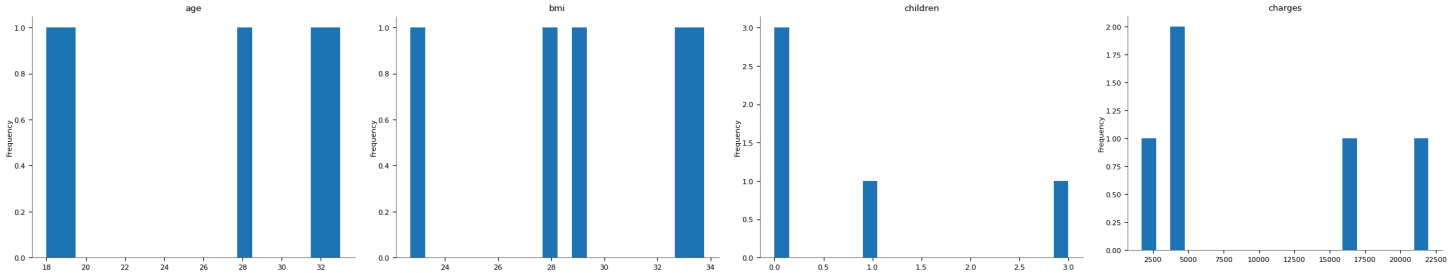
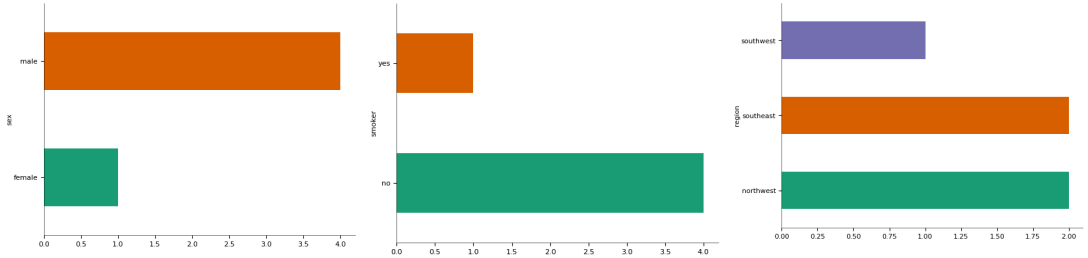
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score

df = pd.read_csv('/content/insurance[1].csv')
display(df.head())
```

	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

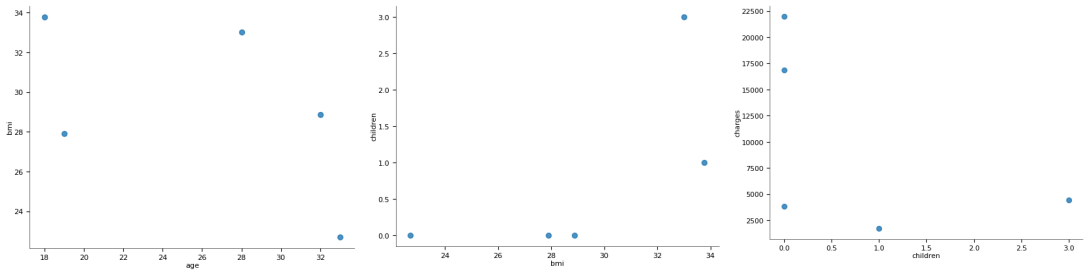
Distributions



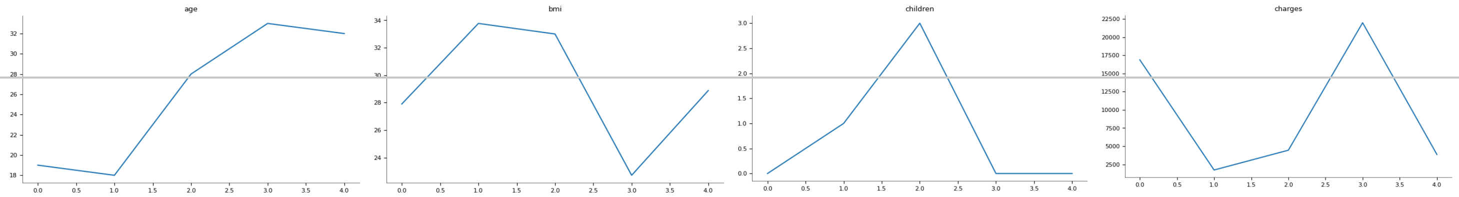
Categorical distributions



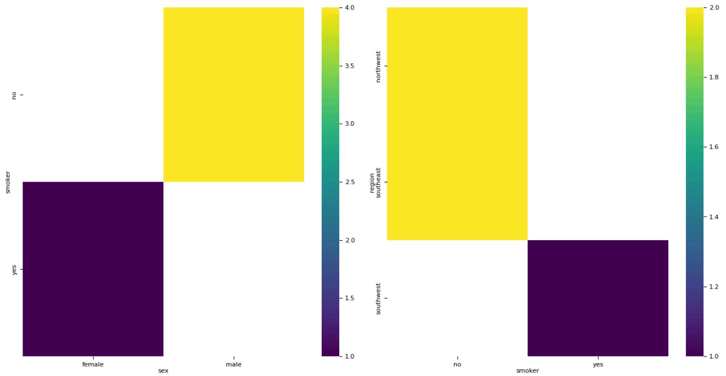
2-d distributions



Values

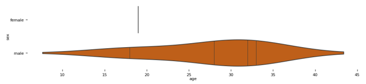


2-d categorical distributions

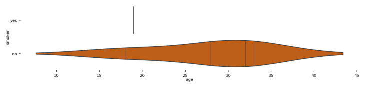


Faceted distributions

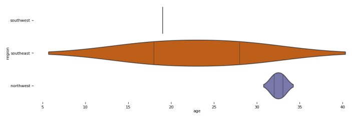
```
<string>:5: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `hue`
```



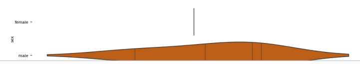
```
<string>:5: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `hue`
```



```
<string>:5: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `hue`
```



```
<string>:5: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `hue`
```

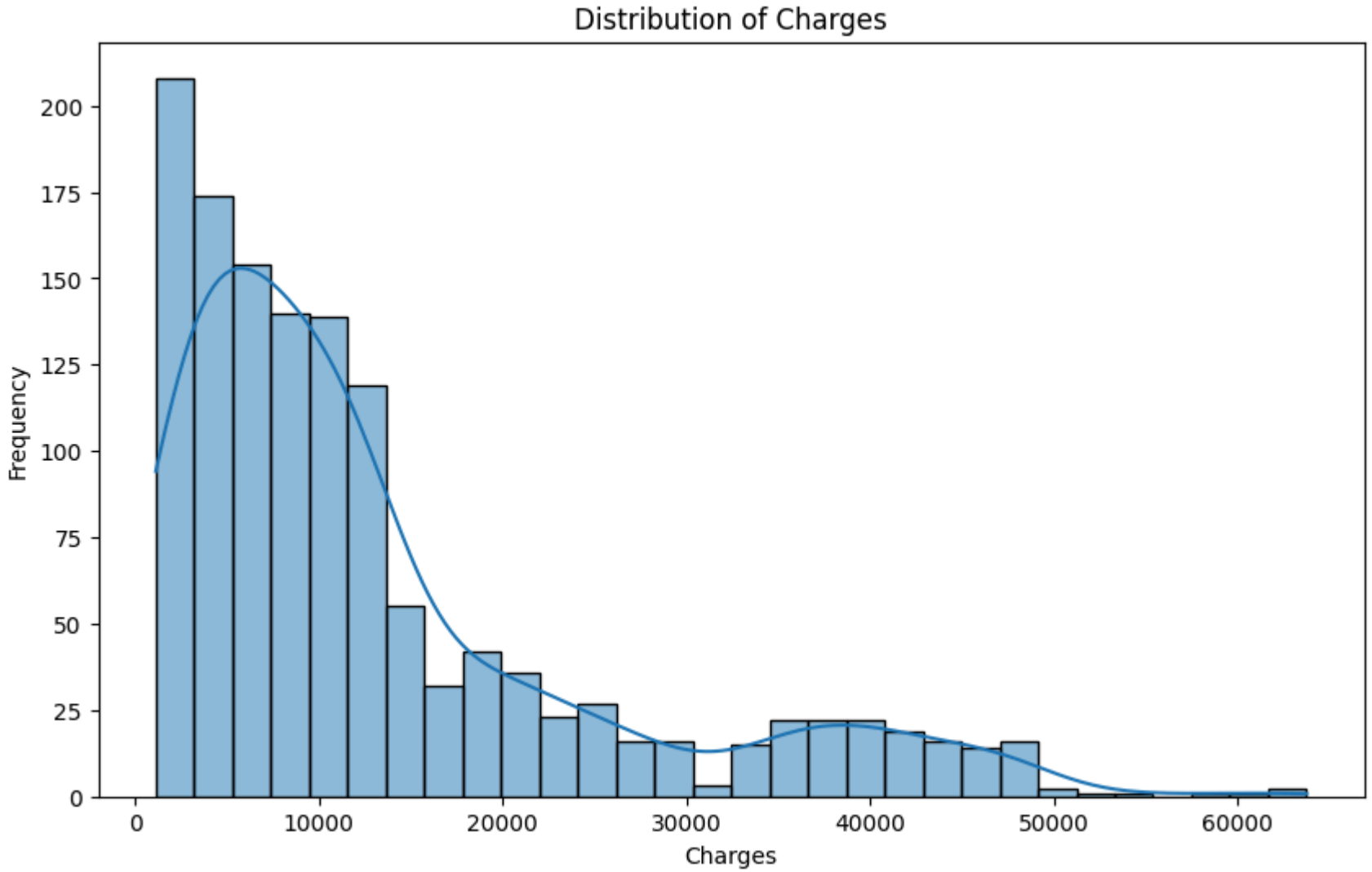


```
df.info()
```

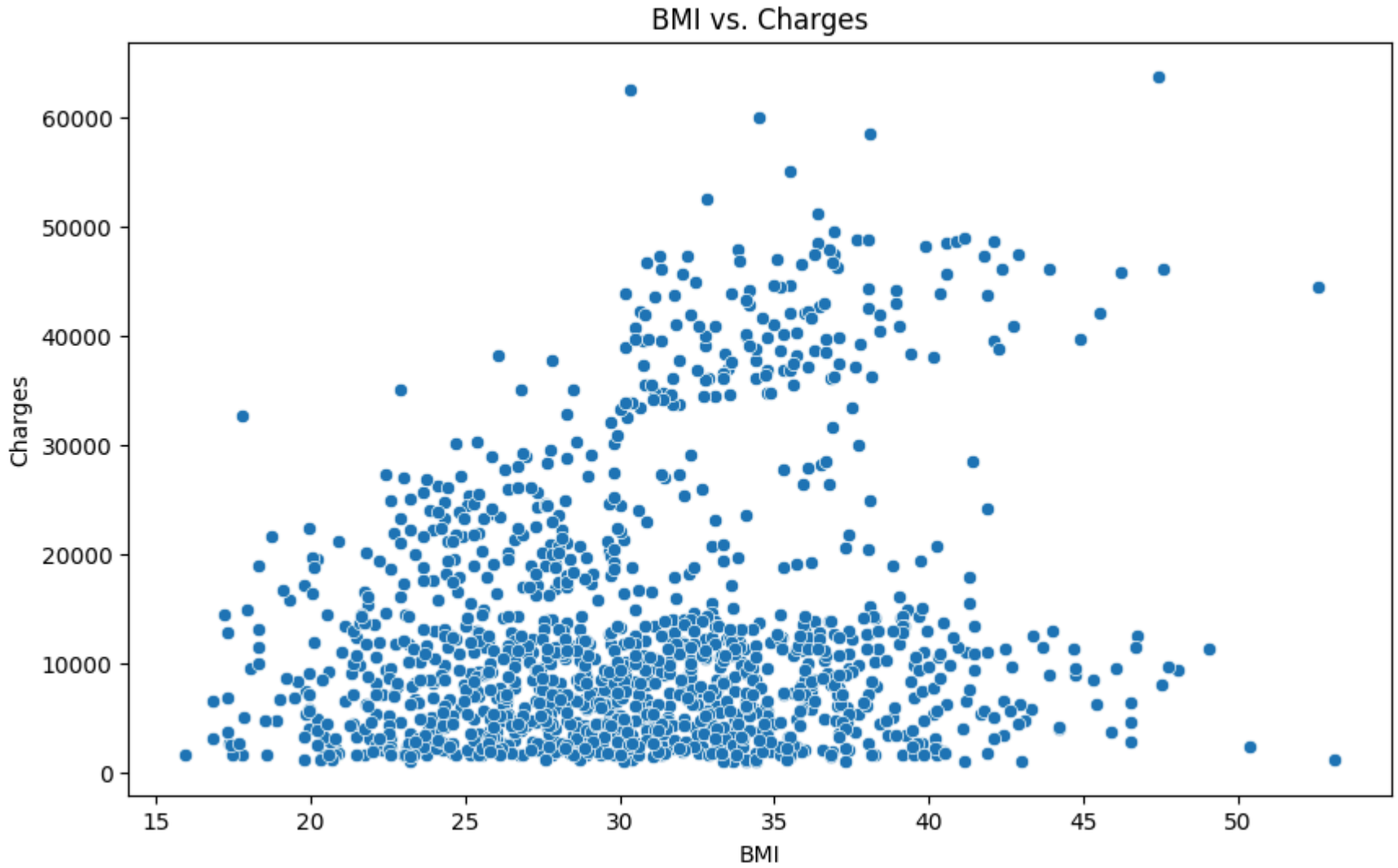
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1338 entries, 0 to 1337
Data columns (total 7 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   age       1338 non-null   int64  
 1   sex       1338 non-null   object 
 2   bmi       1338 non-null   float64
 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
```

From the above output, we can see that there are no missing values.

```
plt.figure(figsize=(10, 6))
sns.histplot(df['charges'], kde=True)
plt.title('Distribution of Charges')
plt.xlabel('Charges')
plt.ylabel('Frequency')
plt.show()
```




```
plt.figure(figsize=(10, 6))
sns.scatterplot(x='bmi', y='charges', data=df)
plt.title('BMI vs. Charges')
plt.xlabel('BMI')
plt.ylabel('Charges')
plt.show()
```



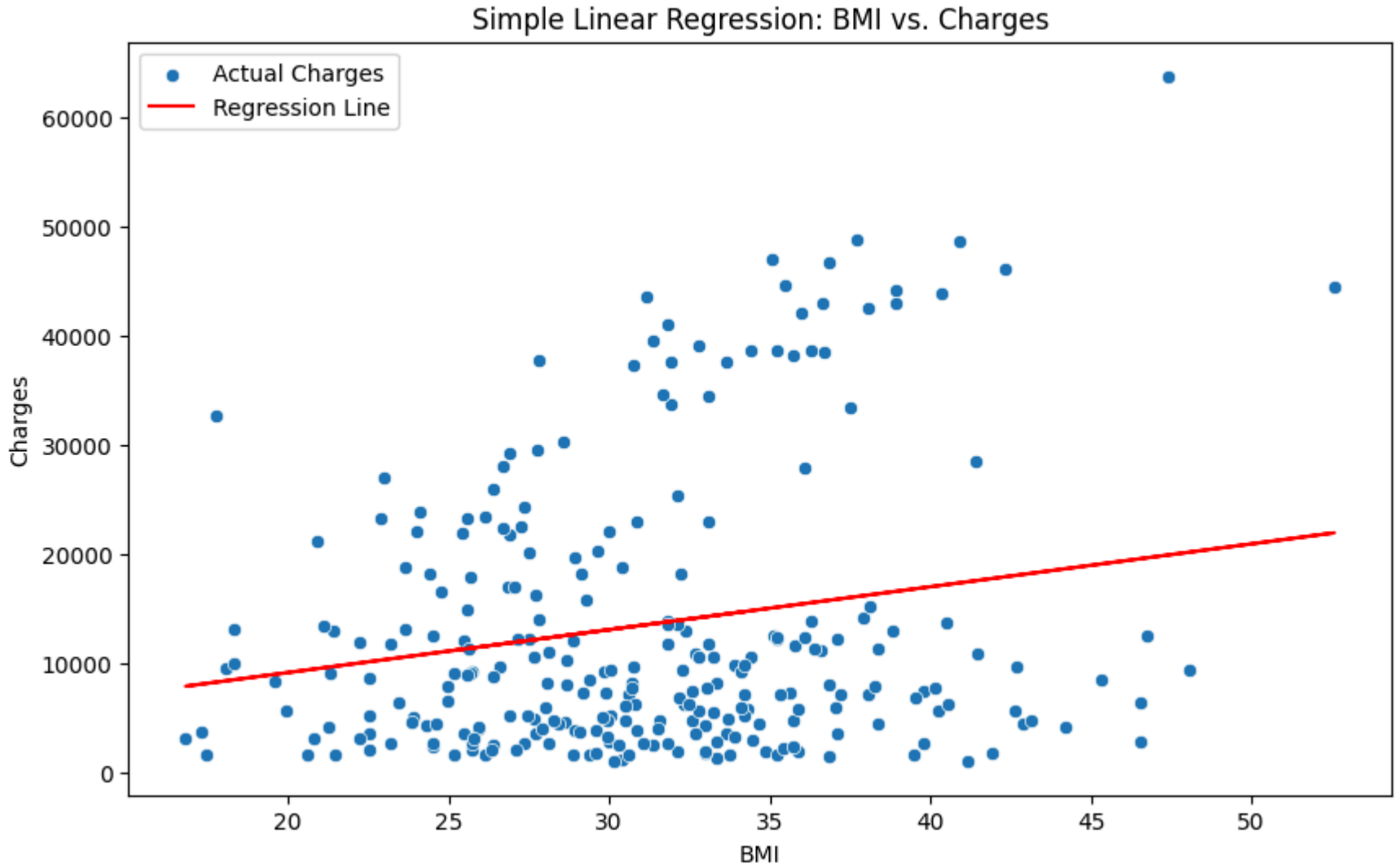
The scatter plot suggests a positive,somewhat dispersed linear relationship between BMI and charges, making it a suitable candidate for simple linear regression.

```
X = df[['bmi']]
y = df['charges']
```

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

model = LinearRegression()
model.fit(X_train, y_train)

y_pred = model.predict(X_test)

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

print(f'Mean Squared Error (MSE): {mse:.2f}')
print(f'R-squared (R2): {r2:.2f}')
```

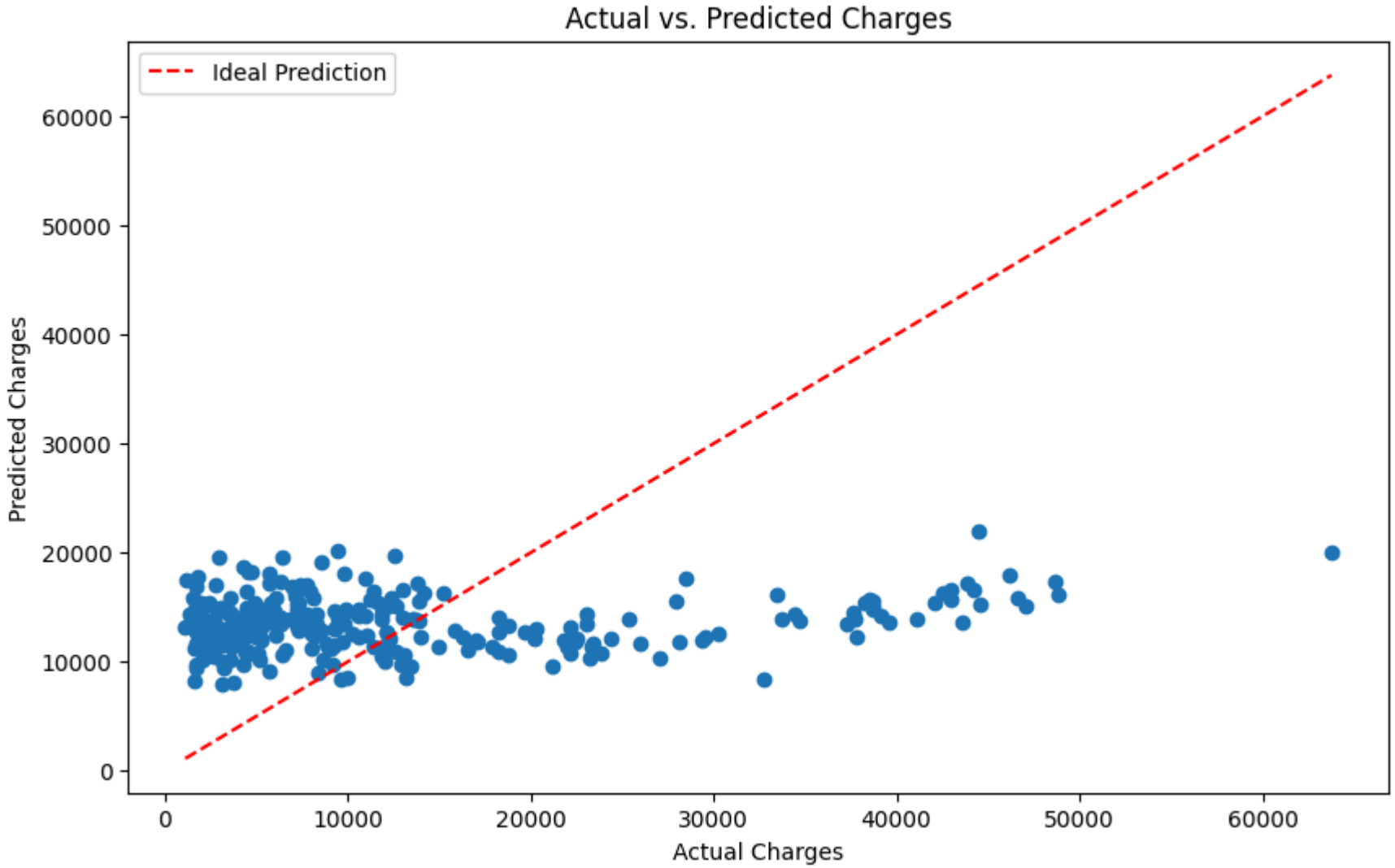
```
Mean Squared Error (MSE): 149085057.04
R-squared (R2): 0.04
```

```
plt.figure(figsize=(10, 6))
sns.scatterplot(x=X_test['bmi'], y=y_test, label='Actual Charges')
plt.plot(X_test['bmi'], y_pred, color='red', label='Regression Line')
plt.title('Simple Linear Regression: BMI vs. Charges')
plt.xlabel('BMI')
plt.ylabel('Charges')
plt.legend()
plt.show()
```



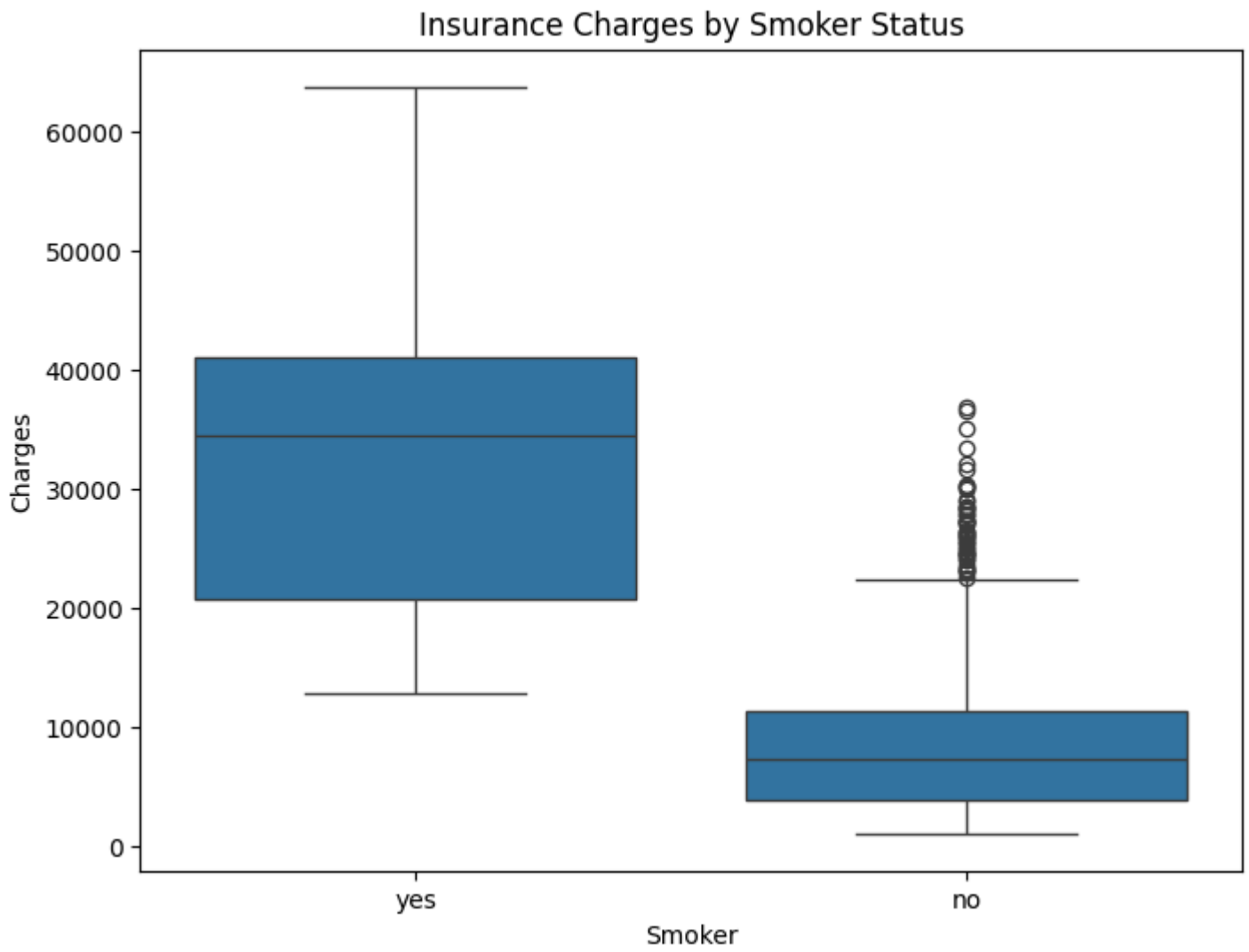

```
plt.figure(figsize=(10, 6))
plt.scatter(y_test, y_pred)
plt.plot([min(y_test), max(y_test)], [min(y_test), max(y_test)], linestyle='--', color='red', label='Ideal Prediction')
plt.title('Actual vs. Predicted Charges')
plt.xlabel('Actual Charges')
plt.ylabel('Predicted Charges')
plt.legend()
```

```
plt.show()
```

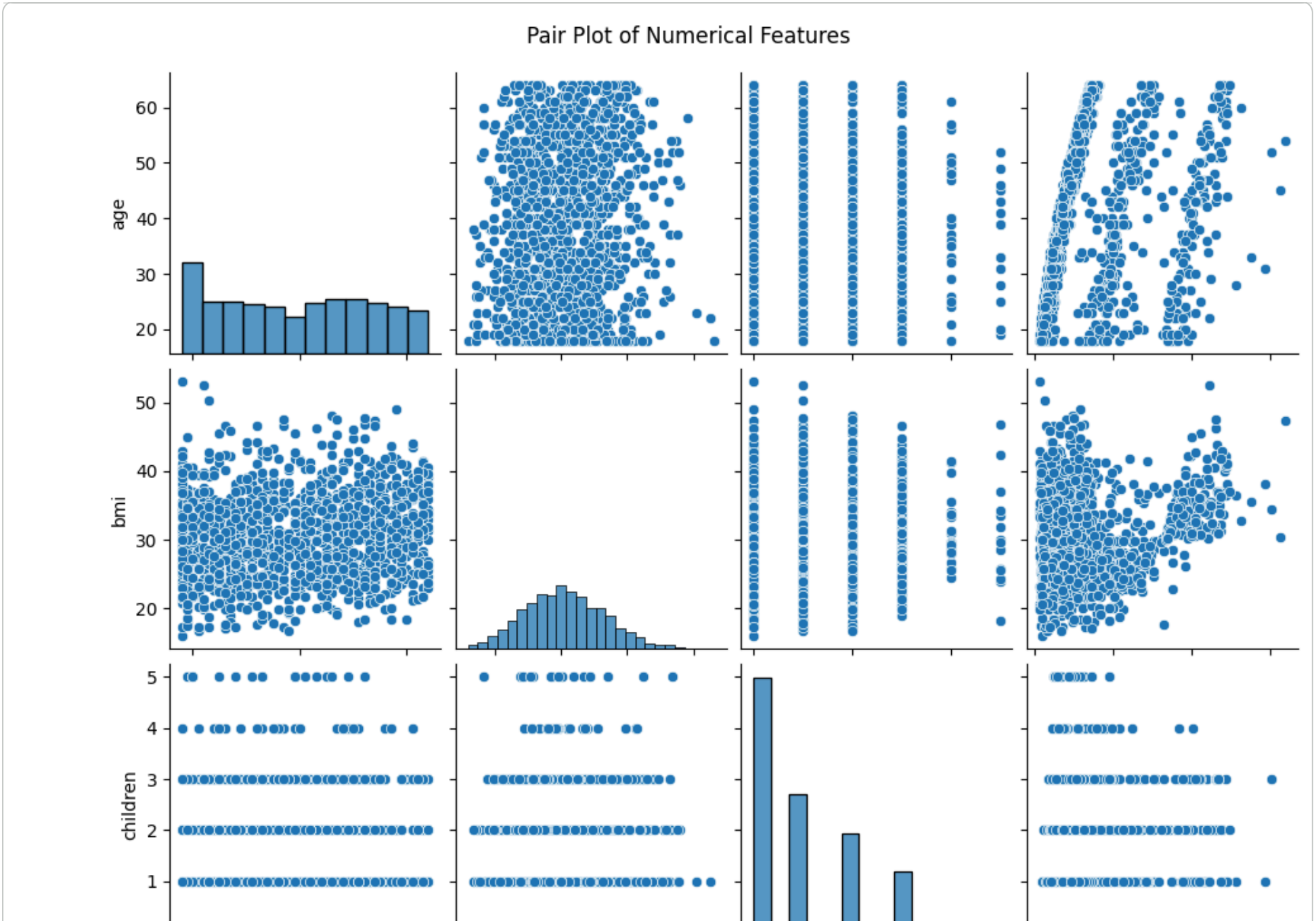



```
plt.figure(figsize=(8, 6))
sns.boxplot(x='smoker', y='charges', data=df)
plt.title('Insurance Charges by Smoker Status')
plt.xlabel('Smoker')
plt.ylabel('Charges')
```

```
plt.show()
```




```
numerical_features = ['age', 'bmi', 'children', 'charges']
sns.pairplot(df[numerical_features])
plt.suptitle('Pair Plot of Numerical Features', y=1.02)
plt.show()
```


Pair Plot of Numerical Features
age
bmi
children
60
50
40
30
20
50
40
30
20
5
4
3
2
1