In [1]:

```
    import pandas as pd
    import numpy as np
    import joblib
    import matplotlib.pyplot as plt
    import seaborn as sns
    from sklearn.feature_extraction.text import TfidfVectorizer
    from sklearn.preprocessing import LabelEncoder
    from sklearn.ensemble import RandomForestClassifier
    from sklearn.model_selection import train_test_split, GridSearchCV
    from sklearn.metrics import accuracy_score, classification_report
```

In [2]:

```
# Load dataset
file_path = "Career Dataset.xlsx"
df = pd.read_excel(file_path)
df
```

Out[2]:

	Career	Skill
0	Software Development and Engineering	Web Development, Mobile App Development, Artif...
1	Development	Web Development, Mobile App Development, Datab...
2	Data Science	Data Analysis and Visualization, Data Engineering
3	Development	Web Development
4	Artificial Intelligence	Data Analysis and Visualization, Data Analysis...
...	...	...
3783	Data Science	Deep Learning, Machine Learning, Data Engineer...
3784	User Experience (UX) and User Interface (UI) D...	UI/UX Knowledge
3785	Development	Web Development, Mobile App Development
3786	Software Development and Engineering	Artificial Intelligence (AI) and Machine Learn...
3787	Security	Cybersecurity, Data Analysis and Visualization...

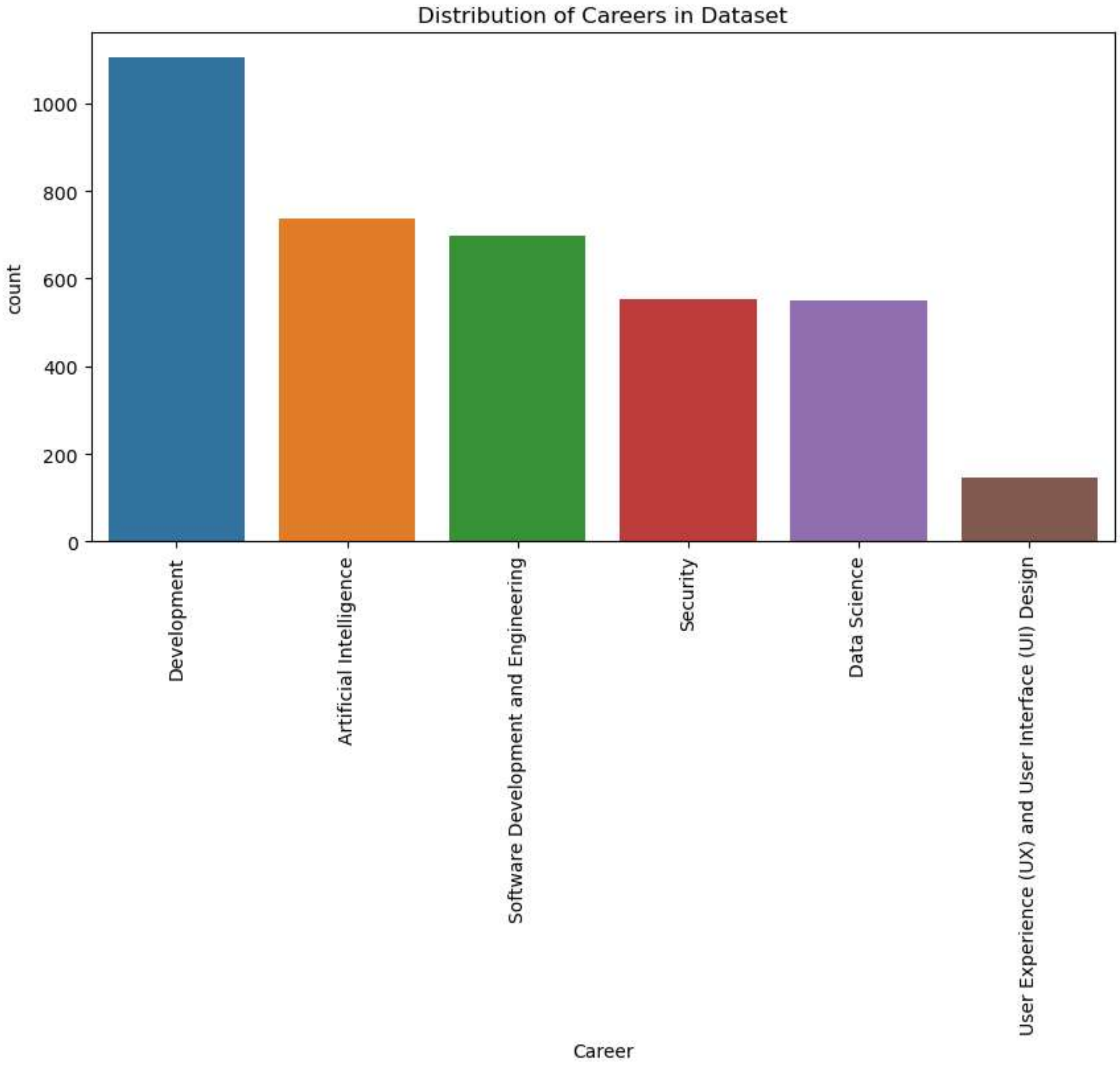
3788 rows × 2 columns

In [3]:

```
# Convert 'Skill' column to lowercase for case insensitivity
df['Skill'] = df['Skill'].str.lower()
```

In [4]:

```
# Data visualization
plt.figure(figsize=(10, 5))
sns.countplot(x=df['Career'], order=df['Career'].value_counts().index)
plt.xticks(rotation=90)
plt.title("Distribution of Careers in Dataset")
plt.show()
```



In [5]:

```
# Preprocessing
vectorizer = TfidfVectorizer()
X = vectorizer.fit_transform(df['Skill'])  # Convert skills to numerical featur

y_encoder = LabelEncoder()
y = y_encoder.fit_transform(df['Career'])
```

In [6]:

```
# Split into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, randon
```

In [7]:

```
# Train model with hyperparameter tuning
param_grid = {
    'n_estimators': [100, 200, 300],
    'max_depth': [10, 20, None],
    'min_samples_split': [2, 5, 10],
}

model = RandomForestClassifier(random_state=42)
grid_search = GridSearchCV(model, param_grid, cv=4, n_jobs=-1, verbose=2)
grid_search.fit(X_train, y_train)

best_model = grid_search.best_estimator_
```

```
Fitting 4 folds for each of 27 candidates, totalling 108 fits
```

In [8]:

```
# Model evaluation
y_pred = best_model.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
print(f"Model Accuracy: {accuracy * 100:.2f}%")
print("Classification Report:\n", classification_report(y_test, y_pred, target_
```

```
Model Accuracy: 92.08%
Classification Report:
                                                       precision    recall  f1
-score   support

                            Artificial Intelligence       0.90      0.94      
0.92       161
                                       Data Science       0.94      0.95      
0.94       108
                                        Development       0.94      0.96      
0.95       206
                                           Security       0.91      0.96      
0.93       102
               Software Development and Engineering       0.90      0.78      
0.83       143
User Experience (UX) and User Interface (UI) Design       0.97      0.97      
0.97        38

                                           accuracy                           
0.92       758
                                          macro avg       0.93      0.93      
0.93       758
                                       weighted avg       0.92      0.92      
0.92       758
```

In [9]:

```
# Save the model and vectorizer
joblib.dump(best_model, "job_role_model.pkl")
joblib.dump(vectorizer, "vectorizer.pkl")
joblib.dump(y_encoder, "label_encoder.pkl")
```

Out[9]:

```
['label_encoder.pkl']
```

```
In [10]: # # Prediction function with case insensitivity
         # def predict_job_roles(skills):
         #     skills = skills.lower()  # Convert input to lowercase
         #     skills_transformed = vectorizer.transform([skills])
         #     probabilities = best_model.predict_proba(skills_transformed)[0]
         #     sorted_indices = np.argsort(probabilities)[::-1]  # Sort by probability i
         #     sorted_roles = y_encoder.inverse_transform(sorted_indices)
         #     sorted_probs = probabilities[sorted_indices]

         #     predictions = []
         #     for role, prob in zip(sorted_roles, sorted_probs):
         #         if prob >= 0.7:
         #             predictions.append(f"High confidence: {role} ({prob:.2f})")
         #         elif 0.5 <= prob < 0.7:
         #             predictions.append(f"Medium confidence: {role} ({prob:.2f})")
         #         elif 0.1 <= prob < 0.5:
         #             predictions.append(f"Low confidence: {role} ({prob:.2f})")
         #         else:
         #             break  # Stop when confidence is too low

         #     return predictions if predictions else ["Confidence too low to determine


         def predict_job_roles(skills):
             skills = skills.lower()  # Convert input to lowercase
             skills_transformed = vectorizer.transform([skills])
             probabilities = best_model.predict_proba(skills_transformed)[0]
             sorted_indices = np.argsort(probabilities)[::-1]  # Sort by probability in
             sorted_roles = y_encoder.inverse_transform(sorted_indices)
             sorted_probs = probabilities[sorted_indices]

             predictions = {
                 "High confidence": [],
                 "Medium confidence": [],
                 "Low confidence": []
             }

             for role, prob in zip(sorted_roles, sorted_probs):
                 if prob >= 0.7:
                     predictions["High confidence"].append({"job_role": role, "Probabili
                 elif 0.5 <= prob < 0.7:
                     predictions["Medium confidence"].append({"job_role": role, "Probabi
                 elif 0.1 <= prob < 0.5:
                     predictions["Low confidence"].append({"job_role": role, "Probabilit
                 else:
                     break  # Stop when confidence is too low

             # Remove empty confidence levels
             predictions = {k: v for k, v in predictions.items() if v}

             return predictions if predictions else "Confidence too low to determine sui
```

In [11]:

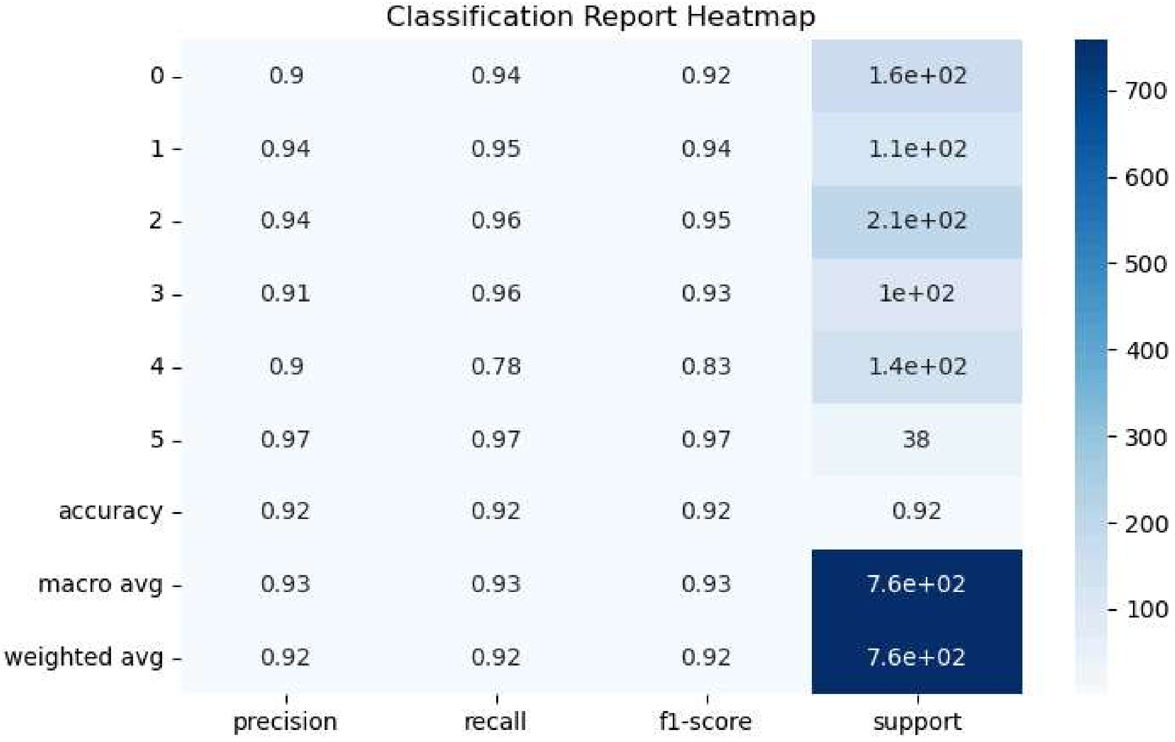
```
# # Example usage
# example_skills = "Graphic Design, Web Development"
# predicted_roles = predict_job_roles(example_skills)
# print("Predicted Job Roles:")
# for role in predicted_roles:
#     print(role)


# Example usage
example_skills = "Graphic Design, Web Development"
predicted_roles = predict_job_roles(example_skills)
print("Predicted Job Roles:", predicted_roles)
```

```
Predicted Job Roles: {'Medium confidence': [{'job_role': 'Development', 'Prob
ability': 0.55}], 'Low confidence': [{'job_role': 'Software Development and E
ngineering', 'Probability': 0.17}]}
```

In [12]:

```
# Visualizing model performance
plt.figure(figsize=(8, 5))
sns.heatmap(pd.DataFrame(classification_report(y_test, y_pred, output_dict=True
plt.title("Classification Report Heatmap")
plt.show()
```



In [ ]:

In [ ]: