Pruning Multiple neurons at one play

March 30, 2017

Compute the performance of MAB methods of pruning Multiple neurons at one time
MAP for choosing multi arms at one time

```
In [12]: import numpy as np
         import time
         import sys
         from numpy import *
         import matplotlib.pyplot as plt
         from sklearn import metrics
         %matplotlib inline
         #plt.rcParams['figure.figsize'] = (15, 6)
```

1 Load Bokeh

```
In [13]: from bokeh.layouts import row, gridplot
         from bokeh.plotting import figure, output_notebook, show
         from bokeh.models import Legend
         TOOLS = 'box_zoom,box_select,crosshair,resize,reset,lasso_select,pan,save,poly_select,t
         output_notebook()
```

2 Load the data

```
In [14]: X_train = np.load('./cancer/X_train.npy')
         y_train = np.load('./cancer/y_train.npy')
         X_test = np.load('./cancer/X_test.npy')
         y_test = np.load('./cancer/y_test.npy')
         X_deploy = np.load('./cancer/X_deploy.npy')
         y_deploy = np.load('./cancer/y_deploy.npy')
         print('Number of training examples',len(X_train))
         print('Number of validation examples',len(X_test))
         print('Number of testing examples',len(X_deploy))
```

```
Number of training examples 364
Number of validation examples 91
Number of testing examples 114
```

```
In [15]: exec(open("core.py").read())   # pyhton 3x
```

2.1 Run Thompson Sampling pruning Algorithm

In [16]:
```
algo = Thompson_Sampling([], [])
Alg_name = 'Thompson_Sampling Algorithm'
path = './Thompson_Sampling/'
sys.path.append("./Thompson_Sampling")
exec(open("mnist_cnnFORTESTING.py").read())
```

```
Test fraction correct (NN-Score) = 0.13
Test fraction correct (NN-Accuracy) = 0.96
The time for running this method is 4.9852728843688965 seconds
Finsh playing start pruining:
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
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Test after pruning= 0.97
Test after pruning= 0.97
Test after pruning= 0.97
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.94
Test after pruning= 0.89
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
```
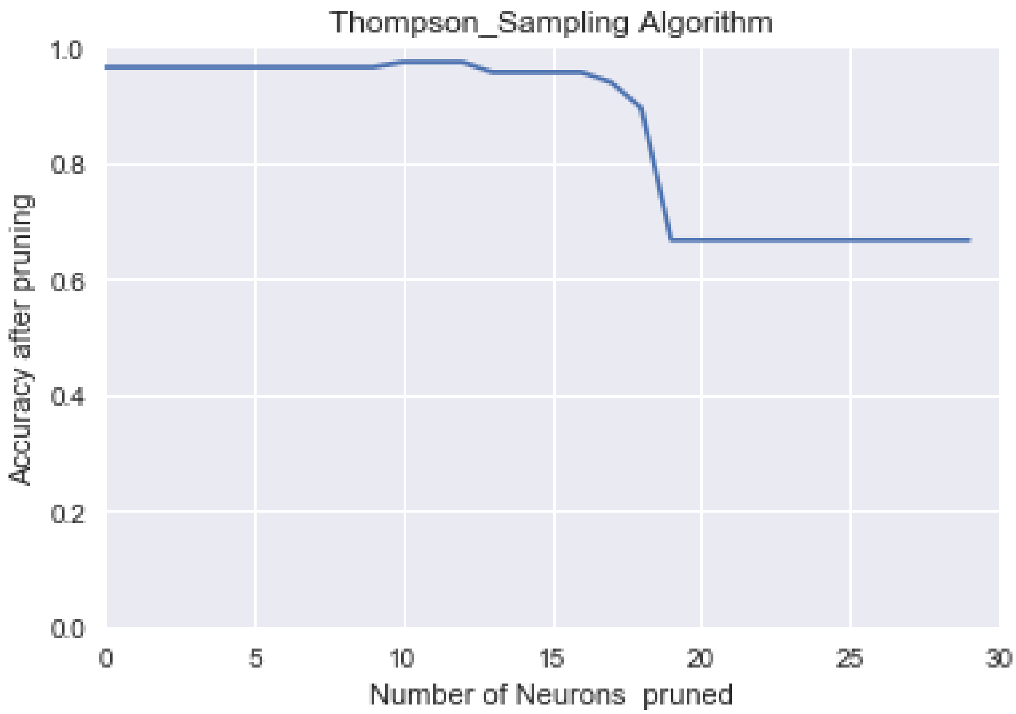
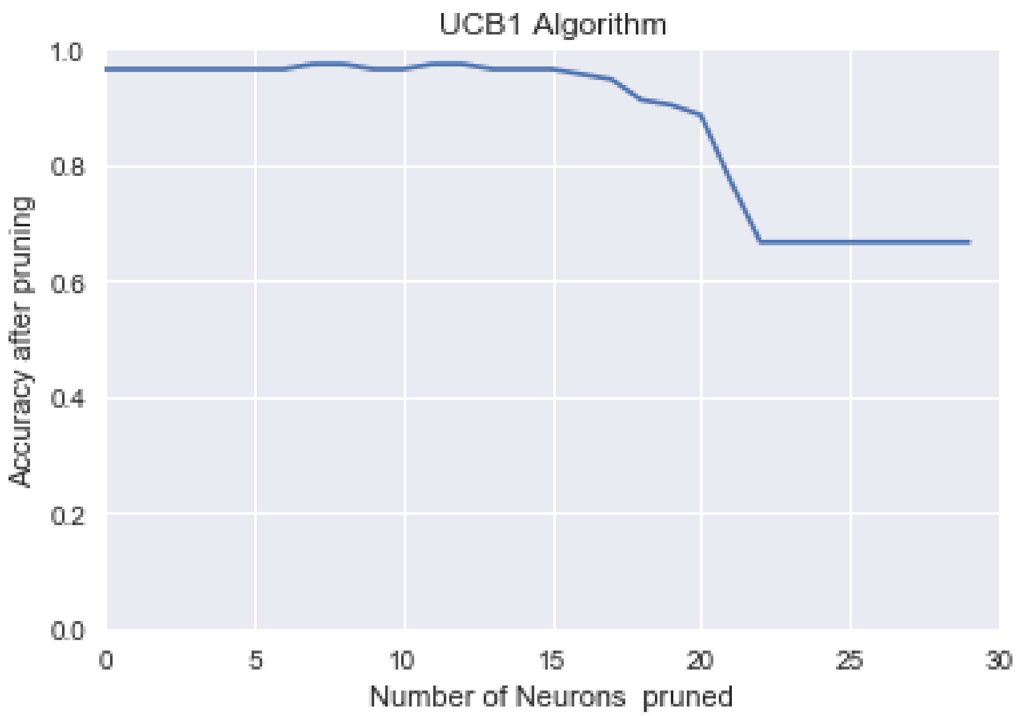



2.2 Run UCB1 pruning Algorithm

In [17]:
```
algo = UCB1([], [])
Alg_name = 'UCB1 Algorithm'
path = './UCB1/'
sys.path.append("./UCB1")
exec(open("mnist_cnnFORTESTING.py").read())
```

```
Test fraction correct (NN-Score) = 0.13
Test fraction correct (NN-Accuracy) = 0.96
The time for running this method is 4.986270427703857 seconds
Finsh playing start pruining:
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.97
Test after pruning= 0.97
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.97
```

```
Test after pruning= 0.97
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.96
Test after pruning= 0.95
Test after pruning= 0.91
Test after pruning= 0.90
Test after pruning= 0.89
Test after pruning= 0.77
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
Test after pruning= 0.67
```

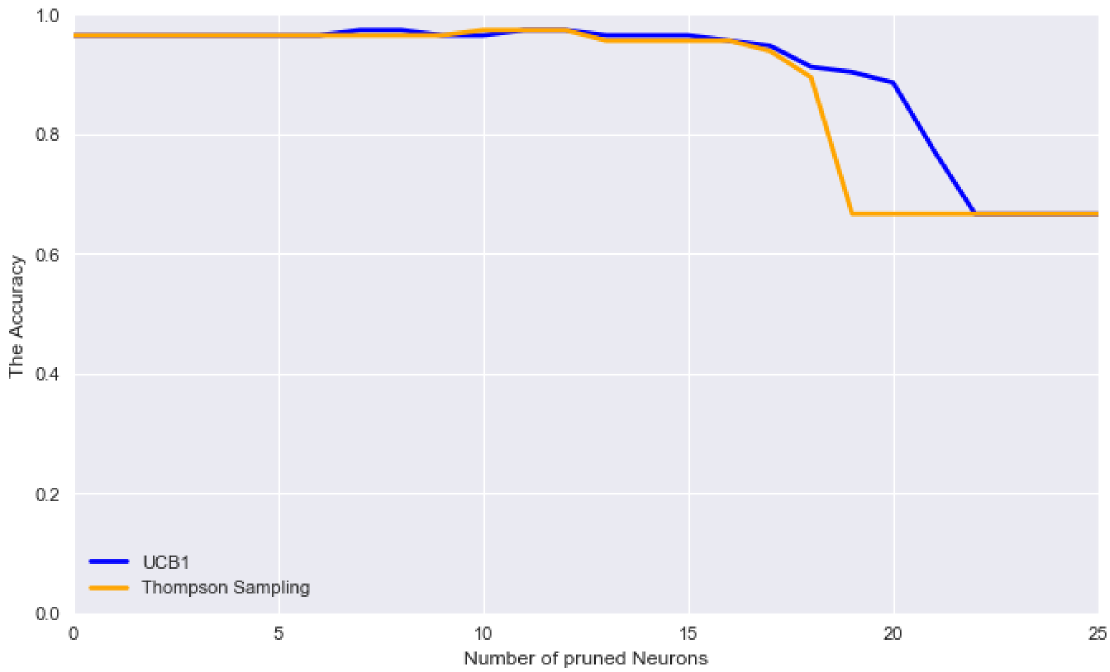


3 Compare the accuracy

```
In [18]: ucb1 = np.load('./UCB1/AccuracyAftrerPrune.npy')
         ThompsonSampling = np.load('./Thompson_Sampling/AccuracyAftrerPrune.npy')
```

```
Accuracy = np.load('AccuracyBeforePruning.npy')
```

In [19]:
```
fig = plt.figure(figsize=(10, 6), dpi=80)
ax = fig.add_subplot(111)
N = len(ucb1)
ind = np.arange(N)                      # the x locations for the groups
plt.plot(ind , ucb1 , color="blue", linewidth=2.5, linestyle="-", label="UCB1")
plt.plot(ind , ThompsonSampling, color="orange", linewidth=2.5, linestyle="-", label="T
plt.legend(loc = 3)
plt.axis([0, 25, 0, 1])
plt.xlabel('Number of pruned Neurons')
plt.ylabel('The Accuracy')
plt.grid(True)
plt.show()
```

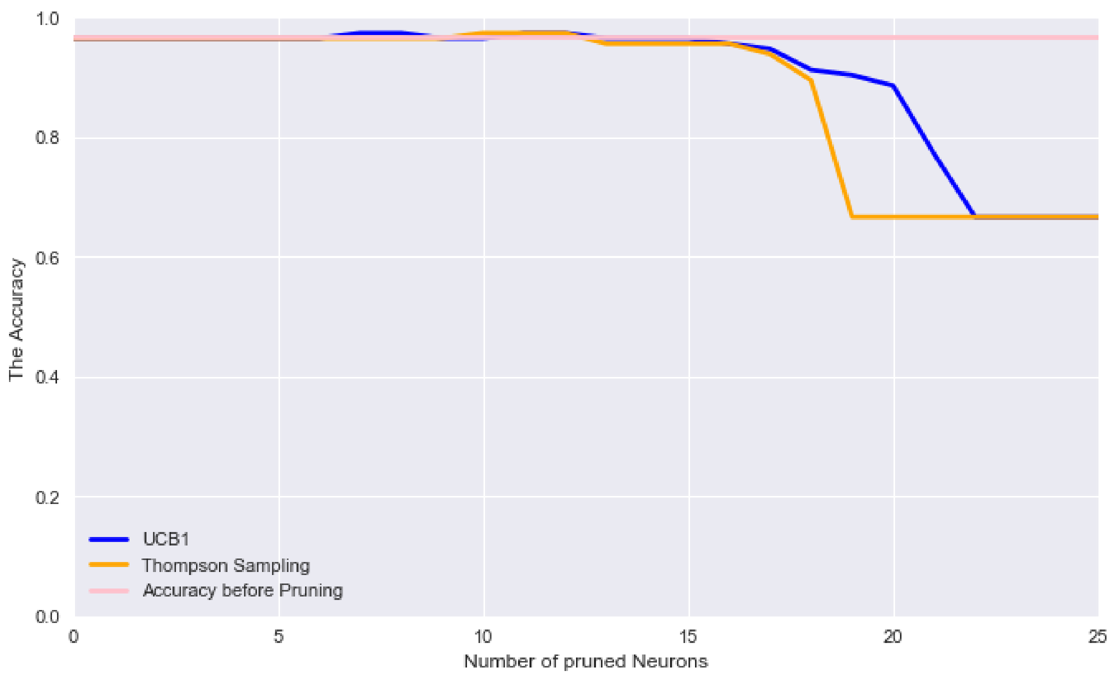


In [20]:
```
p1 = figure(title="The Performance over the number of neurons' pruned", tools=TOOLS)
p1.line(ind, ucb1, legend="ucb1", line_color="blue", line_width=2)
p1.line(ind, ThompsonSampling, legend="Thompson Sampling", line_color="red", line_width
p1.title.align = "center"
show(p1)
```

4 Comparing All algorithms with the model before pruning

In [21]:
```
fig = plt.figure(figsize=(10, 6), dpi=80)
ax = fig.add_subplot(111)
```

```
N = len(ucb1)
Acc = [Accuracy for col in range(N)]
ind = np.arange(N)                    # the x locations for the groups
plt.plot(ind , ucb1 , color="blue", linewidth=2.5, linestyle="-", label="UCB1")
plt.plot(ind , ThompsonSampling, color="orange", linewidth=2.5, linestyle="-", label="T
plt.plot(ind , Acc, color="pink", linewidth=2.5, linestyle="-", label="Accuracy before
plt.legend(loc = 3)
plt.axis([0, 25, 0, 1])
plt.xlabel('Number of pruned Neurons')
plt.ylabel('The Accuracy')
plt.grid(True)
plt.show()
```




```
In [22]: p1 = figure(title="The Performance over the number of neurons' pruned", tools=TOOLS)
         p1.line(ind, ucb1, legend="ucb1", line_color="green", line_width=2)
         p1.line(ind, ThompsonSampling, legend="Thompson Sampling", line_color="red", line_width
         p1.line(ind, Acc, legend="Accuracy", line_dash=(4, 4), line_color="blue", line_width=2)
         p1.title.align = "center"
         show(p1)
```