ARTIFICIAL INTELLIGENCE FOR BUSINESS DECISIONS AND TRANSFORMATION CSCN8030

Group:1

ASSIGNMENT: 1

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PART: 2 Data Analysis and Visualization

- Insights from Data Analysis

1. The dataset provides detailed records of animal intakes and outcomes from Austin Animal Center.
2. Key outcome types include Adoption, Transfer, Return to Owner, Euthanasia, and more.
3. Adoption is the most frequent outcome, highlighting its importance in shelter operations.

In [13]:
```python
import pandas as pd
import matplotlib.pyplot as plt

# Load the datasets with proper encoding
intakes_path = 'Austin_Animal_Center_Intakes.csv'
outcomes_path = 'Austin_Animal_Center_Outcomes.csv'

# Try using 'latin1' encoding to read the files
intakes_df = pd.read_csv(intakes_path, encoding='latin1')
outcomes_df = pd.read_csv(outcomes_path, encoding='latin1')

# Display the first few rows of each dataset
print("Intakes Dataset:")
display(intakes_df.head())
print("\nOutcomes Dataset:")
display(outcomes_df.head())
```

Intakes Dataset:

	Animal ID	Name	DateTime	MonthYear	Found Location	Intake Type	Intake Condition	Animal Type	Sex upon Intake	Age upon Intake	Breed	Color
0	A786884	*Brock	01/03/2019 04:19:00 PM	January 2019	2501 Magin Meadow Dr in Austin (TX)	Stray	Normal	Dog	Neutered Male	2 years	Beagle Mix	Tricolor
1	A706918	Belle	07/05/2015 12:59:00 PM	July 2015	9409 Bluegrass Dr in Austin (TX)	Stray	Normal	Dog	Spayed Female	8 years	English Springer Spaniel	White/Liver
2	A724273	Runster	04/14/2016 06:43:00 PM	April 2016	2818 Palomino Trail in Austin (TX)	Stray	Normal	Dog	Intact Male	11 months	Basenji Mix	Sable/White
3	A857105	Johnny Ringo	05/12/2022 12:23:00 AM	May 2022	4404 Sarasota Drive in Austin (TX)	Public Assist	Normal	Cat	Neutered Male	2 years	Domestic Shorthair	Orange Tabby
4	A682524	Rio	06/29/2014 10:38:00 AM	June 2014	800 Grove Blvd in Austin (TX)	Stray	Normal	Dog	Neutered Male	4 years	Doberman Pinsch/Australian Cattle Dog	Tan/Gray

Outcomes Dataset:

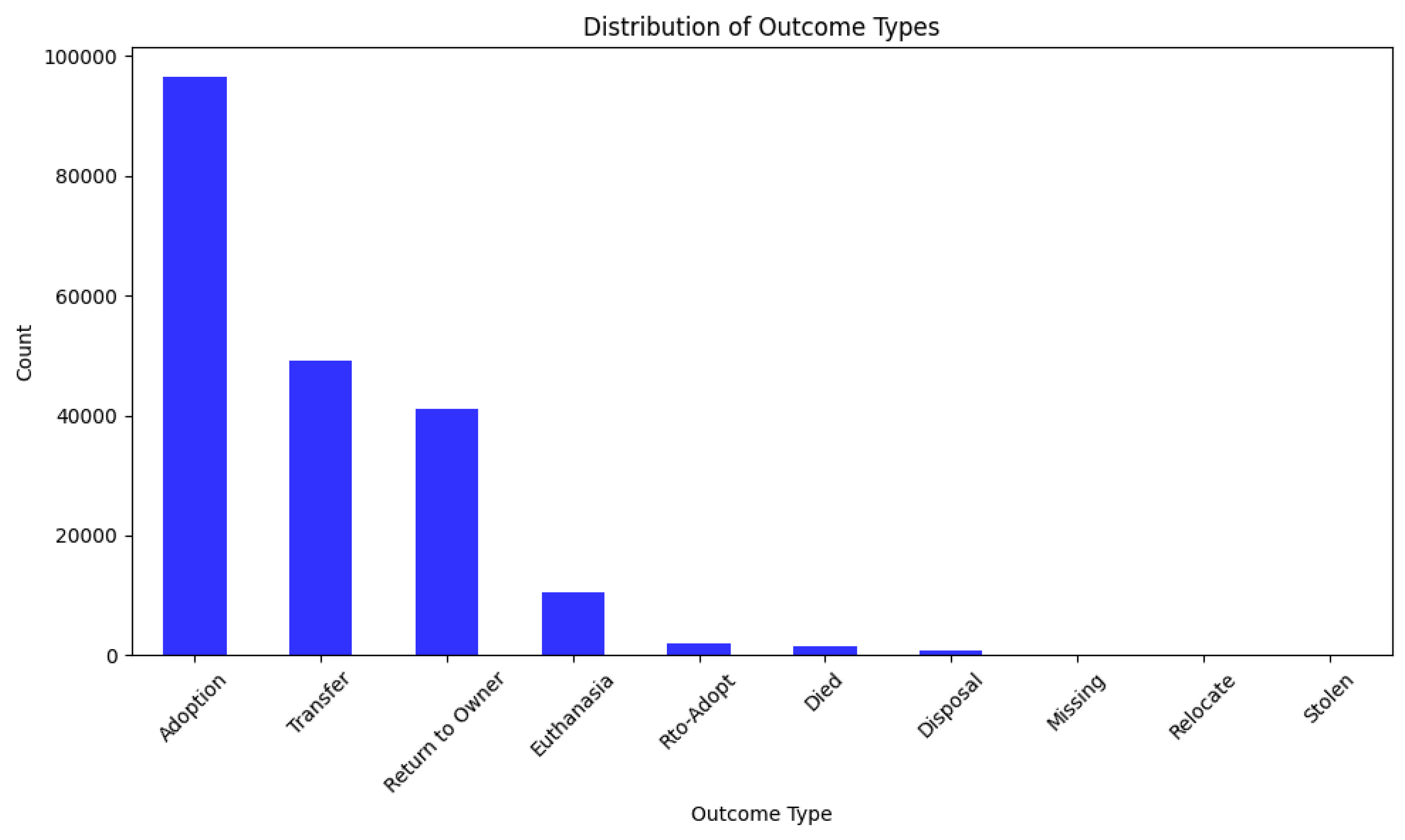
	Animal ID	Name	DateTime	MonthYear	Date of Birth	Outcome Type	Outcome Subtype	Animal Type	Sex upon Outcome	Age upon Outcome	Breed	Color
0	A794011	Chunk	05/08/2019 06:20:00 PM	May 2019	05/02/2017	Rto-Adopt	NaN	Cat	Neutered Male	2 years	Domestic Shorthair Mix	Brown Tabby/White
1	A776359	Gizmo	07/18/2018 04:02:00 PM	Jul 2018	07/12/2017	Adoption	NaN	Dog	Neutered Male	1 year	Chihuahua Shorthair Mix	White/Brown
2	A821648	NaN	08/16/2020 11:38:00 AM	Aug 2020	08/16/2019	Euthanasia	NaN	Other	Unknown	1 year	Raccoon	Gray
3	A720371	Moose	02/13/2016 05:59:00 PM	Feb 2016	10/08/2015	Adoption	NaN	Dog	Neutered Male	4 months	Anatol Shepherd/Labrador Retriever	Buff
4	A674754	NaN	03/18/2014 11:47:00 AM	Mar 2014	03/12/2014	Transfer	Partner	Cat	Intact Male	6 days	Domestic Shorthair Mix	Orange Tabby

In [14]:
```python
# Merge datasets based on common identifiers (e.g., Animal ID)
merged_df = pd.merge(intakes_df, outcomes_df, on="Animal ID", how="inner")

# Analyze trends: Outcomes distribution
outcome_counts = merged_df["Outcome Type"].value_counts()

# Visualization: Outcomes distribution
plt.figure(figsize=(10, 6))
outcome_counts.plot(kind='bar', color='blue', alpha=0.8)
plt.title("Distribution of Outcome Types")
plt.xlabel("Outcome Type")
plt.ylabel("Count")
plt.xticks(rotation=45)
plt.tight_layout()

# Show plot
plt.show()
```



- **Proposed DSS-Based Solutions**

1. **Outcome Prediction System:**

- Objective: Forecast the likely outcomes (adoption, transfer, etc.) for incoming animals.
- Implementation: Use machine learning models to analyze historical data and predict outcomes based on attributes such as age, breed, and health condition.

2. **Adoption Priority Dashboard:**

- Objective: Identify animals with lower adoption probabilities and prioritize their visibility to adopters.
- Implementation: Create a dashboard highlighting animals at higher risk of prolonged stays or euthanasia.

3. **Seasonal Intake and Outcome Analysis:**

- Objective: Prepare shelters for seasonal trends in intakes and outcomes.
- Implementation: Use time-series analysis to predict seasonal variations and align resources accordingly.

4. **Enhanced Animal Profile System:**

- Objective: Increase adoption rates by providing detailed and visually appealing animal profiles.
- Implementation: Use AI-powered tools to generate descriptive profiles, including photos and behavior summaries.

5. **Resource Allocation Tool:**

- Objective: Optimize shelter resources (e.g., food, space) based on predicted intake trends.
- Implementation: Integrate predictive analytics into resource planning modules.

Part 3: Building a Simple AI Model

In [16]:
```python
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, classification_report
from sklearn.preprocessing import LabelEncoder

# Load the outcomes dataset
outcomes_path = 'Austin_Animal_Center_Outcomes.csv'
outcomes_df = pd.read_csv(outcomes_path, encoding='latin1')

# Select relevant features and target variable
features = ['Animal Type', 'Sex upon Outcome', 'Age upon Outcome', 'Breed', 'Color']
target = 'Outcome Type'

# Handle missing values
outcomes_df = outcomes_df.dropna(subset=features + [target])

# Encode categorical variables
X = pd.get_dummies(outcomes_df[features], drop_first=True)
label_encoder = LabelEncoder()
y = label_encoder.fit_transform(outcomes_df[target])

# Split the 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)

# Train a Random Forest Classifier
model = RandomForestClassifier(random_state=42)
model.fit(X_train, y_train)

# Make predictions
y_pred = model.predict(X_test)

# Evaluate the model
accuracy = accuracy_score(y_test, y_pred)
report = classification_report(y_test, y_pred, labels=range(len(label_encoder.classes_)), target_names=label_encoder.classes_)

print("Accuracy of the AI Model:", accuracy)
print("\nClassification Report:\n", report)

# Feature importance
feature_importance = pd.DataFrame({'Feature': X.columns, 'Importance': model.feature_importances_})
feature_importance = feature_importance.sort_values(by='Importance', ascending=False)
print("\nTop Features Contributing to Predictions:\n", feature_importance.head())

# Decision-Making Integration
print("\nThis model can help prioritize actions based on predicted outcomes, improving resource allocation and decision-making in the shelter.")
```

```
Accuracy of the AI Model: 0.6792776208461612

Classification Report:
                  precision    recall  f1-score   support

       Adoption       0.72      0.87      0.79     14939
           Died       0.14      0.02      0.04       321
       Disposal       0.32      0.05      0.08       155
     Euthanasia       0.76      0.56      0.64      1940
        Missing       0.20      0.05      0.08        19
       Relocate       0.00      0.00      0.00         3
Return to Owner       0.47      0.37      0.41      4983
      Rto-Adopt       0.04      0.01      0.01       215
         Stolen       0.00      0.00      0.00         0
       Transfer       0.68      0.62      0.65      8932

       accuracy                           0.68     31507
      macro avg       0.33      0.25      0.27     31507
   weighted avg       0.66      0.68      0.66     31507


Top Features Contributing to Predictions:
                           Feature  Importance
6   Sex upon Outcome_Spayed Female    0.095463
5   Sex upon Outcome_Neutered Male    0.074512
4     Sex upon Outcome_Intact Male    0.055332
29       Age upon Outcome_2 months    0.038468
7         Sex upon Outcome_Unknown    0.032951

This model can help prioritize actions based on predicted outcomes, improving resource allocation and decision-making in the shelter.
```

```
c:\Users\ratho\Desktop\CONESTOGA\CSCN8010\ML_labs\Lib\site-packages\sklearn\metrics\_classification.py:1531: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
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```