Lab Assignment 2

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In [256...
```
import numpy as np
import pandas as pd
from sklearn.metrics import mean_squared_error
import matplotlib.pyplot as plt
```

In [257...
```
df = pd.read_csv('Training_set_heights200.csv')
df.head()
```

Out[257...

	Height	Weight
0	127.8296	67.63371
1	123.4114	65.95421
2	134.4043	66.14316
3	155.9981	73.45251
4	136.1354	69.30943

In [258...
```
from sklearn.preprocessing import MinMaxScaler
```

In [259...
```
scaler = MinMaxScaler()
df_scaled = scaler.fit_transform(df)
```

In [260...
```
X = df_scaled[:,0]
y = df_scaled[:,1]
```

In [261...
```
from sklearn.linear_model import LinearRegression
```

In [262...
```
LR = LinearRegression()
LR.fit(X.reshape(-1, 1), y)

print(f"Intercept: {LR.intercept_}")
print(f"Coefficient: {LR.coef_}")
```

```
Intercept: 0.2707514895889285
Coefficient: [0.52653218]
```

Spliting in Train and Test Set

In [263...
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_
```

In [264...
```
LR2 = LinearRegression()
LR2.fit(X_train.reshape(-1, 1), y_train)
```

```
print(f"Intercept: {LR2.intercept_}")
print(f"Coefficient: {LR2.coef_}")
```

```
Intercept: 0.2612785266616628
Coefficient: [0.56093988]
```

Gradient Descent

In [265…

```
def gd(xt, yt, m_b, n_b, L):
    D_m = 0
    D_n = 0
    for i in range(len(xt)):
        D_m = D_m + (2/len(xt))*((m_b*xt[i]+n_b - yt[i])*xt[i])
        D_n = D_n+(2/len(xt))*(m_b*xt[i]+n_b - yt[i])
    m_b = m_b - L*D_m
    n_b = n_b - L*D_n
    return m_b, n_b

m = 0
n = 0
L = 0.77
epochs = 900

for i in range(epochs):
    m,n = gd(X_train, y_train, m, n, L)

print(m,n)
```

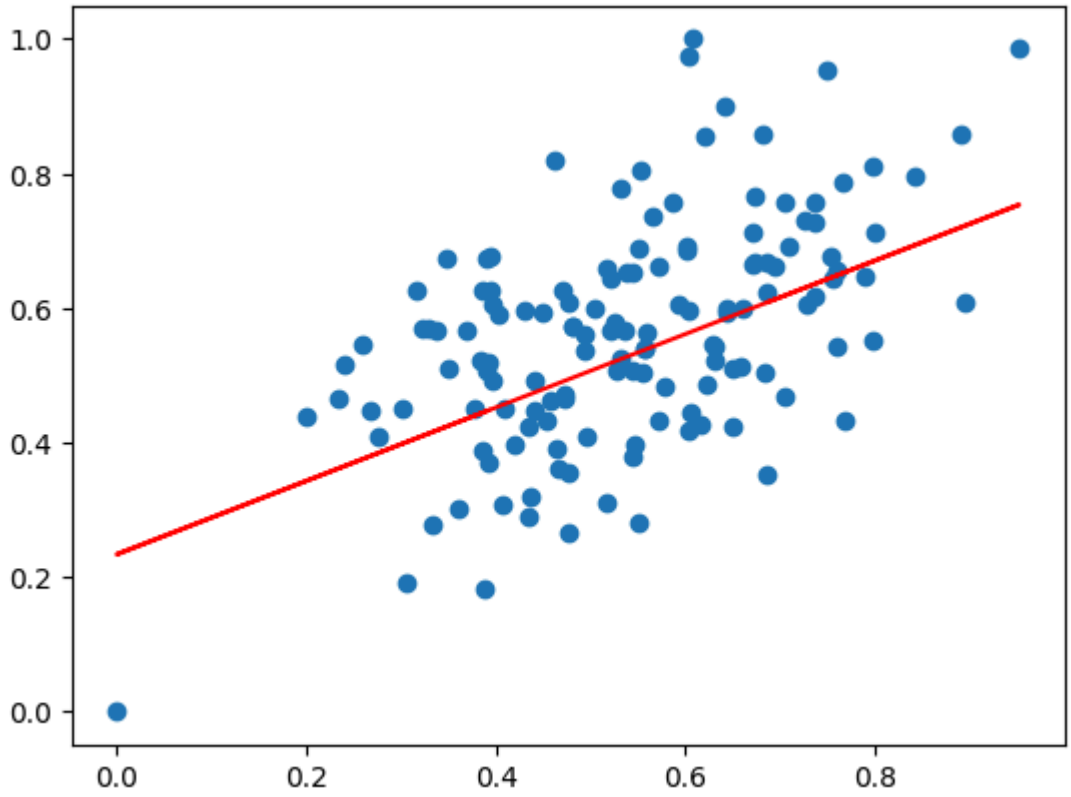
```
0.5459409679484901 0.2340138965683014
```

In [266…

```
plt.scatter(X_train, y_train)
y_pred = m*X_train+n
plt.plot(X_train, y_pred, color="red")
```

Out[266…

```
[<matplotlib.lines.Line2D at 0x22e07a9fe00>]
```



In [267…
```
y_test_pred = m*X_test +n
err = mean_squared_error(y_test, y_test_pred)
print(f"Testing Mean Squared Error: {err}")
```

```
Testing Mean Squared Error: 0.01576159799891117
```

Q1. Now create a linear regression model using gradient descent technique to predict height in terms of weight.

In [268…
```
df2 = pd.read_csv('Training_set_heights200.csv')
df2.head()
```

Out[268…

	Height	Weight
0	127.8296	67.63371
1	123.4114	65.95421
2	134.4043	66.14316
3	155.9981	73.45251
4	136.1354	69.30943

In [269…
```
scaler = MinMaxScaler()
df_scaled = scaler.fit_transform(df)
```

height in terms of weight

In [270…
```
X = df_scaled[:,1]
y = df_scaled[:,0]
```

In [271…
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_
```

In [272…
```
LR3 = LinearRegression()
LR3.fit(X_train.reshape(-1, 1), y_train)

print(f"Intercept: {LR3.intercept_}")
print(f"Coefficient: {LR3.coef_}")
```

```
Intercept: 0.24649525701785846
Coefficient: [0.51939401]
```

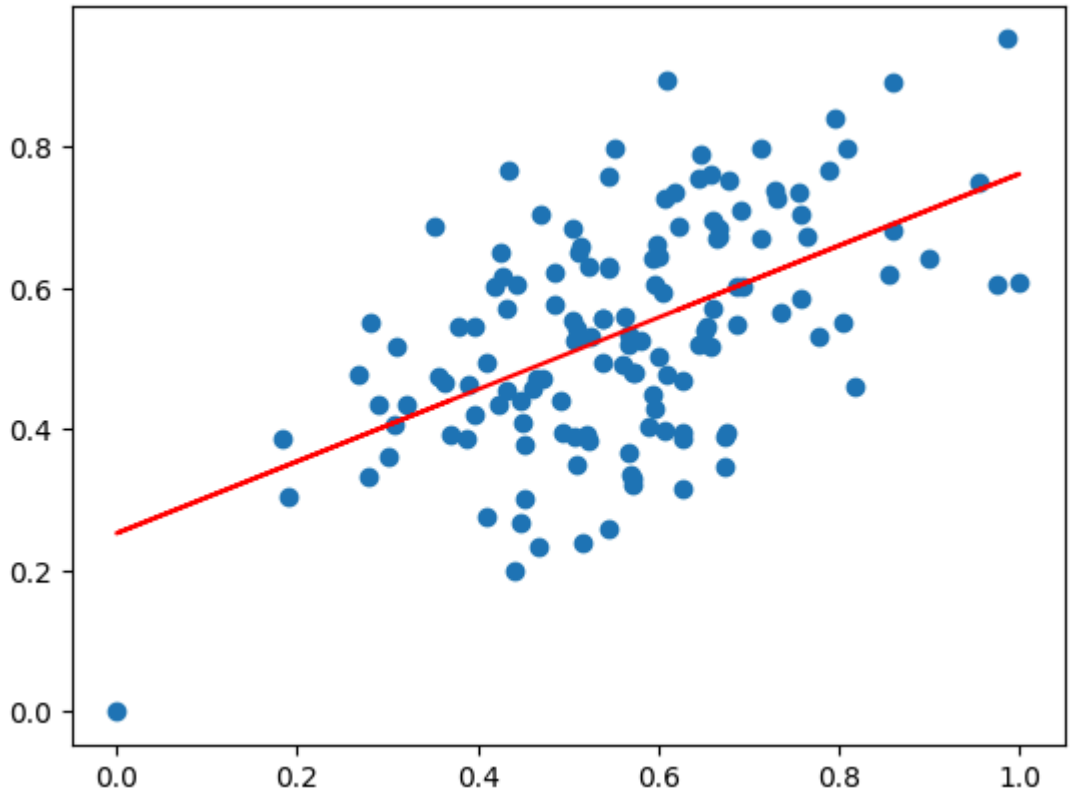
Iteration till 4 decimal points unchanged

In [273…
```
def gradient_decent(xt, yt, m_b, n_b, L):
    D_m = 0
    D_n = 0
    for i in range(len(xt)):
        D_m += (2 / len(xt)) * ((m_b * xt[i] + n_b - yt[i]) * xt[i])
        D_n += (2 / len(xt)) * (m_b * xt[i] + n_b - yt[i])
    m_b_new = m_b - L * D_m
    n_b_new = n_b - L * D_n
    return m_b_new, n_b_new

def run_gradient_descent(xt, yt, m_b, n_b, L, max_iterations=1000):
    for iteration in range(max_iterations):
        m_b_new, n_b_new = gradient_decent(xt, yt, m_b, n_b, L)
        if np.all(np.round(m_b_new, 4) == np.round(m_b, 4)) and np.all(np.round(
            print(f"Converged after {iteration + 1} iterations.")
            break
        m_b, n_b = m_b_new, n_b_new
    else:
        print("Maximum iterations reached without full convergence.")
    return m_b, n_b

m_b = 0.0
n_b = 0.0
learning_rate = 0.2

m_b, n_b = run_gradient_descent(X_train, y_train, m_b, n_b, learning_rate)
print(f"Final parameters: m_b = {m_b}, n_b = {n_b}")
```

```
Converged after 393 iterations.
Final parameters: m_b = 0.5085540073514879, n_b = 0.2527363774675484
```

In [274…
```
plt.scatter(X_train, y_train)
y_pred = m_b*X_train+n_b
plt.plot(X_train, y_pred, color="red")
```

Out[274…
```
[<matplotlib.lines.Line2D at 0x22e09566b10>]
```



In [275…
```
y_test_pred = m*X_test +n
err = mean_squared_error(y_test, y_test_pred)
print(f"Testing Mean Squared Error: {err}")
```

```
Testing Mean Squared Error: 0.018597048067984106
```

Multiple Linear Regression

Application on Book1.csv file

In [276…
```
book = pd.read_csv('Book1.csv')
book.head()
```

Out[276…

	price	area	bedrooms	bathrooms	stories	parking	furnishingstatus
0	13300000	7420	4	2	3	2	furnished
1	12250000	8960	4	4	4	3	furnished
2	12250000	9960	3	2	2	2	semi-furnished
3	12215000	7500	4	2	2	3	furnished
4	11410000	7420	4	1	2	2	furnished

In [277…
```
book.shape
```

Out[277… (249, 7)

In [278…
```
book.isna().sum()
```

Out[278…
```
price             0
area              0
bedrooms          0
bathrooms         0
stories           0
parking           0
furnishingstatus  0
dtype: int64
```

In [279…
```
book['furnishingstatus'].unique()
```

Out[279…
```
array(['furnished', 'semi-furnished', 'unfurnished'], dtype=object)
```

In [280…
```
X_train, X_test, y_train, y_test = train_test_split(book.drop(['furnishingstatus
```

1-hot encoding

In [281…
```
from sklearn.preprocessing import OneHotEncoder
```

In [282…
```
encoder = OneHotEncoder(sparse_output=False)
one_hot_encoded = encoder.fit_transform(book[['furnishingstatus']])
```

In [283…
```
one_hot_book = pd.DataFrame(one_hot_encoded, columns=encoder.get_feature_names_o
```

In [284…
```
book_encoded = pd.concat([book, one_hot_book], axis=1)
book_encoded.drop(['furnishingstatus'], axis=1, inplace=True)
book_encoded
```

Out[284…

	price	area	bedrooms	bathrooms	stories	parking	furnishingstatus_furnishe
0	13300000	7420	4	2	3	2	1.
1	12250000	8960	4	4	4	3	1.
2	12250000	9960	3	2	2	2	0.
3	12215000	7500	4	2	2	3	1.
4	11410000	7420	4	1	2	2	1.
…	…	…	…	…	…	…	.
244	4550000	5320	3	1	2	0	0.
245	4550000	5360	3	1	2	2	0.
246	4550000	3520	3	1	1	0	0.
247	4550000	8400	4	1	4	3	0.
248	4543000	4100	2	2	1	0	0.

249 rows × 9 columns

In [285…
```
X = book_encoded.drop(['price'], axis=1)
y = book_encoded['price']
```

```
y = np.array(y).reshape(-1, 1)
```

Preprocessing

In [286…
```
from sklearn.preprocessing import StandardScaler

SS = StandardScaler()
X_scaled = SS.fit_transform(X)
y_scaled = SS.fit_transform(y)
```

In [287…
```
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y_scaled, test_siz
```

In [288…
```
y_train = np.array(y_train.reshape(199))

y_train.shape
```

Out[288… (199,)

In [289…
```
m_b = 0.0
n_b = 0.0
learning_rate = 0.2

m_b, n_b = run_gradient_descent(X_train, y_train, m_b, n_b, learning_rate)
print(f"Final parameters: m_b = {m_b}, n_b = {n_b}")
```

```
Converged after 19 iterations.
Final parameters: m_b = [ 0.28879476  0.30878645  0.46680269  0.25548182  0.30603
175  0.27005068
 -0.20558665 -0.05654349], n_b = [-0.01839882 -0.01134067 -0.01044147 -0.03059856
-0.00618137 -0.01388126
 -0.01126489 -0.02028817]

Final parameters: m_b = [ 0.28879476  0.30878645  0.46680269  0.25548182  0.30603
175  0.27005068
 -0.20558665 -0.05654349], n_b = [-0.01839882 -0.01134067 -0.01044147 -0.03059856
-0.00618137 -0.01388126
 -0.01126489 -0.02028817]
```

In [290…
```
y_p = 0
for m in m_b:
    y_p = y_p + m*X_test

y_p = y_p + n_b[-1]
```

In [291…
```
y_p.shape
```

Out[291… (50, 8)

In [ ]:

In [ ]: