Exploratory Data Analysis (EDA)

In [10]:
```
# Importing necessary libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [3]:
```
# Loading the data
data = pd.read_csv(r'C:\Users\SamDutse\Documents\GitHub\Insurance\insurance.csv')
```

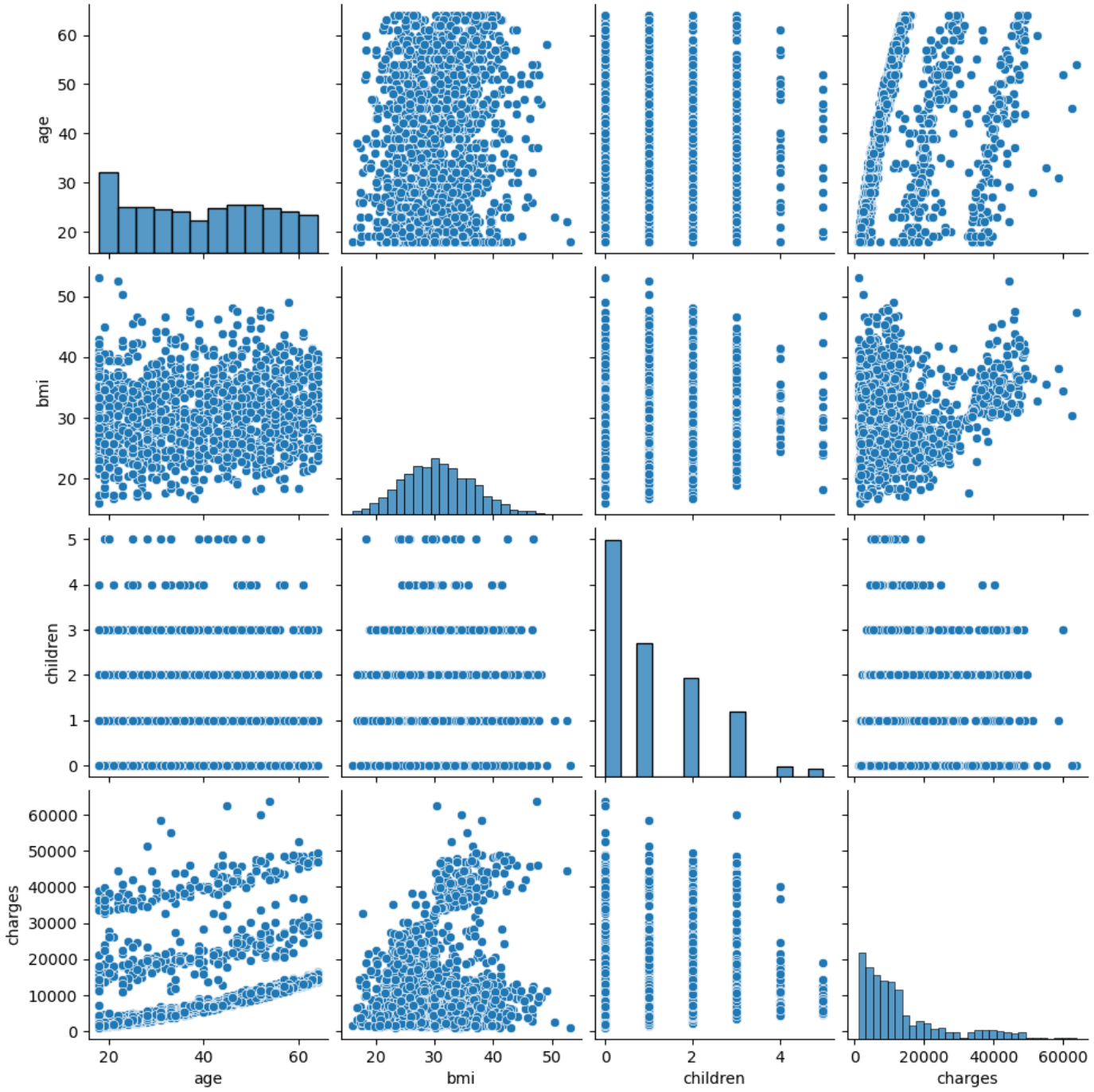
In [7]:
```
# Displaying basic info about the data
print(data.head())
print(data.info())
print(data.describe(include = "all"))
```

```
   age     sex     bmi  children smoker     region      charges
0   19  female  27.900         0    yes  southwest  16884.92400
1   18    male  33.770         1     no  southeast   1725.55230
2   28    male  33.000         3     no  southeast   4449.46200
3   33    male  22.705         0     no  northwest  21984.47061
4   32    male  28.880         0     no  northwest   3866.85520
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1338 entries, 0 to 1337
Data columns (total 7 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   age       1338 non-null   int64
 1   sex       1338 non-null   object
 2   bmi       1338 non-null   float64
 3   children  1338 non-null   int64
 4   smoker    1338 non-null   object
 5   region    1338 non-null   object
 6   charges   1338 non-null   float64
dtypes: float64(2), int64(2), object(3)
memory usage: 73.3+ KB
None
                age   sex          bmi     children smoker     region  \
count   1338.000000  1338  1338.000000  1338.000000   1338       1338
unique          NaN     2          NaN          NaN      2          4
top             NaN  male          NaN          NaN     no  southeast
freq            NaN   676          NaN          NaN   1064        364
mean      39.207025   NaN    30.663397     1.094918    NaN        NaN
std       14.049960   NaN     6.098187     1.205493    NaN        NaN
min       18.000000   NaN    15.960000     0.000000    NaN        NaN
25%       27.000000   NaN    26.296250     0.000000    NaN        NaN
50%       39.000000   NaN    30.400000     1.000000    NaN        NaN
75%       51.000000   NaN    34.693750     2.000000    NaN        NaN
max       64.000000   NaN    53.130000     5.000000    NaN        NaN

             charges
count    1338.000000
unique           NaN
top              NaN
freq             NaN
mean    13270.422265
std     12110.011237
min      1121.873900
25%      4740.287150
50%      9382.033000
```

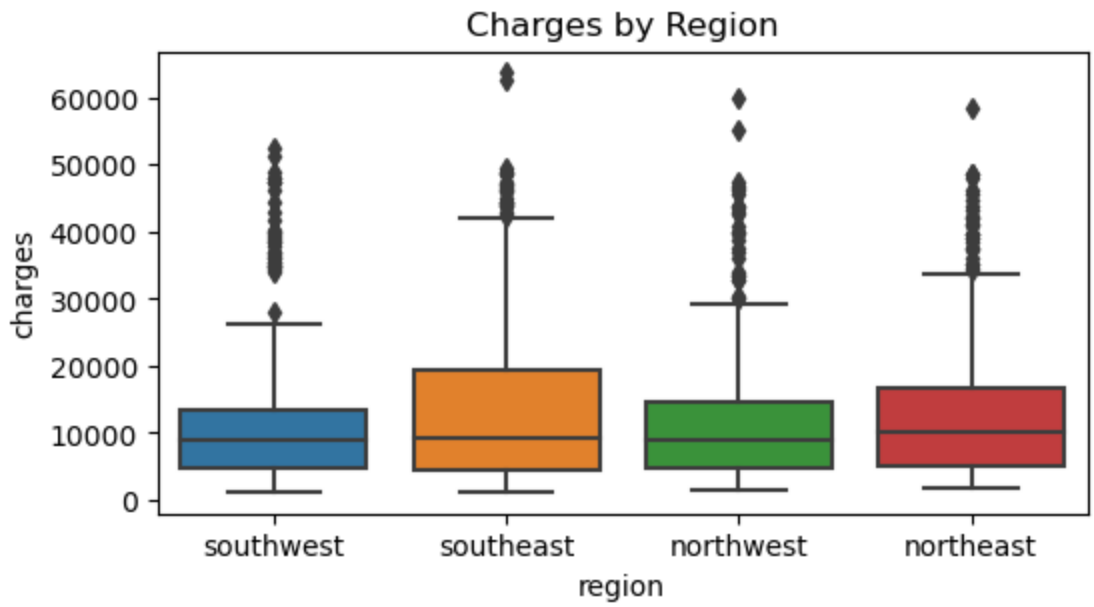
```
75%      16639.912515
max      63770.428010
```

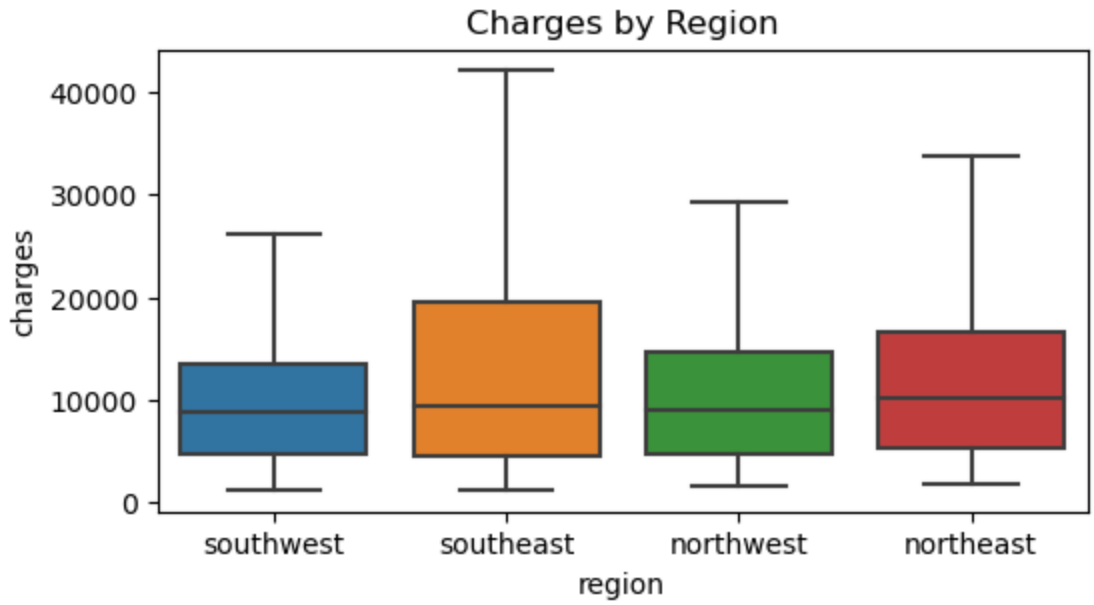
In [13]:
```
# Visualizing the data
# Pairplot to visualize relationships between numeric variables
sns.pairplot(data)
plt.show()
```



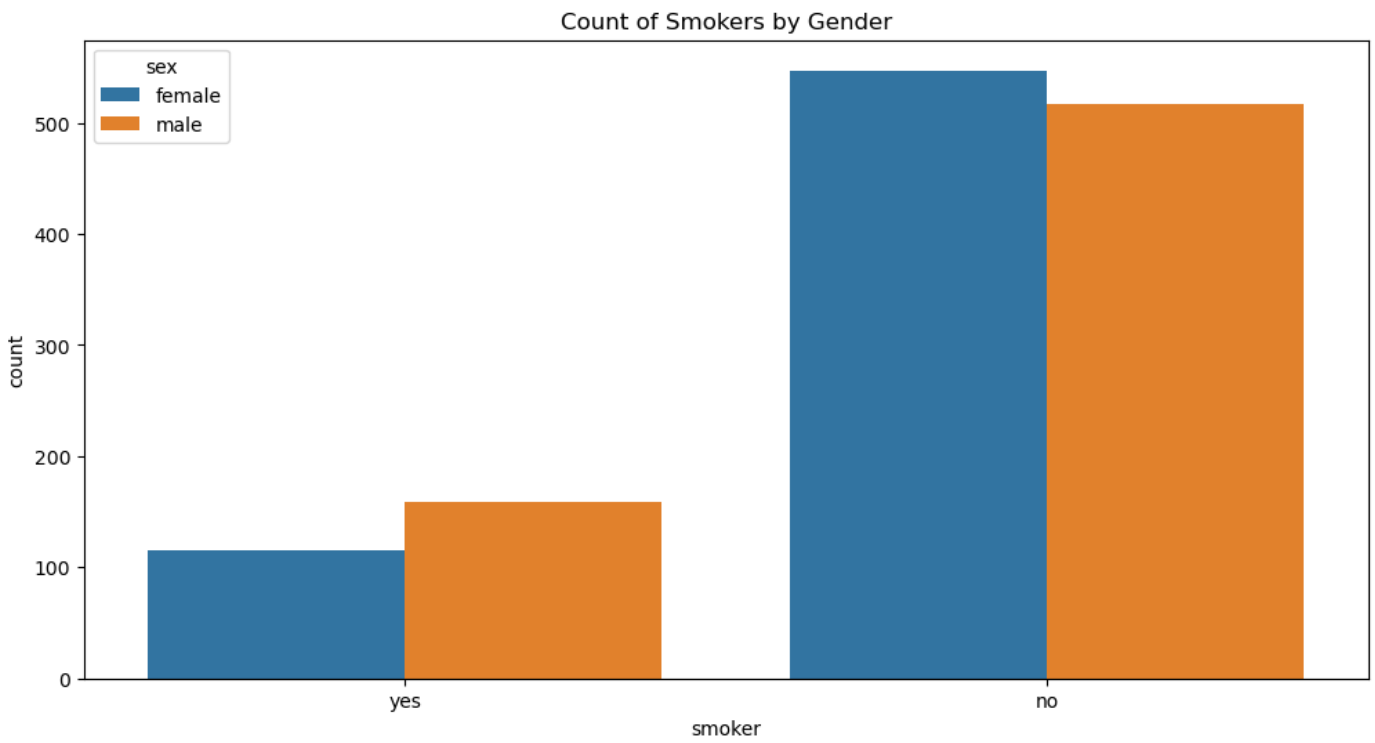
In [16]:
```
# Boxplot to visualize the distribution of charges based on categorical variables
plt.figure(figsize=(6, 3))
sns.boxplot(x='region', y='charges', data=data)
plt.title('Charges by Region')
plt.show()


#Plot removing outliers
plt.figure(figsize=(6, 3))
sns.boxplot(x='region', y='charges', data=data, showfliers = False)
plt.title('Charges by Region')
plt.show()
```





In [17]:
```
# Countplot to visualize the distribution of smokers and sexes
plt.figure(figsize=(12, 6))
sns.countplot(x='smoker', hue='sex', data=data)
plt.title('Count of Smokers by Gender')
plt.show()
```



Data Preprocessing

In [18]:
```
# Converting categorical variables into numerical format
data['sex'] = data['sex'].apply(lambda x: 1 if x == 'female' else 0)
data['smoker'] = data['smoker'].apply(lambda x: 1 if x == 'yes' else 0)
data['region'] = data['region'].map({'southeast': 0, 'southwest': 1, 'northeast': 2, 'no
```

In [19]:
```
# Viewing to see the effect of the changes
data.head(3)
```

Out[19]:

	age	sex	bmi	children	smoker	region	charges
0	19	1	27.90	0	1	1	16884.9240
1	18	0	33.77	1	0	0	1725.5523
2	28	0	33.00	3	0	0	4449.4620

Splitting the Data

In [20]:
```
# Split the data into features (X) and target variable (y) or into independent and depen
X = data.drop('charges', axis=1)
y = data['charges']
```

In [21]:
```
# Split the data into training and testing sets:
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42
```

Building and Training the Regression Model

In [22]:
```
# Import and instantiate a regression model
from sklearn.linear_model import LinearRegression
```

```
model = LinearRegression()
```

In [23]:
```
# Fit the model to the training data:
model.fit(X_train, y_train)
```

Out[23]:
```
LinearRegression()
```

Model Evaluation

In [24]:
```
# Predict charges on the test set:
y_pred = model.predict(X_test)
```

In [25]:
```
# Evaluate the model's performance using appropriate metrics (e.g., Mean Absolute Error,
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score

mae = mean_absolute_error(y_test, y_pred)
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Absolute Error:", mae)
print("Mean Squared Error:", mse)
print("R-squared:", r2)
```

```
Mean Absolute Error: 4190.220190137917
Mean Squared Error: 33685623.35414443
R-squared: 0.783021587162344
```