Market Segmentation -EV’s

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Abstract:

The electric vehicle market is rapidly growing, and with the increasing number of electric vehicle models available, it has become essential for companies to identify and target specific customer segments. Market segmentation involves dividing a larger market into smaller groups of consumers with similar needs and characteristics. This approach helps companies to develop targeted marketing strategies and tailor their product offerings to meet the specific needs of each customer group. In the electric vehicle market, segmentation is typically based on factors such as customer demographics, driving habits, and charging infrastructure availability. By understanding the different segments within the electric vehicle market, companies can better position their products and services to meet the unique needs and preferences of each group, ultimately driving sales and market share.

Problem Statement:

The problem with the electric vehicle market is that it is highly diverse, with a wide range of consumers who have varying needs, preferences, and driving habits. As such, it can be challenging for companies to develop effective marketing strategies and product offerings that resonate with all potential customers. Failure to properly segment the market can result in missed sales opportunities, ineffective marketing campaigns, and an overall lack of understanding of the customer base. Therefore, the problem statement for market segmentation in the electric vehicle industry is how to identify and target specific customer segments that have unique needs, preferences, and driving habits to develop targeted marketing strategies and product offerings that increase sales and market share.

Code:

1. Importing Libraries

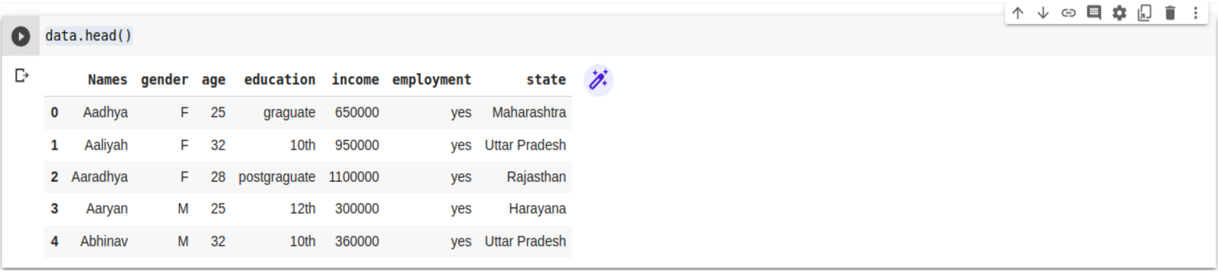
```
import pandas as pd
import matplotlib as mpl
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
from statsmodels.graphics.mosaicplot import mosaic
```

2. Loading datasets

customer dataset:

```
data=pd.read_csv("EV_dataset.csv")
data.head()
```

output:

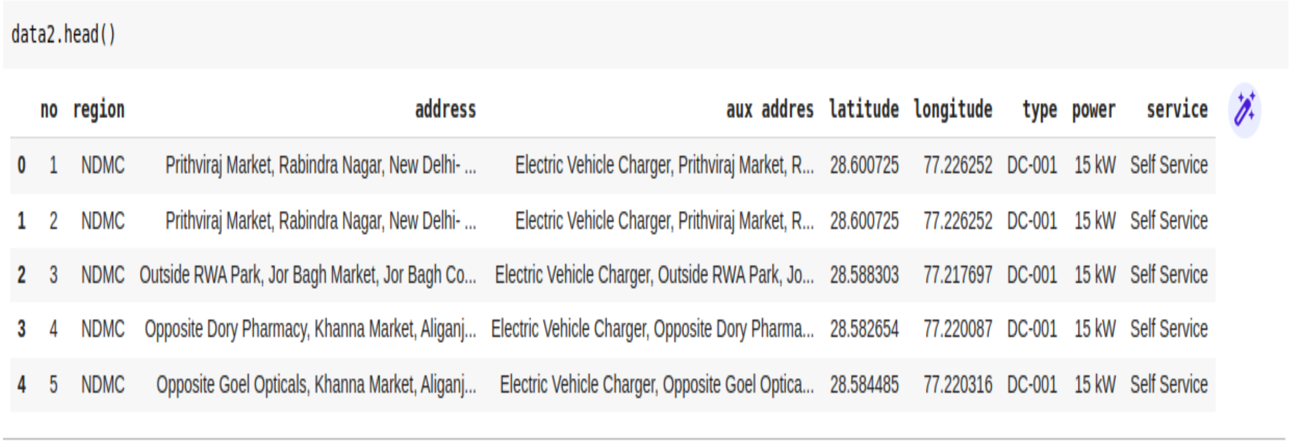


```
data.head()
```

	Names	gender	age	education	income	employment	state
0	Aadhya	F	25	graguate	650000	yes	Maharashtra
1	Aaliyah	F	32	10th	950000	yes	Uttar Pradesh
2	Aaradhya	F	28	postgraguate	1100000	yes	Rajasthan
3	Aaryan	M	25	12th	300000	yes	Harayana
4	Abhinav	M	32	10th	360000	yes	Uttar Pradesh

Charging Stations- Dataset:

```
data2=pd.read_csv("electric_vehicle_charging_station_list.csv")
```



```
data2.head()
```

	no	region	address	aux addres	latitude	longitude	type	power	service
0	1	NDMC	Prithviraj Market, Rabindra Nagar, New Delhi- ...	Electric Vehicle Charger, Prithviraj Market, R...	28.600725	77.226252	DC-001	15 kW	Self Service
1	2	NDMC	Prithviraj Market, Rabindra Nagar, New Delhi- ...	Electric Vehicle Charger, Prithviraj Market, R...	28.600725	77.226252	DC-001	15 kW	Self Service
2	3	NDMC	Outside RWA Park, Jor Bagh Market, Jor Bagh Co...	Electric Vehicle Charger, Outside RWA Park, Jo...	28.588303	77.217697	DC-001	15 kW	Self Service
3	4	NDMC	Opposite Dory Pharmacy, Khanna Market, Aliganj...	Electric Vehicle Charger, Opposite Dory Pharma...	28.582654	77.220087	DC-001	15 kW	Self Service
4	5	NDMC	Opposite Goel Opticals, Khanna Market, Aliganj...	Electric Vehicle Charger, Opposite Goel Optica...	28.584485	77.220316	DC-001	15 kW	Self Service

3.Exploring the Data

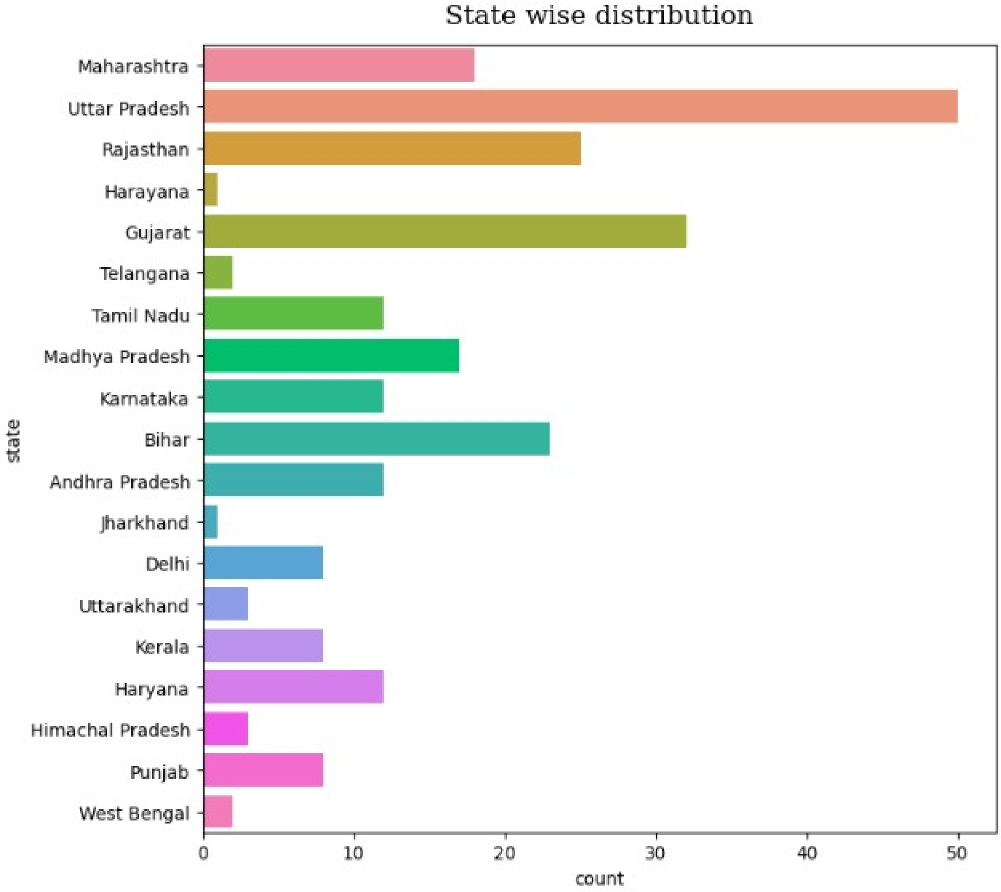
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 249 entries, 0 to 248
Data columns (total 7 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   Names       249 non-null    object
 1   gender      249 non-null    object
 2   age         249 non-null    int64
 3   education   249 non-null    object
 4   income      249 non-null    int64
 5   employment  249 non-null    object
 6   state       249 non-null    object
dtypes: int64(2), object(5)
memory usage: 13.7+ KB
```

State Wise Distribution

```
fig = plt.figure(figsize=(8,8))
sns.countplot(y="state", data=data)
plt.title(label="State wise distribution",weight=200, family='serif',
size=15, pad=12)
```

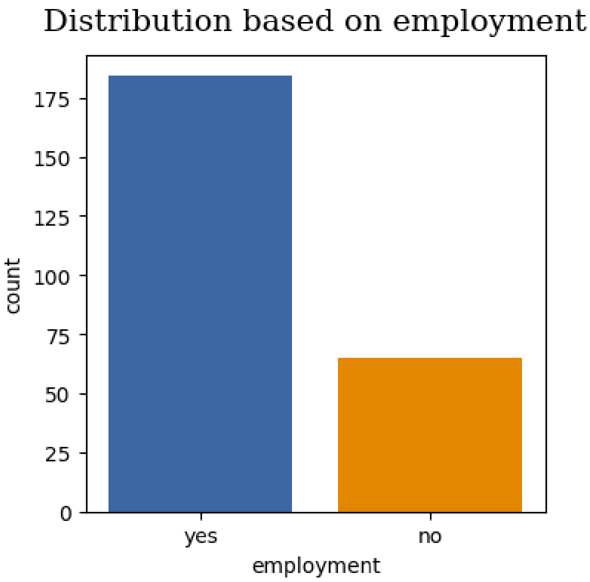
```
Text(0.5, 1.0, 'State wise distribution')
```



Distribution Based on Employment

```
fig = plt.figure(figsize=(4,4))
sns.countplot(x="employment", data=data)
plt.title(label="Distribution based on employment",weight=200,
family='serif', size=15, pad=12)
```

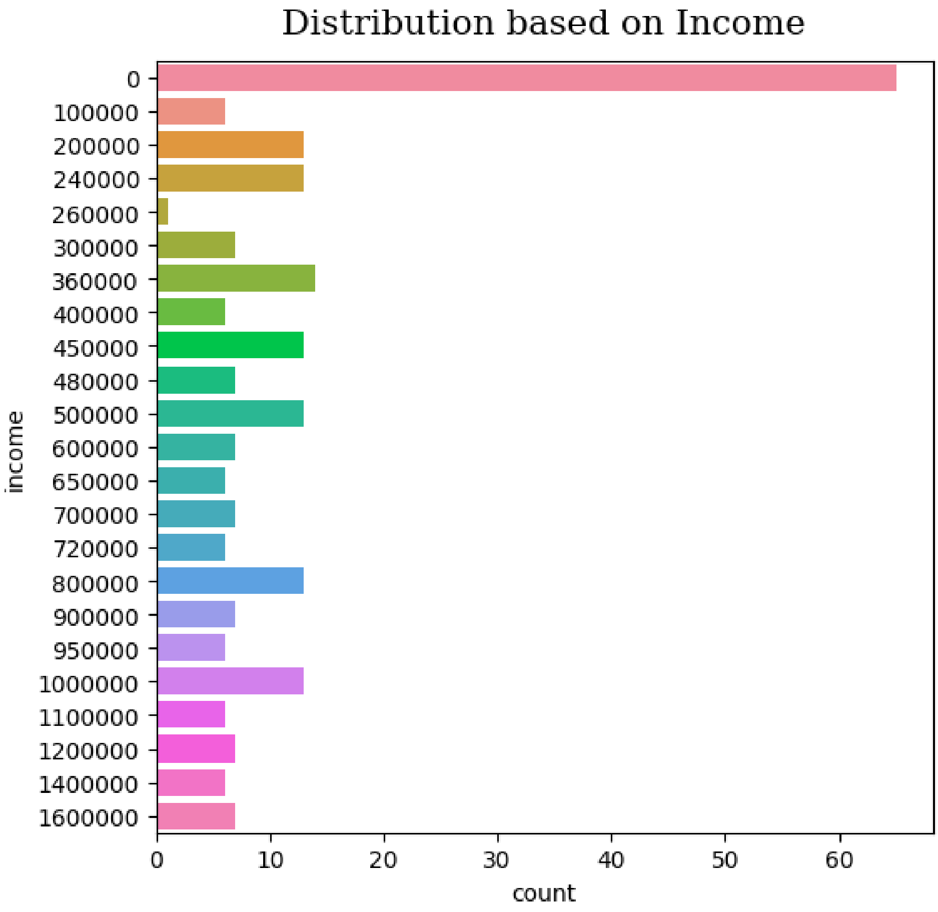
```
Text(0.5, 1.0, 'Distribution based on employment')
```



Distribution based on Income

```
fig = plt.figure(figsize=(6,6))
sns.countplot(y="income", data=data)
plt.title(label="Distribution based on Income",weight=200, family='serif',
size=15, pad=12)
```

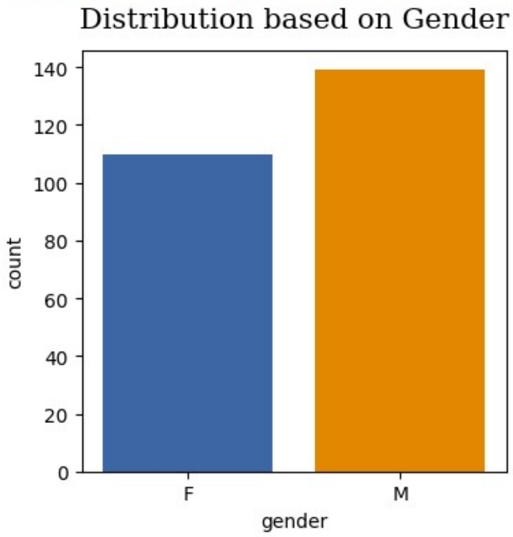
```
Text(0.5, 1.0, 'Distribution based on Income')
```



Distribution based on Gender

```
fig = plt.figure(figsize=(4,4))
sns.countplot(x="gender", data=data)
plt.title(label="Distribution based on
Gender",weight=200, family='serif',
size=15, pad=12)
```

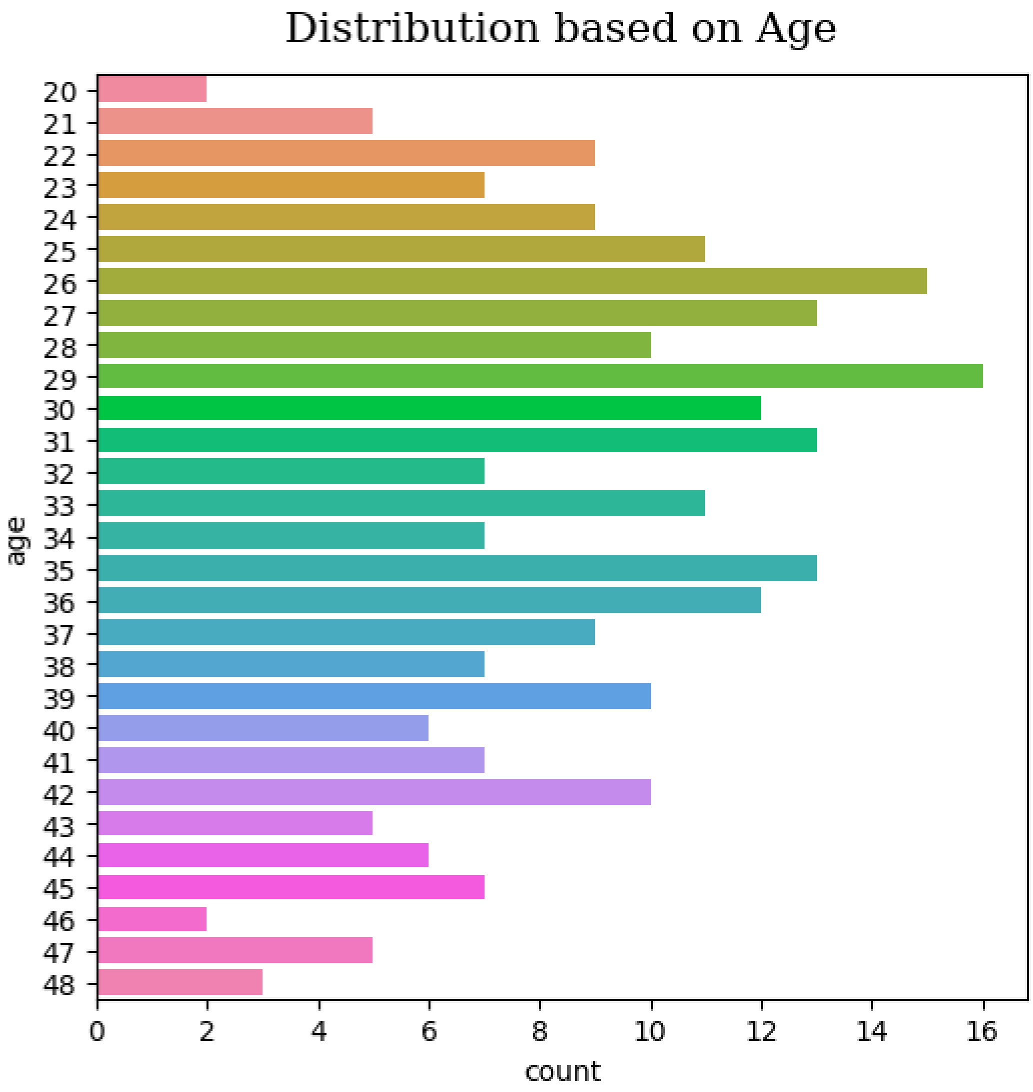
```
Text(0.5, 1.0, 'Distribution based on Gender')
```



Distribution based on Age

```
fig = plt.figure(figsize=(6,6))
sns.countplot(y="age", data=data)
plt.title(label="Distribution based on Age",weight=200, family='serif',
size=15, pad=12)
```

```
Text(0.5, 1.0, 'Distribution based on Age')
```

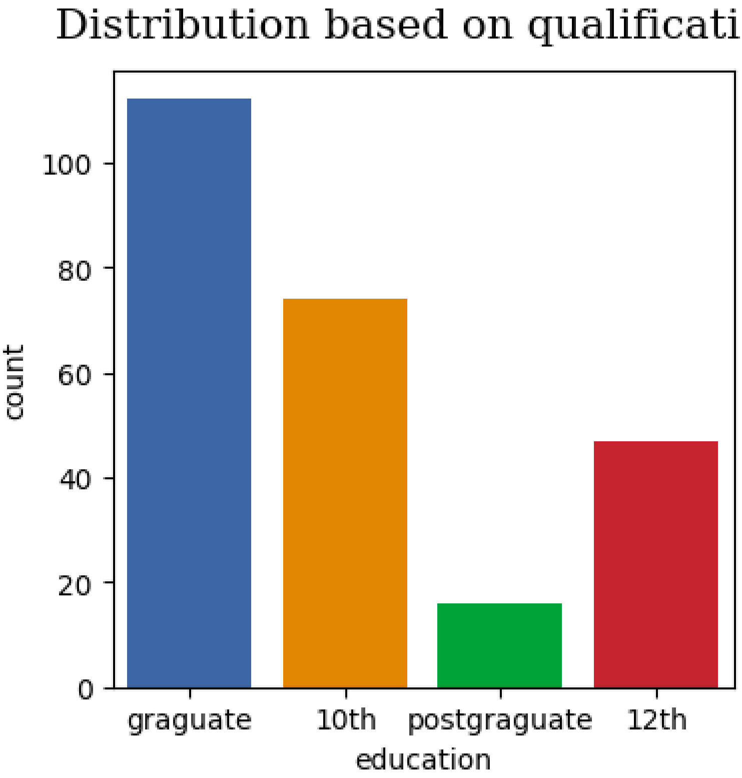


Distribution based on qualification

```
fig = plt.figure(figsize=(4,4))
sns.countplot(x="education", data=data)
```

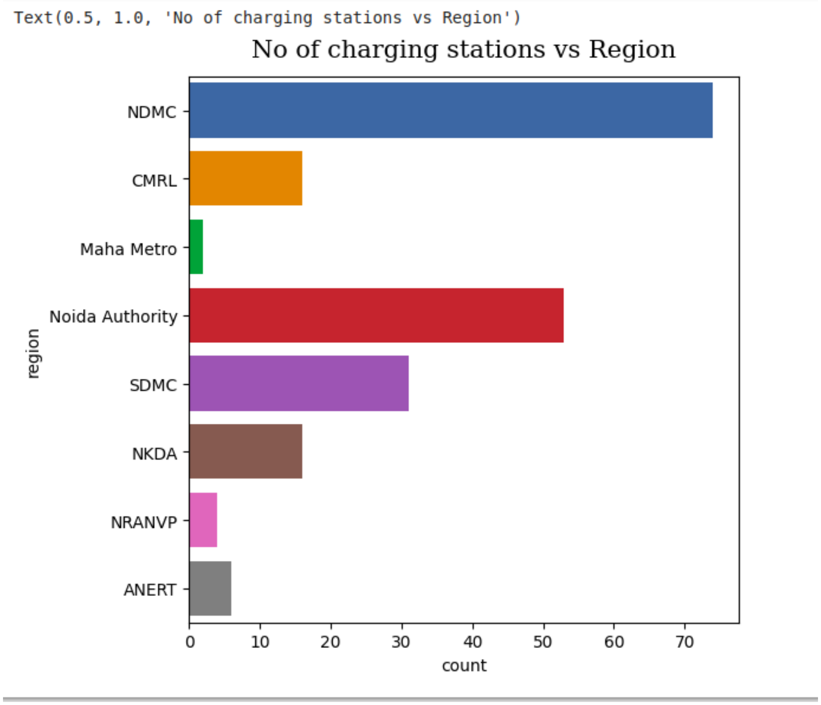
```
plt.title(label="Distribution based on qualification",weight=200,
family='serif', size=15, pad=12)
```

```
Text(0.5, 1.0, 'Distribution based on qualification')
```



No of charging stations vs Region

```
fig = plt.figure(figsize=(6,6))
sns.countplot(y="region", data=data2)
plt.title(label="No of charging stations vs Region",weight=200,
family='serif', size=15, pad=12)
```

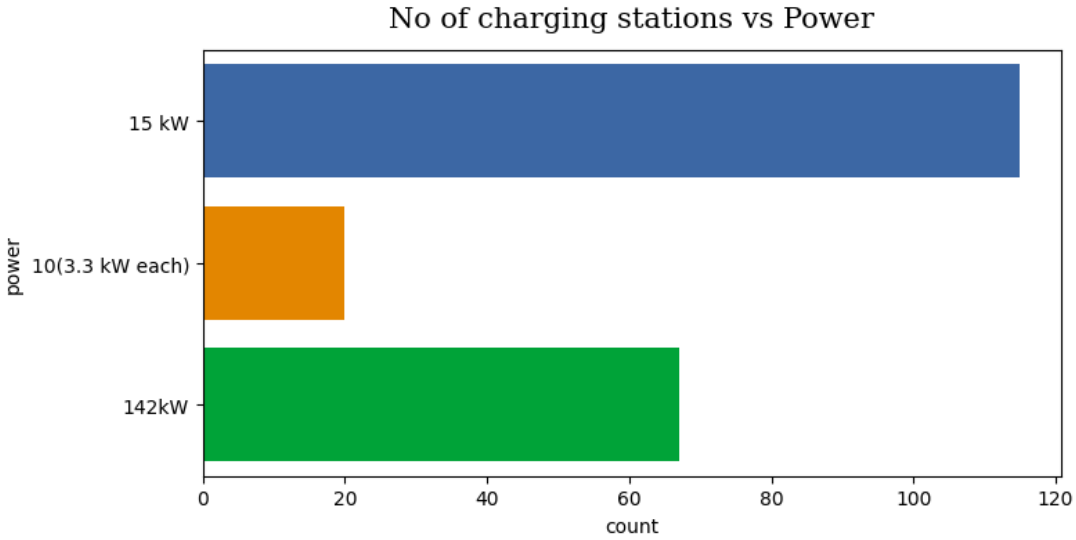


```
Text(0.5, 1.0, 'No of charging stations vs Region')
```

No of charging stations vs Power

```
fig = plt.figure(figsize=(8,4))
sns.countplot(y="power", data=data2)
plt.title(label="No of charging stations vs Power",weight=200,
family='serif', size=15, pad=12)
```

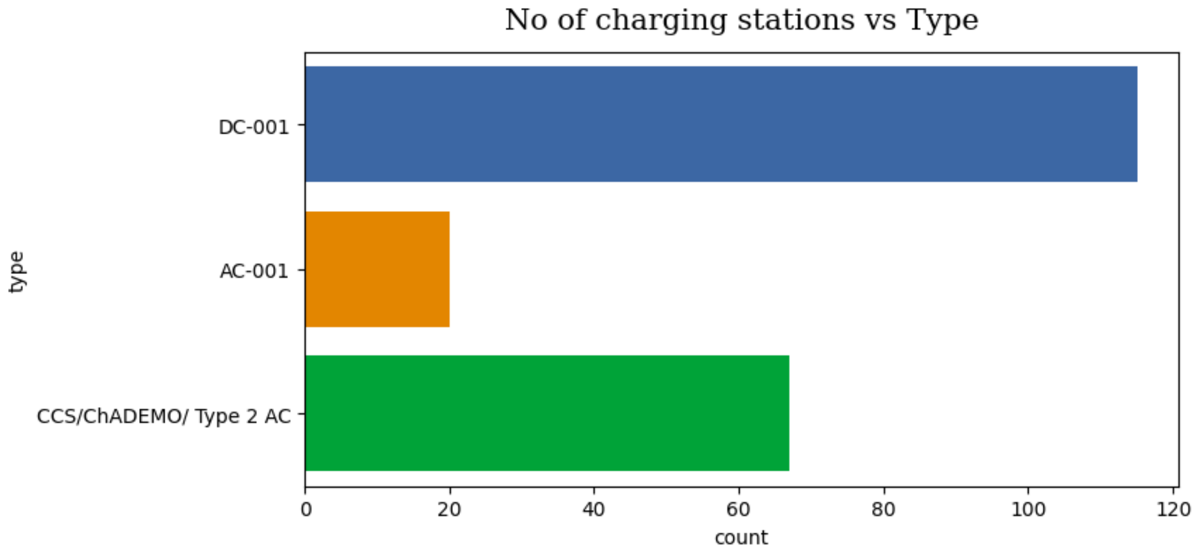
```
Text(0.5, 1.0, 'No of charging stations vs Power')
```



No of charging stations vs Type

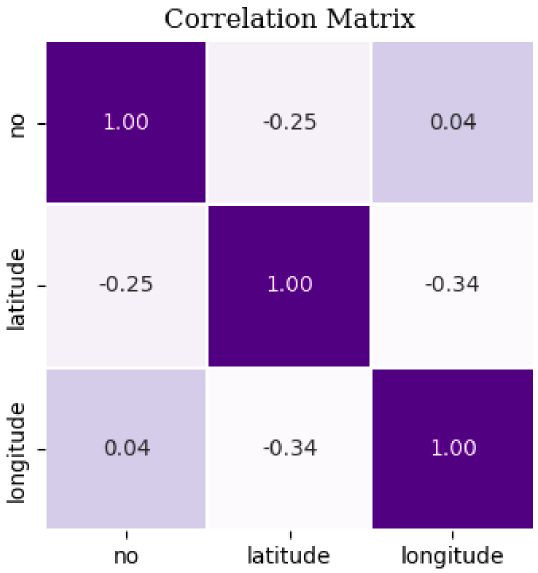
```
fig = plt.figure(figsize=(8,4))
sns.countplot(y="type", data=data2)
plt.title(label="No of charging stations vs Type",weight=200,
family='serif', size=15, pad=12)
```

```
Text(0.5, 1.0, 'No of charging stations vs Type')
```



Correlation Matrix

```
plt.figure(figsize=(4,4))
sns.heatmap(data=data2.corr(), annot=True, cmap='Purples', cbar=False,
square=True, fmt='.2f', linewidths=.3)
plt.title('Correlation Matrix', family='serif');
```

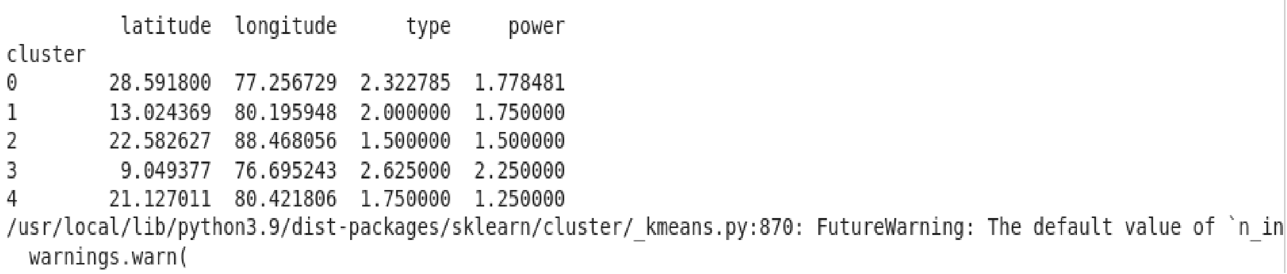


```
df=data2.drop(['no'], axis=1)
df.replace({'AC-001': 1, 'DC-001':2,'CCS/ChADEMO/ Type 2 AC':3},
inplace=True)
df.replace({'15 kW': 1, '10(3.3 kW each)':2,'142kW':3}, inplace=True)
```

4.Segmentation

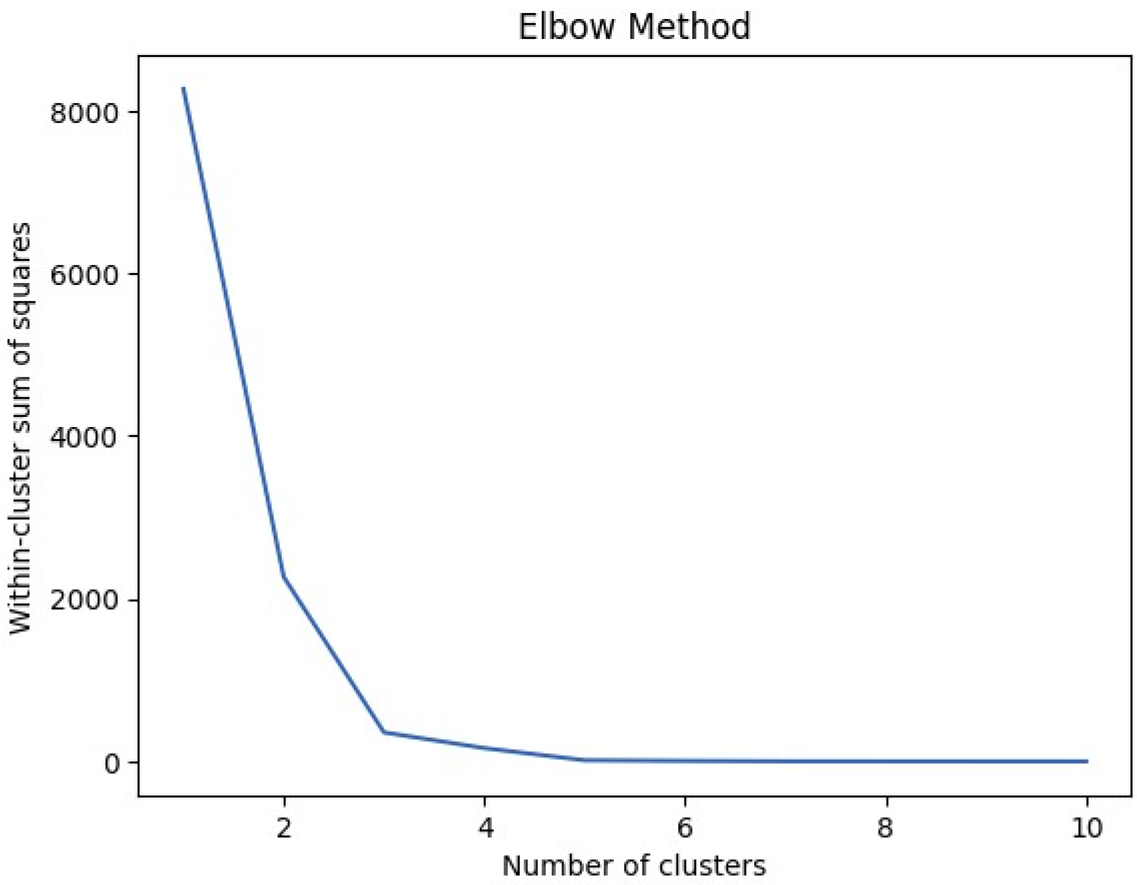
K-Mean clustering for charging Stations

```
# select relevant features for clustering
features = ['latitude', 'longitude']
kmeans = KMeans(n_clusters=5)
kmeans.fit(df[features])
df['cluster'] = kmeans.labels_

# examine cluster assignments
print(df.groupby('cluster').mean())
```



```
          latitude  longitude      type     power
cluster
0        28.591800  77.256729  2.322785  1.778481
1        13.024369  80.195948  2.000000  1.750000
2        22.582627  88.468056  1.500000  1.500000
3         9.049377  76.695243  2.625000  2.250000
4        21.127011  80.421806  1.750000  1.250000
/usr/local/lib/python3.9/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_in
  warnings.warn(
```

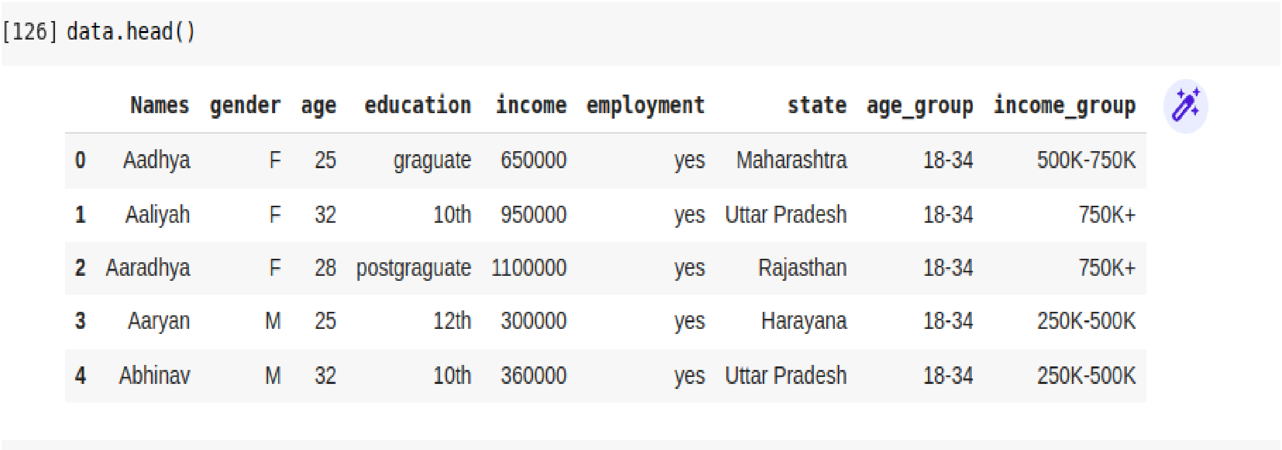
```
wcss = []
for k in range(1, 11):
kmeans = KMeans(n_clusters=k, init='k-means++', max_iter=300, n_init=10,
random_state=0)
kmeans.fit(df[features])
wcss.append(kmeans.inertia_)

# plot within-cluster sum of squares for different k values
plt.plot(range(1, 11), wcss)
plt.title('Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('Within-cluster sum of squares')
plt.show()
```



Describing Segments:

```
# segment customers based on age
age_groups = []
for age in data['age']:
if age < 18:
age_groups.append('Under 18')
elif age >= 18 and age < 35:
age_groups.append('18-34')
elif age >= 35 and age < 50:
age_groups.append('35-49')
else:
age_groups.append('50+')

# add age groups to customer data
data['age_group'] = age_groups

# segment customers based on income
income_groups = []
for income in data['income']:
if income < 250000:
income_groups.append('Under 250K')
elif income >= 250000 and income < 500000:
```

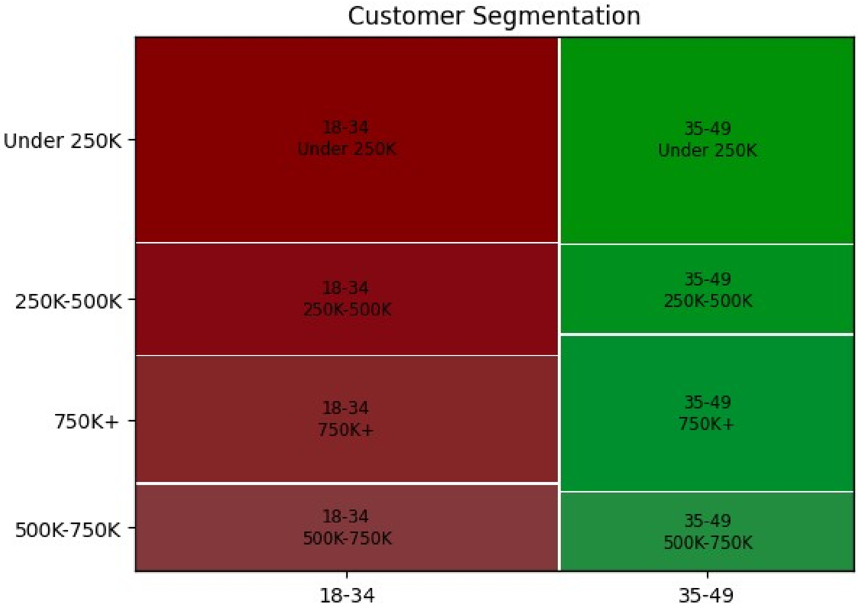
```
income_groups.append('250K-500K')
elif income >= 500000 and income < 750000:
income_groups.append('500K-750K')
else:
income_groups.append('750K+')

# add income groups to customer data
data['income_group'] = income_groups
```



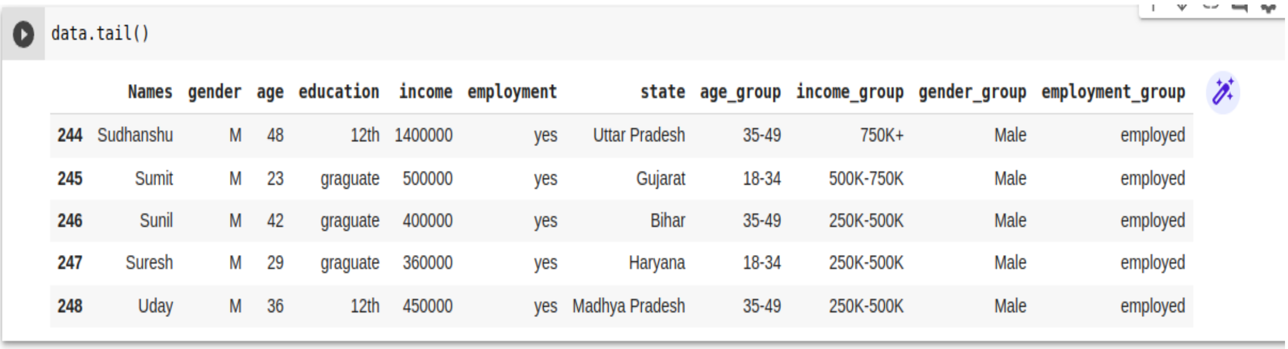
```
[126] data.head()
```

	Names	gender	age	education	income	employment	state	age_group	income_group
0	Aadhya	F	25	graguate	650000	yes	Maharashtra	18-34	500K-750K
1	Aaliyah	F	32	10th	950000	yes	Uttar Pradesh	18-34	750K+
2	Aaradhya	F	28	postgraguate	1100000	yes	Rajasthan	18-34	750K+
3	Aaryan	M	25	12th	300000	yes	Harayana	18-34	250K-500K
4	Abhinav	M	32	10th	360000	yes	Uttar Pradesh	18-34	250K-500K

```
mosaic(data, ['age_group', 'income_group'], title='Customer Segmentation')
plt.show()
```



```
# segment customers based on gender
gender_groups = []
for gender in data['gender']:
if gender == 'M':
gender_groups.append('Male')
elif gender == 'F':
gender_groups.append('Female')
else:
gender_groups.append('Other')

# add gender groups to customer data
data['gender_group'] = gender_groups

# segment customers based on employment status
employment_groups = []
for employment in data['employment']:
if employment == 'yes':
employment_groups.append('employed')
else:
employment_groups.append('Unemployed')

# add employment groups to customer data
data['employment_group'] = employment_groups
```

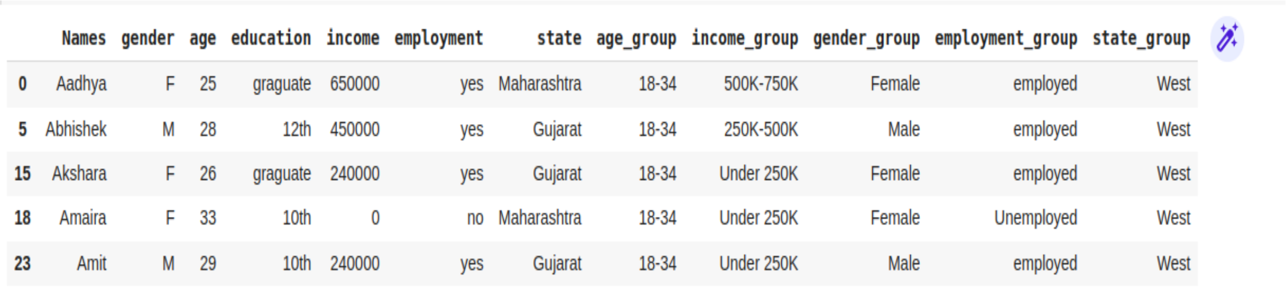


```
data.tail()
```

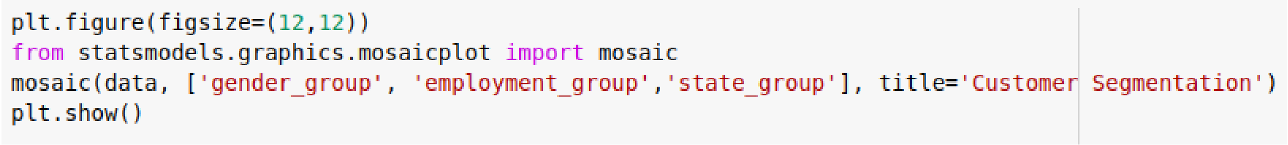
	Names	gender	age	education	income	employment	state	age_group	income_group	gender_group	employment_group
244	Sudhanshu	M	48	12th	1400000	yes	Uttar Pradesh	35-49	750K+	Male	employed
245	Sumit	M	23	graguate	500000	yes	Gujarat	18-34	500K-750K	Male	employed
246	Sunil	M	42	graguate	400000	yes	Bihar	35-49	250K-500K	Male	employed
247	Suresh	M	29	graguate	360000	yes	Haryana	18-34	250K-500K	Male	employed
248	Uday	M	36	12th	450000	yes	Madhya Pradesh	35-49	250K-500K	Male	employed

```
state_groups = []
for state in data['state']:
if state in ['Maharashtra', 'Gujarat', 'Goa']:
state_groups.append('West')
elif state in ['Delhi', 'Uttar Pradesh', 'Haryana']:
state_groups.append('North')
elif state in ['Tamil Nadu', 'Karnataka', 'Kerala']:
state_groups.append('South')
elif state in ['Rajasthan', 'Madhya Pradesh', 'Chhattisgarh']:
state_groups.append('Central')
else:
```

```
state_groups.append('Other')

# add state groups to customer data
data['state_group'] = state_groups
# select market segment
market_segment = data.loc[data['state_group'] == 'West']

market_segment.head()
```

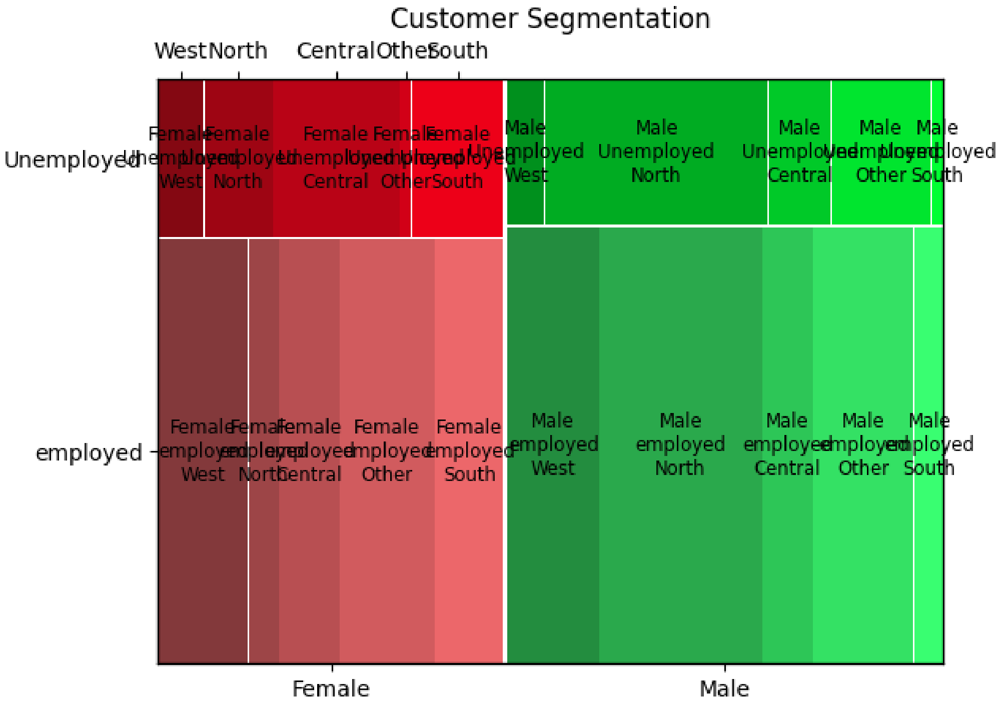


	Names	gender	age	education	income	employment	state	age_group	income_group	gender_group	employment_group	state_group
0	Aadhya	F	25	graguate	650000	yes	Maharashtra	18-34	500K-750K	Female	employed	West
5	Abhishek	M	28	12th	450000	yes	Gujarat	18-34	250K-500K	Male	employed	West
15	Akshara	F	26	graguate	240000	yes	Gujarat	18-34	Under 250K	Female	employed	West
18	Amaira	F	33	10th	0	no	Maharashtra	18-34	Under 250K	Female	Unemployed	West
23	Amit	M	29	10th	240000	yes	Gujarat	18-34	Under 250K	Male	employed	West



```
plt.figure(figsize=(12,12))
from statsmodels.graphics.mosaicplot import mosaic
mosaic(data, ['gender_group', 'employment_group','state_group'], title='Customer Segmentation')
plt.show()
```

```
<Figure size 1200x1200 with 0 Axes>
```


Customer Segmentation
West
North
Central
Other
South
Unemployed
employed
Female Unemployed West
Female Unemployed North
Female Unemployed Central
Female Unemployed Other
Female Unemployed South
Male Unemployed West
Male Unemployed North
Male Unemployed Central
Male Unemployed Other
Male Unemployed South
Female employed West
Female employed North
Female employed Central
Female employed Other
Female employed South
Male employed West
Male employed North
Male employed Central
Male employed Other
Male employed South
Female
Male