CO_HW4_zhenshox

November 8, 2020

[8]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import cvxpy as cp
```

1 Question 1

[10]:
```
err=1e-4
lamb=1
eta=2*lamb

w1s=[]
w2s=[]
alpha1s=[]
alpha2s=[]
ws=[]

w1,w2,w=0,0,0
alpha1,alpha2=0,0

while True:
    #store the last value for convergence check
    w1_last,w2_last,alpha1_last,alpha2_last=w1,w2,alpha1,alpha2
    print(w1,w2,alpha1,alpha2)
    #1.update wj
    w1=(2*lamb*w+4-alpha1)/(2*(1+lamb))
    w2=(2*lamb*w-8-alpha2)/(2*(3+lamb))
    #2.update w
    w=(w1+w2)/2
    #3.update alphaj
    alpha1-=eta*(w-w1)
    alpha2-=eta*(w-w2)
    #store the value for plotting

    w1s.append(w1)
```

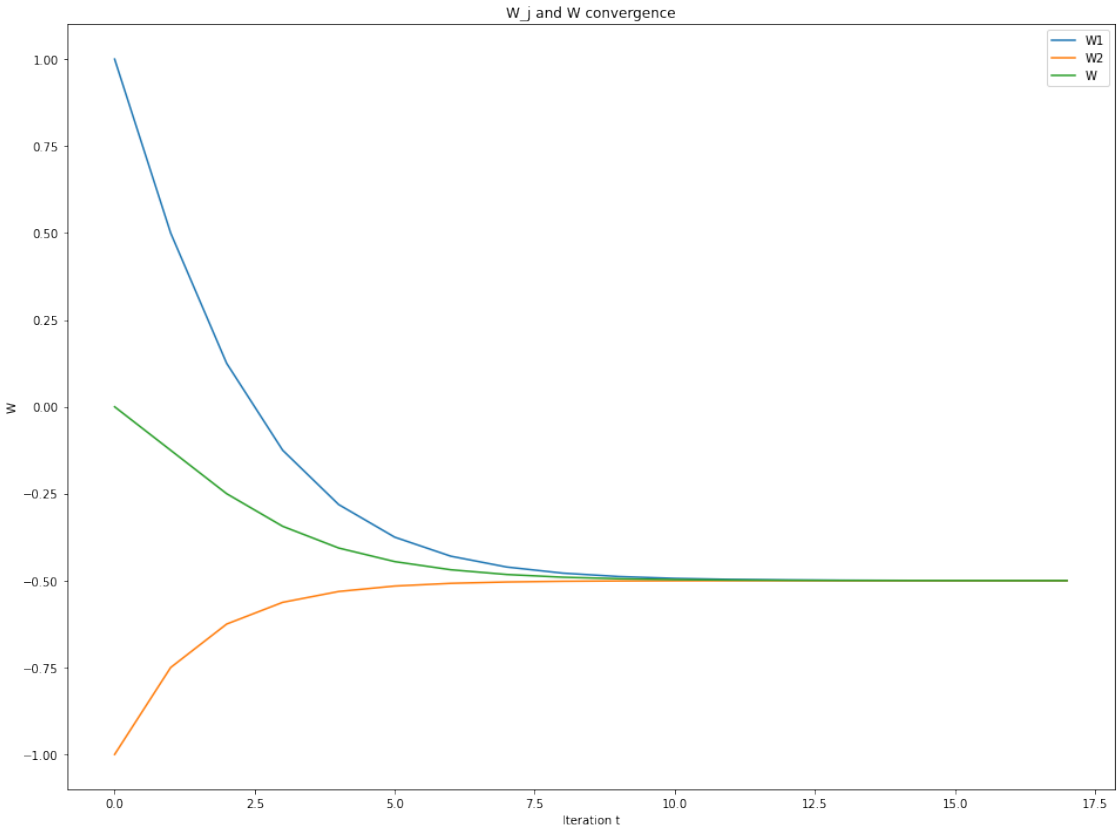
```
    w2s.append(w2)
    ws.append(w)
    alpha1s.append(alpha1)
    alpha2s.append(alpha2)


    if abs(w1-w1_last)<err and abs(w2-w2_last)<err and␣
↪abs(alpha1-alpha1_last)<err and abs(alpha2-alpha2_last)<err:
        break
```

```
0 0 0 0
1.0 -1.0 2.0 -2.0
0.5 -0.75 3.25 -3.25
0.125 -0.625 4.0 -4.0
-0.125 -0.5625 4.4375 -4.4375
-0.28125 -0.53125 4.6875 -4.6875
-0.375 -0.515625 4.828125 -4.828125
-0.4296875 -0.5078125 4.90625 -4.90625
-0.4609375 -0.50390625 4.94921875 -4.94921875
-0.478515625 -0.501953125 4.97265625 -4.97265625
-0.48828125 -0.5009765625 4.9853515625 -4.9853515625
-0.49365234375 -0.50048828125 4.9921875 -4.9921875
-0.49658203125 -0.500244140625 4.995849609375 -4.995849609375
-0.4981689453125 -0.5001220703125 4.997802734375 -4.997802734375
-0.4990234375 -0.50006103515625 4.99884033203125 -4.99884033203125
-0.499481201171875 -0.500030517578125 4.9993896484375 -4.9993896484375
-0.499725341796875 -0.5000152587890625 4.9996795654296875 -4.9996795654296875
-0.49985504150390625 -0.5000076293945312 4.9998321533203125 -4.9998321533203125
```

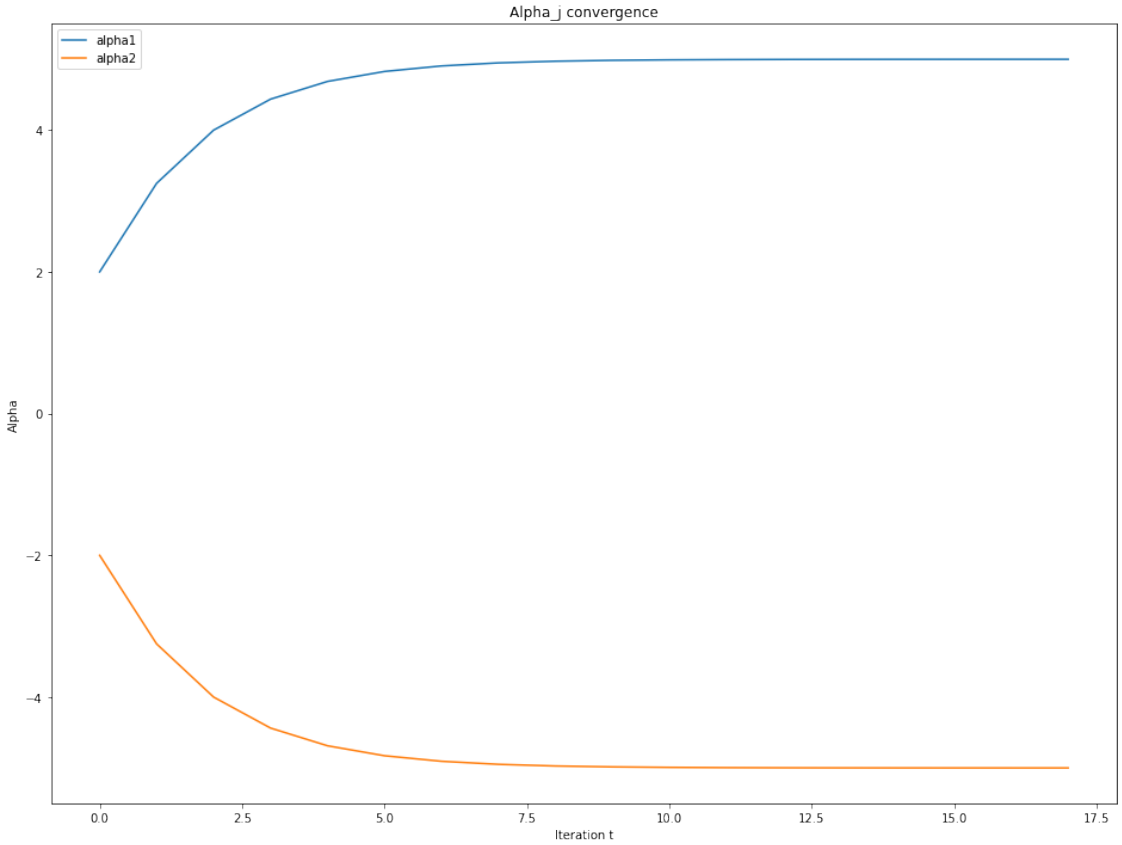
[11]:
```
plt.figure(figsize=(16,12))
plt.plot(w1s,label='W1')
plt.plot(w2s,label='W2')
plt.plot(ws,label='W')

plt.xlabel('Iteration t')
plt.ylabel('W')
#plt.yscale('log')
plt.title('W_j and W convergence')
plt.legend()
plt.show()
```



[12]:
```
plt.figure(figsize=(16,12))
plt.plot(alpha1s,label='alpha1')
plt.plot(alpha2s,label='alpha2')
#plt.plot(ws,label='W')

plt.xlabel('Iteration t')
plt.ylabel('Alpha')
#plt.yscale('log')
plt.title('Alpha_j convergence')
plt.legend()
plt.show()
```


Alpha_j convergence
alpha1
alpha2
Alpha
Iteration t
4
2
0
−2
−4
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5

[ ]: