3

Prediction: The predicted crash type is 1.
```