medical-cost-analysis

May 25, 2024

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as pl
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))
```

```
/kaggle/input/insurance/insurance.csv
```

[2]:
```
df = pd.read_csv("/kaggle/input/insurance/insurance.csv")
df.head()
```

[2]:

	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

[3]:
```
df.isnull().sum()
```

[3]:
```
age         0
sex         0
bmi         0
children    0
smoker      0
region      0
charges     0
dtype: int64
```

[4]:
```
from sklearn.preprocessing import LabelEncoder
df_aug = pd.read_csv('/kaggle/input/insurance/insurance.csv')
#sex
le = LabelEncoder()
```

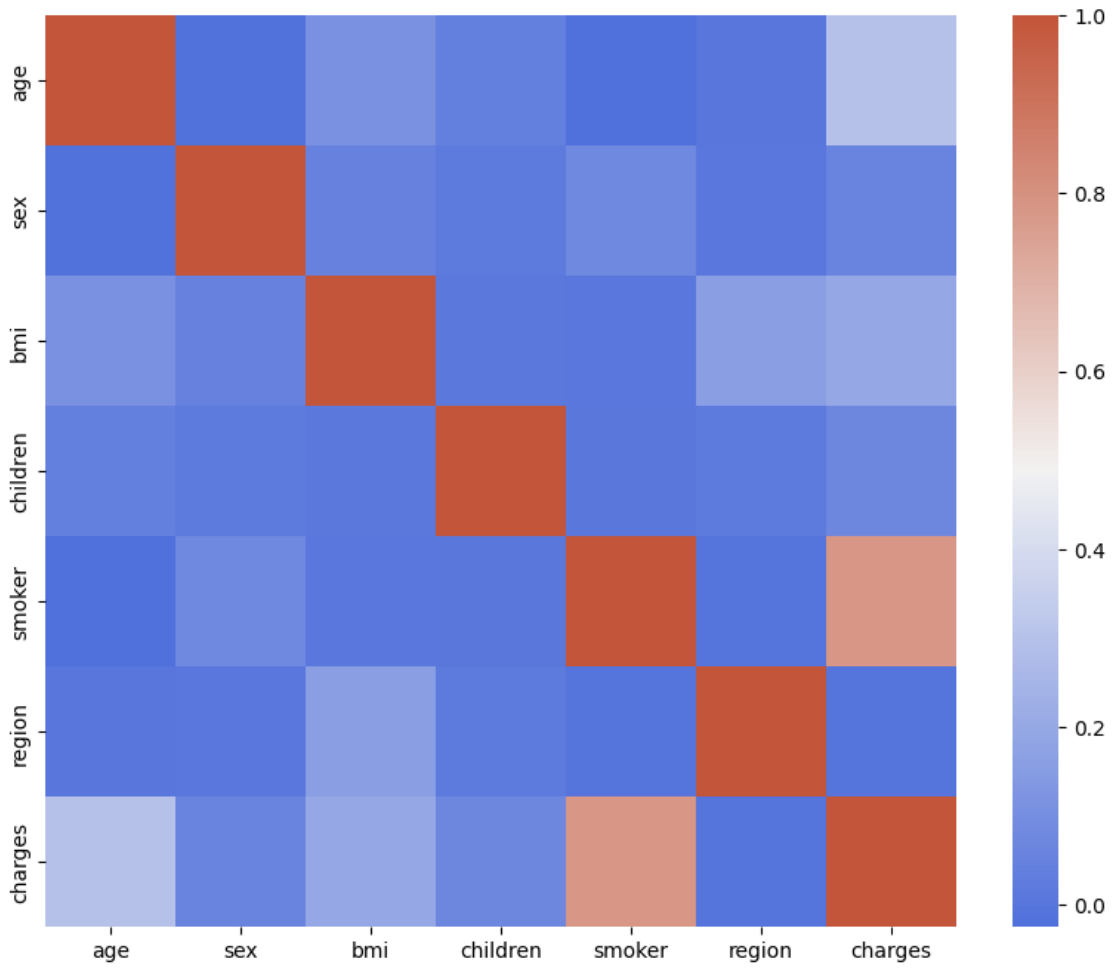
```
le.fit(df_aug.sex.drop_duplicates())
df_aug.sex = le.transform(df_aug.sex)
# smoker or not
le.fit(df_aug.smoker.drop_duplicates())
df_aug.smoker = le.transform(df_aug.smoker)
#region
le.fit(df_aug.region.drop_duplicates())
df_aug.region = le.transform(df_aug.region)
```

[5]:
```
df_aug.corr()['charges'].sort_values()
```

[5]:
```
region     -0.006208
sex         0.057292
children    0.067998
bmi         0.198341
age         0.299008
smoker      0.787251
charges     1.000000
Name: charges, dtype: float64
```

[6]:
```
f, ax = pl.subplots(figsize=(10, 8))
corr = df_aug.corr()
sns.heatmap(corr, mask=np.zeros_like(corr, dtype=bool), cmap=sns.
 ↪diverging_palette(260 ,20,as_cmap=True),
            square=True, ax=ax)
```

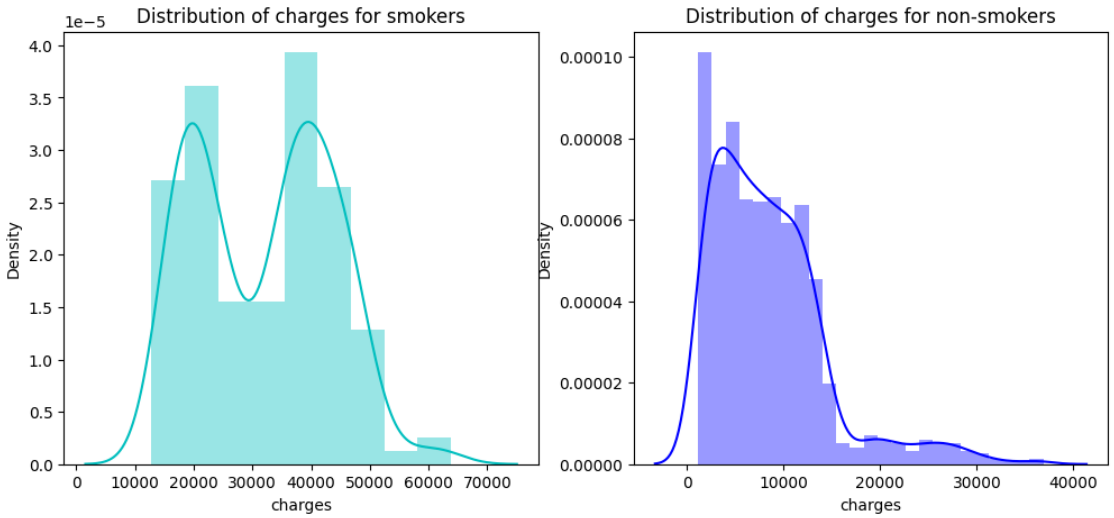
[6]:
```
<Axes: >
```



[ ]:

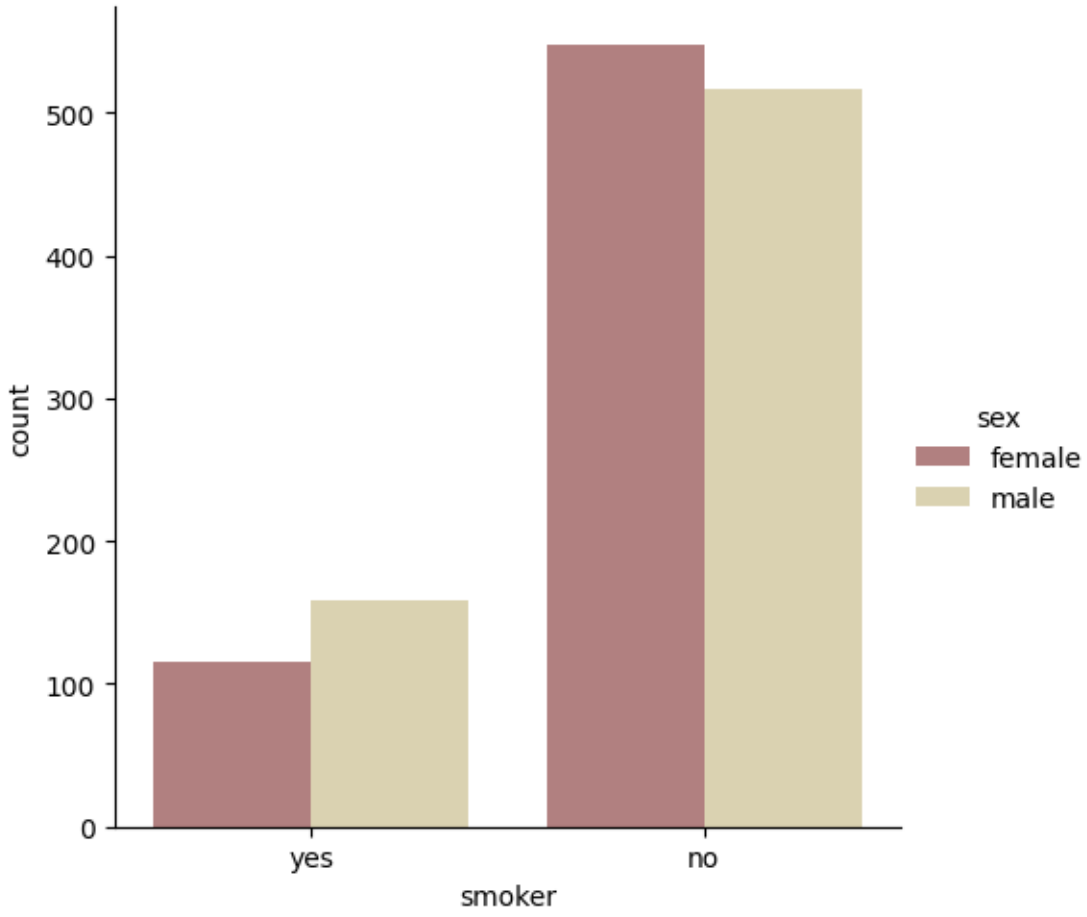
[7]:
```
f= pl.figure(figsize=(12,5))

ax=f.add_subplot(121)
sns.distplot(df_aug[(df_aug.smoker == 1)]["charges"],color='c',ax=ax)
ax.set_title('Distribution of charges for smokers')

ax=f.add_subplot(122)
sns.distplot(df_aug[(df_aug.smoker == 0)]['charges'],color='b',ax=ax)
ax.set_title('Distribution of charges for non-smokers')
```

[7]: Text(0.5, 1.0, 'Distribution of charges for non-smokers')



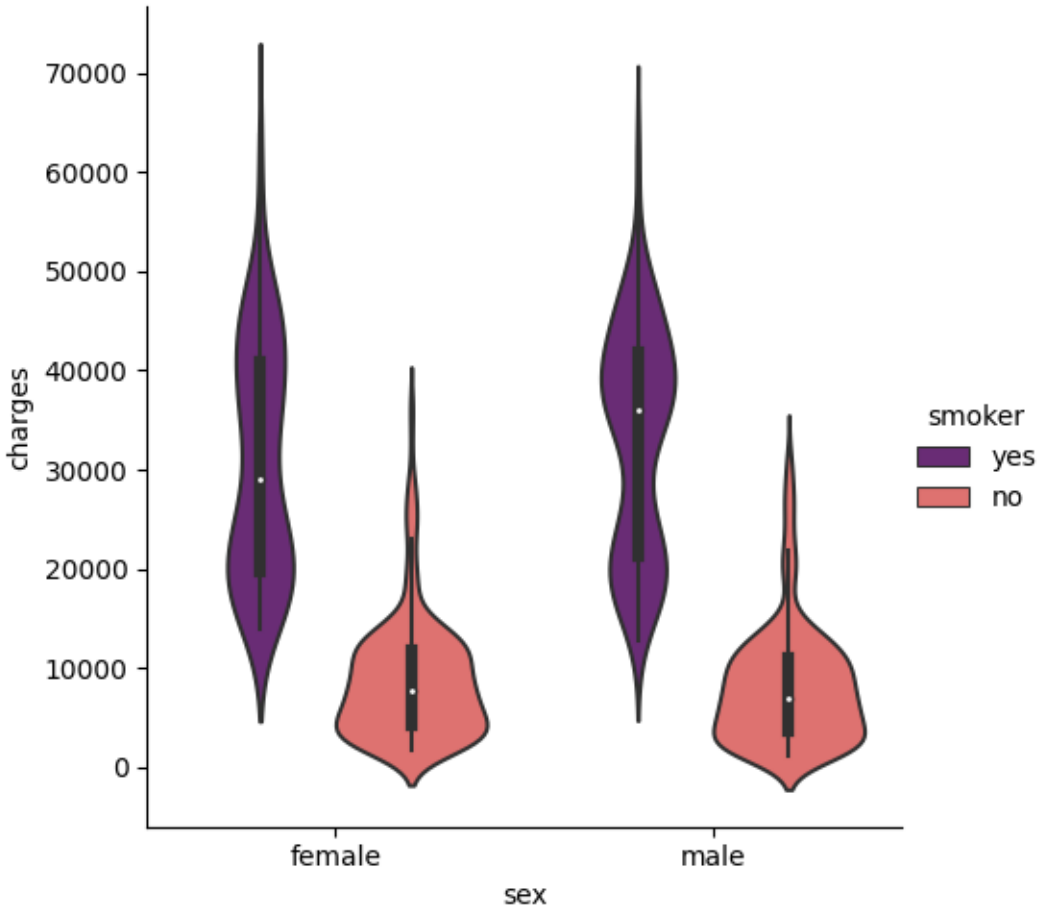
[8]:
```
sns.catplot(x="smoker", kind="count",hue = 'sex', palette="pink", data=df)
```

[8]: <seaborn.axisgrid.FacetGrid at 0x7b10fb55c730>



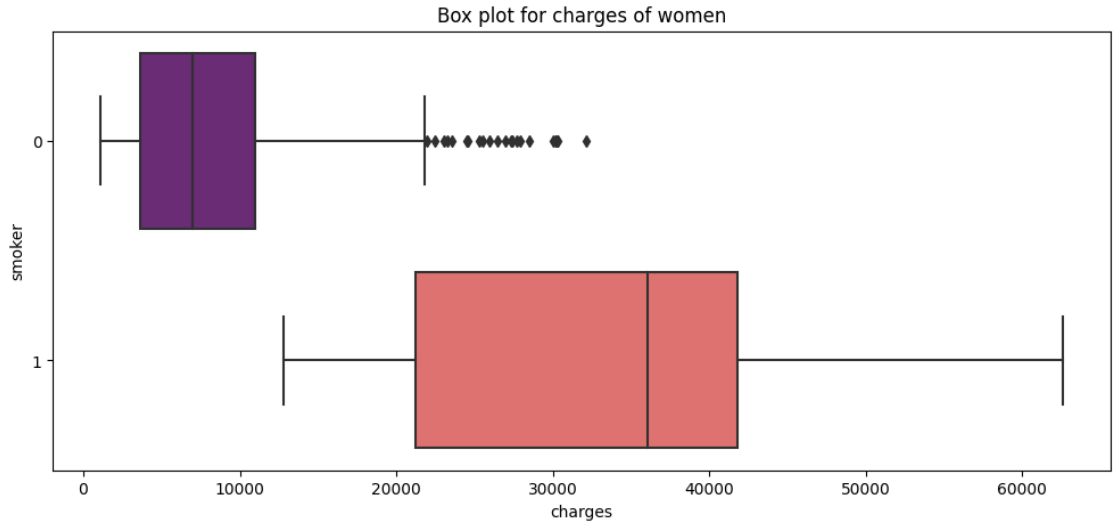
[9]:
```
sns.catplot(x="sex", y="charges", hue="smoker",
            kind="violin", data=df, palette = 'magma')
```

[9]: <seaborn.axisgrid.FacetGrid at 0x7b10faa3feb0>



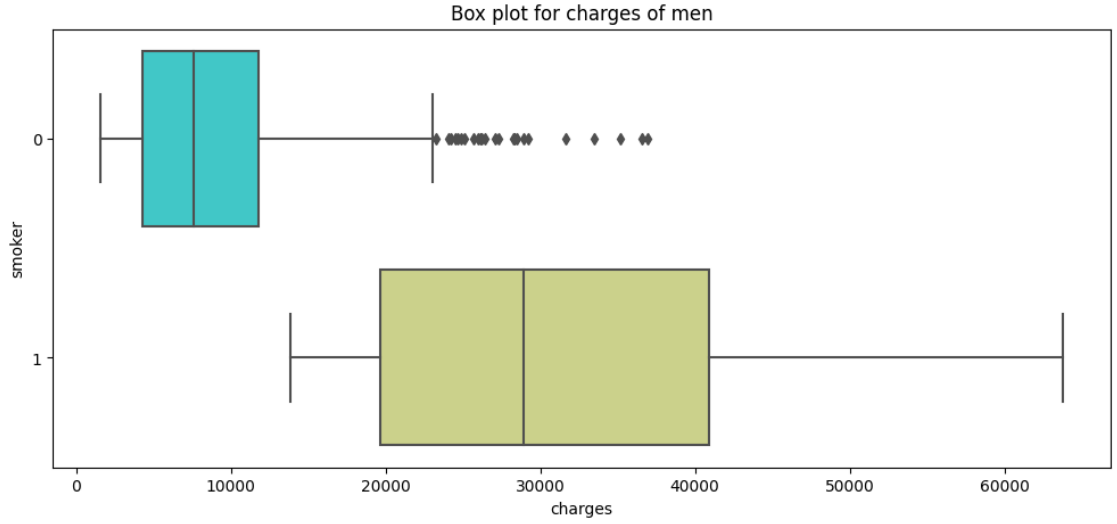
[10]:
```
pl.figure(figsize=(12,5))
pl.title("Box plot for charges of women")
sns.boxplot(y="smoker", x="charges", data =  df_aug[(df_aug.sex == 1)] ,␣
 ↪orient="h", palette = 'magma')
```

[10]: <Axes: title={'center': 'Box plot for charges of women'}, xlabel='charges', ylabel='smoker'>

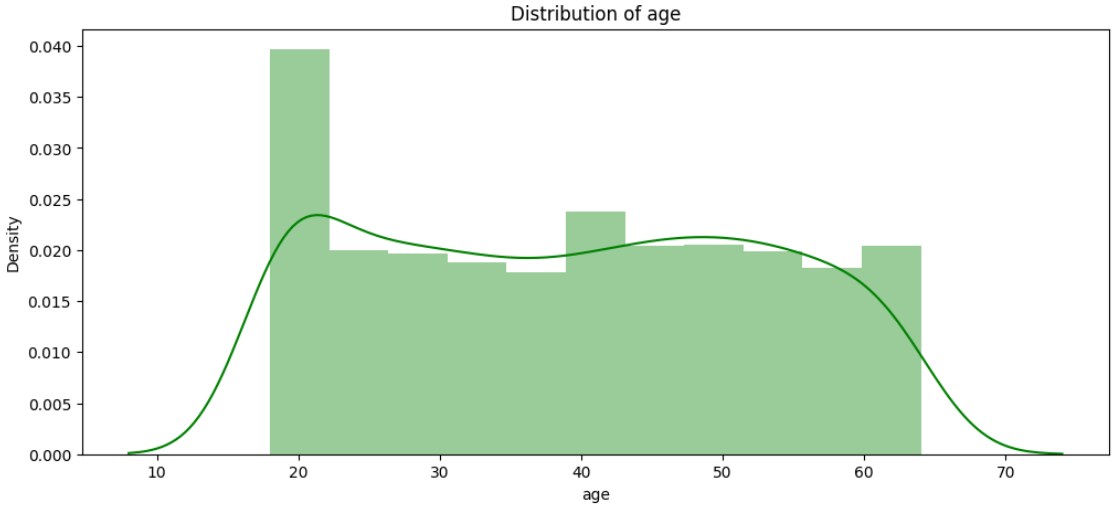


[11]:
```
pl.figure(figsize=(12,5))
pl.title("Box plot for charges of men")
sns.boxplot(y="smoker", x="charges", data =  df_aug[(df_aug.sex == 0)] ,␣
 ↪orient="h", palette = 'rainbow')
```

[11]:
```
<Axes: title={'center': 'Box plot for charges of men'}, xlabel='charges',
ylabel='smoker'>
```

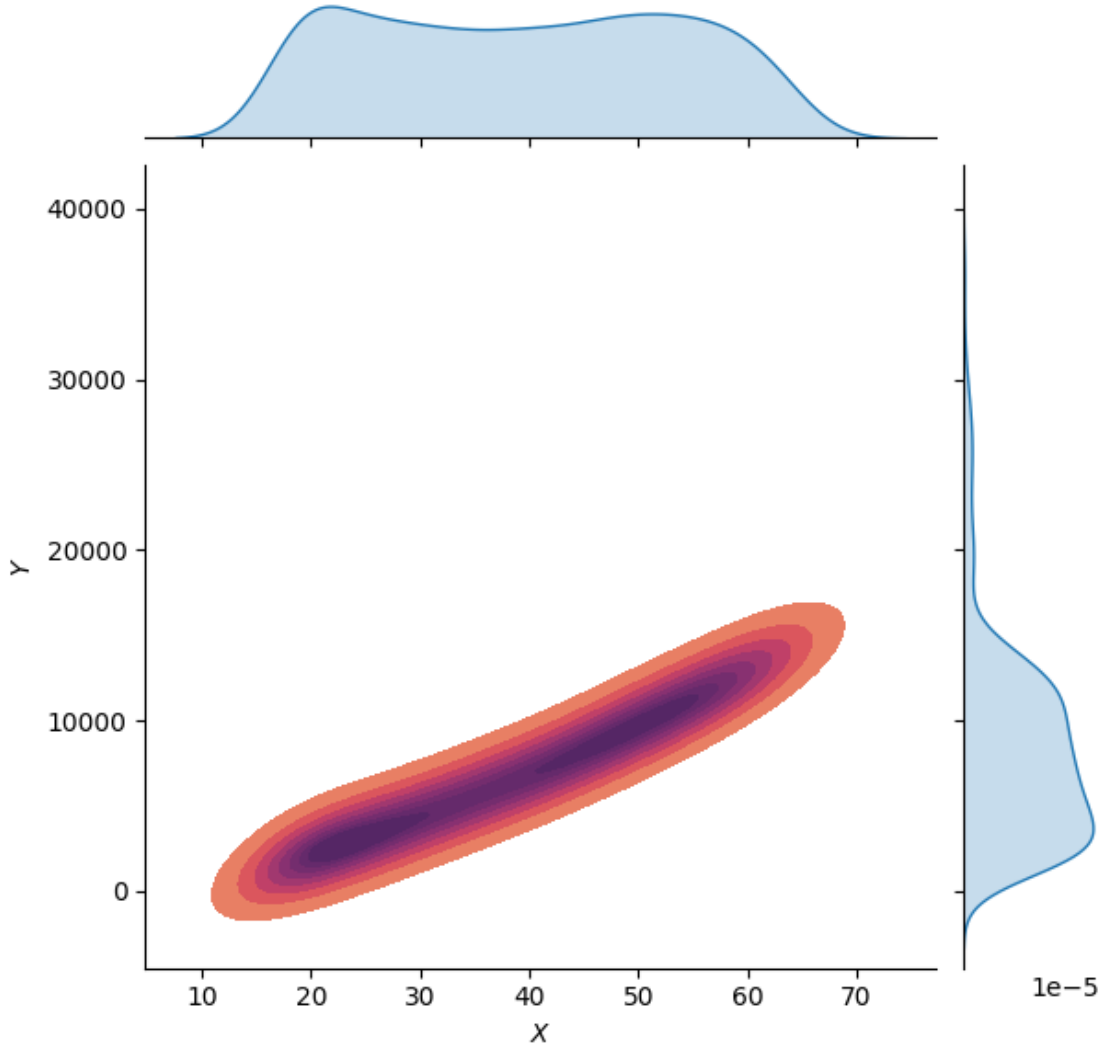


[12]:
```
pl.figure(figsize=(12,5))
pl.title("Distribution of age")
ax = sns.distplot(df_aug["age"], color = 'g')
```



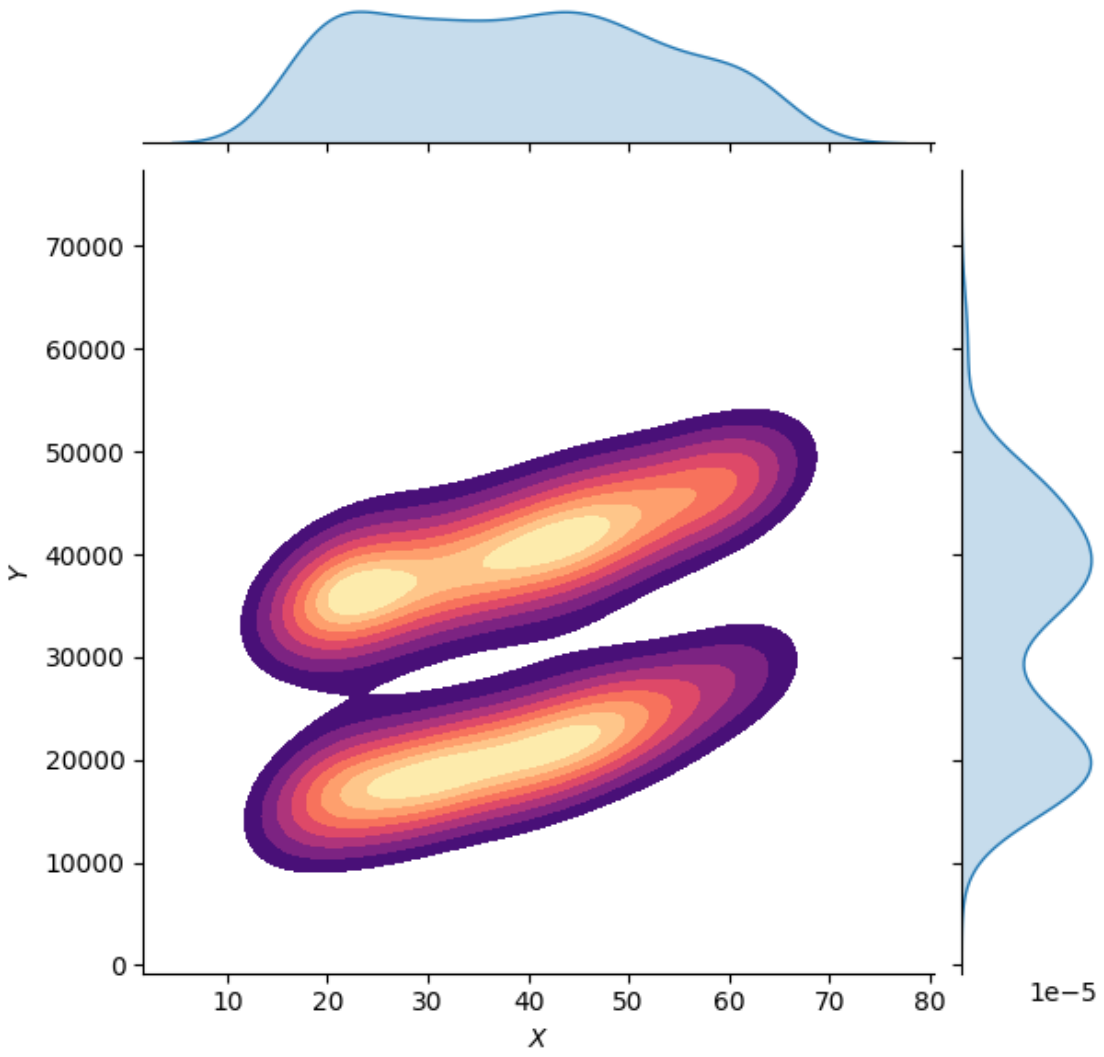
[13]:
```
g = sns.jointplot(x="age", y="charges", data = df_aug[(df_aug.smoker ==␣
↪0)],kind="kde", fill=True, cmap= "flare")
g.plot_joint(pl.scatter, c="w", s=0, linewidth=1, marker="+")
g.ax_joint.collections[0].set_alpha(0)
g.set_axis_labels("$X$", "$Y$")
ax.set_title('Distribution of charges and age for non-smokers')
```

[13]:
```
Text(0.5, 1.0, 'Distribution of charges and age for non-smokers')
```



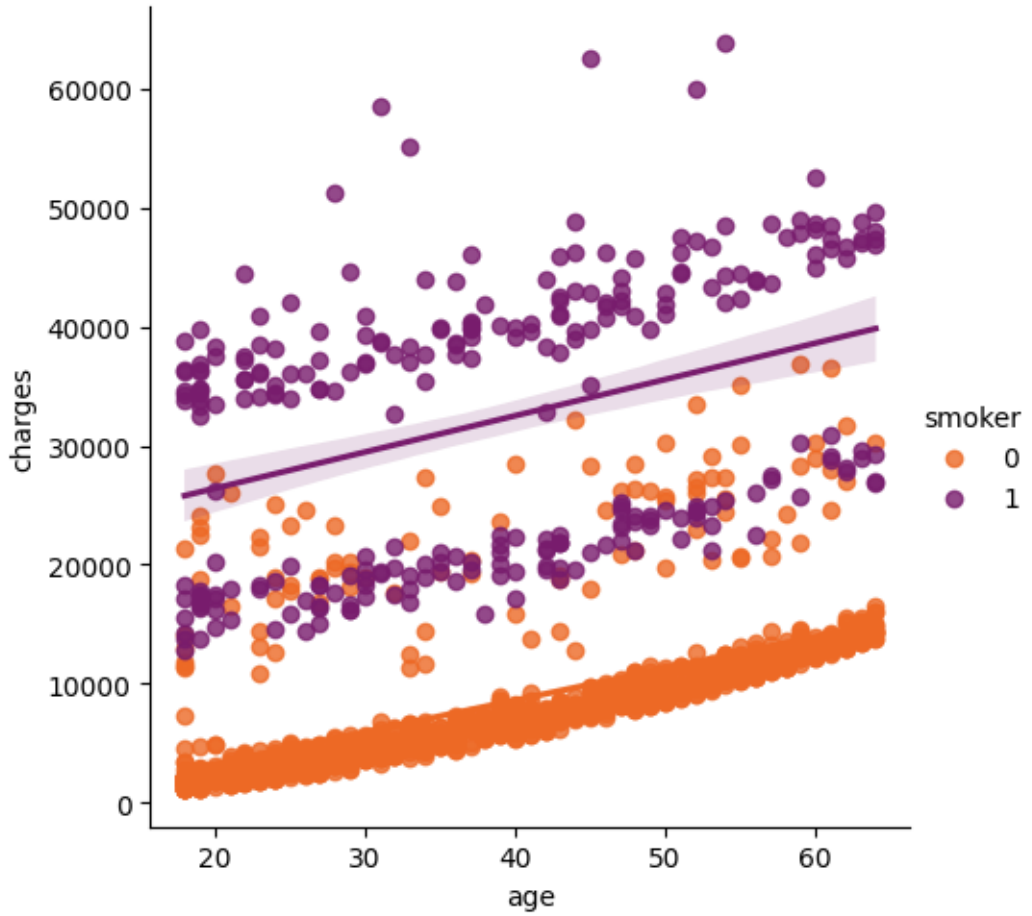
[14]:
```
g = sns.jointplot(x="age", y="charges", data = df_aug[(df_aug.smoker ==␣
↪1)],kind="kde", fill=True, cmap="magma")
g.plot_joint(pl.scatter, c="w", s=0, linewidth=1, marker="+")
g.ax_joint.collections[0].set_alpha(0)
g.set_axis_labels("$X$", "$Y$")
ax.set_title('Distribution of charges and age for smokers')
```

[14]:
```
Text(0.5, 1.0, 'Distribution of charges and age for smokers')
```

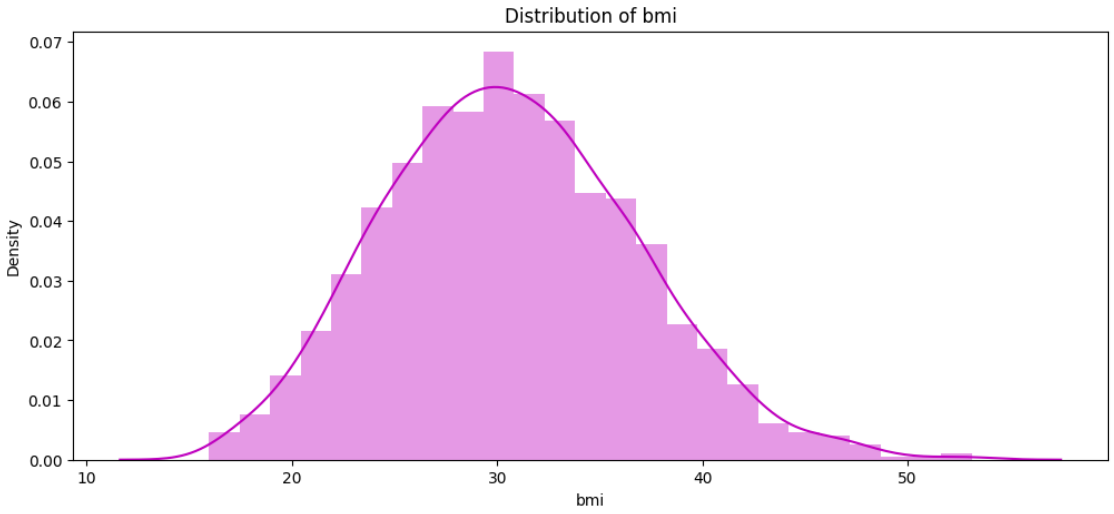


[15]:
```
sns.lmplot(x="age", y="charges", hue="smoker", data=df_aug, palette =␣
↪'inferno_r')
ax.set_title('Smokers and non-smokers')
```

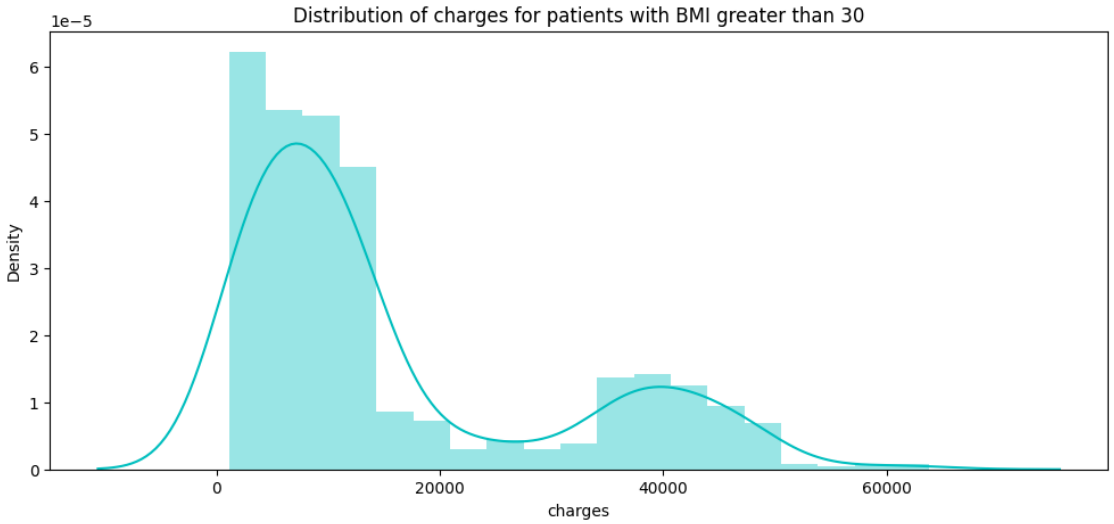
[15]: Text(0.5, 1.0, 'Smokers and non-smokers')



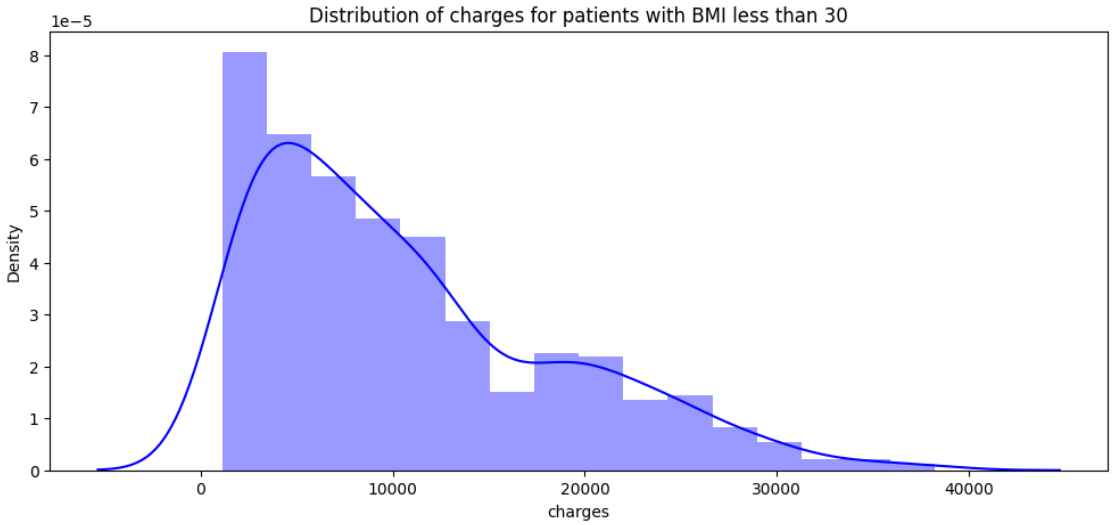
[16]:
```
pl.figure(figsize=(12,5))
pl.title("Distribution of bmi")
ax = sns.distplot(df["bmi"], color = 'm')
```



[17]:
```
pl.figure(figsize=(12,5))
pl.title("Distribution of charges for patients with BMI greater than 30")
ax = sns.distplot(df[(df.bmi >= 30)]['charges'], color = 'c')
```

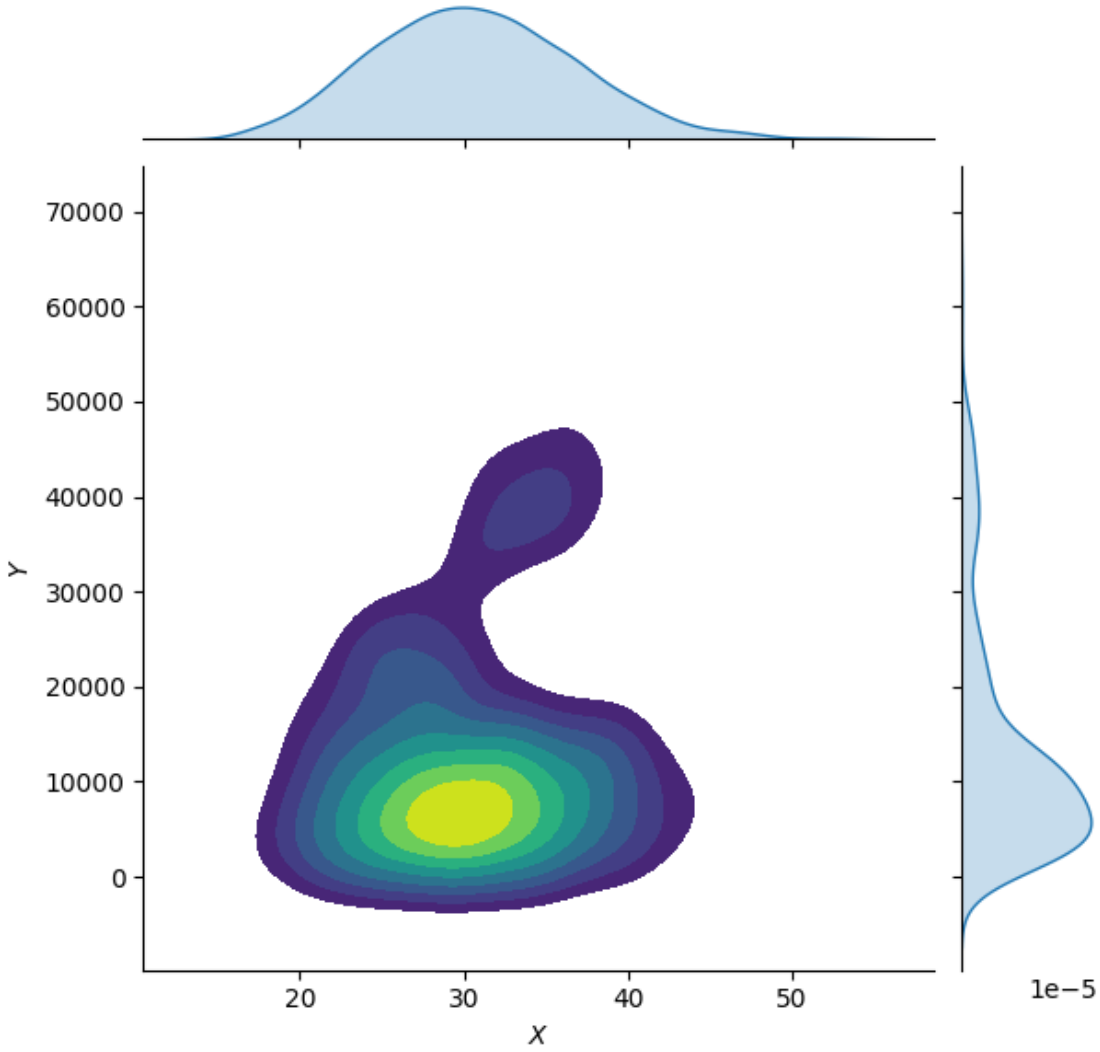


[18]:
```
pl.figure(figsize=(12,5))
pl.title("Distribution of charges for patients with BMI less than 30")
ax = sns.distplot(df[(df.bmi < 30)]['charges'], color = 'b')
```



[19]:
```
g = sns.jointplot(x="bmi", y="charges", data = df,kind="kde", fill = True, cmap␣
↪= 'viridis')
g.plot_joint(pl.scatter, c="w", s=0, linewidth=1, marker="+")
g.ax_joint.collections[0].set_alpha(0)
g.set_axis_labels("$X$", "$Y$")
ax.set_title('Distribution of bmi and charges')
```

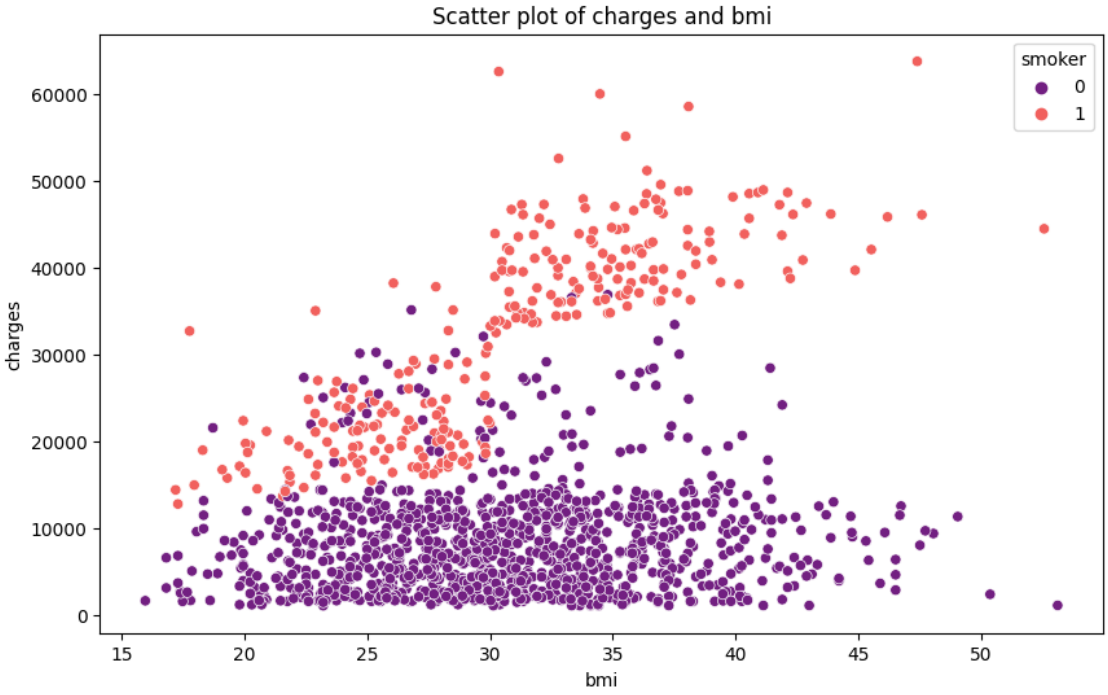
[19]:
```
Text(0.5, 1.0, 'Distribution of bmi and charges')
```

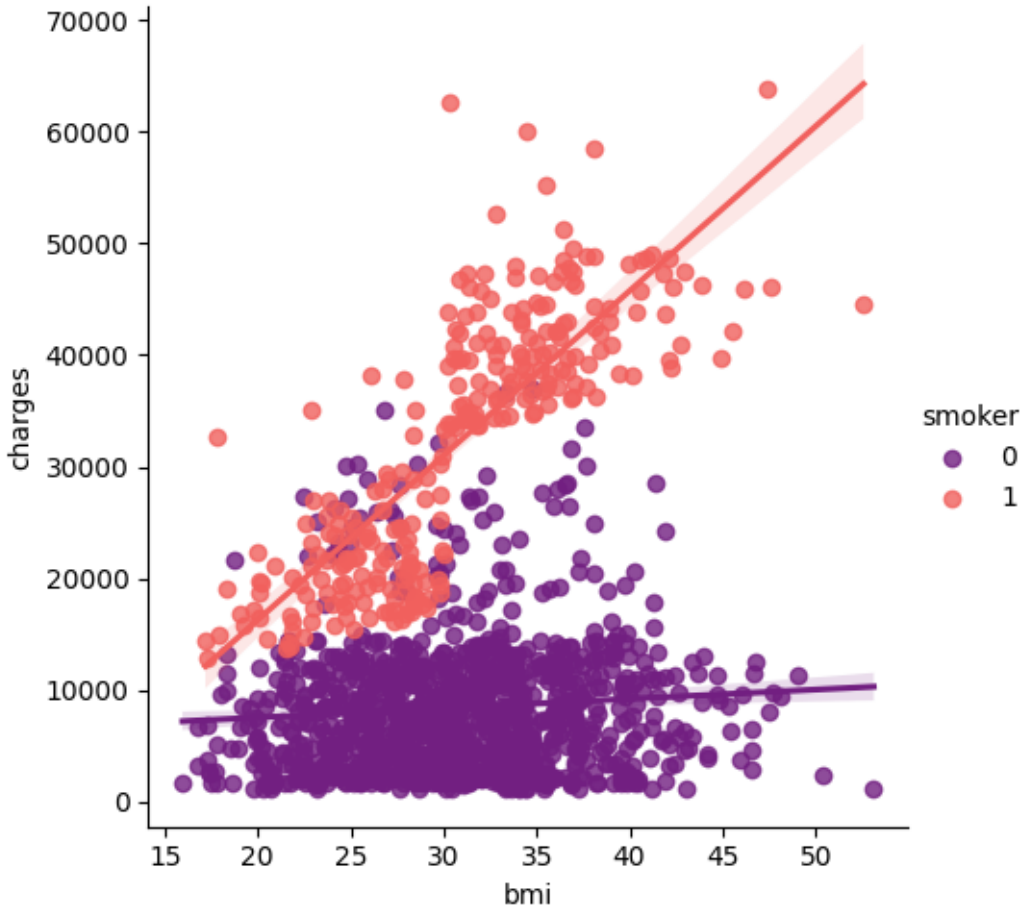


[20]:
```
pl.figure(figsize=(10,6))
ax = sns.
↪scatterplot(x='bmi',y='charges',data=df_aug,palette='magma',hue='smoker')
ax.set_title('Scatter plot of charges and bmi')
```

```
sns.lmplot(x="bmi", y="charges", hue="smoker", data=df_aug, palette = 'magma')
```

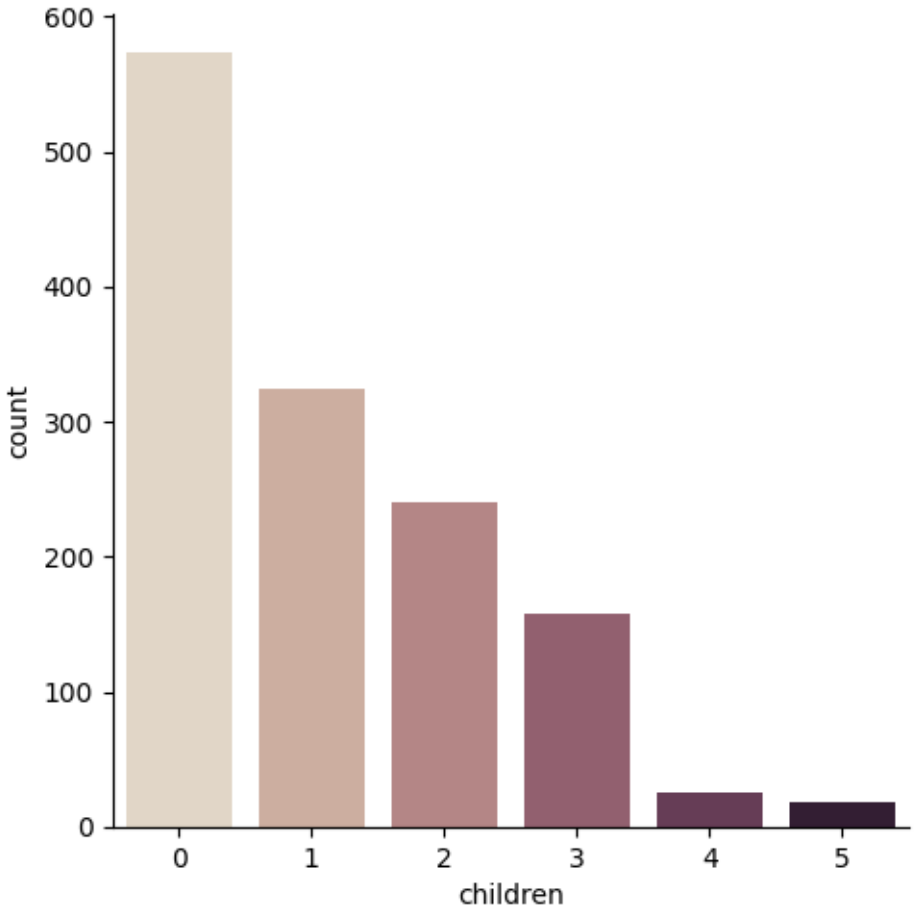
[20]: <seaborn.axisgrid.FacetGrid at 0x7b10f40a3610>





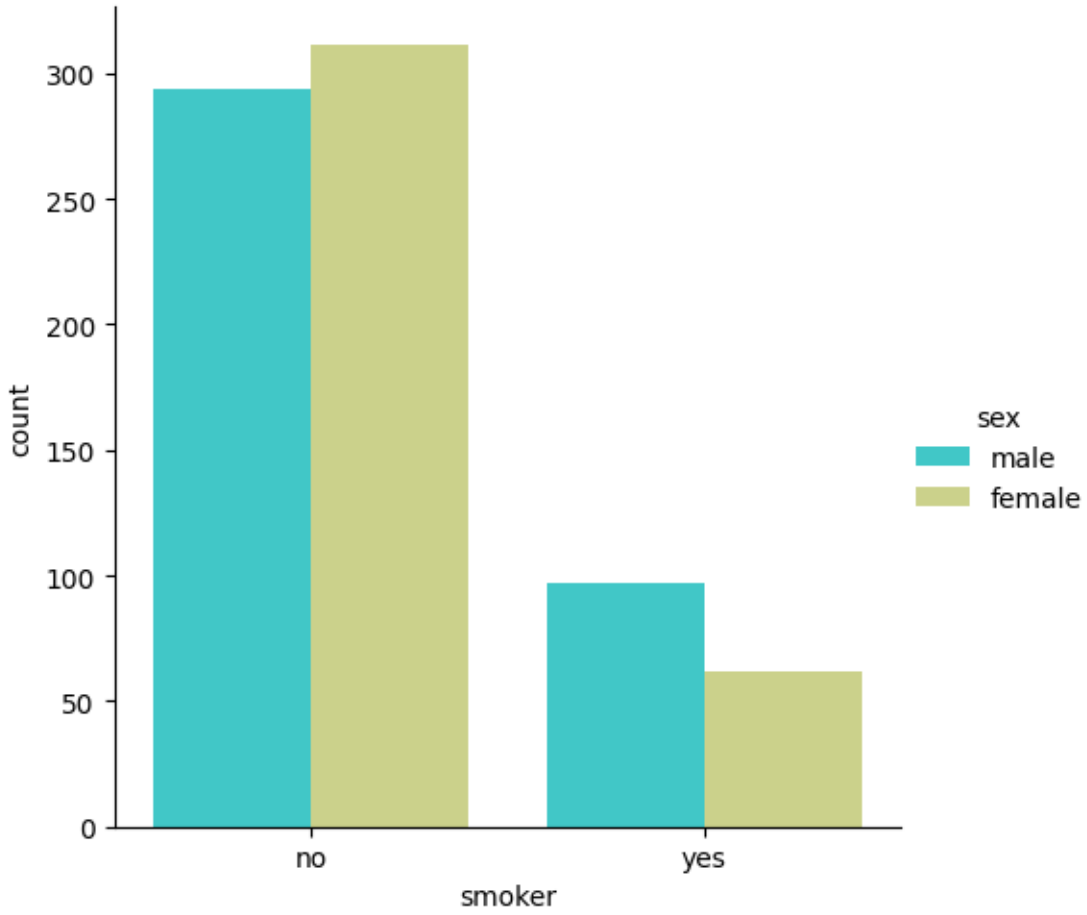
[21]:
```
sns.catplot(x="children", kind="count", palette="ch:.25", data=df_aug)
```

[21]: <seaborn.axisgrid.FacetGrid at 0x7b10f40a25c0>



[22]:
```
sns.catplot(x="smoker", kind="count", palette="rainbow",hue = "sex",
            data=df[(df.children > 0)])
ax.set_title('Smokers and non-smokers who have childrens')
```

[22]: Text(0.5, 1.0, 'Smokers and non-smokers who have childrens')



[23]:
```
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import PolynomialFeatures
from sklearn.metrics import r2_score,mean_squared_error
from sklearn.ensemble import RandomForestRegressor
```

[24]:
```
x = df_aug.drop(['charges'], axis = 1)
y = df_aug.charges

x_train,x_test,y_train,y_test = train_test_split(x,y, random_state = 0)
lr = LinearRegression().fit(x_train,y_train)

y_train_pred = lr.predict(x_train)
y_test_pred = lr.predict(x_test)

print(lr.score(x_test,y_test))
```

```
0.7962732059725786
```

[25]:
```
X = df_aug.drop(['charges','region'], axis = 1)
Y = df_aug.charges



quad = PolynomialFeatures (degree = 2)
x_quad = quad.fit_transform(X)

X_train,X_test,Y_train,Y_test = train_test_split(x_quad,Y, random_state = 0)

plr = LinearRegression().fit(X_train,Y_train)

Y_train_pred = plr.predict(X_train)
Y_test_pred = plr.predict(X_test)

print(plr.score(X_test,Y_test))
```

```
0.8849197344147234
```

[ ]:

[ ]: