In [1]:
```
import os
os.getcwd()#my current path
```

Out[1]: 'C:\\Users\\sumit\\Data Science\\Live Project\\Projects end to end\\ML Height Prediction'

In [2]:
```
#os.chdir('D:\heightweight') #changing path
```

In [3]:
```
#importing eda libraries
import numpy as np  #math
import pandas as pd #excelent for data manuplation

#visualization
import matplotlib.pyplot as plt
import seaborn as sns

#preprocessing
from sklearn.preprocessing import StandardScaler

#spliting the data
from sklearn.model_selection import train_test_split

# importing Algorithms
from sklearn.linear_model import LinearRegression
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import RandomForestRegressor

#evalution matrics
from sklearn.metrics import mean_squared_error


```

In [4]:
```
df=pd.read_csv('SOCR-HeightWeight.csv') #reading csv file
```

In [5]:
```
df.head() #1 pound=453grams
```

Out[5]:

	Index	Height(Inches)	Weight(Pounds)
0	1	65.78331	112.9925
1	2	71.51521	136.4873
2	3	69.39874	153.0269
3	4	68.21660	142.3354
4	5	67.78781	144.2971

In [6]:
```
#converting weight pounds to kg
df['Weight_kg']=df['Weight(Pounds)']*0.453592

# Convert inches to the desired format (feet.inches)
df['Height(Feet.Inches)'] = df['Height(Inches)'] // 12 + (df['Height(In
```

In [7]:
```
df.describe()
```

Out[7]:

	Index	Height(Inches)	Weight(Pounds)	Weight_kg	Height(Feet.Inches)
count	25000.000000	25000.000000	25000.000000	25000.000000	25000.000000
mean	12500.500000	67.993114	127.079421	57.642209	5.795967
std	7217.022701	1.901679	11.660898	5.289290	0.183513
min	1.000000	60.278360	78.014760	35.386871	5.027836
25%	6250.750000	66.704397	119.308675	54.117461	5.670440
50%	12500.500000	67.995700	127.157750	57.677738	5.799570
75%	18750.250000	69.272958	134.892850	61.186318	5.927296
max	25000.000000	75.152800	170.924000	77.529759	6.315280

In [8]:
```
drop_col=['Index','Height(Inches)','Weight(Pounds)'] # selecting columr

#droping columns
df=df.drop(columns=drop_col,axis=1)
```

In [9]:
```
df.sample(3)
```

Out[9]:

	Weight_kg	Height(Feet.Inches)
15349	59.688217	5.781337
486	57.838967	5.926560
493	57.390773	5.602496

In [10]:
```
df.shape  #checking shape of the data
```

Out[10]:
```
(25000, 2)
```

In [11]:
```
df.isna().any() #checking null values
```

Out[11]:
```
Weight_kg              False
Height(Feet.Inches)    False
dtype: bool
```

In [12]:
```
df.dtypes #checking dtypes for our dataframe

```

Out[12]:
```
Weight_kg              float64
Height(Feet.Inches)    float64
dtype: object
```

In [13]:
```
df.corr() #correlation
```

Out[13]:

	Weight_kg	Height(Feet.Inches)
Weight_kg	1.000000	0.499192
Height(Feet.Inches)	0.499192	1.000000

In [14]:
```
df.describe()
```

Out[14]:

	Weight_kg	Height(Feet.Inches)
count	25000.000000	25000.000000
mean	57.642209	5.795967
std	5.289290	0.183513
min	35.386871	5.027836
25%	54.117461	5.670440
50%	57.677738	5.799570
75%	61.186318	5.927296
max	77.529759	6.315280

Mean:

The mean height is approximately 67.99 inches. The mean weight is approximately 127.08 pounds. Standard Deviation (Std):

The standard deviation for height is approximately 1.90 inches, indicating the spread or dispersion of heights around the mean. The standard deviation for weight is approximately 11.66 pounds, indicating the spread or dispersion of weights around the mean. Minimum and Maximum Values:

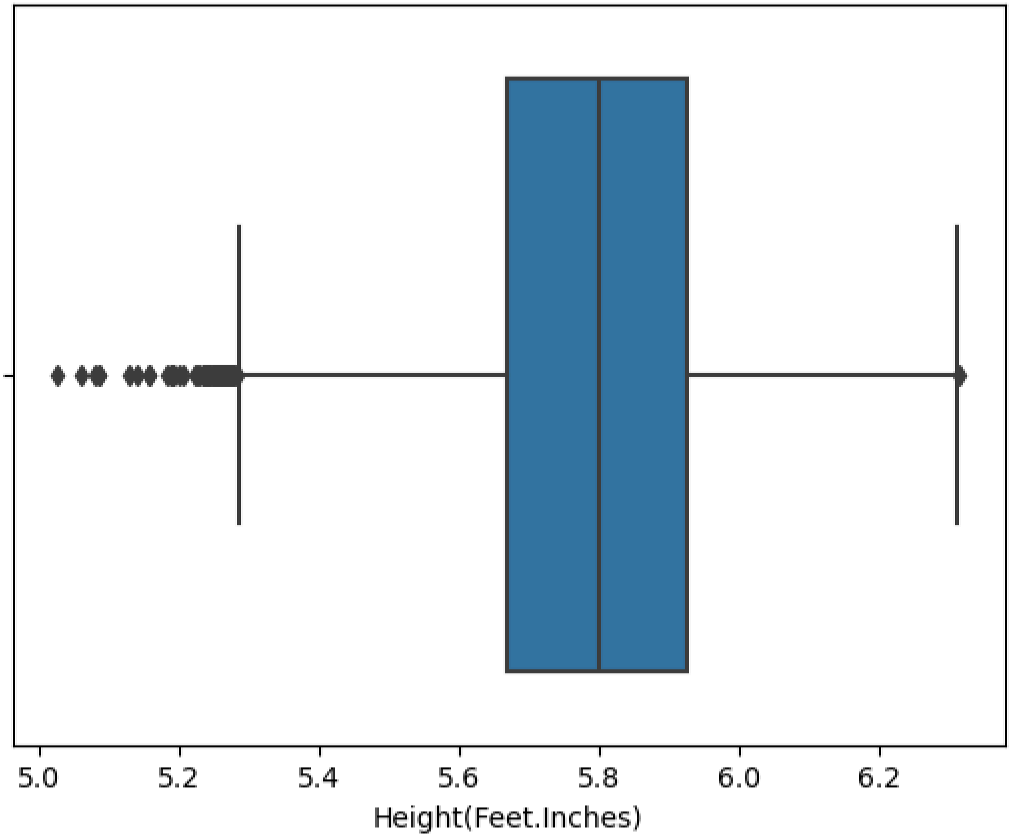
The minimum height recorded is approximately 60.28 inches, and the maximum height is approximately 75.15 inches. The minimum weight recorded is approximately 78.01 pounds, and the maximum weight is approximately 170.92 pounds. Percentiles (25th, 50th, and 75th):

The 25th percentile (Q1) indicates that 25% of the data falls below a height of approximately 66.70 inches and a weight of approximately 119.31 pounds. The 50th percentile (median) indicates that 50% of the data falls below a height of approximately 67.99 inches and a weight of approximately 127.16 pounds. The 75th percentile (Q3) indicates that 75% of the data falls below a height of approximately 69.27 inches and a weight of approximately 134.89 pounds.

Checking outliers using boxplot

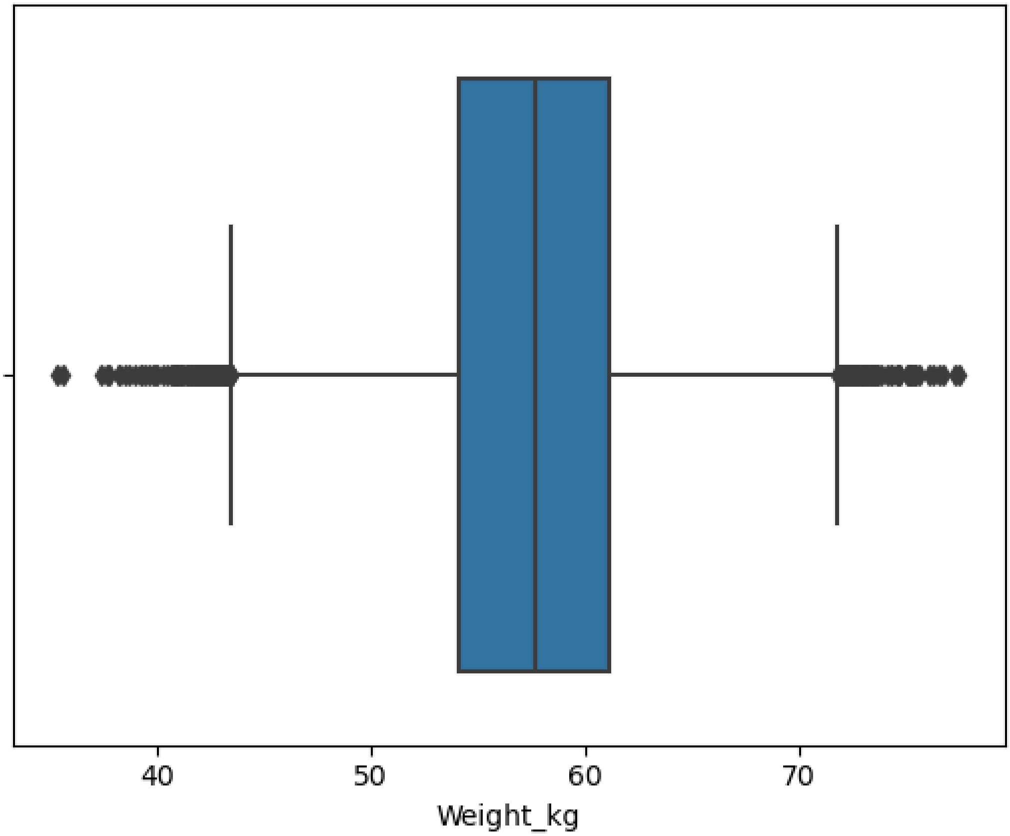
In [15]:
```
sns.boxplot(x=df['Height(Feet.Inches)'])
```

Out[15]: <Axes: xlabel='Height(Feet.Inches)'>



In [16]:
```
sns.boxplot(x=df['Weight_kg']) #checking outliers for
```

Out[16]: <Axes: xlabel='Weight_kg'>

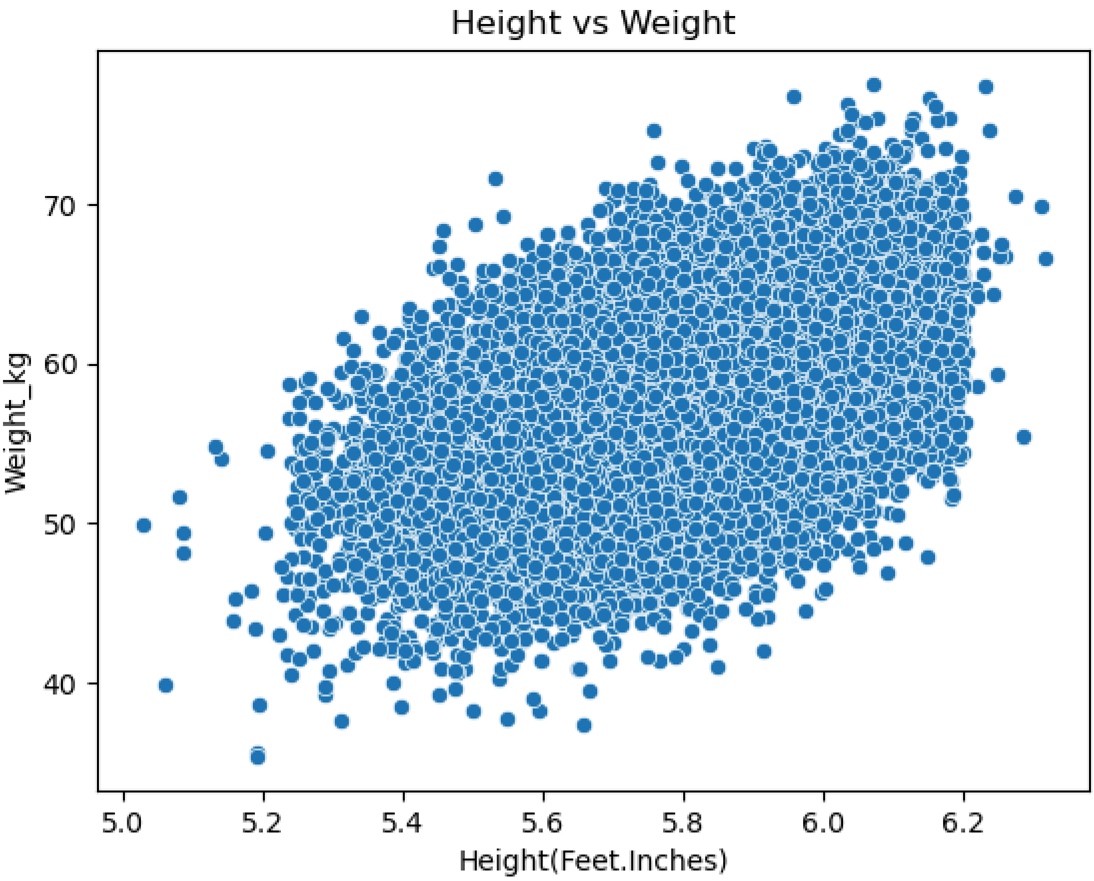


A correlation coefficient of 0.502859 suggests a moderate positive correlation between height and weight

In [17]:

```
x=df['Height(Feet.Inches)']
y=df['Weight_kg']

sns.scatterplot(x=x,y=y)
plt.title('Height vs Weight')
plt.xlabel('Height(Feet.Inches)')
plt.ylabel('Weight_kg')
plt.show()
```



In [18]:

```
df.sample(3)
```

Out[18]:

	Weight_kg	Height(Feet.Inches)
7148	50.461067	5.765882
12746	62.735448	6.000383
10106	55.045566	5.750667

In [19]:

```
X=df.iloc[:,1]
y=df.iloc[:,0]
```

In [20]:
```
X
```

Out[20]:
```
0        5.578331
1        6.151521
2        5.939874
3        5.821660
4        5.778781
           ...
24995    5.950215
24996    5.454826
24997    5.469855
24998    5.752918
24999    5.887761
Name: Height(Feet.Inches), Length: 25000, dtype: float64
```

In [21]:
```
df.columns[1] #X variable column name
```

Out[21]:
```
'Height(Feet.Inches)'
```

In [22]:
```
df.columns[0] # y variable
```

Out[22]:
```
'Weight_kg'
```

In [23]:
```
#Data scaling(preprocessing data)
```

In [24]:
```
scaler_X = StandardScaler()
X_scaled = scaler_X.fit_transform(X.values.reshape(-1,1))


scaler_y = StandardScaler()
y_scaled = scaler_y.fit_transform(y.values.reshape(-1, 1))
```

spliting data into 70% 30% radio

In [25]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2
```

In [26]:
```
print('Shape of trining data')
print(X_train.shape)
print(y_train.shape)

print('Shpae of testing data')
print(X_test.shape)
print(y_test.shape)
```

```
Shape of trining data
(20000,)
(20000,)
Shpae of testing data
(5000,)
(5000,)
```

In [27]:
```
#linear regression model X should be 2d array so we are reshaping it to

# Reshape training data
X_train_2d = X_train.values.reshape(-1, 1)
y_train_2d = y_train.values.reshape(-1, 1)

# Reshape testing data
X_test_2d = X_test.values.reshape(-1, 1)
y_test_2d = y_test.values.reshape(-1, 1)

print("Shape of training data (X):", X_train_2d.shape)
print("Shape of training data (y):", y_train_2d.shape)
print("Shape of testing data (X):", X_test_2d.shape)
print("Shape of testing data (y):", y_test_2d.shape)
```

```
Shape of training data (X): (20000, 1)
Shape of training data (y): (20000, 1)
Shape of testing data (X): (5000, 1)
Shape of testing data (y): (5000, 1)
```

In [28]:
```
lr=LinearRegression() #linear Regression
lr
```

Out[28]:
```
▾ LinearRegression
LinearRegression()
```

In [29]:
```
lr.fit(X_train_2d,y_train_2d)
```

Out[29]:
```
▾ LinearRegression
LinearRegression()
```

In [30]:
```
y_pred=lr.predict(X_test_2d)
y_pred[:10]
```

Out[30]:
```
array([[58.30995889],
       [57.55379225],
       [57.21368631],
       [59.15305375],
       [59.14955828],
       [57.21726773],
       [54.13829253],
       [57.67365521],
       [60.77133975],
       [58.75644733]])
```

In [31]:
```
y_test_2d[:10]
```

Out[31]:
```
array([[60.91082852],
       [50.78715403],
       [61.68266066],
       [57.32504768],
       [45.44130015],
       [48.93509253],
       [56.34655902],
       [60.25330155],
       [59.08262596],
       [63.5877017 ]])
```

In [32]:
```
mean_squared_error(y_pred,y_test_2d)
```

Out[32]:
```
21.232939817362524
```

In [33]:
```
model_dtr=DecisionTreeRegressor()
model_dtr
```

Out[33]:
```
▾ DecisionTreeRegressor
DecisionTreeRegressor()
```

In [34]:
```
model_dtr.fit(X_train_2d, y_train_2d)
```

Out[34]:
```
▾ DecisionTreeRegressor
DecisionTreeRegressor()
```

In [35]:
```
y_pred_dtr=model_dtr.predict(X_test_2d)
y_pred_dtr[:10]
```

Out[35]:
```
array([53.40614888, 47.98372867, 58.31968422, 52.68566334, 57.0185102 ,
       55.81358842, 54.73145398, 50.68808953, 58.78946945, 50.35941677])
```

In [36]:
```
mean_squared_error(y_pred_dtr,y_test_2d)
```

Out[36]:
```
40.98078515849597
```

RandomForestRegresor

In [37]:
```
model_rfr=RandomForestRegressor()
model_rfr.fit(X_train_2d,y_train_2d)
```

```
C:\Users\sumit\AppData\Local\Temp\ipykernel_9532\3179291635.py:2: DataConv
ersionWarning: A column-vector y was passed when a 1d array was expected.
Please change the shape of y to (n_samples,), for example using ravel().
  model_rfr.fit(X_train_2d,y_train_2d)
```

Out[37]:
```
▾ RandomForestRegressor
RandomForestRegressor()
```

In [38]:
```
y_pred_rfr=(X_test_2d)
y_pred_rfr[:10]
```

Out[38]:
```
array([[5.842447],
       [5.789663],
       [5.765922],
       [5.901299],
       [5.901055],
       [5.766172],
       [5.551245],
       [5.79803 ],
       [6.014263],
       [5.873614]])
```

In [39]:
```
mean_squared_error(y_pred_rfr,y_test_2d)
```

Out[39]:
```
2715.7568554601735
```

Hyperparameter tuning

In [40]:
```
from sklearn.model_selection import GridSearchCV
from sklearn.linear_model import LinearRegression

# Define hyperparameters to tune
param_grid = {
    'fit_intercept': [True, False],
    'copy_X': [True, False]
}

# Create a Linear Regression model
model_lr = LinearRegression()

# Initialize GridSearchCV
grid_search = GridSearchCV(model_lr, param_grid, cv=5, scoring='neg_mea

# Fit the model
grid_search.fit(X_train_2d, y_train_2d)

# Print the best parameters and best MSE score
print("Best Parameters:", grid_search.best_params_)
print("Best Negative MSE Score:", grid_search.best_score_)

```

```
Best Parameters: {'copy_X': True, 'fit_intercept': True}
Best Negative MSE Score: -20.951832946201606
```

In [41]:

```
from sklearn.model_selection import cross_val_score
from sklearn.linear_model import LinearRegression

# Create a Linear Regression model
model_lr = LinearRegression()

# Perform 10-fold cross-validation
accuracy_scores = cross_val_score(model_lr, X_train_2d, y_train_2d, cv=

# Convert negative mean squared error to positive
mse_scores = -accuracy_scores

# Print the MSE scores
print("MSE Scores:", mse_scores)

```

```
MSE Scores: [20.89965582 21.67357185 22.39972494 20.26920314 20.56598084 2
0.7416008
 20.67197687 20.67941739 21.2313776  20.38123774]
```

final model

In [42]:

```
from sklearn.linear_model import LinearRegression

# Initialize the Linear Regression model with the best parameters
final_model = LinearRegression(fit_intercept=False, copy_X=True)

# Fit the model to the entire training data
final_model.fit(X_train_2d, y_train_2d)

# Now you can use final_model to make predictions on new data

```

Out[42]:

```
▾ LinearRegression
LinearRegression(fit_intercept=False)
```

converting to pickle file

In [43]:

```
import pickle

# Define the filename for the pickle file
filename = 'final_model.pkl'

# Save the final_model to a pickle file
with open(filename, 'wb') as file:
    pickle.dump(final_model, file)

```

In [44]:

```
os.path.abspath('final_model.pkl')
```

Out[44]:

```
'C:\\Users\\sumit\\Data Science\\Live Project\\Projects end to end\\ML Hei
ght Prediction\\final_model.pkl'
```

In [45]:

```
import pickle
import numpy as np

# Load the saved model from the file
filename = 'final_model.pkl'
with open(filename, 'rb') as file:
    loaded_model = pickle.load(file)

# Input height for prediction
height_input = 6.0

# Reshape the input height to match the shape expected by the model (2D
height_input_2d = np.array(height_input).reshape(1, -1)

# Use the loaded model to make predictions
predicted_weight = loaded_model.predict(height_input_2d)

# Print the predicted weight
print("Predicted weight:", predicted_weight[0, 0])

```

```
Predicted weight: 59.69879152974141
```