IA & Data science (LU3IN026) -- Projet MNIST -- 2019-2020

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In [1]:
```
# Importation des librairies standards:
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import random as rd
%matplotlib inline

# Importation de la librairie iads
import iads as iads

# importation de Classifiers
from iads import Classifiers as cl

# importation de utils
from iads import utils as ut
```

Classes binaires :

In [57]:
```
mnist_df_train = pd.read_csv("data/train.csv",sep=';')
mnist_df_test = pd.read_csv("data/test.csv",sep=';')
mnist_df_eval = pd.read_csv("data/eval.csv",sep=';')
names = pd.read_csv("data/names.csv",sep=';').columns.values
```

In [58]:
```
mnist_df_train.columns = names
mnist_df_test.columns = names
mnist_df_eval.columns = names
```

In [59]:
```
mnist_df_train
```

Out[59]:

	ident	1x1	1x2	1x3	1x4	1x5	1x6	1x7	1x8	1x9	...	28x20	28x21	28x22	28x23	28x24	28x25	28x26	28x27
0	10002	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
1	10003	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
2	10004	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
3	10005	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
4	10006	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
994	10996	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
995	10997	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
996	10998	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
997	10999	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
998	11000	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0

999 rows × 786 columns

In [60]:
```
mnist_df_test
```

Out[60]:

	ident	1x1	1x2	1x3	1x4	1x5	1x6	1x7	1x8	1x9	...	28x20	28x21	28x22	28x23	28x24	28x25	28x26	28x27
0	20002	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
1	20003	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
2	20004	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
3	20005	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
4	20006	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
994	20996	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
995	20997	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
996	20998	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
997	20999	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
998	21000	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0

999 rows × 786 columns

In [61]:
```
mnist_df_eval
```

Out[61]:

	ident	1x1	1x2	1x3	1x4	1x5	1x6	1x7	1x8	1x9	...	28x20	28x21	28x22	28x23	28x24	28x25	28x26	28x27
0	90002	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
1	90003	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
2	90004	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
3	90005	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
4	90006	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
994	90996	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
995	90997	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
996	90998	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
997	90999	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0
998	91000	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0

999 rows × 786 columns

In [62]:
```
train = mnist_df_train.iloc[:, 1:-1].values,mnist_df_train.iloc[:, -1].values
test = mnist_df_test.iloc[:, 1:-1].values,mnist_df_test.iloc[:, -1].values
evaal = mnist_df_eval.iloc[:, 1:-1].values,mnist_df_eval.iloc[:, -1].values
```

Calcul d'accuracy:

In [8]:
```
def getAccuracy(Liste_Classifiers,training,testing):
    print("\n*****\nAffichage des résultats:")
    for k in range(0,len(Liste_Classifiers)):
        print("Classifieur ", Liste_Classifiers[k].toString())
        Liste_Classifiers[k].train(training[0],training[1])
        print("\t Accuracy :", Liste_Classifiers[k].accuracy(testing[0],testing
[1]))
```

In [9]:
```
Liste_Classifiers = []
Liste_Classifiers.append(cl.ClassifierLineaireRandom(train[0].shape[1]))
Liste_Classifiers.append(cl.ClassifierArbreDecision(train[0].shape[1],0.0,names
))
Liste_Classifiers.append(cl.ClassifierArbreDecision(train[0].shape[1],0.25,name
s))
Liste_Classifiers.append(cl.ClassifierPerceptron(train[0].shape[1],0.01))
Liste_Classifiers.append(cl.ClassifierPerceptron(train[0].shape[1],0.001))
Liste_Classifiers.append(cl.ClassifierPerceptron(train[0].shape[1],0.0001))
Liste_Classifiers.append(cl.ClassifierKNN(train[0].shape[1],1))
Liste_Classifiers.append(cl.ClassifierKNN(train[0].shape[1],5))
Liste_Classifiers.append(cl.ClassifierKNN(train[0].shape[1],10))

getAccuracy(Liste_Classifiers,train,test)
```

```
*****
Affichage des résultats:
Classifieur  ClassifierLineaireRandom
         Accuracy : 44.24424424424424
Classifieur  ClassifierArbreDecision eps=0.0
         Accuracy : 68.86886886886887
Classifieur  ClassifierArbreDecision eps=0.25
         Accuracy : 68.86886886886887
Classifieur  ClassifierPerceptron rate=0.01
         Accuracy : 86.68668668668668
Classifieur  ClassifierPerceptron rate=0.001
         Accuracy : 85.88588588588588
Classifieur  ClassifierPerceptron rate=0.0001
         Accuracy : 86.78678678678679
Classifieur  ClassifierKNN n=1
         Accuracy : 93.4934934934935
Classifieur  ClassifierKNN n=5
         Accuracy : 94.5945945945946
Classifieur  ClassifierKNN n=10
         Accuracy : 93.69369369369369
```

Generation des fichiers resultats :

```
prenant les deux classifieurs Perceptron et KNN pour generer les fichiers result
at ci dessus:
    - resultat-1.csv : KNN avec k=5 ( meilleur performance)
    - resultat-2.csv : KNN avec k=1
    - resultat-3.csv : Perceptron avec rate=0.01
    - resultat-4.csv : Perceptron avec rate=0.001
comme le classifieur lineaire et de l'arbre de decision ont une accuracy < 70% j
e les ai pas utilisé pour eval.
```

In [23]:
```
res1 = pd.DataFrame(columns = ['ident', 'label'])
res2 = pd.DataFrame(columns = ['ident', 'label'])
res3 = pd.DataFrame(columns = ['ident', 'label'])
res4 = pd.DataFrame(columns = ['ident', 'label'])

liste = []
liste.append(cl.ClassifierKNN(train[0].shape[1],5))
liste.append(cl.ClassifierKNN(train[0].shape[1],1))
liste.append(cl.ClassifierPerceptron(train[0].shape[1],0.01))
liste.append(cl.ClassifierPerceptron(train[0].shape[1],0.001))

liste[0].train(train[0],train[1])
liste[1].train(train[0],train[1])
liste[2].train(train[0],train[1])
liste[3].train(train[0],train[1])
```

In [25]:
```
i=0
for row in evaal[0]:
    res1.loc[i] = [i+90002,liste[0].predict(row)]
    res2.loc[i] = [i+90002,liste[1].predict(row)]
    res3.loc[i] = [i+90002,liste[2].predict(row)]
    res4.loc[i] = [i+90002,liste[3].predict(row)]
    i+=1
```

In [29]:
```
res1.to_csv("resultat-1.csv",sep=';',index=False)
res2.to_csv("resultat-2.csv",sep=';',index=False)
res3.to_csv("resultat-3.csv",sep=';',index=False)
res4.to_csv("resultat-4.csv",sep=';',index=False)
```

Multiclasses :

In [2]:
```
multi_mnist_df_train = pd.read_csv("multiclasses/train_multi.csv",sep=';')
multi_mnist_df_test = pd.read_csv("multiclasses/test_multi.csv",sep=';')
multi_mnist_df_eval = pd.read_csv("multiclasses/eval_multi.csv",sep=';')
multi_names = pd.read_csv("multiclasses/names.csv",sep=';').columns.values
```

In [3]:
```
multi_mnist_df_train.columns = multi_names
multi_mnist_df_test.columns = multi_names
multi_mnist_df_eval.columns = multi_names
```

In [4]:
```
multi_mnist_df_train
```

Out[4]:

	ident	1x1	1x2	1x3	1x4	1x5	1x6	1x7	1x8	1x9	...	28x20	28x21	28x22	28x23	28x24	28x25	28x26	28x2
0	10002	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1	10003	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
2	10004	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
3	10005	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
4	10006	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
1994	11996	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1995	11997	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1996	11998	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1997	11999	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1998	12000	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	

1999 rows × 786 columns

In [5]:
```
multi_mnist_df_test
```

Out[5]:

	ident	1x1	1x2	1x3	1x4	1x5	1x6	1x7	1x8	1x9	...	28x20	28x21	28x22	28x23	28x24	28x25	28x26	28x2
0	20002	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1	20003	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
2	20004	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
3	20005	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
4	20006	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
1994	21996	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1995	21997	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1996	21998	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1997	21999	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1998	22000	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	

1999 rows × 786 columns

In [6]:
```
multi_mnist_df_eval
```

Out[6]:

	ident	1x1	1x2	1x3	1x4	1x5	1x6	1x7	1x8	1x9	...	28x20	28x21	28x22	28x23	28x24	28x25	28x26	28x2
0	90002	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1	90003	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
2	90004	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
3	90005	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
4	90006	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
1994	91996	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1995	91997	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1996	91998	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1997	91999	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
1998	92000	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	

1999 rows × 786 columns

One vs All :

```
Using KNN with k=5 (training):
```

In [9]:
```
data = []
for i in range(10):
    train = multi_mnist_df_train.copy()
    train.loc[train['label'] != i,'label'] = -1
    train.loc[train['label'] == i,'label'] = 1
    train = (train.iloc[:, 1:-1].values,train.iloc[:, -1].values)
    data.append(train)
```

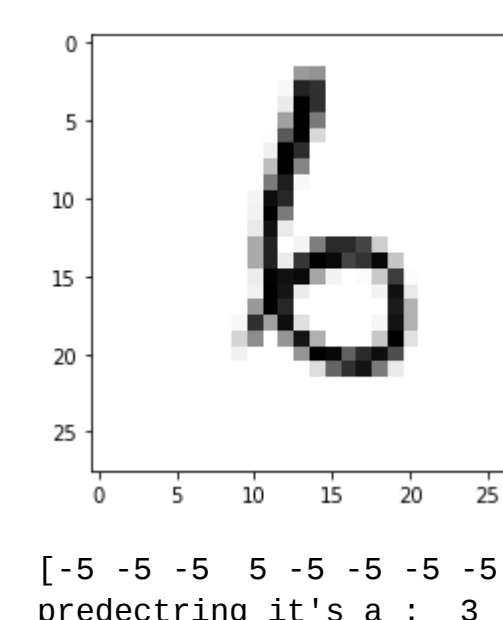
In [10]:
```
size = data[0][0].shape[1]
k = 5
LC = [] # liste des classifieurs pour chaque digit
for i in range(10):
    LC.append(cl.ClassifierKNN(size,k))
    LC[i].train(data[i][0],data[i][1])
```

```
Testing accuracy of 3 exemples :
```

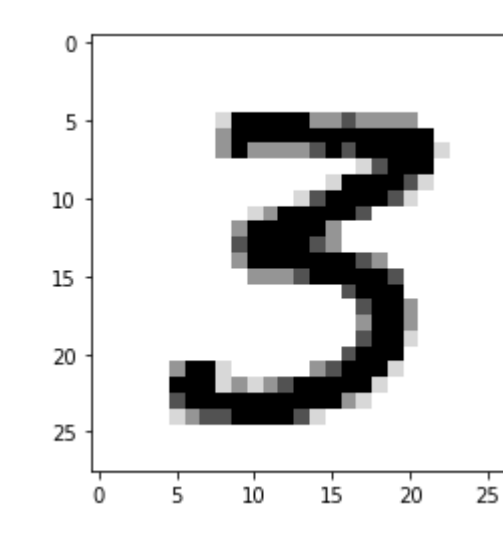
In [7]:
```
def showDigit(dataset,line):
    img = dataset.iloc[line][1:785].values.reshape(28,28)
    plt.imshow(img, cmap="Greys")
    plt.show()
```

In [10]:
```
for _ in range(3):
    line = rd.randint(0,1999)
    x = multi_mnist_df_test.iloc[line][1:785]
    tab = []
    for i in range(10):
        tab.append(LC[i].score(x))
    tab = np.asarray(tab)
    print(tab)
    print("predectring it's a : ",np.argmax(tab))
    print("real digit was : ")
    showDigit(multi_mnist_df_test,line)
```

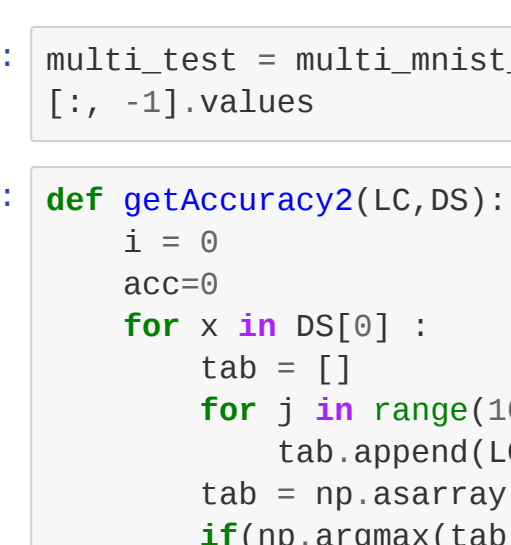
```
[-5 -5 -5 -5 -5 -5 -5  5 -5 -5]
predectring it's a :  7
real digit was :
```



```
[-5 -5 -5 -5 -5 -5  5 -5 -5 -5]
predectring it's a :  6
real digit was :
```



```
[-5 -5 -5  5 -5 -5 -5 -5 -5 -5]
predectring it's a :  3
real digit was :
```



```
Calcul d'accuracy :
```

In [11]:
```
multi_test = multi_mnist_df_test.iloc[:, 1:-1].values,multi_mnist_df_test.iloc
[:, -1].values
```

In [27]:
```
def getAccuracy2(LC,DS):
    i = 0
    acc=0
    for x in DS[0] :
        tab = []
        for j in range(10):
            tab.append(LC[j].score(x))
        tab = np.asarray(tab)
        if(np.argmax(tab) == DS[1][i]):
            acc+=1
        i+=1

    return acc/DS[0].shape[0]*100
```

In [28]:
```
getAccuracy2(LC,multi_test)
```

Out[28]:
```
90.24512256128064
```

In [14]:
```
res_multi = pd.DataFrame(columns = ['ident', 'label'])
eval_multi = multi_mnist_df_eval.iloc[:, 1:-1].values,multi_mnist_df_eval.iloc
[:, -1].values
i=0
for row in eval_multi[0]:
    tab = []
    for j in range(10):
        tab.append(LC[j].score(row))
    tab = np.asarray(tab)
    res_multi.loc[i] = [i+90002,np.argmax(tab)]
    i+=1
```