r4nhldtj5

March 3, 2025

[5]:
```python
# Import all the Dependincies
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.linear_model import LinearRegression
from sklearn import metrics
```

[17]:
```python
# Data Collection and analysis
from google.colab import files
uploaded = files.upload()
```

```
<IPython.core.display.HTML object>
```

```
Saving insurance.csv to insurance (1).csv
```

[7]:
```python
# Load the csv dataset into a pandas dataframe
insurance_dataset = pd.read_csv("insurance.csv")
```

[8]:
```python
# Display the first fiverows of a dataset
insurance_dataset.head()
```

[8]:

	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

[9]:
```python
# Find the number of rows and columns
insurance_dataset.shape
```

[9]: (1338, 7)

[10]:
```python
# Getting some information about the dataset
insurance_dataset.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
```

[11]:
```
# We three categorical features
# 1 whether a person is a smoker or non-smoker (smoker)
# 2 whether the person is male or female (sex)
# 3 The region
# Charges is the target variable
```

[12]:
```
# Checking for missing values
insurance_dataset.isnull().sum()
```

[12]:
```
age         0
sex         0
bmi         0
children    0
smoker      0
region      0
charges     0
dtype: int64
```

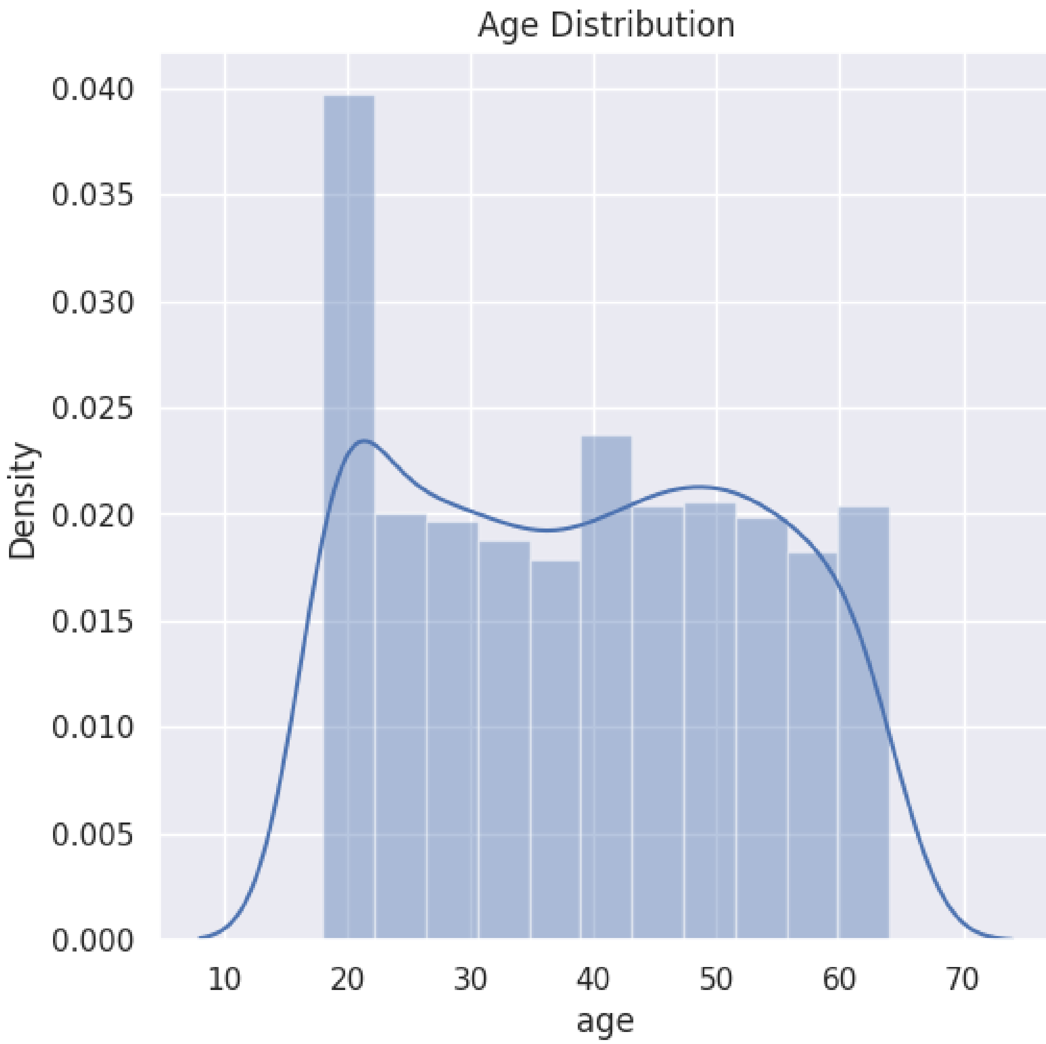
[13]:
```
# Data Analysis
# Statistical measures about the dataset
insurance_dataset.describe()
```

[13]:

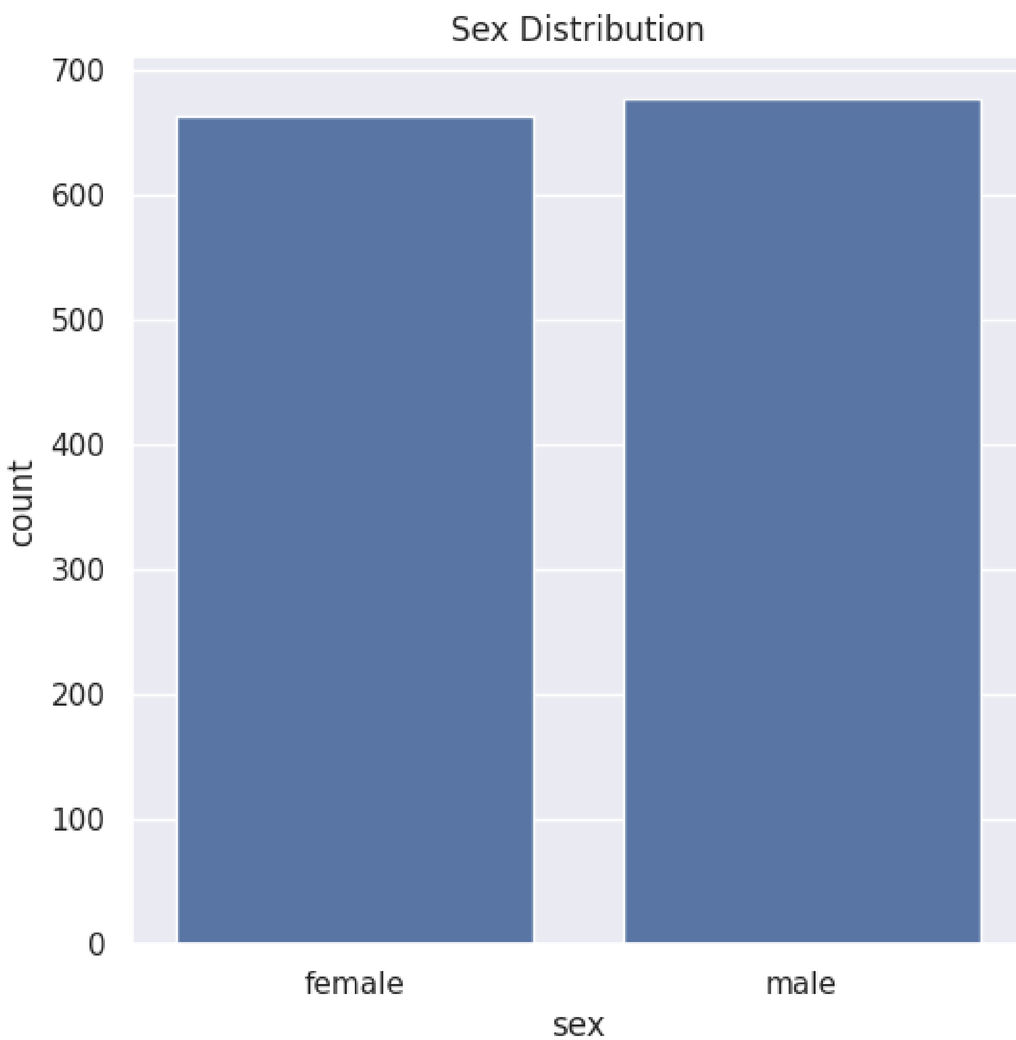
	age	bmi	children	charges
count	1338.000000	1338.000000	1338.000000	1338.000000
mean	39.207025	30.663397	1.094918	13270.422265
std	14.049960	6.098187	1.205493	12110.011237
min	18.000000	15.960000	0.000000	1121.873900
25%	27.000000	26.296250	0.000000	4740.287150
50%	39.000000	30.400000	1.000000	9382.033000
75%	51.000000	34.693750	2.000000	16639.912515
max	64.000000	53.130000	5.000000	63770.428010

[14]:
```python
# Find the distribution of age value
sns.set()
plt.figure(figsize=(6,6))
sns.distplot(insurance_dataset['age'])
plt.title('Age Distribution')
plt.show()
```

```
<ipython-input-14-2e9101a5988b>:4: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(insurance_dataset['age'])
```



[20]:
```
# Finding the distribution for gender column
plt.figure(figsize=(6,6))
sns.countplot(x='sex', data=insurance_dataset)
plt.title("Sex Distribution")
plt.show()
```



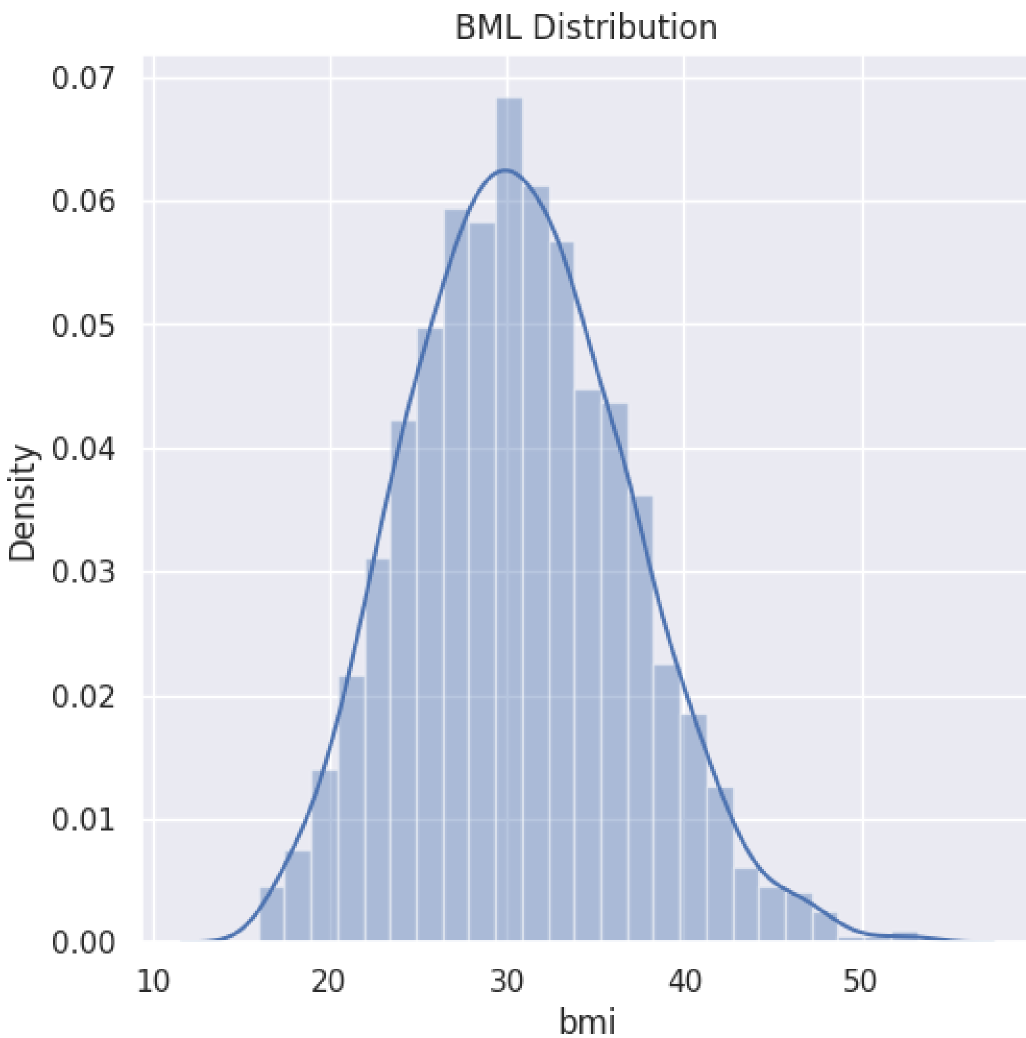
[21]:
```
insurance_dataset['sex'].value_counts() -# Checking values for the gender and␣
↪howit is distributed
```

[21]:
```
sex
male      676
female    662
Name: count, dtype: int64
```

[23]:
```
# Finding the distribution of the BMI
plt.figure(figsize=(6,6))
sns.distplot(insurance_dataset['bmi'])
plt.title('BML Distribution')
plt.show()
```

```
<ipython-input-23-5572a4a62209>:3: UserWarning:
```

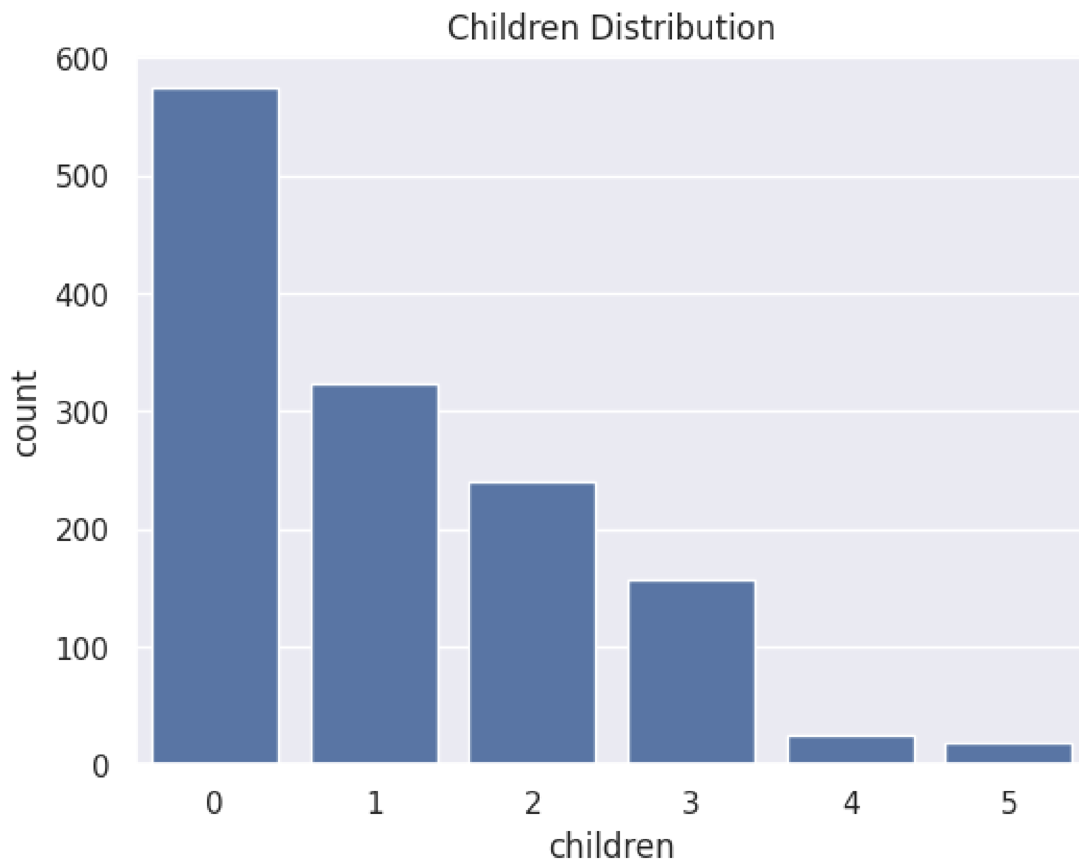
```
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(insurance_dataset['bmi'])
```



[24]:
```
# Normal BMI range for a person is 18,5-24,9
# if bml< 18,5 - person is underweight
# if bmi is > 24,9 - person is overweight
```

```
# Based on the grapgh above, a lot of people are overweight this can influence
↪the insurance cost a person get. It might increase the insurance cost.
```

[25]:
```
# Use count plof for finding the distribution of the Children column
plt.Figure(figsize=(6,6))
sns.countplot(x='children', data=insurance_dataset)
plt.title('Children Distribution')
plt.show()
```

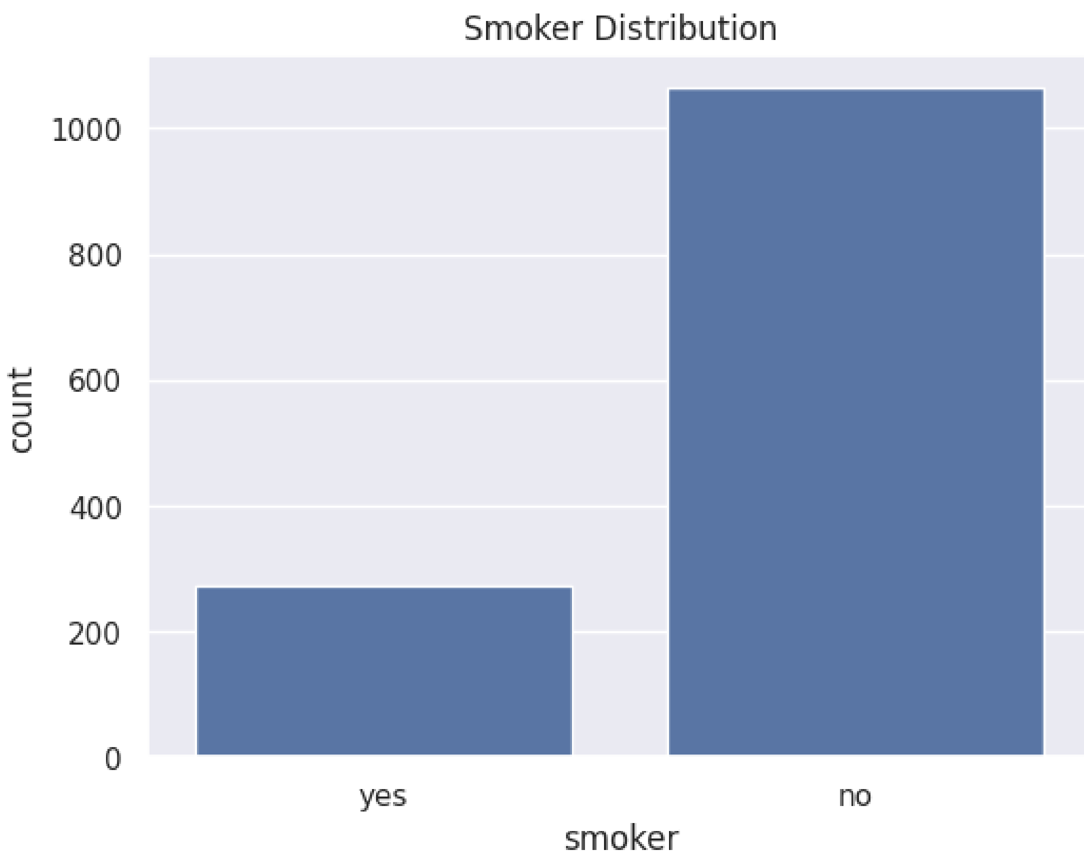


[26]:
```
# Find the number of the Children using value counts
insurance_dataset['children'].value_counts()
```

[26]:
```
children
0    574
1    324
2    240
3    157
4     25
5     18
```

```
Name: count, dtype: int64
```

[28]:
```
# Finding the distribution for the smoker column
plt.Figure(figsize=(6,6))
sns.countplot(x='smoker', data=insurance_dataset)
plt.title('Smoker Distribution')
plt.show()
```

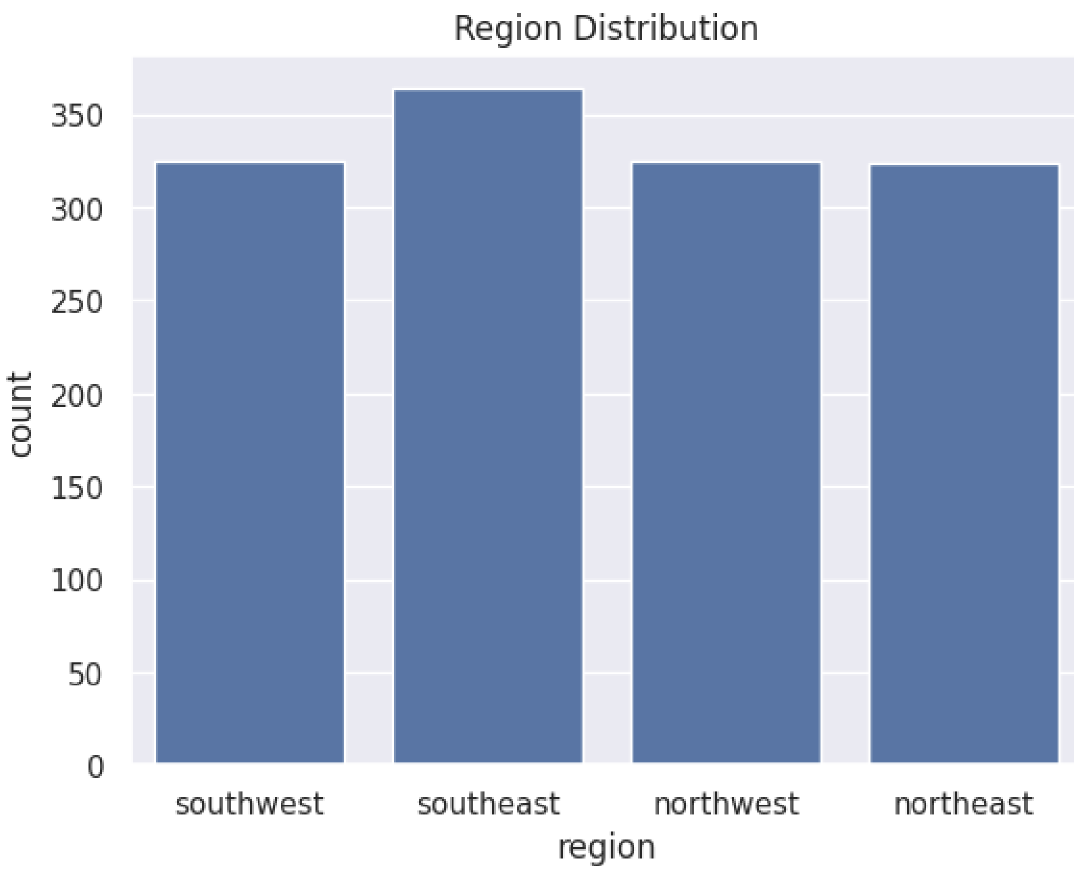


[30]:
```
insurance_dataset['smoker'].value_counts() - # the numerical value of the␣
↪distribution of the smoker column
```

[30]:
```
smoker
no      1064
yes      274
Name: count, dtype: int64
```

[33]:
```
# Finding the distribution of the regions column
plt.Figure(figsize=(6,6))
sns.countplot(x='region', data=insurance_dataset)
plt.title('Region Distribution')
```

```
plt.show()
```



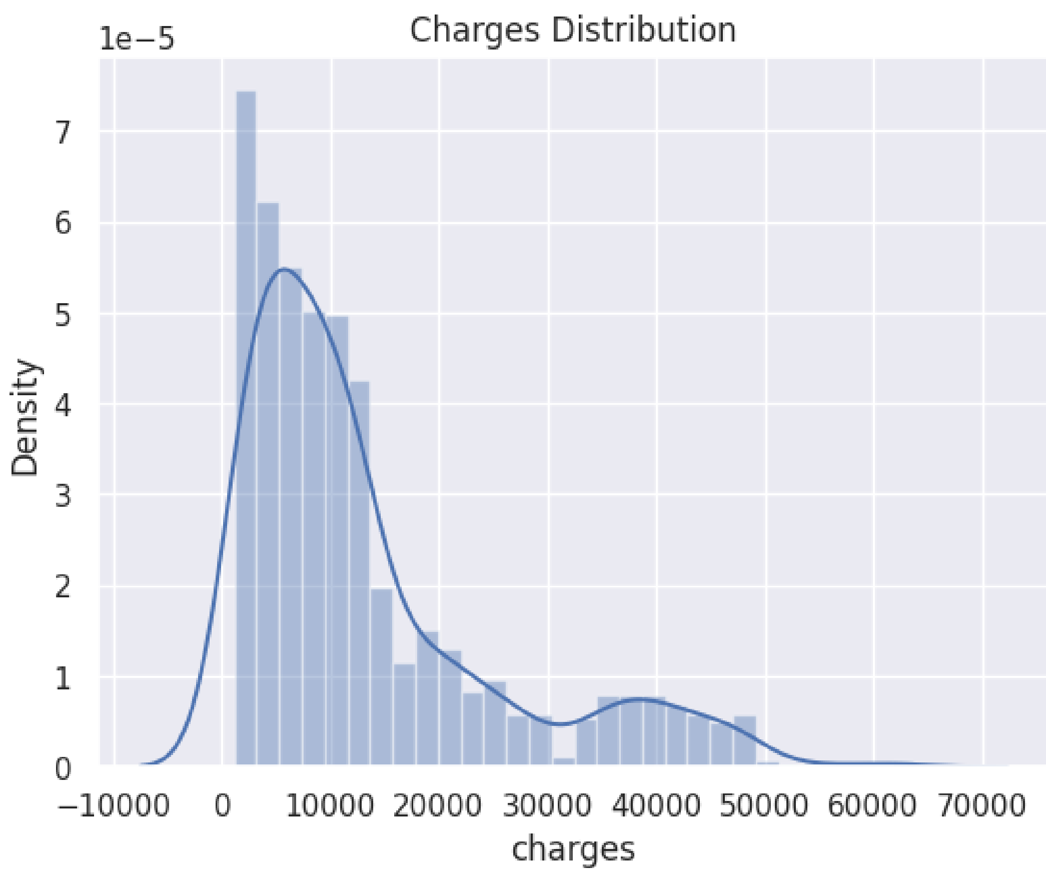
[35]:
```
insurance_dataset['region'].value_counts() # the numerical value of the column␣
↪region
```

[35]:
```
region
southeast    364
southwest    325
northwest    325
northeast    324
Name: count, dtype: int64
```

[37]:
```
# Finding the distribution for the charges using distribution plot
plt.Figure(figsize=(6,6))
sns.distplot(insurance_dataset['charges'])
plt.title('Charges Distribution')
plt.show()
```

```
<ipython-input-37-3b6775a2176c>:3: UserWarning:
```

```
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(insurance_dataset['charges'])
```



[40]:
```python
# Data Preprocessing

# Encoding the categorical features

# encoding the sex column
insurance_dataset.replace({'sex':{'male':0, 'female':1}}, inplace=True)

# Encoding the smoker column
insurance_dataset.replace({'smoker':{'yes':0, 'no':1}}, inplace=True)
```

```python
# Encoding the region column
insurance_dataset.replace({'region':{'southwest':0, 'northwest':1,'southeast':
 ↪2, 'northeast':3}}, inplace=True)
```

```
<ipython-input-40-05afef55c299>:6: FutureWarning: Downcasting behavior in
`replace` is deprecated and will be removed in a future version. To retain the
old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to
the future behavior, set `pd.set_option('future.no_silent_downcasting', True)`
  insurance_dataset.replace({'sex':{'male':0, 'female':1}}, inplace=True)
<ipython-input-40-05afef55c299>:9: FutureWarning: Downcasting behavior in
`replace` is deprecated and will be removed in a future version. To retain the
old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to
the future behavior, set `pd.set_option('future.no_silent_downcasting', True)`
  insurance_dataset.replace({'smoker':{'yes':0, 'no':1}}, inplace=True)
<ipython-input-40-05afef55c299>:12: FutureWarning: Downcasting behavior in
`replace` is deprecated and will be removed in a future version. To retain the
old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to
the future behavior, set `pd.set_option('future.no_silent_downcasting', True)`
  insurance_dataset.replace({'region':{'southwest':0,
'northwest':1,'southeast':2, 'northeast':3}}, inplace=True)
```

[41]:
```python
print(insurance_dataset)
```

```
      age  sex     bmi  children  smoker  region      charges
0      19    1  27.900         0       0       0  16884.92400
1      18    0  33.770         1       1       2   1725.55230
2      28    0  33.000         3       1       2   4449.46200
3      33    0  22.705         0       1       1  21984.47061
4      32    0  28.880         0       1       1   3866.85520
…     …    …     …       …       …       …            …
1333   50    0  30.970         3       1       1  10600.54830
1334   18    1  31.920         0       1       3   2205.98080
1335   18    1  36.850         0       1       2   1629.83350
1336   21    1  25.800         0       1       0   2007.94500
1337   61    1  29.070         0       0       1  29141.36030

[1338 rows x 7 columns]
```

[44]:
```python
# We have to split the features and target
X = insurance_dataset.drop(columns='charges', axis=1)
Y = insurance_dataset['charges']
print(X)
print(Y)
```

```
      age  sex     bmi  children  smoker  region
0      19    1  27.900         0       0       0
1      18    0  33.770         1       1       2
2      28    0  33.000         3       1       2
```

```
3      33    0  22.705        0       1       1
4      32    0  28.880        0       1       1
…   …   …     …        …      …     …
1333   50    0  30.970        3       1       1
1334   18    1  31.920        0       1       3
1335   18    1  36.850        0       1       2
1336   21    1  25.800        0       1       0
1337   61    1  29.070        0       0       1

[1338 rows x 6 columns]
0       16884.92400
1        1725.55230
2        4449.46200
3       21984.47061
4        3866.85520
            …
1333    10600.54830
1334     2205.98080
1335     1629.83350
1336     2007.94500
1337    29141.36030
Name: charges, Length: 1338, dtype: float64
```

[45]:
```python
# Split the data into training data and testing data
X_train, X_test,Y_train,Y_test = train_test_split(X,Y, test_size =0.2,␣
↪random_state =2)
```

[46]:
```python
# Print the shape of this dataset
print(X.shape,X_train,X_test.shape)
```

```
(1338, 6)       age  sex     bmi  children  smoker  region
882    21    1  22.135        0       1       3
505    37    0  30.875        3       1       1
798    58    1  33.100        0       1       0
792    22    1  23.180        0       1       3
201    48    1  32.230        1       1       2
…   …   …     …        …      …     …
466    60    1  28.700        1       1       0
299    48    1  28.880        1       1       1
493    61    0  43.400        0       1       0
527    51    1  25.800        1       1       0
1192   58    1  32.395        1       1       3

[1070 rows x 6 columns] (268, 6)
```

[47]:
```python
# Model training
# Using linear regression model
```

```python
# Loading the linear regression model
regressor = LinearRegression()
```

[48]:
```python
# Fit the model into X & Y
regressor.fit(X_train,Y_train)
```

[48]: LinearRegression()

[49]:
```python
# Model Evaluation
# Use R squared
# prediction on training data
training_data_prediction = regressor.predict(X_train)
```

[51]:
```python
# Finding the r squared value
r2_train = metrics.r2_score(Y_train, training_data_prediction)
print('R squared value:',r2_train)
```

```
R squared value: 0.751618558520502
```

[52]:
```python
# R 2 squared is closer to 1 which means the model performed well.
```

[53]:
```python
# Finding the r squared value on test data

test_data_prediction = regressor.predict(X_test)
r2_test = metrics.r2_score(Y_test, test_data_prediction)
print('R squared value:', r2_test)
```

```
R squared value: 0.7428748503048913
```

[ ]:
```python
# Similiar to the score obtained on training data- this means the model did␣
↪well.
```

[ ]:
```python

```