Group B Assignment B4

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Subject: Machine Learning

0.1 Group B Machine Learning

0.2 Assignment 5

0.2.1 Implement Gradient Descent Algorithm to find the local minima of a function.

0.2.2 For example, find the local minima of the function y=(x+3)š starting from the point x=2.

Step 1 : Initialize parameters

[1]:
```
cur_x = 2 # The algorithm starts at x=2
iters = 0 #iteration counter
max_iters = 10000 # maximum number of iterations
learning_rate = 0.01 # Learning rate
precision = 0.000001 #This tells us when to stop the algorithm
previous_step_size = 1
df = lambda x: 2*(x+3) #Gradient of our function
```

[2]:
```
print(cur_x)
```

```
2
```

Step 2 : Run a loop to perform gradient descent :

[3]:
```
x_history =[cur_x]
while previous_step_size > precision and iters < max_iters:
    prev_x = cur_x #Store current x value in prev_x
    cur_x = cur_x - learning_rate * df(prev_x) #Grad descent
    x_history.append(cur_x)
    previous_step_size = abs(cur_x - prev_x) #Change in x
    iters = iters+1 #iteration count
    print("Iteration",iters,"\nX value is",cur_x) #Print iterations

print("The local minimum occurs at", cur_x)
```

```
Iteration 1
X value is 1.9
Iteration 2
```

```
X value is 1.8019999999999998
Iteration 3
X value is -2.999950130714142
Iteration 571
X value is -2.999951128099859
The local minimum occurs at -2.999951128099859
```

[4]:
```
print("The local minimum occurs at", cur_x)
```

```
The local minimum occurs at -2.999951128099859
```

[5]:
```
print(len(x_history))
```

```
572
```

[6]:
```
import matplotlib.pyplot as plt
import numpy as np
```

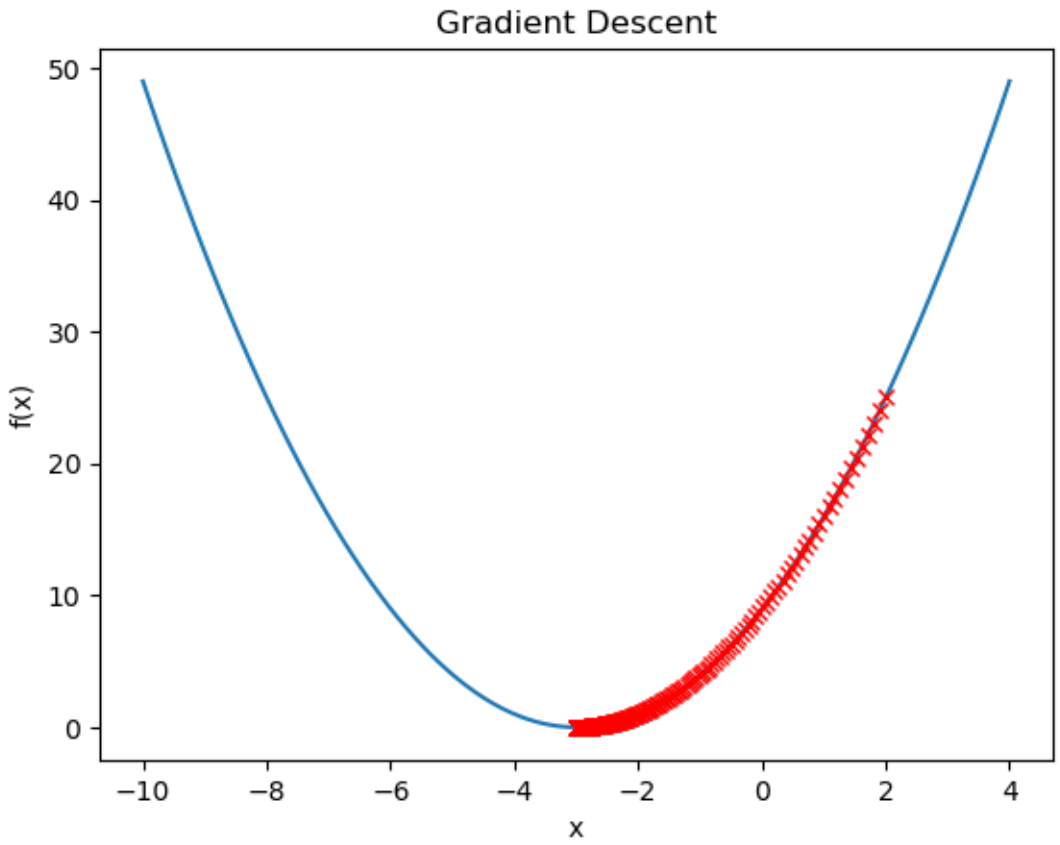
[7]:
```
# Create a range of x values to plot
x_vals = np.linspace(-10, 4, 100)
y = lambda x: x**2 + 6*x +9

# Plot the lamda function y
plt.plot(x_vals, y(x_vals))

# Plot the values of x at each iteration
plt.plot(x_history, y(np.array(x_history)), 'rx')

# Label the axes and add a title
plt.xlabel('x')
plt.ylabel('f(x)')
plt.title('Gradient Descent')

# Show the plot
plt.show()
```


Gradient Descent
50
40
30
20
10
0
f(x)
−10
−8
−6
−4
−2
0
2
4
x