exercise2

September 6, 2023

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

[2]:
```
data = pd.read_csv('salexpdata.csv')

data.head()
```

[2]:

	salary	experience
0	1.7	1.2
1	2.4	1.5
2	2.3	1.9
3	3.1	2.2
4	3.7	2.4

[3]:
```
X_label, Y_label = data.columns[1], data.columns[0]
```

[4]:
```
plt.scatter(data[X_label], data[Y_label])
plt.xlabel(X_label.capitalize())
plt.ylabel(Y_label.capitalize())
plt.title('Salary vs Experience')
plt.show()
```

[ ]:

[5]:
```
X = data[X_label].values
Y = data[Y_label].values
```

[6]:
```
alpha = 0.01
epochs = 5
n = len(X)

a = 0.0
b = 0.0

errors = []
betas = []

for epoch in range(epochs):
    for x, y in zip(X, Y):
        y_pred = b * x + a
        mse = (y - y_pred) ** 2

        betas.append(b)
        errors.append(mse)
```

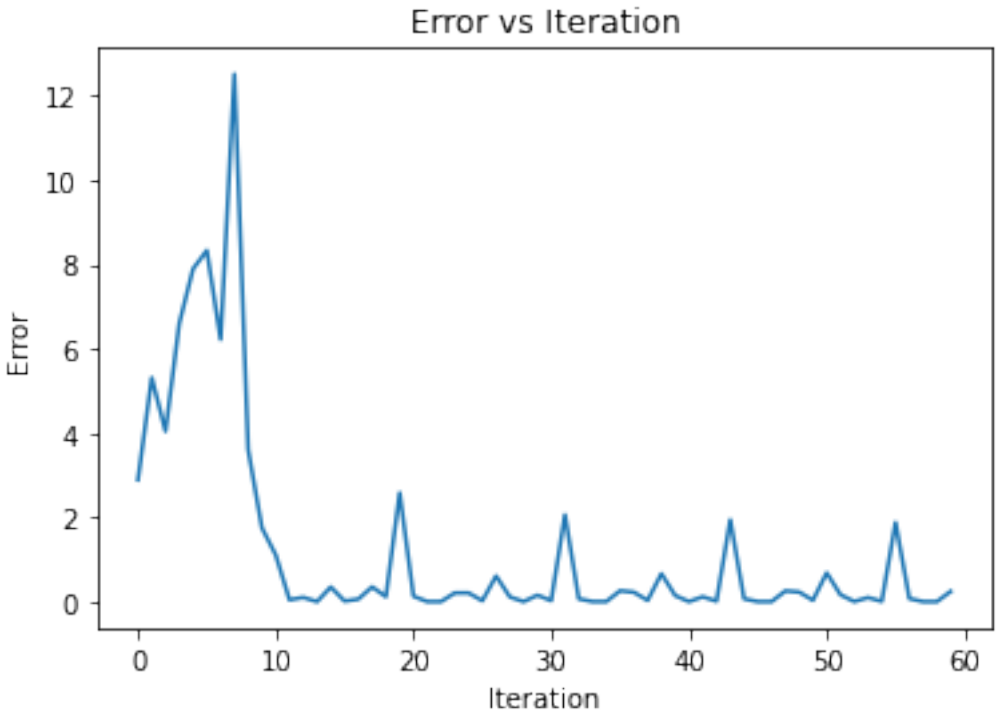
```
        delta_b = - 2 * alpha * (y - y_pred) * x
        delta_a = - 2 * alpha * (y - y_pred)

        b = b - delta_b
        a = a - delta_a


    alpha = alpha / 1.25
```

[7]:
```
print(f'Linear Regression Line: {a} + {b} * X')
```

```
Linear Regression Line: 0.5166146387166289 + 1.3852430871265173 * X
```

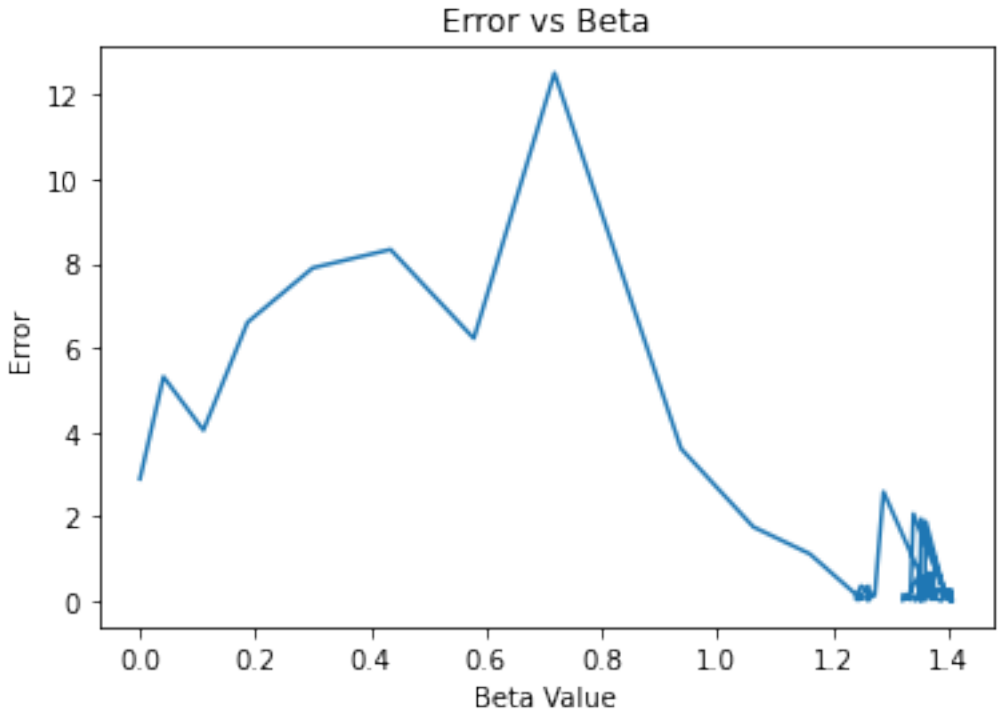
[ ]:

[8]:
```
plt.plot(errors)
plt.xlabel('Iteration')
plt.ylabel('Error')
plt.title('Error vs Iteration')
plt.show()
```



[9]:
```
plt.plot(betas, errors)
plt.xlabel('Beta Value')
```

```
plt.ylabel('Error')
plt.title('Error vs Beta')
plt.show()
```



[ ]:

[10]:
```
X_test = np.linspace(X.min()-0.5, X.max()+0.5, 100)
Y_test = b * X_test + a
```

[11]:
```
plt.scatter(X, Y, label='Actual Data')
plt.plot(X_test, Y_test, '--', color='orange', label='Regression Line (My␣
↪Model)')
plt.xlabel(X_label.capitalize())
plt.ylabel(Y_label.capitalize())
plt.title('Salary vs Experience')
plt.legend()
plt.show()
```

[ ]:

[12]:
```
from sklearn.linear_model import SGDRegressor
```

[13]:
```
sgd_model = SGDRegressor(max_iter=60)

sgd_model.fit(X.reshape(-1, 1), Y)
```

[13]:
```
SGDRegressor(max_iter=60)
```

[14]:
```
print(f'Linear Regression Line: {sgd_model.intercept_[0]} + {sgd_model.
↪coef_[0]} * X')
```

```
Linear Regression Line: 0.4233179167397127 + 1.4154271129710694 * X
```

[ ]:

[15]:
```
Y_pred = sgd_model.predict(X_test.reshape(-1, 1))
```

[16]:
```
plt.scatter(X, Y, label='Actual Data')
plt.plot(X_test, Y_test, '--', color='orange', label='Regression Line (SkLearn␣
↪Model)')
plt.xlabel(X_label.capitalize())
```

```
plt.ylabel(Y_label.capitalize())
plt.title('Salary vs Experience')
plt.legend()
plt.show()
```

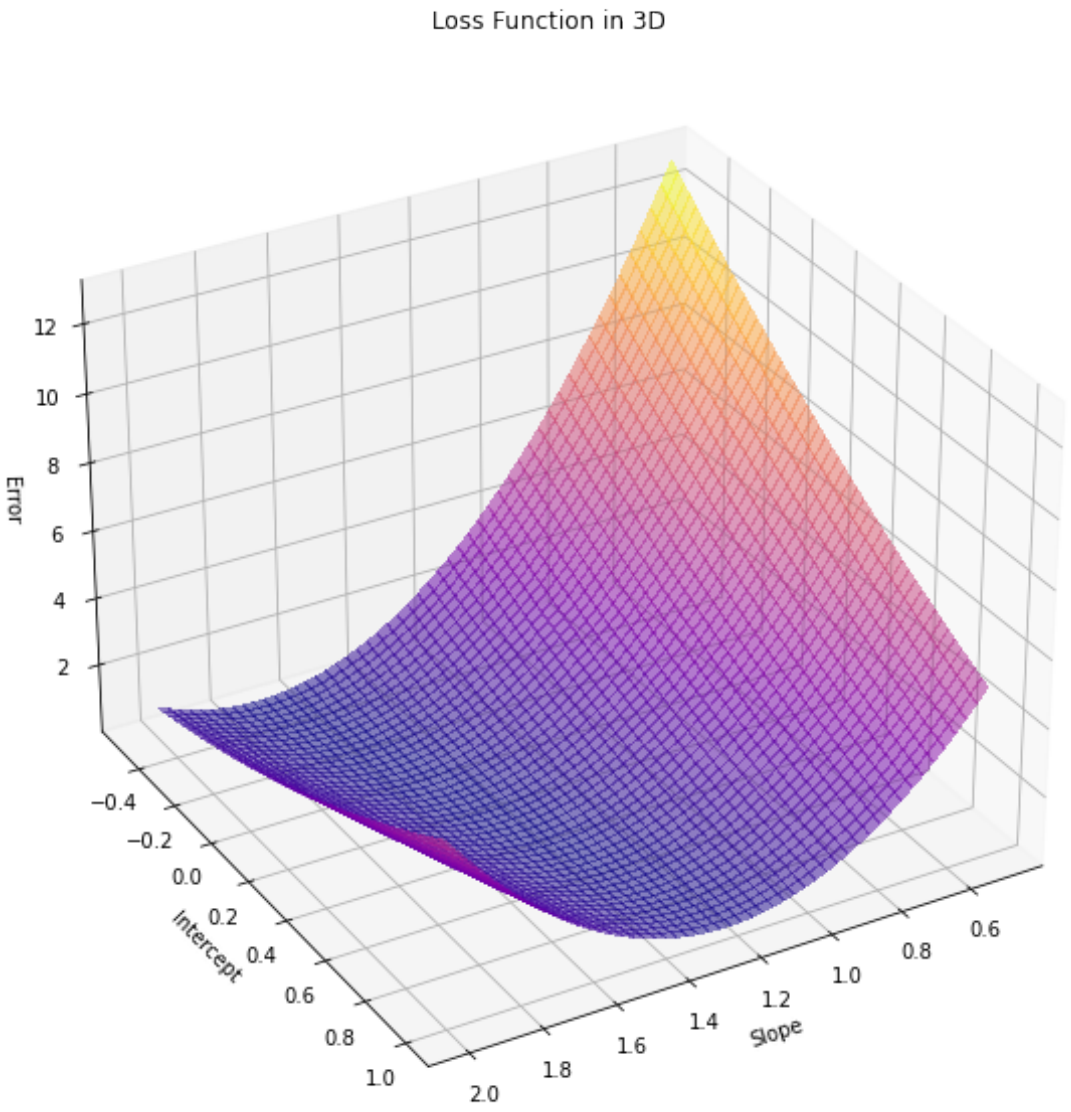
[ ]:

[17]:
```
def mean_squared_error(w, b):
    global X, Y

    Y_pred = w * X + b
    mse = np.sum((Y - Y_pred) ** 2) / len(X)

    return mse
```

[23]:
```
W, B = np.meshgrid(np.linspace(0.5, 2, 1000), np.linspace(-0.5, 1, 1000))

np_mse = np.vectorize(mean_squared_error)
E = np_mse(W, B)
```

[24]:
```
from mpl_toolkits import mplot3d

fig = plt.figure(figsize=(10, 10))
```

```
ax = plt.axes(projection='3d')
ax.plot_surface(W, B, E, cmap="plasma", linewidth=0, antialiased=False, alpha=0.
↪5)
ax.set_xlabel('Slope')
ax.set_ylabel('Intercept')
ax.set_zlabel('Error');
ax.set_title('Loss Function in 3D')
ax.view_init(30, 60)
plt.show()
```



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