```
import pandas as pd
```

```
Patients_df = pd.read_csv('Patients.csv')
```

```
Patients_df
```

| | Age | Diastolic | Gender | Height | LastName | Location | SelfAssessedHealthStatu |
|---|---|---|---|---|---|---|---|
| **0** | 38 | 93 | 'Male' | 71 | 'Smith' | 'County General Hospital' | 'Excelle |
| **1** | 43 | 77 | 'Male' | 69 | 'Johnson' | 'VA Hospital' | 'Fa |
| **2** | 38 | 83 | 'Female' | 64 | 'Williams' | 'St. Mary's Medical Center' | 'Goo |
| **3** | 40 | 75 | 'Female' | 67 | 'Jones' | 'VA Hospital' | 'Fa |
| **4** | 49 | 80 | 'Female' | 64 | 'Brown' | 'County General Hospital' | 'Goo |
| **...** | ... | ... | ... | ... | ... | ... | |
| **95** | 25 | 99 | 'Male' | 69 | 'Alexander' | 'County General Hospital' | 'Goo |

```
!pip install plotly matplotlib seaborn --quiet
```

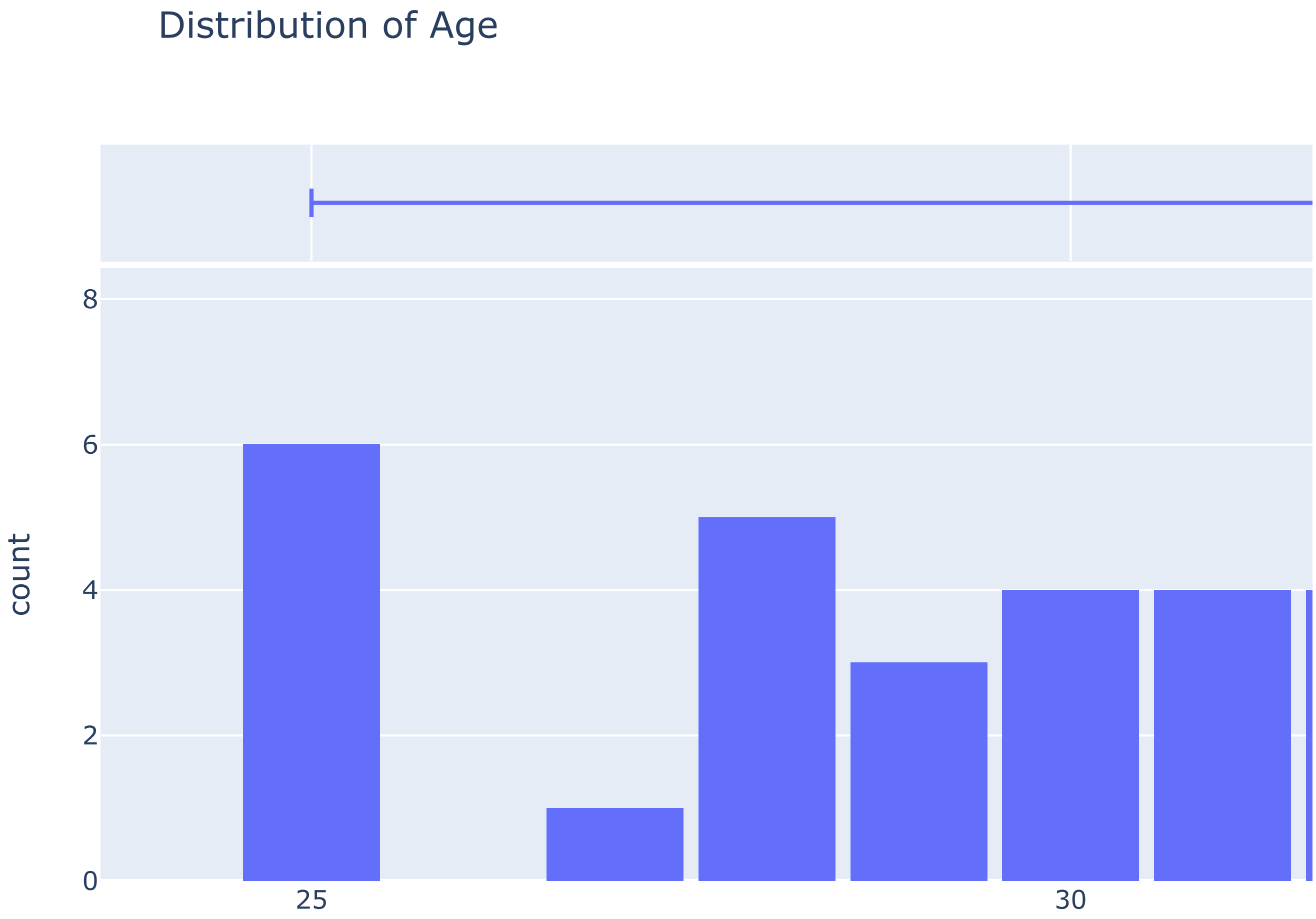
```
import plotly.express as px
import matplotlib
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

```
sns.set_style('darkgrid')
matplotlib.rcParams['font.size'] = 14
matplotlib.rcParams['figure.figsize'] = (10, 6)
matplotlib.rcParams['figure.facecolor'] = '#00000000'
```

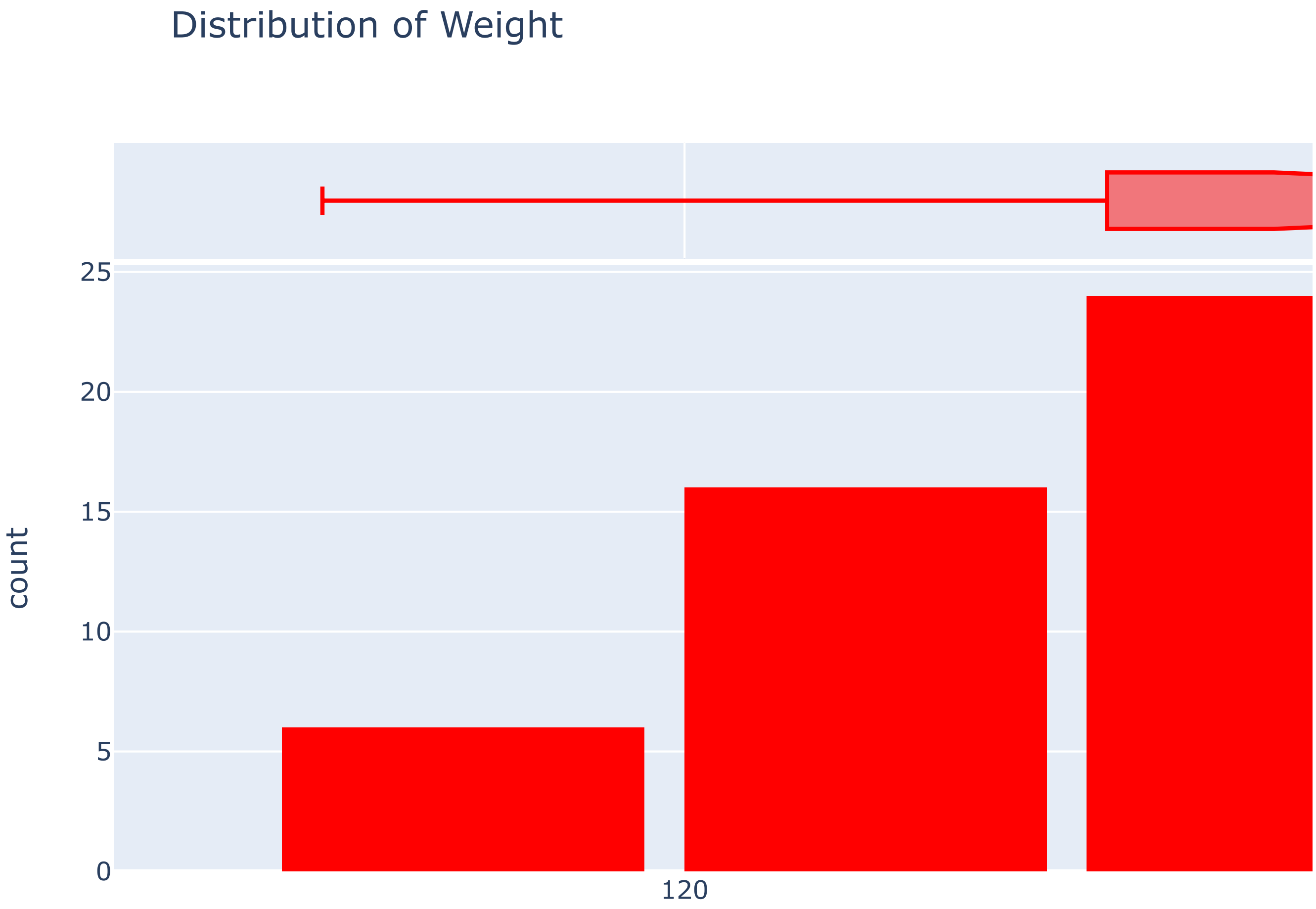
```
Patients_df.Age.describe()
```

```
count    100.000000
mean      38.280000
std        7.215416
min       25.000000
25%       32.000000
50%       39.000000
75%       44.000000
max       50.000000
Name: Age, dtype: float64
```

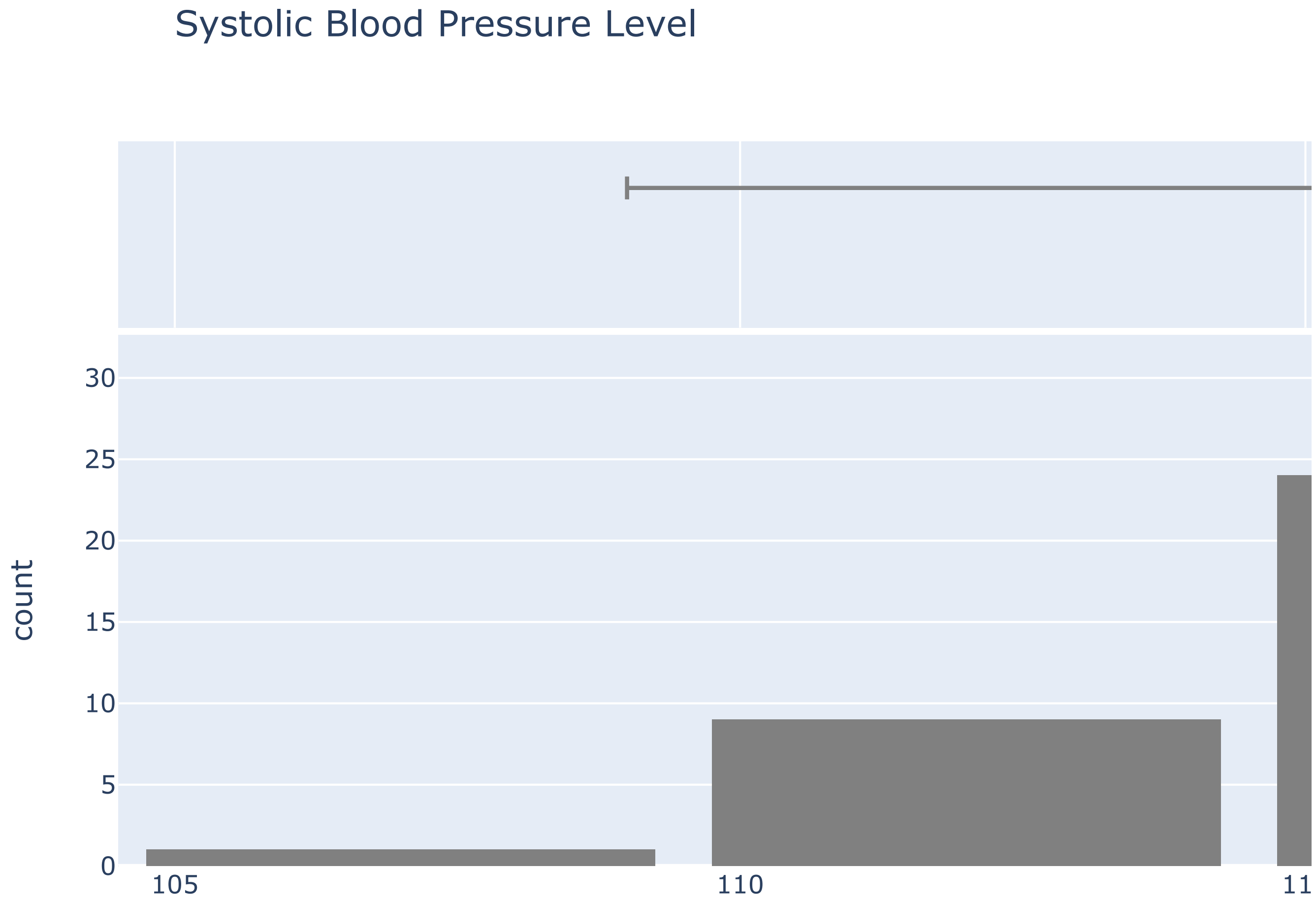
```
fig = px.histogram(Patients_df,
                   x='Age',
                   marginal='box',
                   nbins=26,
                   title='Distribution of Age')
fig.update_layout(bargap=0.1)
fig.show()
```



```
fig = px.histogram(Patients_df,
                   x='Weight',
                   marginal='box',
      ·············color_discrete_sequence=['red'],·
···················title='Distribution·of·Weight')
fig.update_layout(bargap=0.1)
fig.show()
```



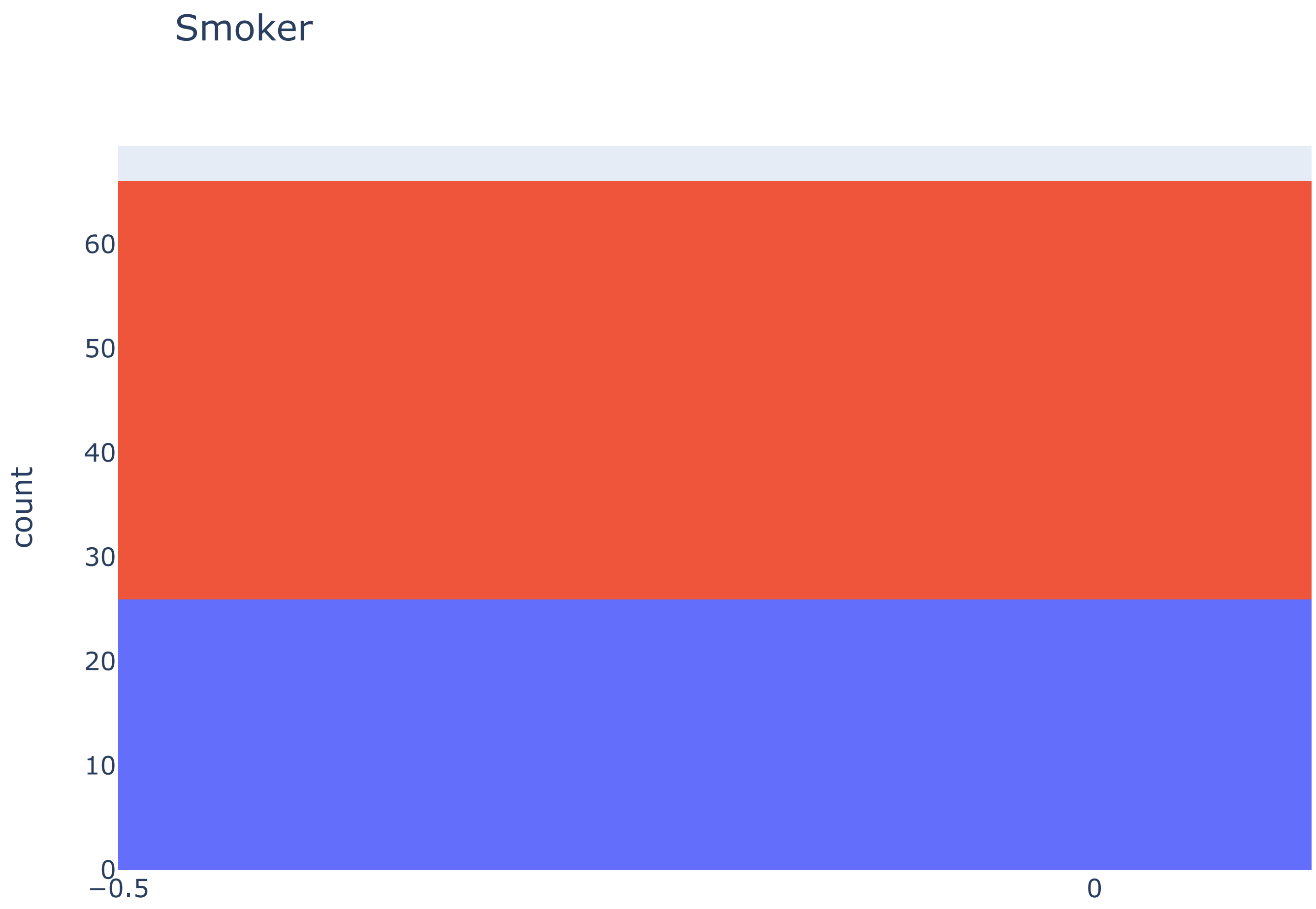
```
fig = px.histogram(Patients_df,
                   x='Systolic',
                   marginal='box',
                   color='Smoker',
                   color_discrete_sequence=['green', 'grey'],
                   title='Systolic Blood Pressure Level')
fig.update_layout(bargap=0.1)
fig.show()
```



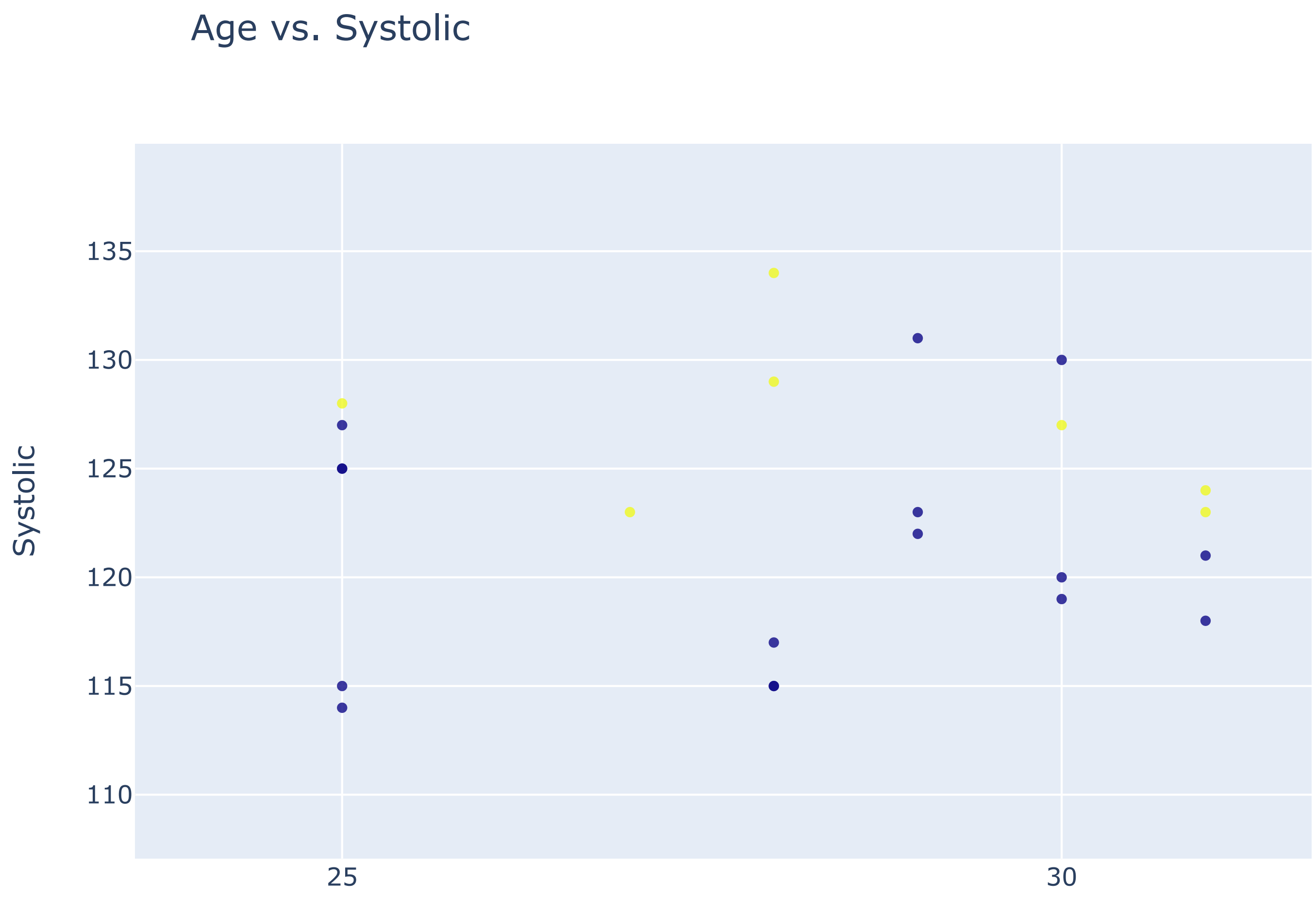
```
Patients_df.Smoker.value_counts()
```

```
    0    66
    1    34
    Name: Smoker, dtype: int64
```

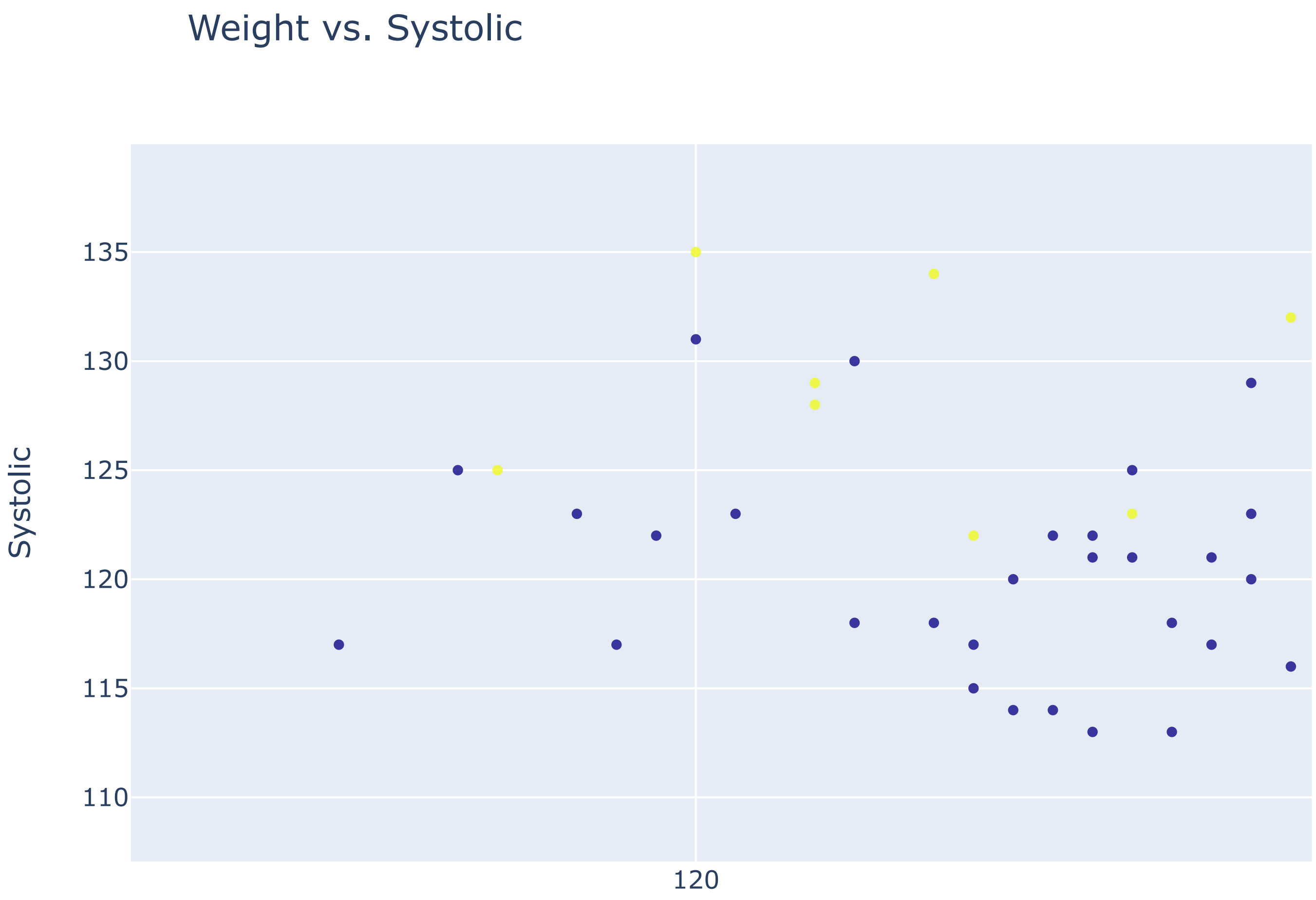
```
px.histogram(Patients_df, x='Smoker', color='Gender', title='Smoker')
```



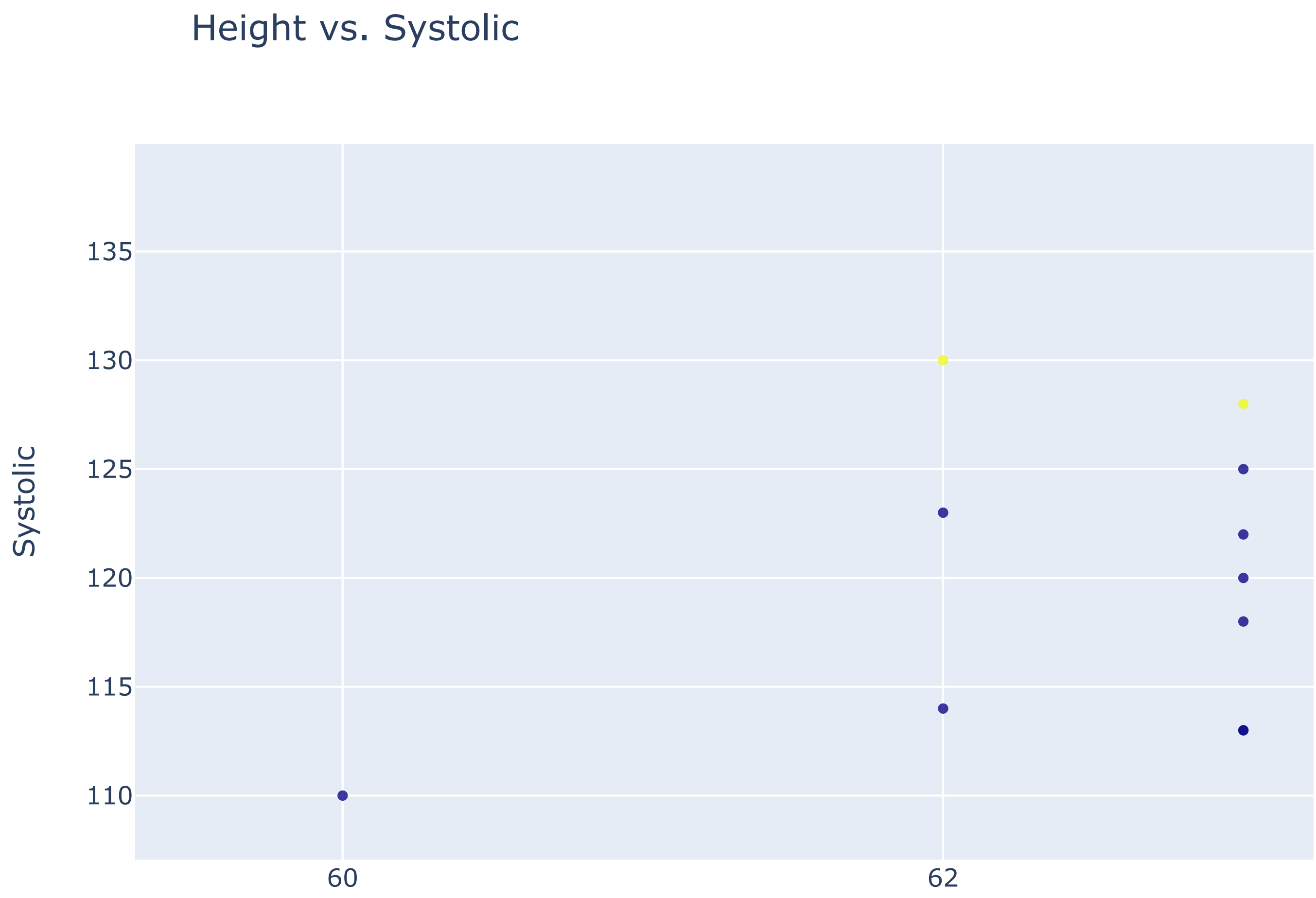
```
fig·=·px.scatter(Patients_df,·
·················x='Age',·
·················y='Systolic',·
·················color='Smoker',·
·················opacity=0.8,·
·················hover_data=['Gender'],·
·················title='Age·vs.·Systolic')
fig.update_traces(marker_size=5)
fig.show()
```



```
fig·=·px.scatter(Patients_df,·
·················x='Weight',·
·················y='Systolic',·
·················color='Smoker',·
·················opacity=0.8,·
·················hover_data=['Gender'],·
·················title='Weight·vs.·Systolic')
fig.update_traces(marker_size=5)
fig.show()
```



```
fig = px.scatter(Patients_df,
                 x='Height',
                 y='Systolic',
                 color='Smoker',
                 opacity=0.8,
                 hover_data=['Gender'],
                 title='Height vs. Systolic')
fig.update_traces(marker_size=5)
fig.show()
```



```
Patients_df.Systolic.corr(Patients_df.Age)
```

```
    0.134126990051016
```

```
Patients_df.Systolic.corr(Patients_df.Weight)
```

```
0.15578811264461603
```

```
Patients_df.Systolic.corr(Patients_df.Height)
```

```
0.21407555251019653
```

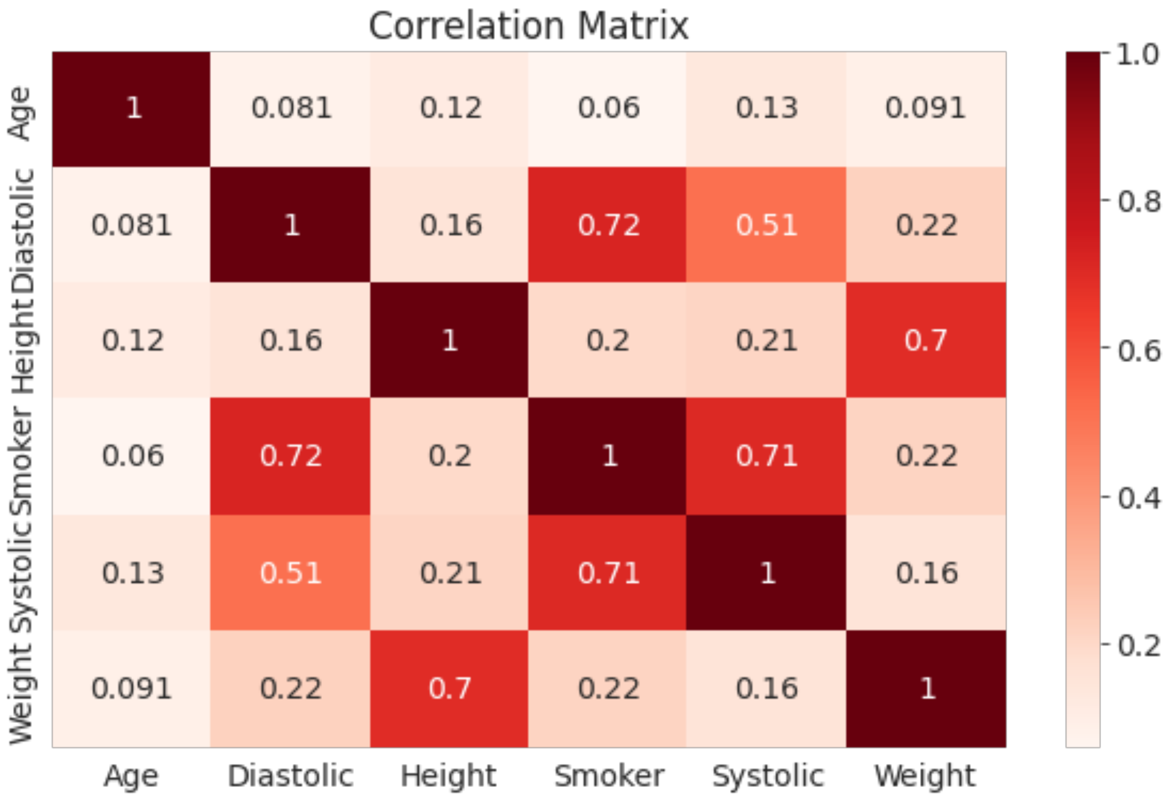
```
smoker_values·=·{'no':·0,·'yes':·1}
smoker_numeric·=·Patients_df.Smoker.map(smoker_values)
Patients_df.Systolic.corr(Patients_df.Smoker)
```

```
0.7063229808258187
```

```
Patients_df.corr()
```

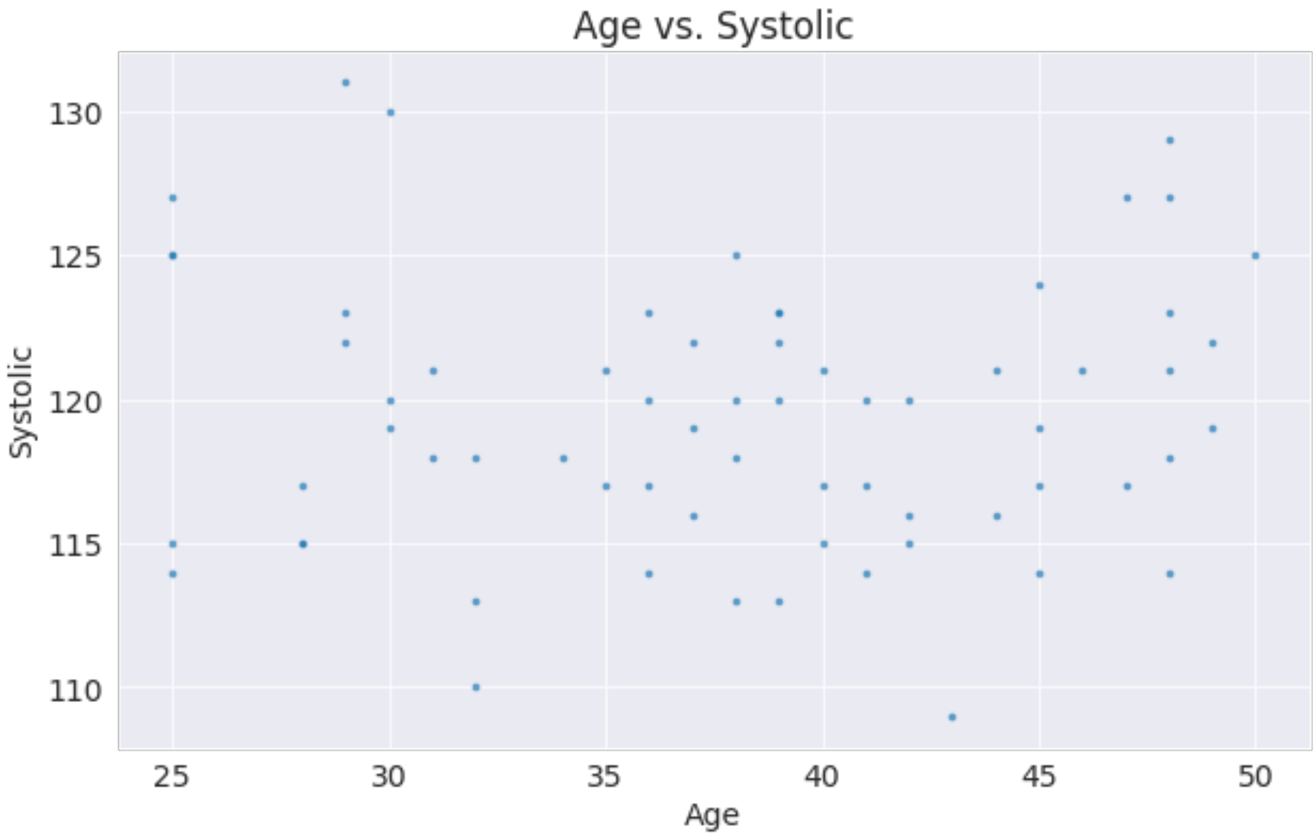
| | Age | Diastolic | Height | Smoker | Systolic | Weight |
|---|---|---|---|---|---|---|
| **Age** | 1.000000 | 0.080597 | 0.116002 | 0.060220 | 0.134127 | 0.091356 |
| **Diastolic** | 0.080597 | 1.000000 | 0.156819 | 0.723365 | 0.511843 | 0.222687 |
| **Height** | 0.116002 | 0.156819 | 1.000000 | 0.199114 | 0.214076 | 0.695970 |
| **Smoker** | 0.060220 | 0.723365 | 0.199114 | 1.000000 | 0.706323 | 0.215586 |
| **Systolic** | 0.134127 | 0.511843 | 0.214076 | 0.706323 | 1.000000 | 0.155788 |
| **Weight** | 0.091356 | 0.222687 | 0.695970 | 0.215586 | 0.155788 | 1.000000 |

```
sns.heatmap(Patients_df.corr(), cmap='Reds', annot=True)
plt.title('Correlation Matrix');
```



```
non_smoker_df = Patients_df[Patients_df.Smoker == 0]
```

```
plt.title('Age vs. Systolic')
sns.scatterplot(data=non_smoker_df, x='Age', y='Systolic', alpha=0.7, s=15);
```



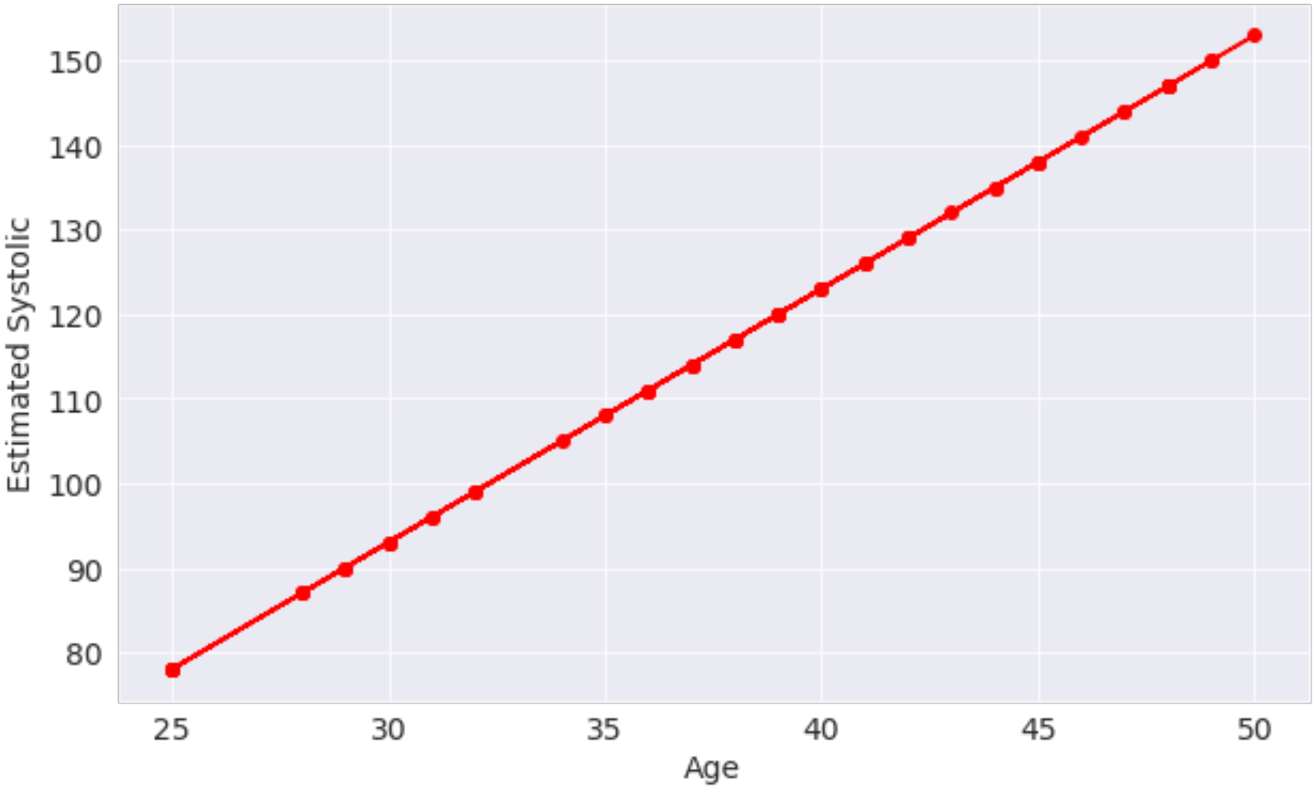
```
def estimate_Systolic(Age, w, b):
    return w * Age + b
```

```
w = 2
b = 30
```

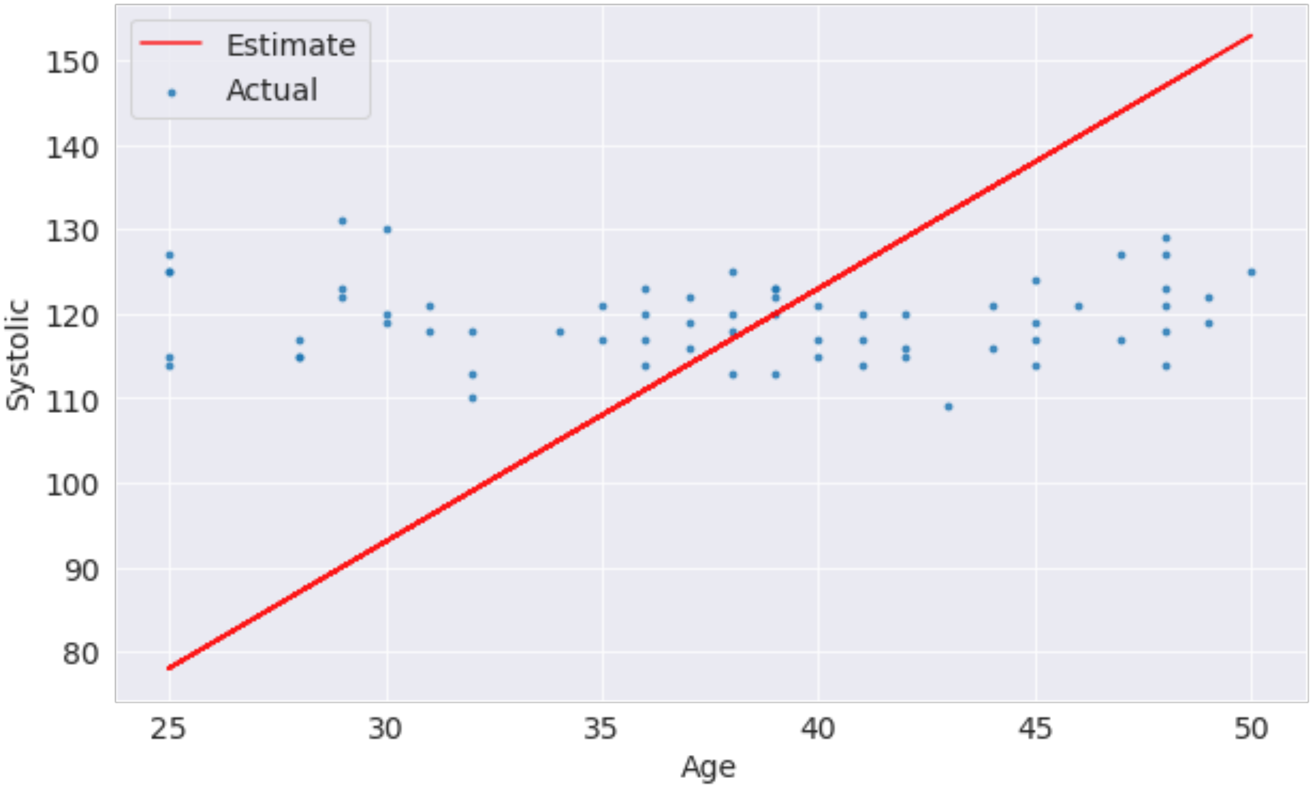
```
w·=·3
b·=·3
```

```
Ages = non_smoker_df.Age
estimated_Systolic = estimate_Systolic(Ages, w, b)
```

```
plt.plot(Ages, estimated_Systolic, 'r-o');
plt.xlabel('Age');
plt.ylabel('Estimated Systolic');
```

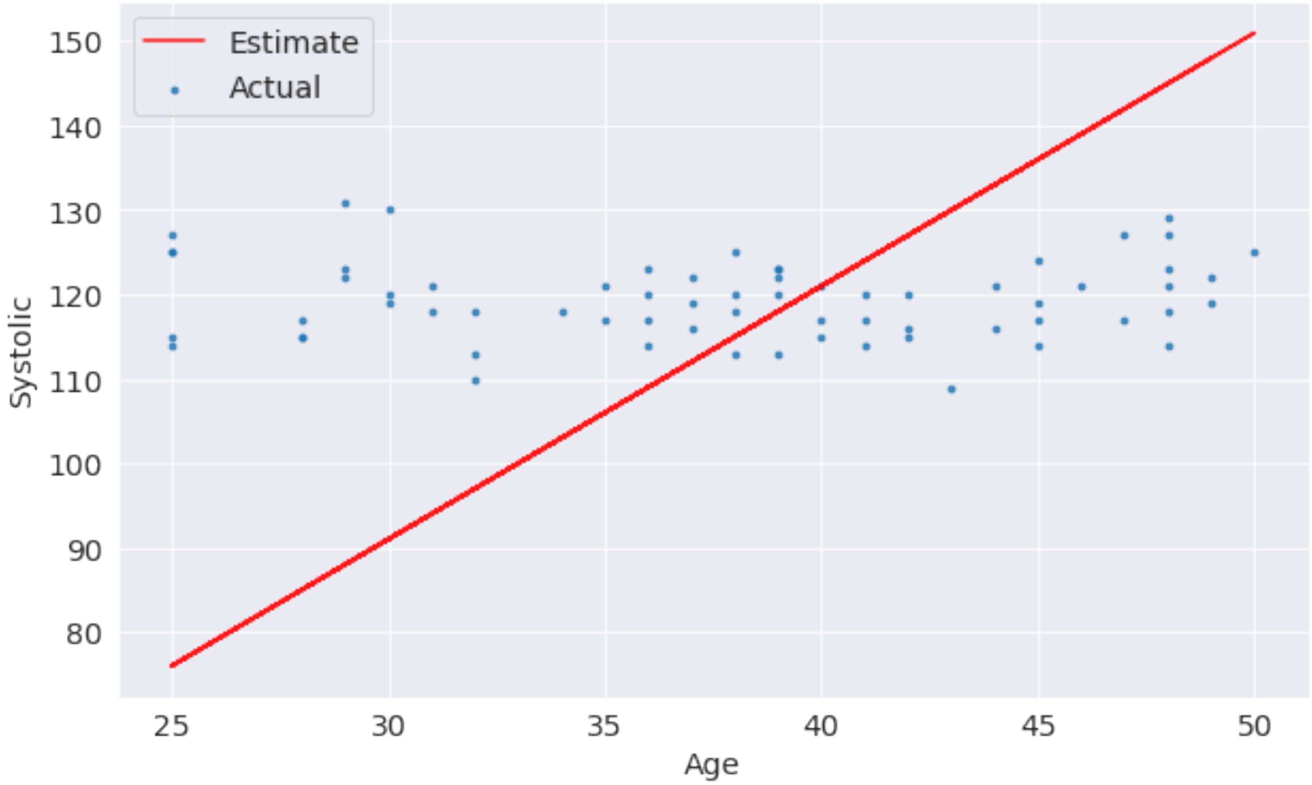


```
target = non_smoker_df.Systolic

plt.plot(Ages, estimated_Systolic, 'r', alpha=0.9);
plt.scatter(Ages, target, s=8,alpha=0.8);
plt.xlabel('Age');
plt.ylabel('Systolic')
plt.legend(['Estimate', 'Actual']);
```



```
def try_parameters(w, b):
    Ages = non_smoker_df.Age
    target = non_smoker_df.Systolic

    estimated_Systolic = estimate_Systolic(Ages, w, b)

    plt.plot(Ages, estimated_Systolic, 'r', alpha=0.9);
    plt.scatter(Ages, target, s=8,alpha=0.8);
    plt.xlabel('Age');
    plt.ylabel('Systolic')
    plt.legend(['Estimate', 'Actual']);
```

```
try_parameters(3, 1)
```



```
import numpy as np
```

```
def rmse(targets, predictions):
    return np.sqrt(np.mean(np.square(targets - predictions)))
```

```
w = 3
b = 3
```

```
targets = non_smoker_df['Systolic']
predicted = estimate_Systolic(non_smoker_df.Age, w, b)
```

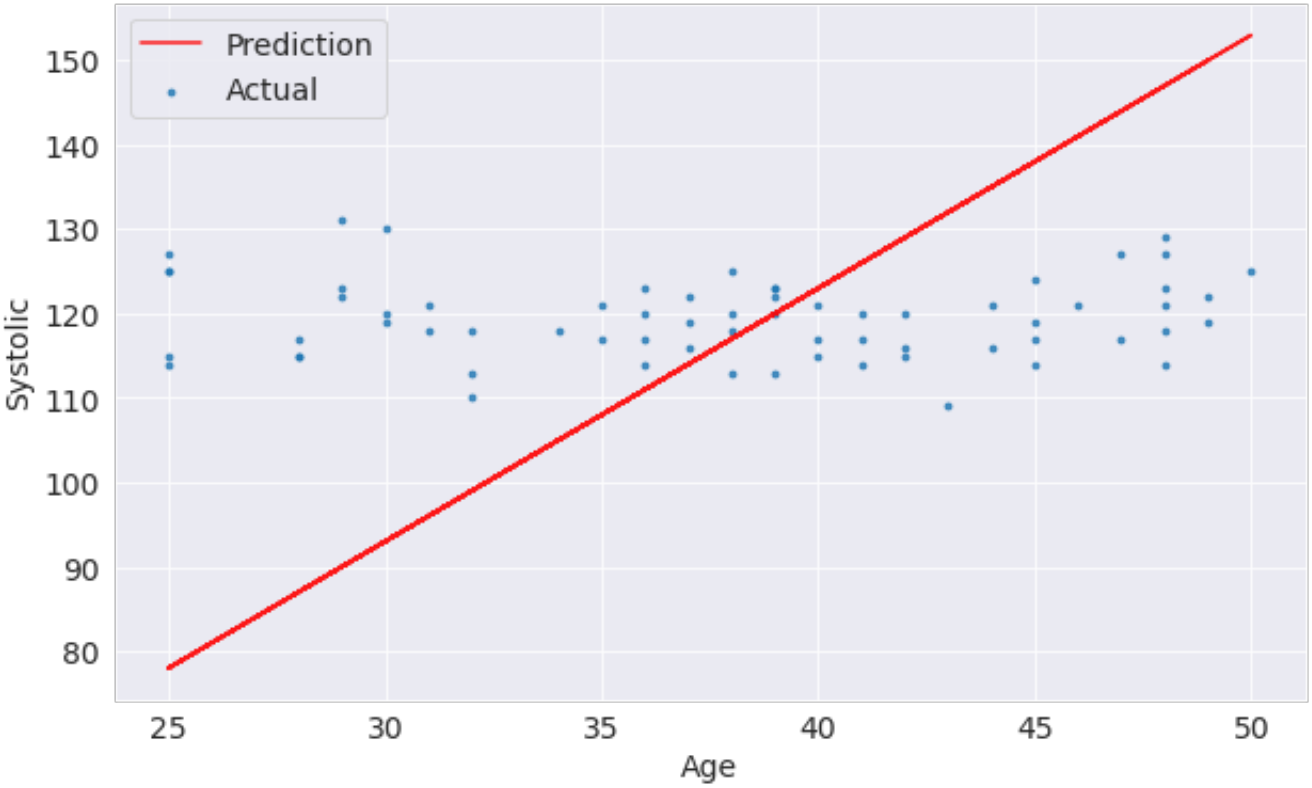
```
rmse(targets, predicted)
```

```
    22.215882934185952
```

```
def try_parameters(w, b):
    Ages = non_smoker_df.Age
    target = non_smoker_df.Systolic
    predictions = estimate_Systolic(Ages, w, b)

    plt.plot(Ages, predictions, 'r', alpha=0.9);
    plt.scatter(Ages, target, s=8,alpha=0.8);
    plt.xlabel('Age');
    plt.ylabel('Systolic')
    plt.legend(['Prediction', 'Actual']);

    loss = rmse(target, predictions)
    print("RMSE Loss: ", loss)
```

```
try_parameters(3, 3)
```

```
RMSE Loss:  22.215882934185952
```



```
!pip install scikit-learn --quiet
```

```
from sklearn.linear_model import LinearRegression
```

```
model = LinearRegression()
```

```
help(model.fit)
```

```
    Help on method fit in module sklearn.linear_model._base:

    fit(X, y, sample_weight=None) method of sklearn.linear_model._base.LinearRegr
        Fit linear model.

        Parameters
        ----------
        X : {array-like, sparse matrix} of shape (n_samples, n_features)
            Training data

        y : array-like of shape (n_samples,) or (n_samples, n_targets)
            Target values. Will be cast to X's dtype if necessary

        sample_weight : array-like of shape (n_samples,), default=None
            Individual weights for each sample

            .. versionadded:: 0.17
               parameter *sample_weight* support to LinearRegression.

        Returns
        -------
        self : returns an instance of self.
```

```
inputs = Patients_df[['Age']]
targets = Patients_df.Systolic
print('inputs.shape :', inputs.shape)
print('targes.shape :', targets.shape)
```

```
    inputs.shape : (100, 1)
    targes.shape : (100,)
```

```
model.fit(inputs, targets)
```

```
    LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=Fals
model.predict(np.array([[25],
                        [36],
                        [50]]))
```

```
array([121.12285998, 122.49549102, 124.24247598])
```

```
predictions = model.predict(inputs)
```

```
predictions
```

```
array([122.7450603 , 123.3689835 , 122.7450603 , 122.99462958,
       124.11769134, 123.74333742, 122.1211371 , 122.99462958,
       121.4972139 , 121.87156782, 123.61855278, 123.24419886,
       121.12285998, 122.86984494, 122.49549102, 123.9929067 ,
       121.99635246, 121.37242926, 122.62027566, 124.24247598,
       123.9929067 , 122.86984494, 123.11941422, 123.49376814,
       121.4972139 , 121.12285998, 122.86984494, 121.12285998,
       122.49549102, 121.74678318, 123.61855278, 122.99462958,
       121.12285998, 123.86812206, 123.49376814, 123.9929067 ,
       123.49376814, 122.37070638, 122.1211371 , 122.7450603 ,
       122.86984494, 123.49376814, 123.49376814, 122.62027566,
       123.61855278, 122.62027566, 121.74678318, 122.86984494,
       123.24419886, 123.24419886, 124.11769134, 123.49376814,
       123.3689835 , 123.86812206, 124.24247598, 122.7450603 ,
       123.11941422, 123.61855278, 122.49549102, 122.7450603 ,
       121.62199854, 121.4972139 , 121.74678318, 121.4972139 ,
       121.62199854, 122.49549102, 123.61855278, 121.99635246,
       121.87156782, 123.9929067 , 121.12285998, 122.99462958,
       122.86984494, 123.11941422, 122.1211371 , 121.87156782,
       122.37070638, 121.99635246, 123.24419886, 123.9929067 ,
       122.24592174, 122.86984494, 121.4972139 , 121.62199854,
       121.99635246, 122.86984494, 122.62027566, 124.11769134,
       121.87156782, 122.62027566, 122.7450603 , 123.61855278,
       121.74678318, 123.9929067 , 123.9929067 , 121.12285998,
       123.49376814, 124.11769134, 123.61855278, 123.9929067 ])
```

```
rmse(targets, predictions)
```

```
6.61883940804608
```

```
# w
model.coef_
```

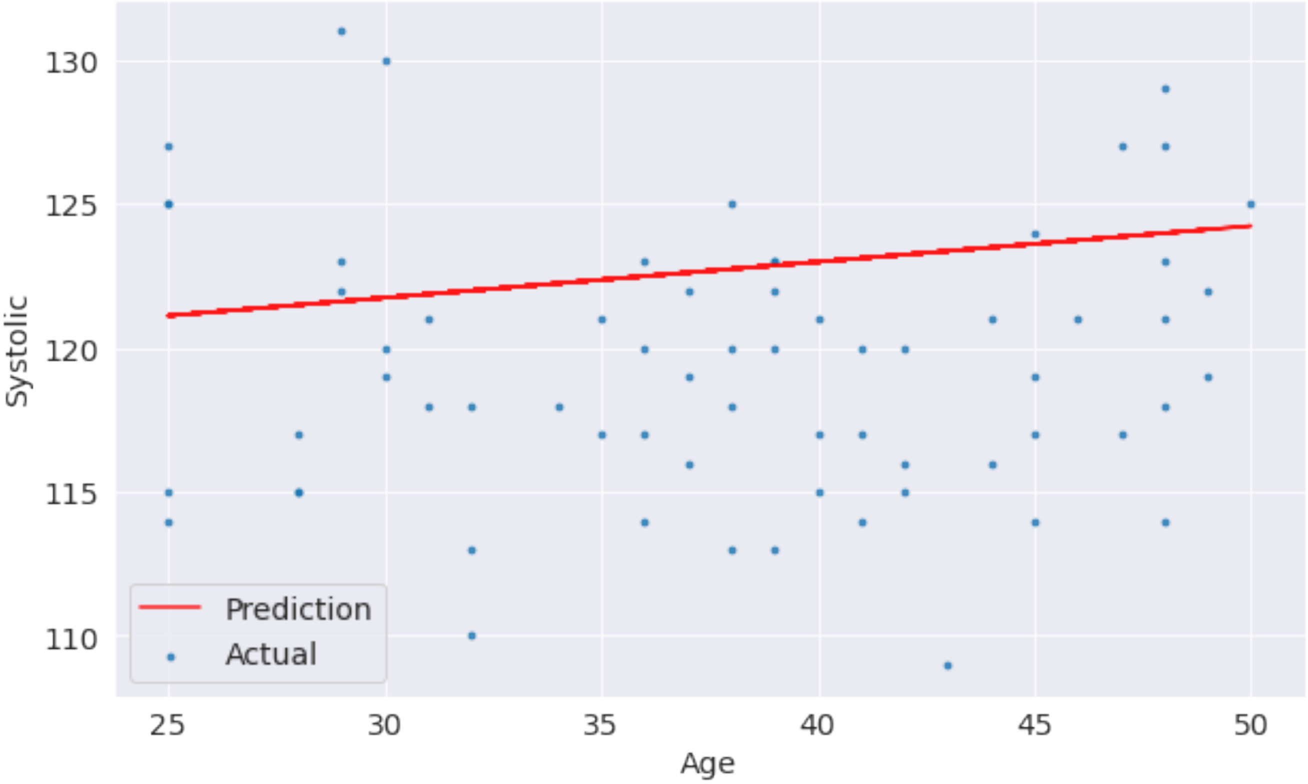
```
array([0.12478464])
```

```
# b
model.intercept_
```

```
118.00324398156053
```

```
try_parameters(model.coef_, model.intercept_)
```

```
RMSE Loss:  5.775580444342182
```



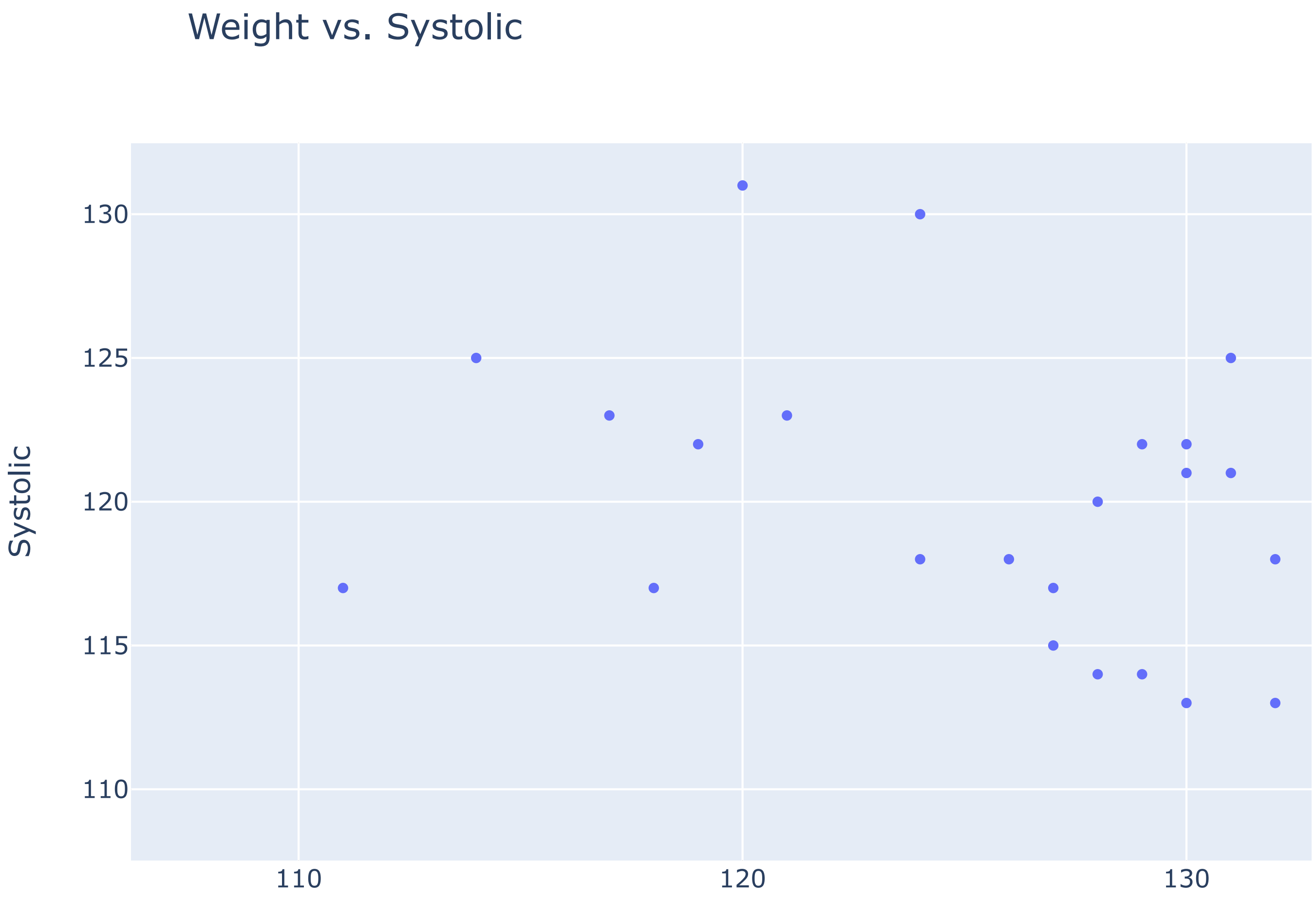
```
# Create inputs and targets
inputs, targets = Patients_df[['Age', 'Weight']], Patients_df['Systolic']

# Create and train the model
model = LinearRegression().fit(inputs, targets)

# Generate predictions
predictions = model.predict(inputs)

# Compute loss to evalute the model
loss = rmse(targets, predictions)
print('Loss:', loss)
```

```
    Loss: 6.548450284122202
```

```
non_smoker_df.Systolic.corr(non_smoker_df.Weight)
```

```
    -0.030177610486751022
```

```
fig = px.scatter(non_smoker_df, x='Weight', y='Systolic', title='Weight vs. Systol
fig.update_traces(marker_size=5)
fig.show()
```



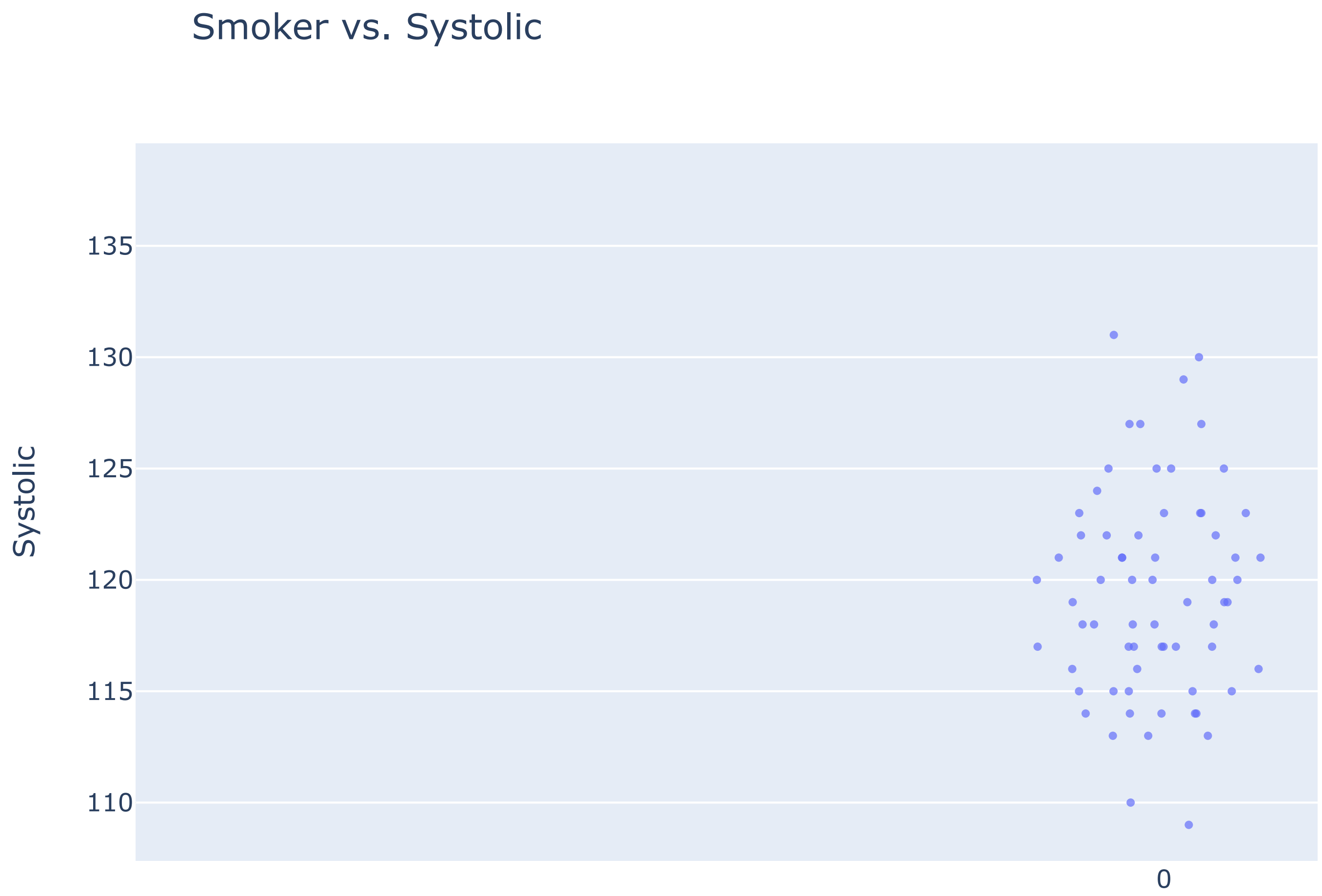
```
model.coef_, model.intercept_
```

```
    (array([0.11248253, 0.03656693]), 112.84286158185228)
```

```
Patients_df.Systolic.corr(Patients_df.Smoker)
```

```
    0.7063229808258187
```

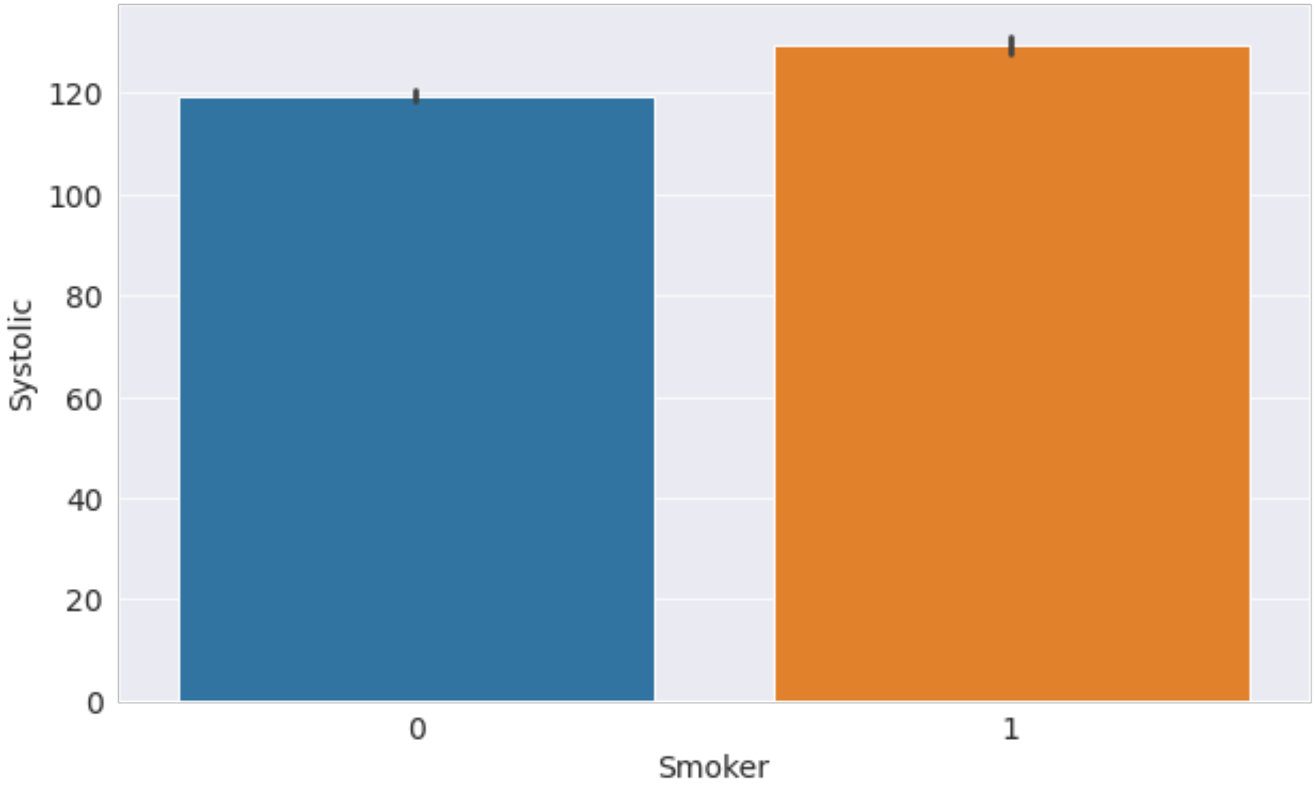
```
fig = px.strip(Patients_df, x='Smoker', y='Systolic', title= "Smoker vs. Systolic"
fig.update_traces(marker_size=4, marker_opacity=0.7)
fig.show()
```



```
# Create inputs and targets
inputs, targets = Patients_df[['Age', 'Weight', 'Smoker']], Patients_df['Systolic'

# Create and train the model
model = LinearRegression().fit(inputs, targets)

# Generate predictions
predictions = model.predict(inputs)

# Compute loss to evalute the model
loss = rmse(targets, predictions)
print('Loss:', loss)
```

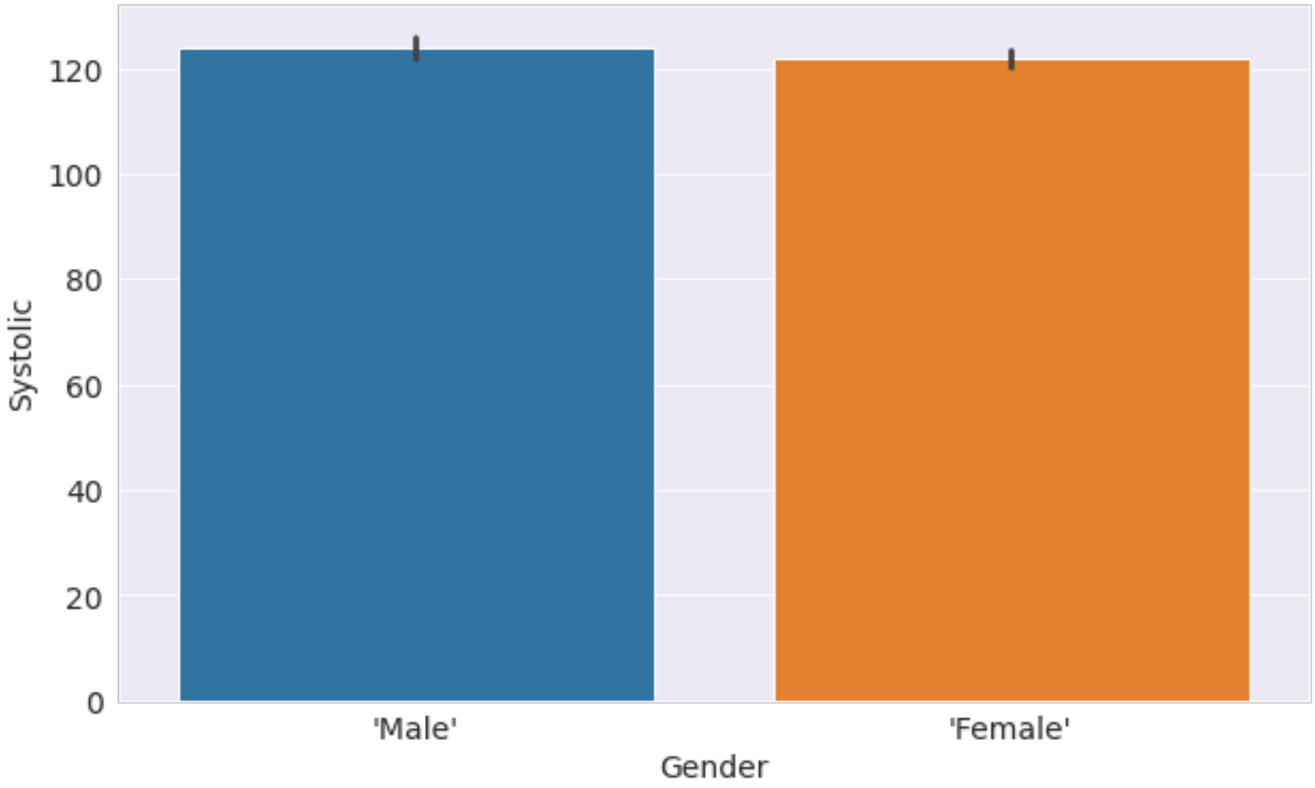
```
    Loss: 4.688172988059595
```

```
sns.barplot(data=Patients_df, x='Smoker', y='Systolic');
```



```
sns.barplot(data=Patients_df, x='Gender', y='Systolic')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb7f56d1310>
```



```
Patients_df
```

| | Age | Diastolic | Gender | Height | LastName | Location | SelfAssessedHealthStatu |
|---|---|---|---|---|---|---|---|
| **0** | 38 | 93 | 'Male' | 71 | 'Smith' | 'County General Hospital' | 'Excellen |
| **1** | 43 | 77 | 'Male' | 69 | 'Johnson' | 'VA Hospital' | 'Fa |
| **2** | 38 | 83 | 'Female' | 64 | 'Williams' | 'St. Mary's Medical Center' | 'Goo |
| **3** | 40 | 75 | 'Female' | 67 | 'Jones' | 'VA Hospital' | 'Fa |
| **4** | 49 | 80 | 'Female' | 64 | 'Brown' | 'County General Hospital' | 'Goo |
| **...** | ... | ... | ... | ... | ... | ... | |
| **95** | 25 | 99 | 'Male' | 69 | 'Alexander' | 'County General Hospital' | 'Goo |

```
sex_codes = {'Female': 1, 'Male': 0}
```

```
Patients_df['sex_code'] = Patients_df.Gender.map(sex_codes)
```

```
Patients_df
```

| | Age | Diastolic | Gender | Height | LastName | Location | SelfAssessedHealthStatu |
|---|---|---|---|---|---|---|---|
| **0** | 38 | 93 | 'Male' | 71 | 'Smith' | 'County General Hospital' | 'Exceller |
| **1** | 43 | 77 | 'Male' | 69 | 'Johnson' | 'VA Hospital' | 'Fa |
| **2** | 38 | 83 | 'Female' | 64 | 'Williams' | 'St. Mary's Medical Center' | 'Goc |
| **3** | 40 | 75 | 'Female' | 67 | 'Jones' | 'VA Hospital' | 'Fa |
| **4** | 49 | 80 | 'Female' | 64 | 'Brown' | 'County General Hospital' | 'Goc |
| **...** | ... | ... | ... | ... | ... | ... | |
| **95** | 25 | 99 | 'Male' | 69 | 'Alexander' | 'County General Hospital' | 'Goc |

```
from sklearn import preprocessing
label = preprocessing.LabelEncoder()

Patients_df['Gender']= label.fit_transform(Patients_df['Gender'])
print(Patients_df['Gender'].unique())
```

```
[1 0]
```

```
Patients_df
```

```
    Age  Diastolic  Gender  Height    LastName    Location  SelfAssessedHealthStatu
                                                  'County
0    38         93       1      71     'Smith'    General                 'Exceller
                                                 Hospital'
                                                      'VA
1    43         77       1      69   'Johnson'   Hospital'                     'Fa
                                                'St. Mary's
2    38         83       0      64  'Williams'    Medical                    'Goo
                                                  Center'
                                                      'VA
3    40         75       0      67     'Jones'   Hospital'                     'Fa
                                                  'County
4    49         80       0      64     'Brown'    General                    'Goo
                                                 Hospital'
...  ...       ...     ...     ...        ...         ...
                                                  'County
95   25         99       1      69 'Alexander'    General                    'Goo
                                                 Hospital'
```

```
Patients_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 100 entries, 0 to 99
Data columns (total 11 columns):
 #   Column                    Non-Null Count  Dtype  
---  ------                    --------------  -----  
 0   Age                       100 non-null    int64  
 1   Diastolic                 100 non-null    int64  
 2   Gender                    100 non-null    int64  
 3   Height                    100 non-null    int64  
 4   LastName                  100 non-null    object 
 5   Location                  100 non-null    object 
 6   SelfAssessedHealthStatus  100 non-null    object 
 7   Smoker                    100 non-null    int64  
 8   Systolic                  100 non-null    int64  
 9   Weight                    100 non-null    int64  
 10  sex_code                  0 non-null      float64
dtypes: float64(1), int64(7), object(3)
memory usage: 8.7+ KB
```

```
from sklearn.preprocessing import OneHotEncoder
from sklearn import preprocessing
Gender = ['Female', 'Male']
Location = ['County General Hospital', 'VA Hospital', "St. Mary's Medical Center"]
SelfAssessedHealthStatus = ['Fair', 'Good', 'Excellent']
enc = preprocessing.OneHotEncoder(categories=[Gender,Location,SelfAssessedHealthSt
X = [['Male', 'County General Hospital', 'Fair'], ['Female', 'VA Hospital', 'Good'
enc.fit(X)
OneHotEncoder(categories=[['Female', 'Male'],
                          ['County General Hospital', 'VA Hospital', "St. Mary's M
                          ['Fair', 'Good', 'Excellent']])
enc.transform([['Female', 'VA Hospital', 'Good']]).toarray()
```

```
array([[1., 0., 0., 1., 0., 0., 1., 0.]])
```

```
from sklearn import preprocessing
enc = preprocessing.OneHotEncoder()
enc.fit(Patients_df[['Location']])
enc.categories_
```

```
[array(["'County General Hospital'", "'St. Mary's Medical Center'",
        "'VA Hospital'"], dtype=object)]
```

```
one_hot = enc.transform(Patients_df[['Location']]).toarray()
one_hot
```

```
       [0., 0., 1.],
       [0., 0., 1.],
       [0., 0., 1.],
       [0., 0., 1.],
       [1., 0., 0.],
       [0., 0., 1.],
       [1., 0., 0.],
       [1., 0., 0.],
       [1., 0., 0.],
       [1., 0., 0.],
       [0., 1., 0.],
       [1., 0., 0.],
       [0., 0., 1.],
       [0., 0., 1.],
       [0., 0., 1.],
       [0., 1., 0.],
       [0., 1., 0.],
       [0., 0., 1.],
       [0., 1., 0.],
       [1., 0., 0.],
       [0., 0., 1.],
       [1., 0., 0.],
       [1., 0., 0.],
       [0., 0., 1.],
       [0., 1., 0.],
       [1., 0., 0.],
       [1., 0., 0.],
       [0., 0., 1.],
       [1., 0., 0.],
       [1., 0., 0.],
       [0., 0., 1.],
       [0., 1., 0.],
       [0., 1., 0.],
       [0., 1., 0.],
       [0., 0., 1.],
       [1., 0., 0.],
       [0., 1., 0.],
       [1., 0., 0.],
       [0., 0., 1.],
       [0., 1., 0.],
       [0., 0., 1.],
       [1., 0., 0.],
       [0., 1., 0.],
       [0., 0., 1.],
       [1., 0., 0.],
       [1., 0., 0.],
       [1., 0., 0.],
       [0., 0., 1.],
       [0., 1., 0.],
       [1., 0., 0.],
       [0., 0., 1.],
       [0., 1., 0.],
       [1., 0., 0.],
       [1., 0., 0.],
       [1., 0., 0.],
       [0., 0., 1.],
       [1., 0., 0.],
       [1., 0., 0.],
       [1., 0., 0.]])
```

```
Patients_df[['County·General·Hospital',·'VA·Hospital',·"St.·Mary's·Medical·Center"
```

```
Patients_df
```

|  | Age | Diastolic | Gender | Height | LastName | Location | SelfAssessedHealthStatu |
|---|---|---|---|---|---|---|---|
| **0** | 38 | 93 | 1 | 71 | 'Smith' | 'County General Hospital' | 'Exceller |
| **1** | 43 | 77 | 1 | 69 | 'Johnson' | 'VA Hospital' | 'Fa |
| **2** | 38 | 83 | 0 | 64 | 'Williams' | 'St. Mary's Medical Center' | 'Goo |
| **3** | 40 | 75 | 0 | 67 | 'Jones' | 'VA Hospital' | 'Fa |
| **4** | 49 | 80 | 0 | 64 | 'Brown' | 'County General Hospital' | 'Goo |
| **...** | ... | ... | ... | ... | ... | ... |  |

```
from sklearn import preprocessing
enc = preprocessing.OneHotEncoder()
enc.fit(Patients_df[['SelfAssessedHealthStatus']])
enc.categories_
```

```
[array(["'Excellent'", "'Fair'", "'Good'", "'Poor'"], dtype=object)]
```

```
one_hot = enc.transform(Patients_df[['SelfAssessedHealthStatus']]).toarray()
one_hot
```

```
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [0., 1., 0., 0.],
       [0., 0., 0., 1.],
       [0., 0., 1., 0.],
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [0., 0., 0., 1.],
       [0., 0., 1., 0.]
       [0., 0., 1., 0.],
       [0., 0., 0., 1.],
       [1., 0., 0., 0.],
       [1., 0., 0., 0.],
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [0., 0., 1., 0.],
       [0., 0., 1., 0.],
       [0., 0., 1., 0.],
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [1., 0., 0., 0.],
       [1., 0., 0., 0.],
       [1., 0., 0., 0.],
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [0., 1., 0., 0.],
       [1., 0., 0., 0.],
       [0., 0., 0., 1.],
       [1., 0., 0., 0.],
       [0., 1., 0., 0.],
       [0., 1., 0., 0.],
       [0., 0., 0., 1.],
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [0., 0., 1., 0.],
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [0., 0., 1., 0.],
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [0., 0., 0., 1.],
       [0., 0., 1., 0.],
       [0., 0., 1., 0.],
       [0., 0., 1., 0.],
       [1., 0., 0., 0.],
       [1., 0., 0., 0.],
       [0., 1., 0., 0.],
       [0., 0., 1., 0.],
       [1., 0., 0., 0.],
       [0., 0., 1., 0.],
       [0., 0., 1., 0.],
       [0., 1., 0., 0.],
       [0., 0., 1., 0.],
       [0., 1., 0., 0.]])
```

```
Patients_df[['Excellent', 'Fair', 'Good', 'Poor']] = one_hot

Patients_df =Patients_df.dropna(axis=1)

Patients_df
```

| | Age | Diastolic | Gender | Height | LastName | Location | SelfAssessedHealthStatu |
|---|---|---|---|---|---|---|---|
| **0** | 38 | 93 | 1 | 71 | 'Smith' | 'County General Hospital' | 'Exceller |
| **1** | 43 | 77 | 1 | 69 | 'Johnson' | 'VA Hospital' | 'Fa |
| **2** | 38 | 83 | 0 | 64 | 'Williams' | 'St. Mary's Medical Center' | 'Goo |
| **3** | 40 | 75 | 0 | 67 | 'Jones' | 'VA Hospital' | 'Fa |
| **4** | 49 | 80 | 0 | 64 | 'Brown' | 'County General Hospital' | 'Goo |
| **...** | ... | ... | ... | ... | ... | ... | |

```
# Create inputs and targets

inputs, targets = Patients_df[['Age', 'Weight', 'Smoker','Gender', 'County·General

# Create and train the model
model = LinearRegression().fit(inputs, targets)


# Generate predictions
predictions = model.predict(inputs)

# Compute loss to evalute the model
loss = rmse(targets, predictions)
print('Loss:', loss)
```

```
    Loss: 4.530621990685625
```

```
Patients_df.isnull().sum()
```

```
    Age                          0
    Diastolic                    0
    Gender                       0
    Height                       0
    LastName                     0
    Location                     0
    SelfAssessedHealthStatus     0
    Smoker                       0
    Systolic                     0
    Weight                       0
    County General Hospital      0
    VA Hospital                  0
    St. Mary's Medical Center    0
    Excellent                    0
    Fair                         0
    Good                         0
    Poor                         0
    dtype: int64
```

```
model.coef_
```

```
    array([ 0.09132731, -0.01515041,  9.87541468,  0.5488521 ,  0.57694361,
            0.17733968, -0.75428329,  0.55602622,  0.77978667, -2.11802701,
            0.78221412])
```

```
model.intercept_
```

```
    117.74376452559399
```

```
from sklearn.preprocessing import StandardScaler
```

```
numeric_cols = ['Age', 'Weight', 'Height']
scaler = StandardScaler()
scaler.fit(Patients_df[numeric_cols])
```

```
    StandardScaler(copy=True, with_mean=True, with_std=True)
```

```
scaler.mean_
```

```
    array([ 38.28, 154.  ,  67.07])
```

```
scaler.var_
```

```
    array([ 51.5416, 698.98  ,   7.9651])
```

```
scaled_inputs = scaler.transform(Patients_df[numeric_cols])
scaled_inputs
```

```
           [ 0.79674084,  1.09689643,  0.68385132],
           [ 0.79674084,  0.56736022,  1.03817844],
           [-0.17829166,  1.51296059,  1.03817844],
           [ 0.9360312 ,  0.68083227, -0.0248029 ],
           [-0.17829166, -0.71865628, -0.73345712],
           [-1.15332416,  1.05907242,  0.32952421],
           [ 0.10028906, -1.24819249, -1.79643845],
           [ 0.51816013,  0.15129606,  1.03817844],
           [ 0.51816013,  0.94560037, -0.0248029 ],
           [ 1.49319263,  0.60518424,  0.32952421],
           [ 0.79674084, -0.68083227, -1.79643845],
           [ 0.65745049, -0.71865628, -1.08778423],
           [ 1.21461191, -0.2647681 , -0.37913001],
           [ 1.63248299,  1.21036847,  1.74683266],
           [-0.0390013 , -1.13472045, -1.44211134],
           [ 0.37886977, -0.7564803 , -0.37913001],
           [ 0.9360312 ,  0.60518424,  1.03817844],
           [-0.31758201,  0.98342439,  1.39250555],
           [-0.0390013 , -0.90777636,  0.32952421],
           [-1.29261451, -0.90777636, -1.44211134],
           [-1.43190487, -1.0212484 , -0.73345712],
           [-1.15332416, -0.49171219, -0.0248029 ],
           [-1.43190487, -1.62643264, -0.37913001],
           [-1.29261451, -0.7564803 ,  0.32952421],
           [-0.31758201,  1.32384052,  1.39250555],
           [ 0.9360312 , -0.64300825,  1.03817844],
           [-0.87474344, -0.68083227, -2.50509268],
           [-1.0140338 , -0.90777636, -1.08778423],
           [ 1.35390227, -0.64300825, -1.08778423],
           [-1.84977594,  1.21036847, -0.37913001],
           [ 0.23957941, -1.0212484 , -1.08778423],
           [ 0.10028906,  0.83212833,  1.74683266],
           [ 0.37886977, -1.0212484 , -0.73345712],
           [-0.73545309, -1.47513658, -0.0248029 ],
           [-1.0140338 ,  0.90777636,  1.74683266],
           [-0.45687237, -0.86995234, -1.08778423],
           [-0.87474344,  1.09689643,  0.32952421],
           [ 0.51816013,  1.51296059, -0.37913001],
           [ 1.35390227, -1.05907242, -1.08778423],
           [-0.59616273,  1.21036847,  0.32952421],
           [ 0.10028906,  1.2860165 ,  0.68385132],
           [-1.43190487,  1.32384052,  0.68385132],
           [-1.29261451, -1.2860165 , -1.08778423],
           [-0.87474344, -0.83212833, -1.44211134],
           [ 0.10028906,  1.05907242,  0.32952421],
           [-0.17829166, -1.2860165 , -0.73345712],
           [ 1.49319263, -1.17254446, -1.44211134],
           [-1.0140338 , -0.49171219, -0.37913001],
           [-0.17829166, -0.94560037, -0.73345712],
           [-0.0390013 ,  1.13472045,  0.32952421],
           [ 0.9360312 ,  1.0212484 ,  1.39250555],
           [-1.15332416, -1.13472045,  1.03817844],
           [ 1.35390227,  0.7564803 ,  1.39250555],
           [ 1.35390227, -0.7564803 , -0.37913001],
           [-1.84977594,  0.64300825,  0.68385132],
           [ 0.79674084,  1.2860165 ,  0.68385132],
           [ 1.49319263,  1.21036847,  1.03817844],
           [ 0.9360312 ,  0.68083227,  0.32952421],
           [ 1.35390227,  0.86995234, -0.37913001]])
```

```
cat_cols = ['Gender','Smoker','County General Hospital','VA Hospital',"St. Mary's
categorical_data = Patients_df[cat_cols].values
```

```
inputs = np.concatenate((scaled_inputs, categorical_data), axis=1)
targets = Patients_df.Systolic

# Create and train the model
model = LinearRegression().fit(inputs, targets)

# Generate predictions
predictions = model.predict(inputs)

# Compute loss to evalute the model
loss = rmse(targets, predictions)
print('Loss:', loss)
```

```
    Loss: 4.445982271245141
```

```
Weights_df = pd.DataFrame({
    'feature': np.append(numeric_cols + cat_cols, 1),
    'weight': np.append(model.coef_, model.intercept_)
})
Weights_df.sort_values('weight', ascending=False)
```

| | feature | weight |
|---|---:|---:|
| **12** | 1 | 119.871389 |
| **4** | Smoker | 9.673087 |
| **2** | Height | 1.325387 |
| **9** | Good | 1.012690 |
| **11** | Poor | 0.885655 |
| **5** | County General Hospital | 0.863780 |
| **0** | Age | 0.576204 |
| **8** | Excellent | 0.426312 |
| **6** | VA Hospital | 0.007280 |
| **1** | Weight | -0.354757 |
| **7** | St. Mary's Medical Center | -0.871060 |
| **3** | Gender | -1.479391 |
| **10** | Fair | -2.324657 |

```
from sklearn.model_selection import train_test_split
```

```
inputs_train, inputs_test, targets_train, targets_test = train_test_split(inputs,
# Create and train the model
model = LinearRegression().fit(inputs_train, targets_train)

# Generate predictions
predictions_test = model.predict(inputs_test)

# Compute loss to evalute the model
loss = rmse(targets_test, predictions_test)
print('Test Loss:', loss)
```

```
    Test Loss: 4.20189185002708
```

```
# Generate predictions
predictions_train = model.predict(inputs_train)

# Compute loss to evalute the model
loss = rmse(targets_train, predictions_train)
print('Training Loss:', loss)
```

```
    Training Loss: 4.504253122353481
```

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