# Tugas Besar 2 AI

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## 0.1 Disusun oleh :

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```
In [1]: #IMPORT FILE CSV
        import pandas as pd
        from sklearn import preprocessing
        attributeName = ["age", "workclass", "fnlwgt", "education", "education-num", "marital-s
        #data=pd.read_csv("D:/CencusIncome.data.txt", names=attributeName)

        data=pd.read_csv("D:/CencusIncome.data.txt", names=attributeName)
        # GANTI PATHNYA ^^^^^^^^^^^^^^^^^^^^^

        data["capital-gain"] = data[["capital-gain"]].replace(' ?', data["capital-gain"].mean(
        data["capital-loss"] = data[["capital-loss"]].replace(' ?', data["capital-loss"].mean(
        data["hours-per-week"] = data[["hours-per-week"]].replace(' ? ', data["hours-per-week"

        data["workclass"] = data[["workclass"]].replace(' ?', " " + data["workclass"].mode()[0
        data["education"] = data[["education"]].replace(' ?', " " + data["education"].mode()[0
        data["marital-status"] = data[["marital-status"]].replace(' ?', " " + data["marital-sta
        data["occupation"] = data[["occupation"]].replace(' ?', " " + data["occupation"].mode(
        data["relationship"] = data[["relationship"]].replace(' ?', " " + data["relationship"]
        data["race"] = data[["race"]].replace(' ?', " " + data["race"].mode()[0])
        data["sex"] = data[["sex"]].replace(' ?', " " + data["sex"].mode()[0])
```

# 1 DATA ENCODING

**Sebelum di proses, data harus di encode terlebih agar dapat diproses. Data akan dirubah kedalam representasi integer, data tidak akan bisa diolah. Encoding dilakukan dengan menggunakan method LabelEncoder(). LaberEncoder() akan mengubah setiap data yang unik men-**

**jadi representasi integer. Tidak seluruh data akan di encode, data yang continuous tidak di encode.**

```
In [2]: cidata = data.as_matrix()

        le1 = preprocessing.LabelEncoder()
        le1.fit(cidata[:,1])
        list(le1.classes_)
        cidata[:,1] = le1.transform(cidata[:,1])


        le3 = preprocessing.LabelEncoder()
        le3.fit(cidata[:,3])
        list(le3.classes_)
        cidata[:,3] = le3.transform(cidata[:,3])

        le5 = preprocessing.LabelEncoder()
        le5.fit(cidata[:,5])
        list(le5.classes_)
        cidata[:,5] = le5.transform(cidata[:,5])

        le6 = preprocessing.LabelEncoder()
        le6.fit(cidata[:,6])
        list(le6.classes_)
        cidata[:,6] = le6.transform(cidata[:,6])

        le7 = preprocessing.LabelEncoder()
        le7.fit(cidata[:,7])
        list(le7.classes_)
        cidata[:,7] = le7.transform(cidata[:,7])

        le8 = preprocessing.LabelEncoder()
        le8.fit(cidata[:,8])
        list(le8.classes_)
        cidata[:,8] = le8.transform(cidata[:,8])

        le9 = preprocessing.LabelEncoder()
        le9.fit(cidata[:,9])
        list(le9.classes_)
        cidata[:,9] = le9.transform(cidata[:,9])

        le13 = preprocessing.LabelEncoder()
        le13.fit(cidata[:,13])
        list(le13.classes_)
        cidata[:,13] = le13.transform(cidata[:,13])

        le14 = preprocessing.LabelEncoder()
        le14.fit(cidata[:,14])
        list(le14.classes_)
        cidata[:,14] = le14.transform(cidata[:,14])
        print(cidata)
```

```
[[39 7 77516 ..., 40 39 0]
 [50 6 83311 ..., 13 39 0]
 [38 4 215646 ..., 40 39 0]
 ...,
 [58 4 151910 ..., 40 39 0]
 [22 4 201490 ..., 20 39 0]
 [52 5 287927 ..., 40 39 1]]
```

```
In [3]: import numpy as np
        index = [str(i) for i in range(0, len(cidata))]
        data2 = pd.DataFrame(data=np.int_(cidata[:,:]), columns=attributeName, index=index)

        target = data2.loc[:,"salary"]
        data = data2.loc[:,"age":"native-country"]
        data = data.drop('education-num', axis=1)
        data = data.drop('fnlwgt', axis=1)
        data = data.drop('native-country', axis=1)
        data = data.drop('age', axis=1)
```

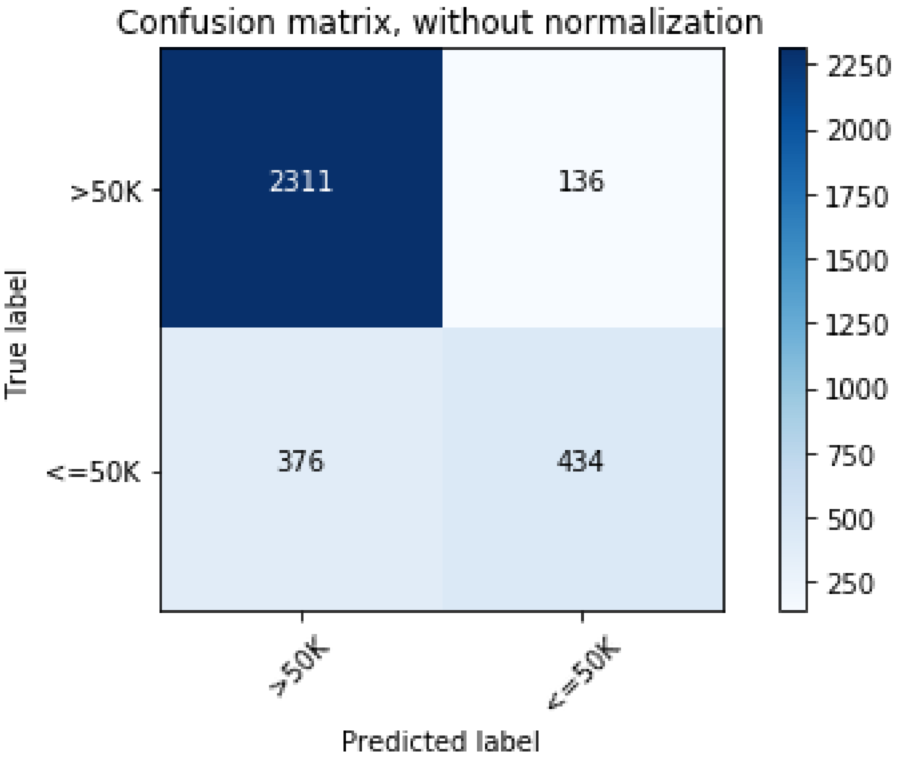
```
In [4]: import itertools
        import numpy as np
        import matplotlib.pyplot as plt

        from sklearn import svm, datasets
        from sklearn.model_selection import train_test_split
        from sklearn.metrics import confusion_matrix
        def plot_confusion_matrix(cm, classes,
                                  normalize=False,
                                  title='Confusion matrix',
                                  cmap=plt.cm.Blues):
            """
            This function prints and plots the confusion matrix.
            Normalization can be applied by setting `normalize=True`.
            """
            if normalize:
                cm = cm.astype('float') / cm.sum(axis=1)[:, np.newaxis]
                print("Normalized confusion matrix")
            else:
                print('Confusion matrix, without normalization')

            print(cm)

            plt.imshow(cm, interpolation='nearest', cmap=cmap)
            plt.title(title)
            plt.colorbar()
            tick_marks = np.arange(len(classes))
            plt.xticks(tick_marks, classes, rotation=45)
            plt.yticks(tick_marks, classes)

            fmt = '.2f' if normalize else 'd'
            thresh = cm.max() / 2.
            for i, j in itertools.product(range(cm.shape[0]), range(cm.shape[1])):
                plt.text(j, i, format(cm[i, j], fmt),
                         horizontalalignment="center",
                         color="white" if cm[i, j] > thresh else "black")

            plt.tight_layout()
            plt.ylabel('True label')
            plt.xlabel('Predicted label')
```

**Hasil analisis data dilakukan dengan cara menentukan performa dari setiap algoritma pembelajaran, performanya diukur dari seberapa sedikit kesalahan yang muncul dari data prediksi dibandingkan dengan data tes dari hasil pembelajaran. Untuk setiap fold menghasilkan persentase akurasi seberapa banyak prediksi yang tepat, sehingga untuk mendapatkan akurasi total kita mendapatkannya dengan cara mencari rata-rata akurasi dari 10 fold pembelajaran yang dilakukan.**

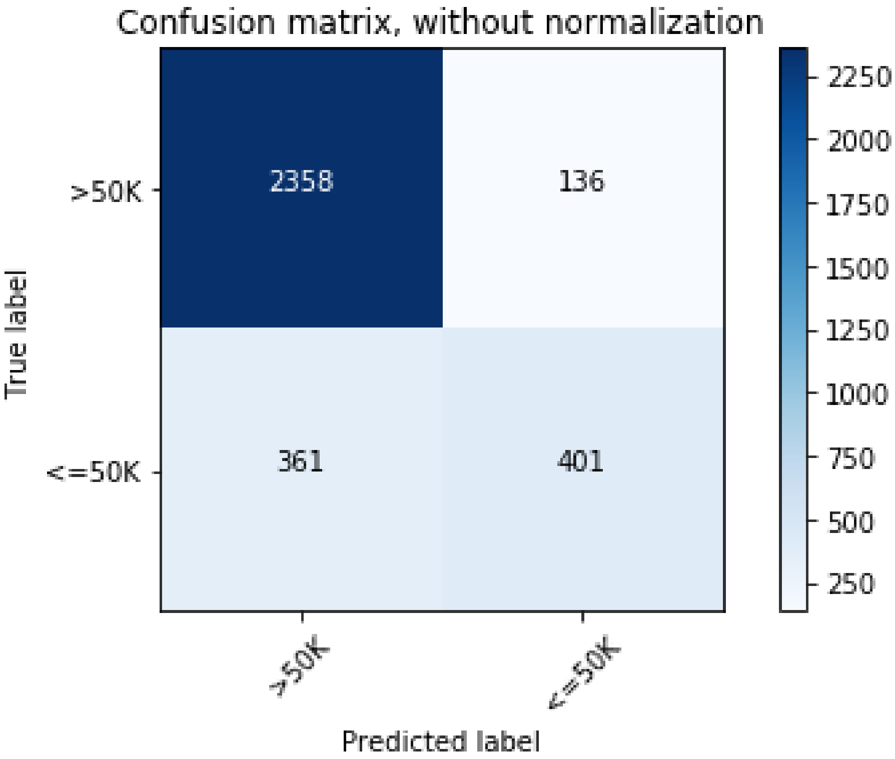
## 1.1 kNN

```
In [5]: from sklearn.model_selection import KFold
        from sklearn.neighbors import KNeighborsClassifier
        from sklearn.metrics import accuracy_score
        class_names = [">50K", "<=50K"]
        print("\n")
        print("kNN 10-fold cross validation")
        print("=======================")
        knn = KNeighborsClassifier(n_neighbors=20, algorithm='ball_tree')
        kf = KFold(n_splits = 10, shuffle = False)
        print(kf)
        i = 1
        temp = 0
        tempacc = 0
        for train_index, test_index in kf.split(data):
            print("Fold ", i)
            print("TRAIN :", train_index, "\nTEST :", test_index)
            x_train = data.iloc[train_index]
            x_test = data.iloc[test_index]
            y_train = target.iloc[train_index]
            y_test = target.iloc[test_index]
            i += 1
            y_pred = knn.fit(x_train, y_train).predict(x_test)
            print("Number of mislabeled points out of a total %d points : %d" % (len(x_test),
            print("Accuracy : %.4f" % accuracy_score(y_test,y_pred))
            temp += (y_test != y_pred).sum()
            tempacc += accuracy_score(y_test,y_pred)
            # Compute confusion matrix
            cnf_matrix = confusion_matrix(y_test, y_pred)
            np.set_printoptions(precision=2)
            # Plot non-normalized confusion matrix
            plt.figure()
            plot_confusion_matrix(cnf_matrix, classes=class_names,
                                  title='Confusion matrix, without normalization')
            plt.show()
        tempacc = tempacc/10
        print("Sum of mislabeled points : %d" % temp)
        print("Mean of mislabeled points : %.4f" % float(temp/10))
        print("Total accuracy : %.4f" % tempacc)
```

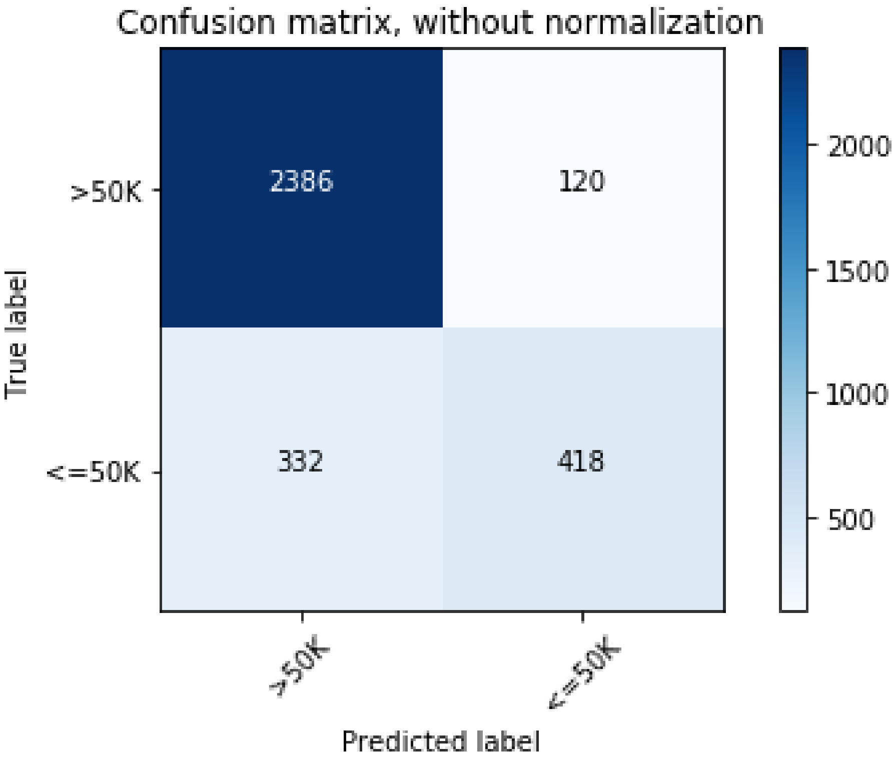
```
kNN 10-fold cross validation
=======================
KFold(n_splits=10, random_state=None, shuffle=False)
Fold  1
TRAIN : [ 3257  3258  3259 ..., 32558 32559 32560]
TEST : [    0     1     2 ..., 3254 3255 3256]
Number of mislabeled points out of a total 3257 points : 512
Accuracy : 0.8428
Confusion matrix, without normalization
[[2311  136]
 [ 376  434]]
```



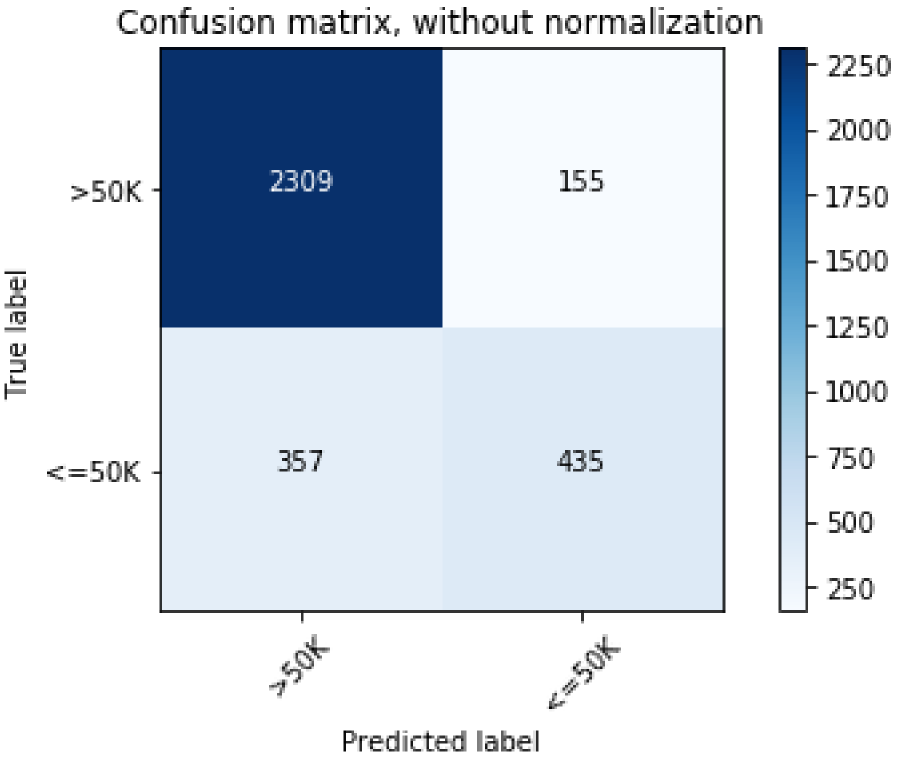
```
Fold  2
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [3257 3258 3259 ..., 6510 6511 6512]
Number of mislabeled points out of a total 3256 points : 497
Accuracy : 0.8474
Confusion matrix, without normalization
[[2358  136]
 [ 361  401]]
```



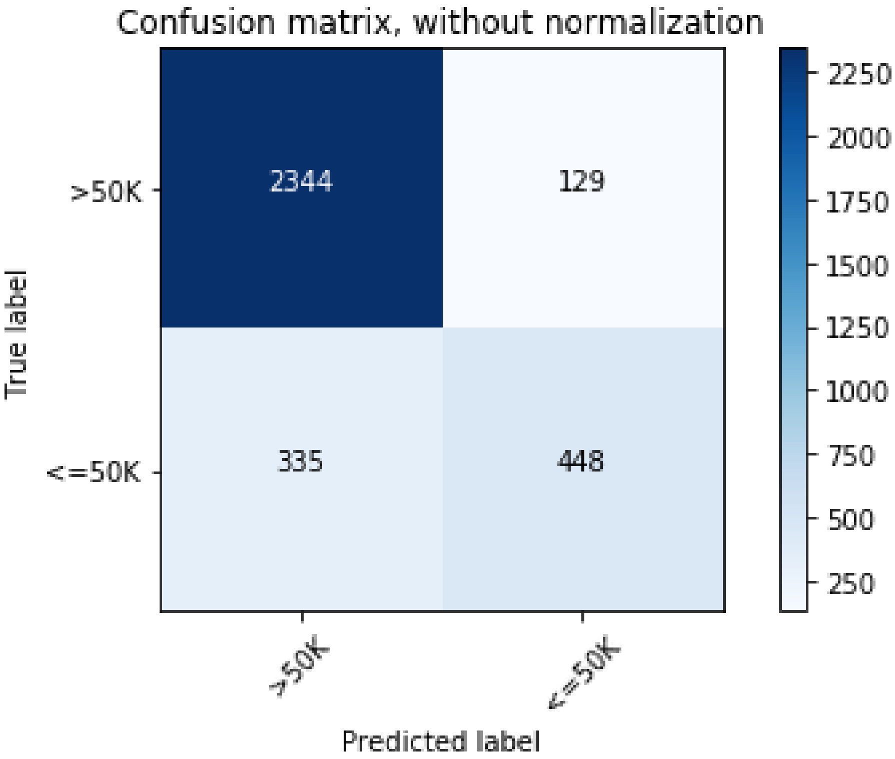
```
Fold  3
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [6513 6514 6515 ..., 9766 9767 9768]
Number of mislabeled points out of a total 3256 points : 452
Accuracy : 0.8612
Confusion matrix, without normalization
[[2386  120]
 [ 332  418]]
```



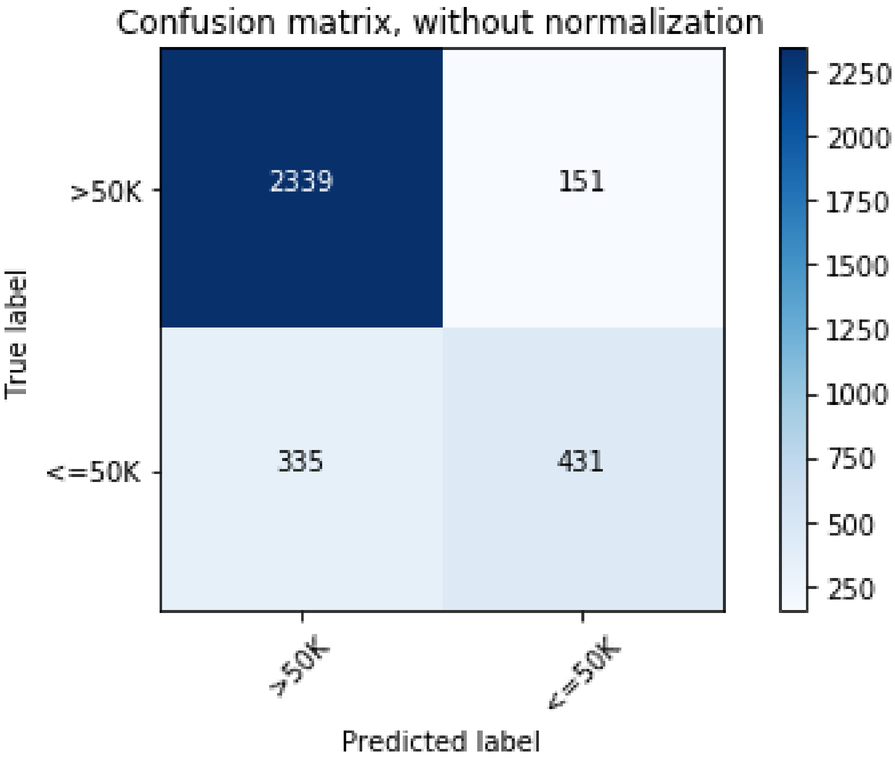
```
Fold  4
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [ 9769  9770  9771 ..., 13022 13023 13024]
Number of mislabeled points out of a total 3256 points : 512
Accuracy : 0.8428
Confusion matrix, without normalization
[[2309  155]
 [ 357  435]]
```



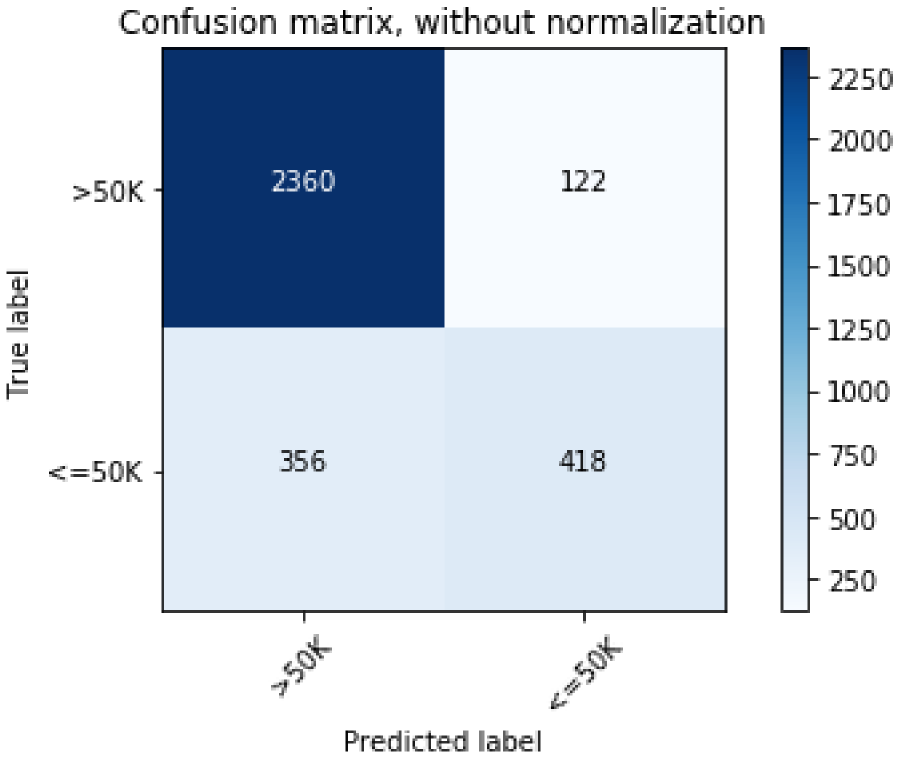
```
Fold  5
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [13025 13026 13027 ..., 16278 16279 16280]
Number of mislabeled points out of a total 3256 points : 464
Accuracy : 0.8575
Confusion matrix, without normalization
[[2344  129]
 [ 335  448]]
```



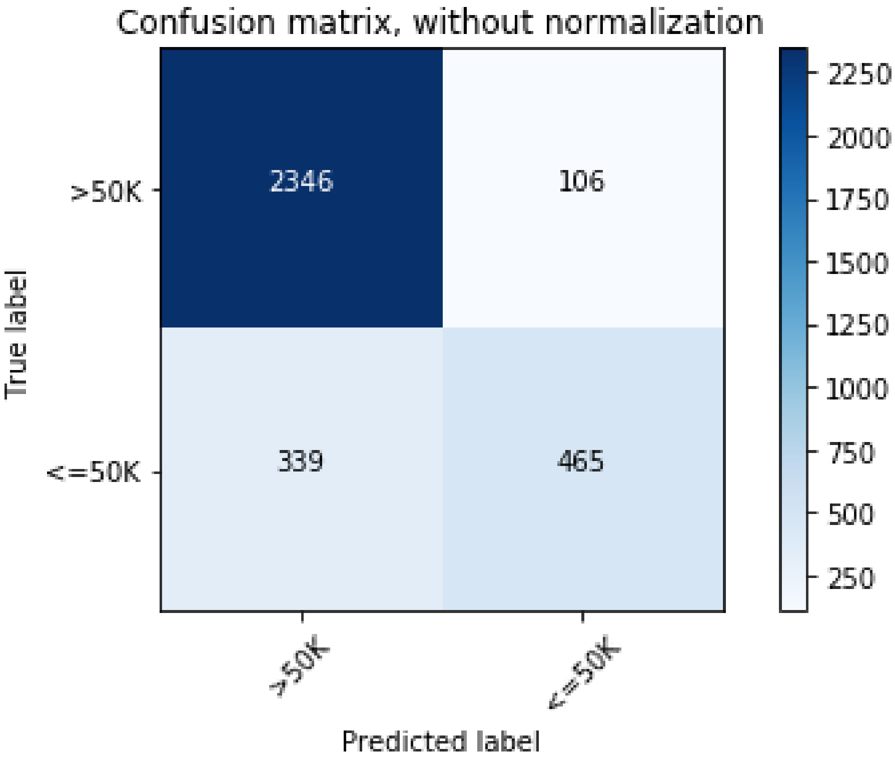
```
Fold  6
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [16281 16282 16283 ..., 19534 19535 19536]
Number of mislabeled points out of a total 3256 points : 486
Accuracy : 0.8507
Confusion matrix, without normalization
[[2339  151]
 [ 335  431]]
```



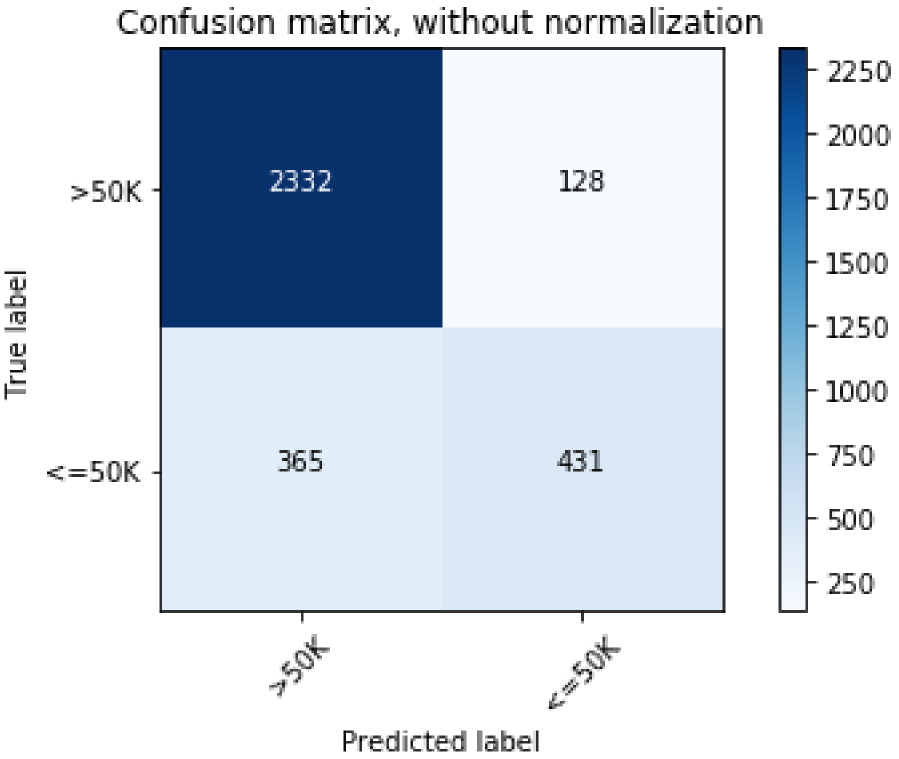
```
Fold  7
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [19537 19538 19539 ..., 22790 22791 22792]
Number of mislabeled points out of a total 3256 points : 478
Accuracy : 0.8532
Confusion matrix, without normalization
[[2360  122]
 [ 356  418]]
```



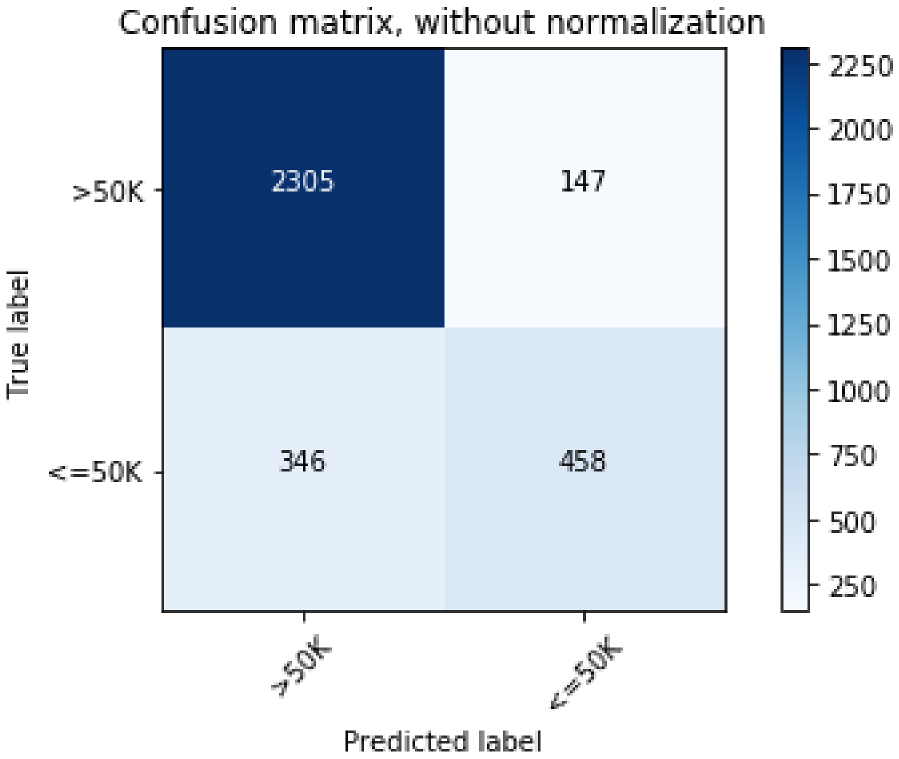
```
Fold  8
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [22793 22794 22795 ..., 26046 26047 26048]
Number of mislabeled points out of a total 3256 points : 445
Accuracy : 0.8633
Confusion matrix, without normalization
[[2346  106]
 [ 339  465]]
```



```
Fold  9
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [26049 26050 26051 ..., 29302 29303 29304]
Number of mislabeled points out of a total 3256 points : 493
Accuracy : 0.8486
Confusion matrix, without normalization
[[2332  128]
 [ 365  431]]
```



```
Fold  10
TRAIN : [    0     1     2 ..., 29302 29303 29304]
TEST : [29305 29306 29307 ..., 32558 32559 32560]
Number of mislabeled points out of a total 3256 points : 493
Accuracy : 0.8486
Confusion matrix, without normalization
[[2305  147]
 [ 346  458]]
```

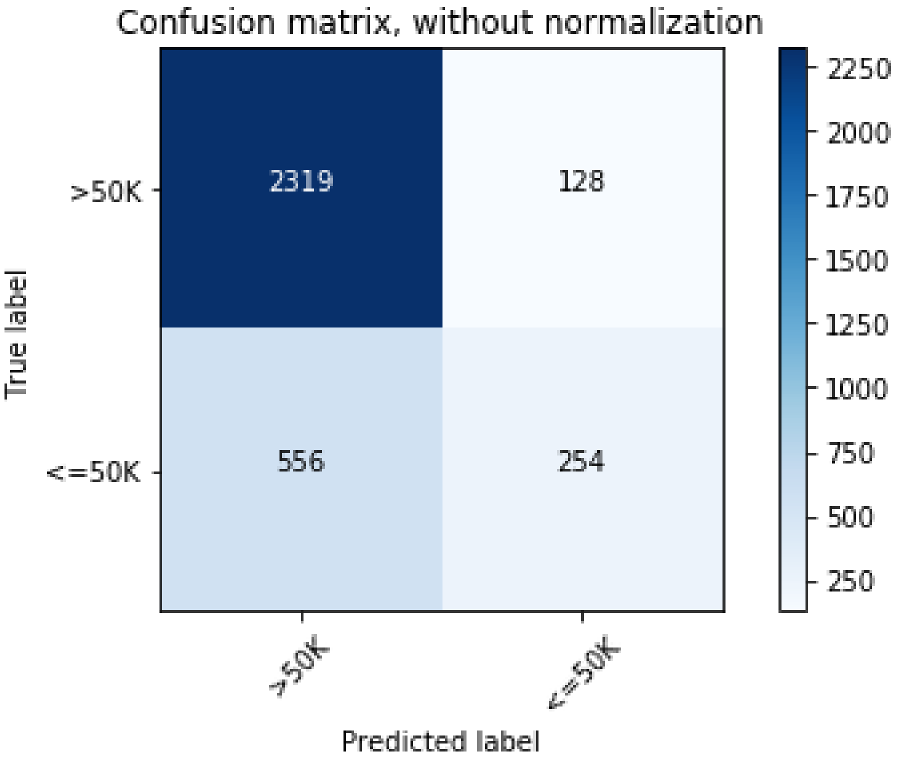


```
Sum of mislabeled points : 4832
Mean of mislabeled points : 483.2000
Total accuracy : 0.8516
```

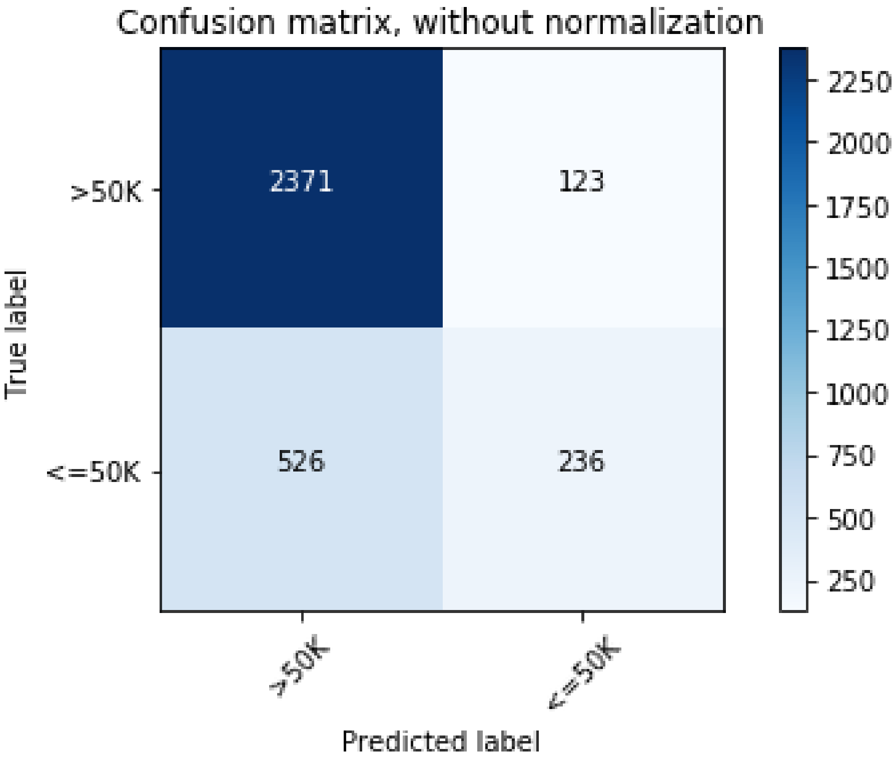
## 1.2 Naive Bayes

```
In [6]: from sklearn.model_selection import KFold
        from sklearn.naive_bayes import GaussianNB
        from sklearn.metrics import accuracy_score
        class_names = [">50K", "<=50K"]
        print("\n")
        print("Naive Bayes 10-fold cross validation")
        print("=======================")
        nb = GaussianNB()
        kf = KFold(n_splits = 10, shuffle = False)
        print(kf)
        i = 1
        temp = 0
        tempacc = 0
        for train_index, test_index in kf.split(data):
            print("Fold ", i)
            print("TRAIN :", train_index, "\nTEST :", test_index)
            x_train = data.iloc[train_index]
            x_test = data.iloc[test_index]
            y_train = target.iloc[train_index]
            y_test = target.iloc[test_index]
            i += 1
            y_pred = nb.fit(x_train, y_train).predict(x_test)
            print("Number of mislabeled points out of a total %d points : %d" % (len(x_test),
            print("Accuracy : %.4f" % accuracy_score(y_test,y_pred))
            temp += (y_test != y_pred).sum()
            tempacc += accuracy_score(y_test,y_pred)
            # Compute confusion matrix
            cnf_matrix = confusion_matrix(y_test, y_pred)
            np.set_printoptions(precision=2)
            # Plot non-normalized confusion matrix
            plt.figure()
            plot_confusion_matrix(cnf_matrix, classes=class_names,
                                  title='Confusion matrix, without normalization')
            plt.show()
        tempacc = tempacc/10
        print("Sum of mislabeled points : %d" % temp)
        print("Mean of mislabeled points : %.4f" % float(temp/10))
        print("Total accuracy : %.4f" % tempacc)
```

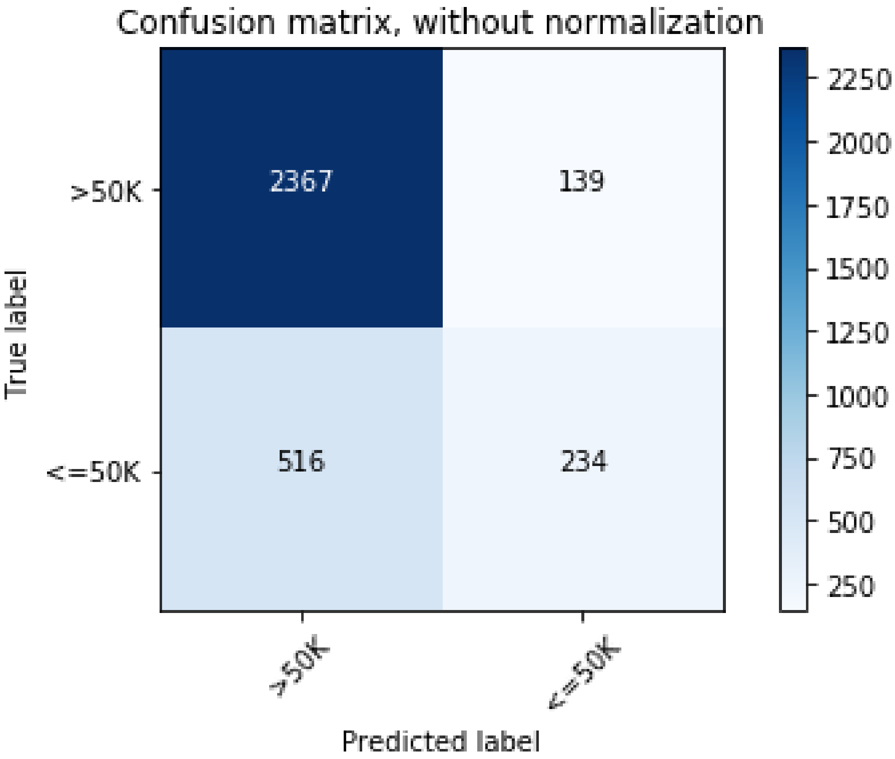
```
Naive Bayes 10-fold cross validation
=======================
KFold(n_splits=10, random_state=None, shuffle=False)
Fold  1
TRAIN : [ 3257  3258  3259 ..., 32558 32559 32560]
TEST : [    0     1     2 ..., 3254 3255 3256]
Number of mislabeled points out of a total 3257 points : 684
Accuracy : 0.7900
Confusion matrix, without normalization
[[2319  128]
 [ 556  254]]
```



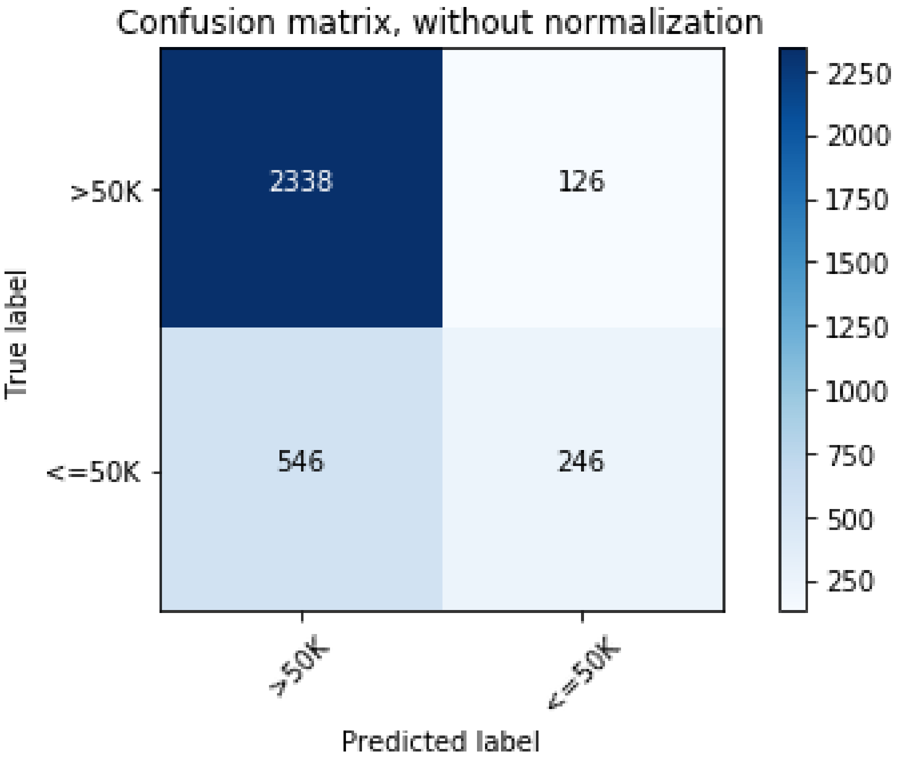
```
Fold  2
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [3257 3258 3259 ..., 6510 6511 6512]
Number of mislabeled points out of a total 3256 points : 649
Accuracy : 0.8007
Confusion matrix, without normalization
[[2371  123]
 [ 526  236]]
```



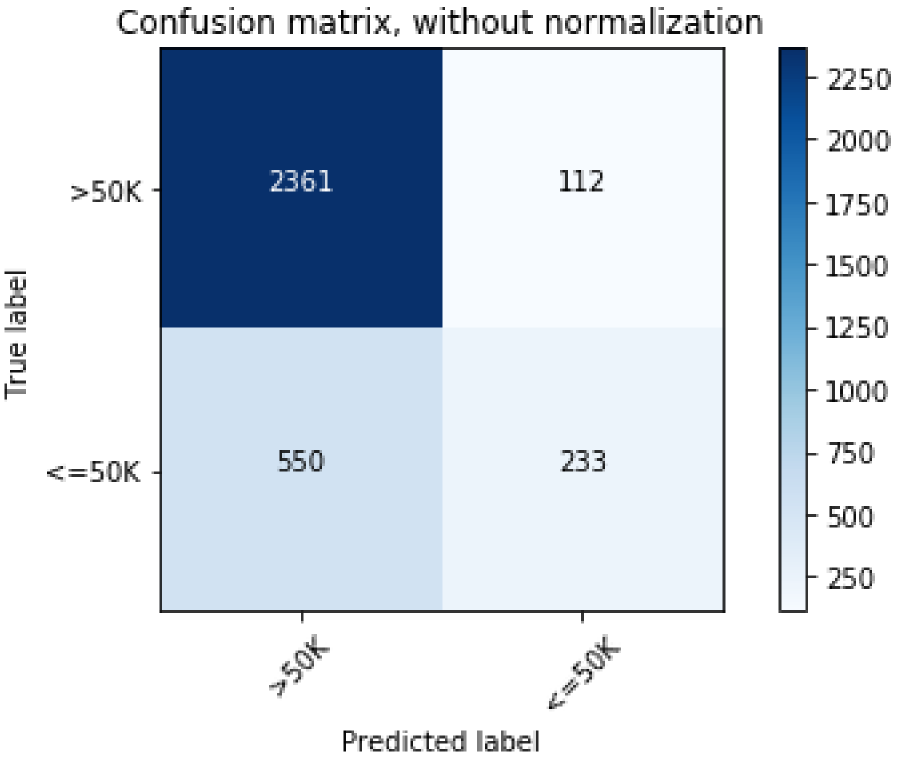
```
Fold  3
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [6513 6514 6515 ..., 9766 9767 9768]
Number of mislabeled points out of a total 3256 points : 655
Accuracy : 0.7988
Confusion matrix, without normalization
[[2367  139]
 [ 516  234]]
```



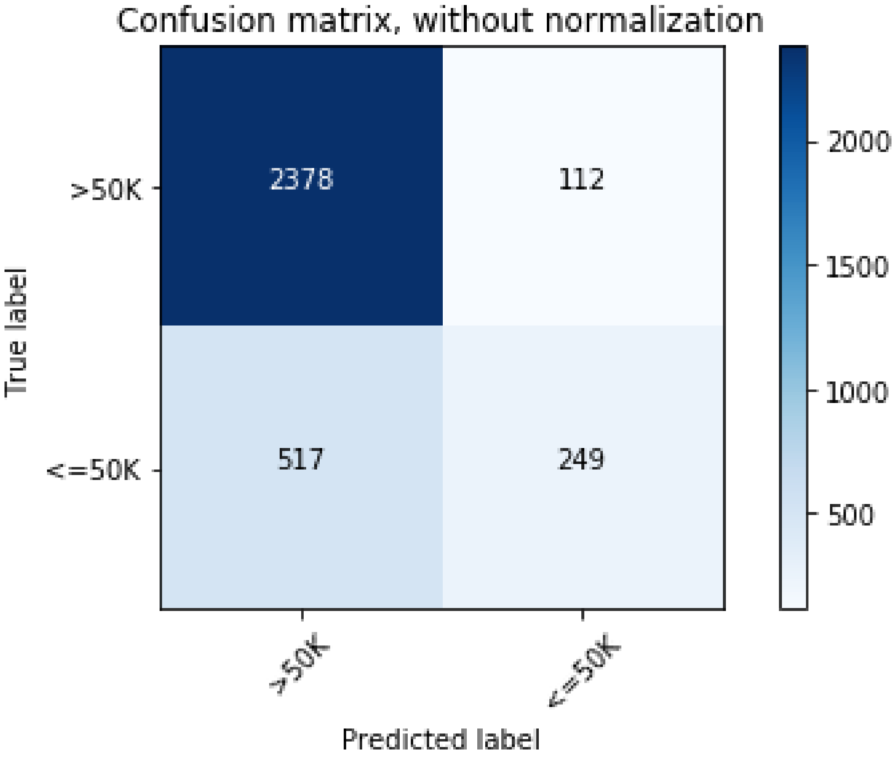
```
Fold  4
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [ 9769  9770  9771 ..., 13022 13023 13024]
Number of mislabeled points out of a total 3256 points : 672
Accuracy : 0.7936
Confusion matrix, without normalization
[[2338  126]
 [ 546  246]]
```



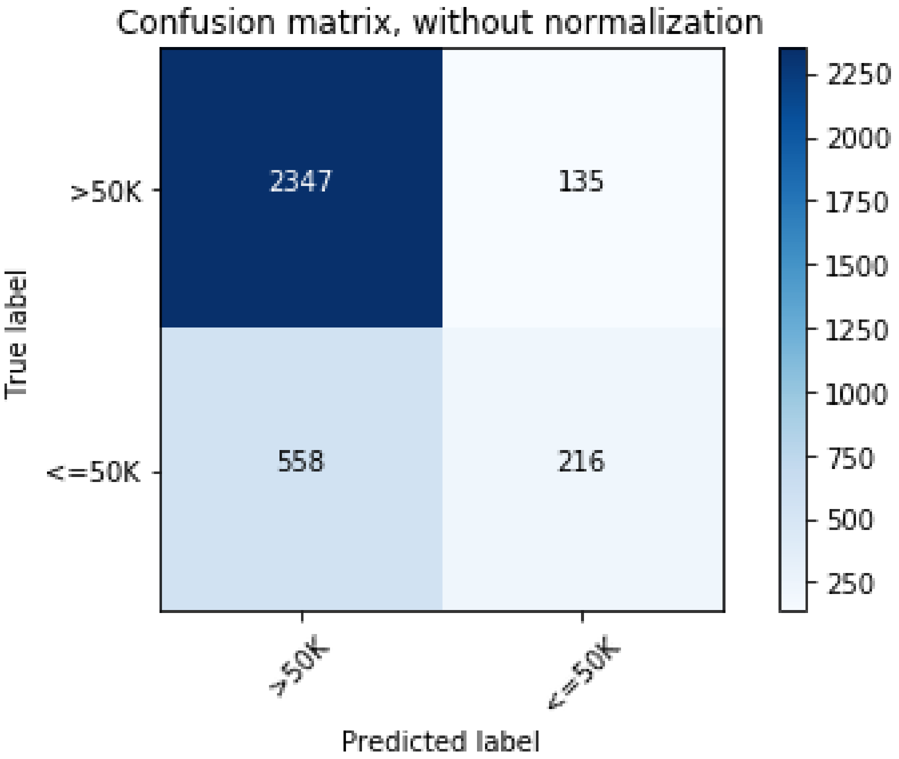
```
Fold  5
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [13025 13026 13027 ..., 16278 16279 16280]
Number of mislabeled points out of a total 3256 points : 662
Accuracy : 0.7967
Confusion matrix, without normalization
[[2361  112]
 [ 550  233]]
```



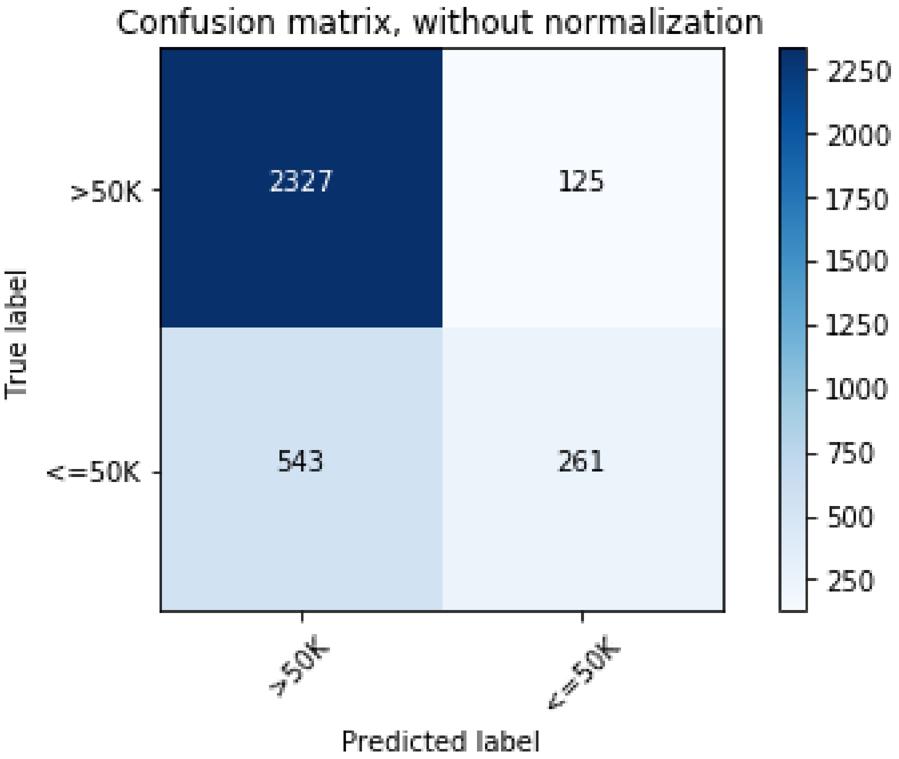
```
Fold  6
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [16281 16282 16283 ..., 19534 19535 19536]
Number of mislabeled points out of a total 3256 points : 629
Accuracy : 0.8068
Confusion matrix, without normalization
[[2378  112]
 [ 517  249]]
```



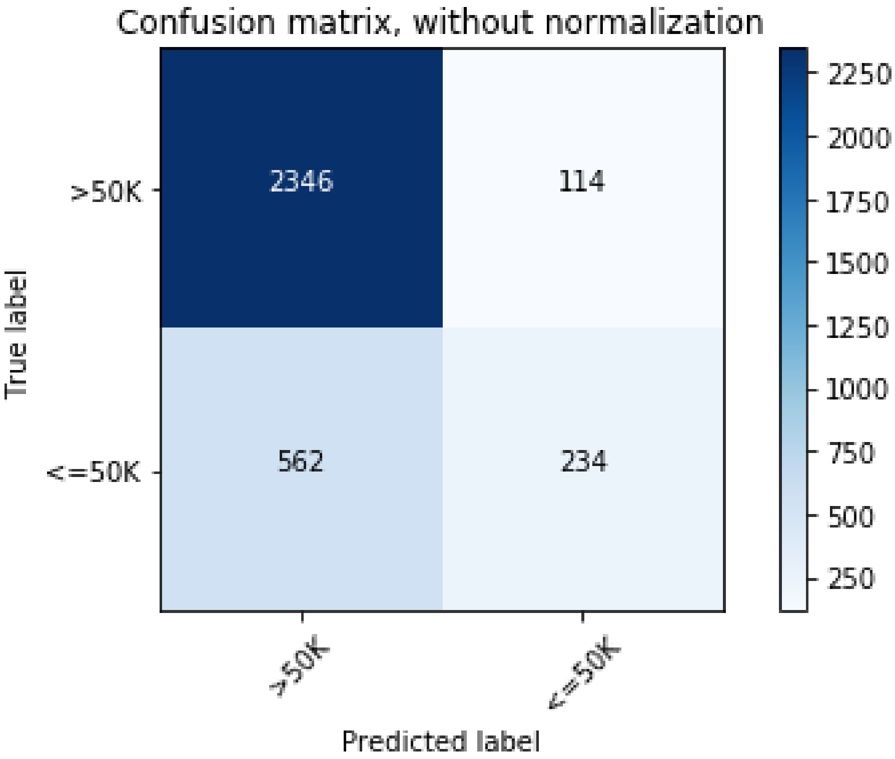
```
Fold  7
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [19537 19538 19539 ..., 22790 22791 22792]
Number of mislabeled points out of a total 3256 points : 693
Accuracy : 0.7872
Confusion matrix, without normalization
[[2347  135]
 [ 558  216]]
```



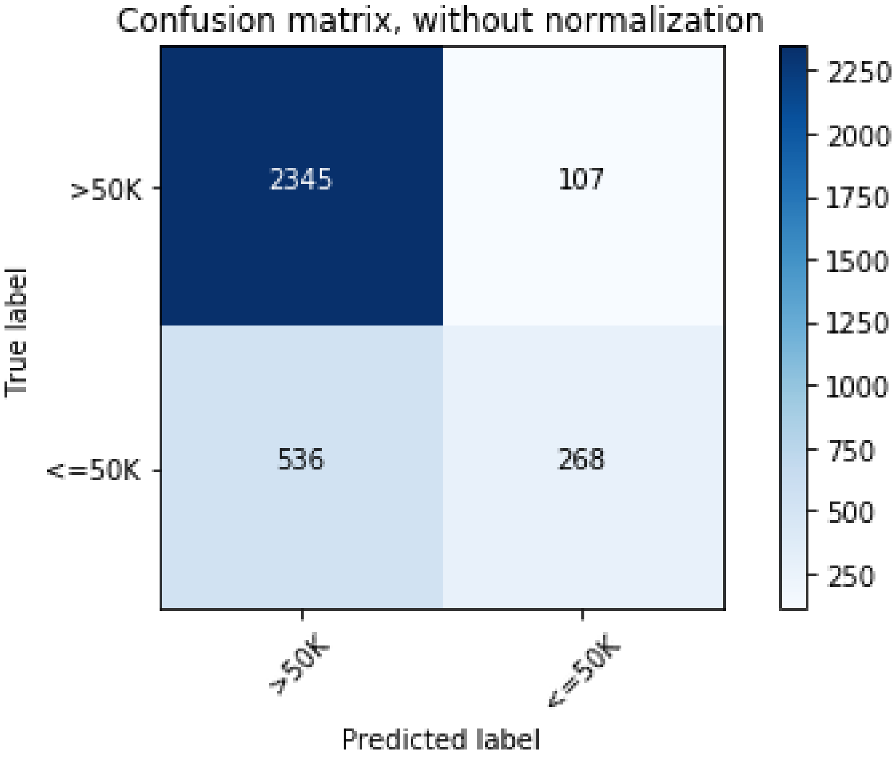
```
Fold  8
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [22793 22794 22795 ..., 26046 26047 26048]
Number of mislabeled points out of a total 3256 points : 668
Accuracy : 0.7948
Confusion matrix, without normalization
[[2327  125]
 [ 543  261]]
```



```
Fold  9
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [26049 26050 26051 ..., 29302 29303 29304]
Number of mislabeled points out of a total 3256 points : 676
Accuracy : 0.7924
Confusion matrix, without normalization
[[2346  114]
 [ 562  234]]
```



```
Fold  10
TRAIN : [    0     1     2 ..., 29302 29303 29304]
TEST : [29305 29306 29307 ..., 32558 32559 32560]
Number of mislabeled points out of a total 3256 points : 643
Accuracy : 0.8025
Confusion matrix, without normalization
[[2345  107]
 [ 536  268]]
```

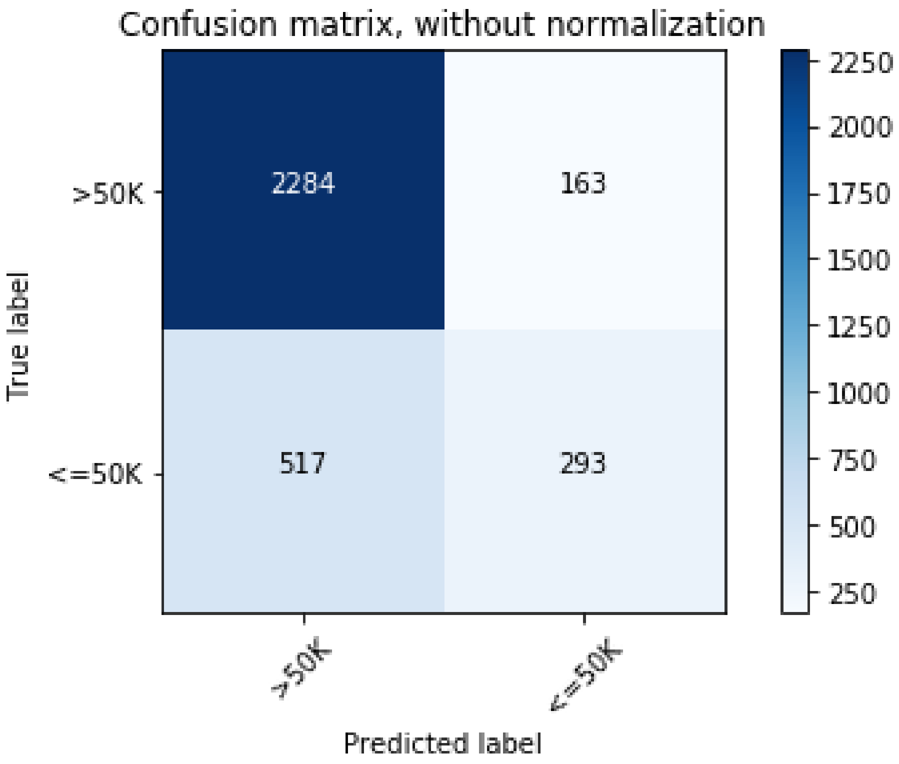


```
Sum of mislabeled points : 6631
Mean of mislabeled points : 663.1000
Total accuracy : 0.7964
```

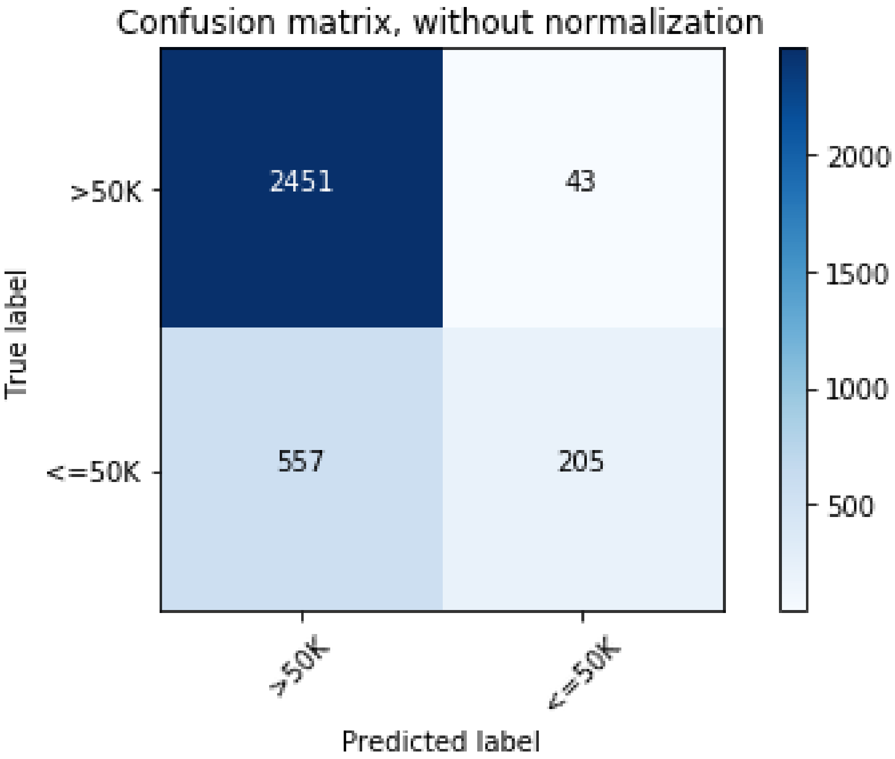
### 1.3 MLP

```
In [7]: from sklearn.model_selection import KFold
        from sklearn.naive_bayes import GaussianNB
        from sklearn.metrics import accuracy_score
        from sklearn.neural_network import MLPClassifier
        class_names = [">50K", "<=50K"]
        print("\n")
        print("MLP 10-fold cross validation")
        print("========================")
        mlp = MLPClassifier()
        kf = KFold(n_splits = 10, shuffle = False)
        print(kf)
        i = 1
        temp = 0
        tempacc = 0
        for train_index, test_index in kf.split(data):
            print("Fold ", i)
            print("TRAIN :", train_index, "\nTEST :", test_index)
            x_train = data.iloc[train_index]
            x_test = data.iloc[test_index]
            y_train = target.iloc[train_index]
            y_test = target.iloc[test_index]
            i += 1
            y_pred = mlp.fit(x_train, y_train).predict(x_test)
            print("Number of mislabeled points out of a total %d points : %d" % (len(x_test),
            print("Accuracy : %.4f" % accuracy_score(y_test,y_pred))
            temp += (y_test != y_pred).sum()
            tempacc += accuracy_score(y_test,y_pred)
            # Compute confusion matrix
            cnf_matrix = confusion_matrix(y_test, y_pred)
            np.set_printoptions(precision=2)
            # Plot non-normalized confusion matrix
            plt.figure()
            plot_confusion_matrix(cnf_matrix, classes=class_names,
                                  title='Confusion matrix, without normalization')
            plt.show()
        tempacc = tempacc/10
        print("Sum of mislabeled points : %d" % temp)
        print("Mean of mislabeled points : %.4f" % float(temp/10))
        print("Total accuracy : %.4f" % tempacc)
```

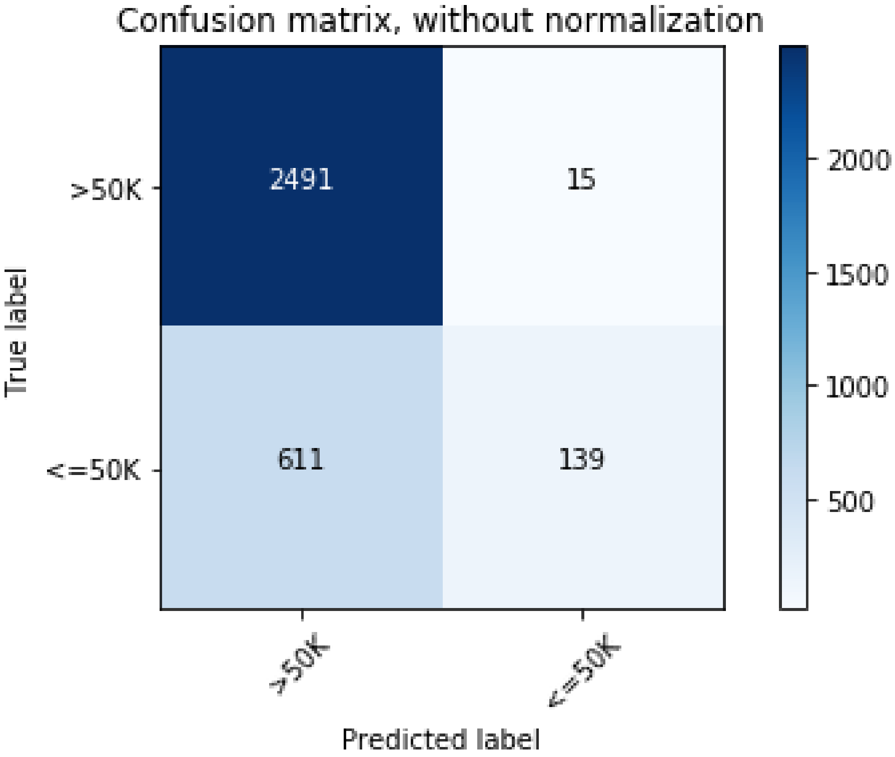
```
MLP 10-fold cross validation
=======================
KFold(n_splits=10, random_state=None, shuffle=False)
Fold  1
TRAIN : [ 3257  3258  3259 ..., 32558 32559 32560]
TEST : [    0     1     2 ..., 3254 3255 3256]
Number of mislabeled points out of a total 3257 points : 680
Accuracy : 0.7912
Confusion matrix, without normalization
[[2284  163]
 [ 517  293]]
```



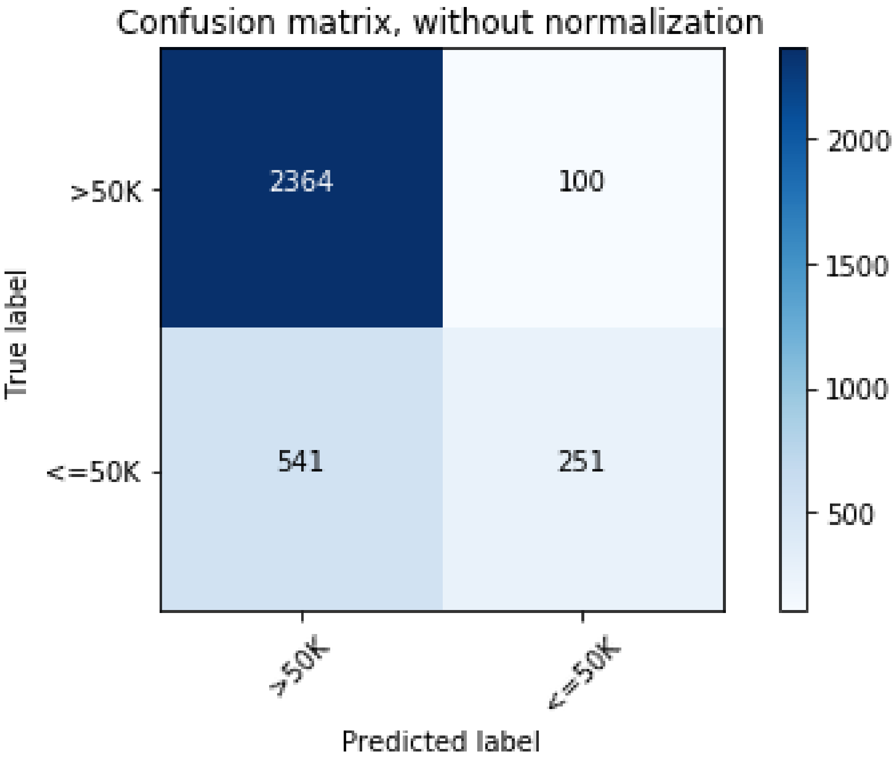
```
Fold  2
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [3257 3258 3259 ..., 6510 6511 6512]
Number of mislabeled points out of a total 3256 points : 600
Accuracy : 0.8157
Confusion matrix, without normalization
[[2451   43]
 [ 557  205]]
```



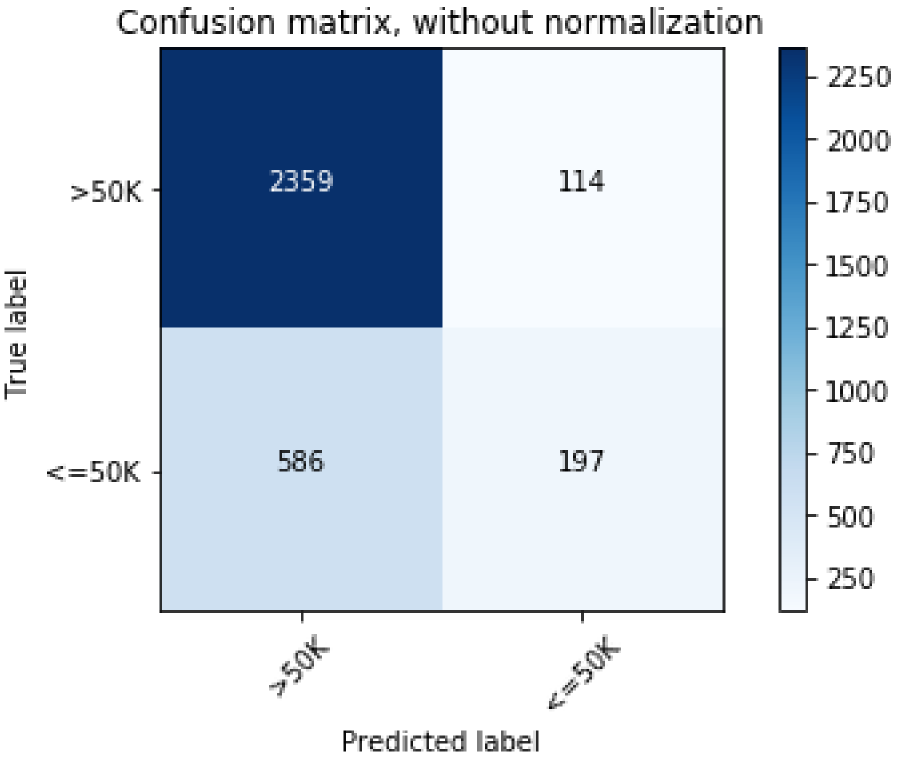
```
Fold  3
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [6513 6514 6515 ..., 9766 9767 9768]
Number of mislabeled points out of a total 3256 points : 626
Accuracy : 0.8077
Confusion matrix, without normalization
[[2491   15]
 [ 611  139]]
```



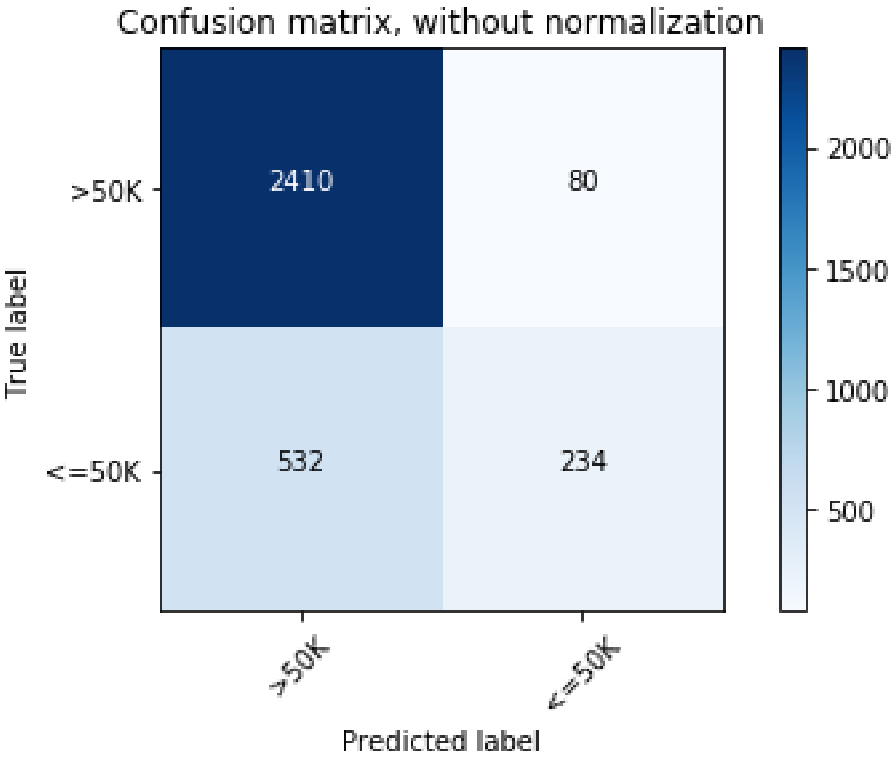
```
Fold  4
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [ 9769  9770  9771 ..., 13022 13023 13024]
Number of mislabeled points out of a total 3256 points : 641
Accuracy : 0.8031
Confusion matrix, without normalization
[[2364  100]
 [ 541  251]]
```



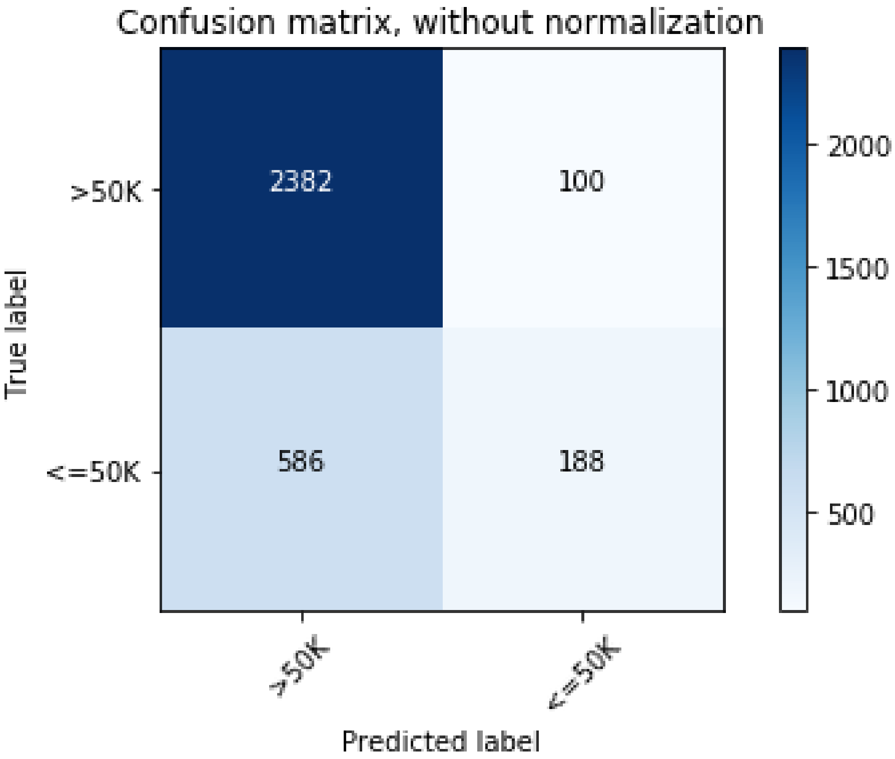
```
Fold  5
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [13025 13026 13027 ..., 16278 16279 16280]
Number of mislabeled points out of a total 3256 points : 700
Accuracy : 0.7850
Confusion matrix, without normalization
[[2359  114]
 [ 586  197]]
```



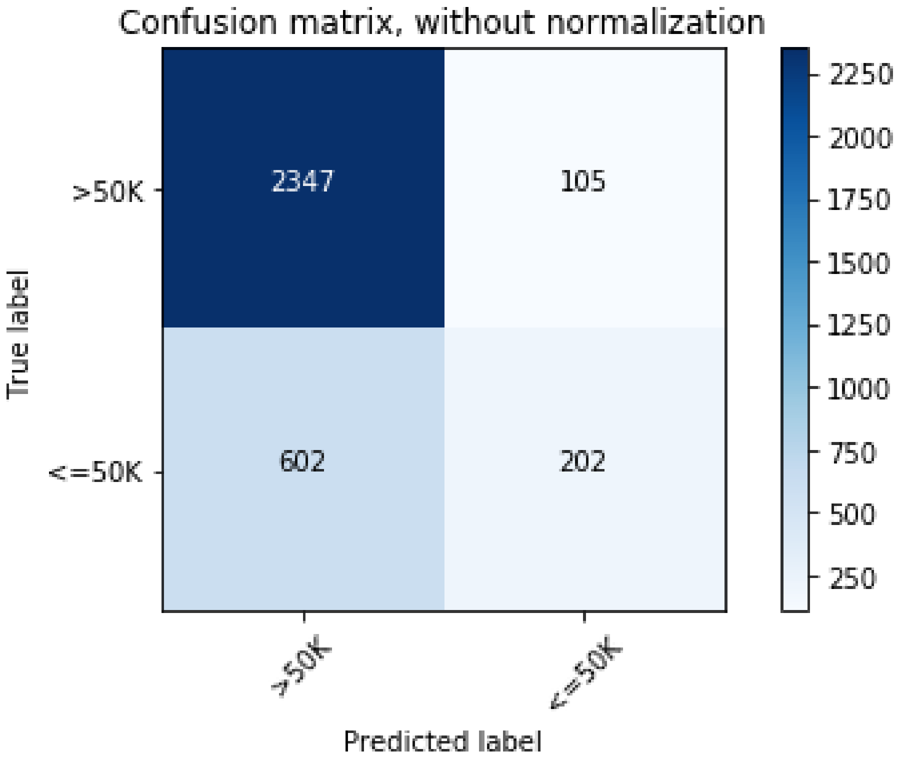
```
Fold  6
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [16281 16282 16283 ..., 19534 19535 19536]
Number of mislabeled points out of a total 3256 points : 612
Accuracy : 0.8120
Confusion matrix, without normalization
[[2410   80]
 [ 532  234]]
```



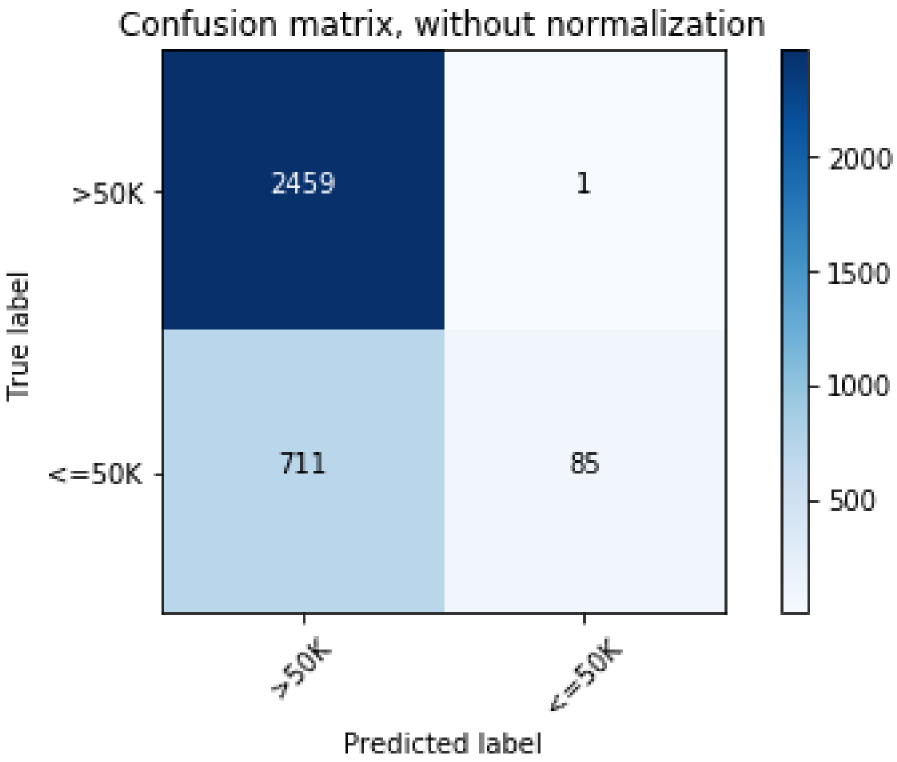
```
Fold  7
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [19537 19538 19539 ..., 22790 22791 22792]
Number of mislabeled points out of a total 3256 points : 686
Accuracy : 0.7893
Confusion matrix, without normalization
[[2382  100]
 [ 586  188]]
```



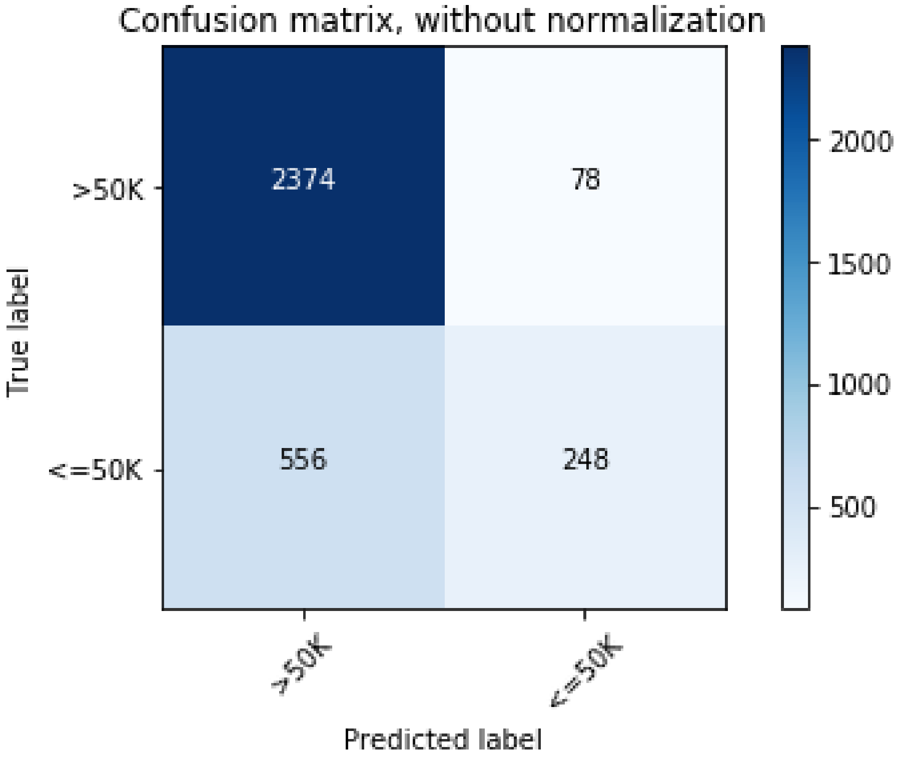
```
Fold  8
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [22793 22794 22795 ..., 26046 26047 26048]
Number of mislabeled points out of a total 3256 points : 707
Accuracy : 0.7829
Confusion matrix, without normalization
[[2347  105]
 [ 602  202]]
```



```
Fold  9
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [26049 26050 26051 ..., 29302 29303 29304]
Number of mislabeled points out of a total 3256 points : 712
Accuracy : 0.7813
Confusion matrix, without normalization
[[2459    1]
 [ 711   85]]
```



```
Fold  10
TRAIN : [    0     1     2 ..., 29302 29303 29304]
TEST : [29305 29306 29307 ..., 32558 32559 32560]
Number of mislabeled points out of a total 3256 points : 634
Accuracy : 0.8053
Confusion matrix, without normalization
[[2374   78]
 [ 556  248]]
```



```
Sum of mislabeled points : 6598
Mean of mislabeled points : 659.8000
Total accuracy : 0.7974
```

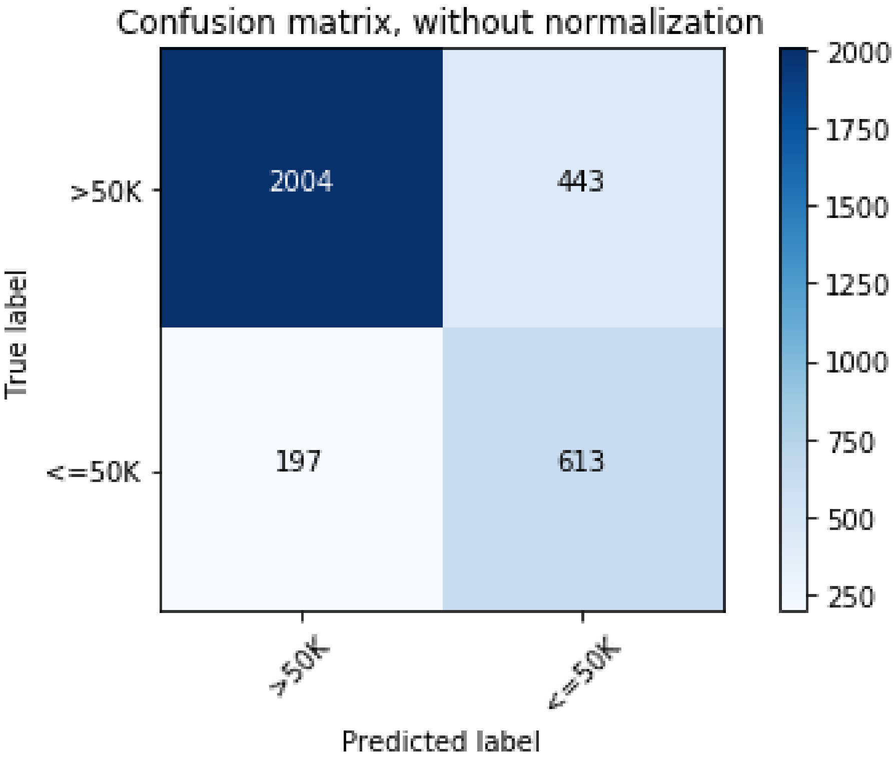
## 1.4 Decision Tree

**Untuk mendapatkan akurasi yang lebih tinggi, maka akan digunakan parameter class_weight='balanced'**

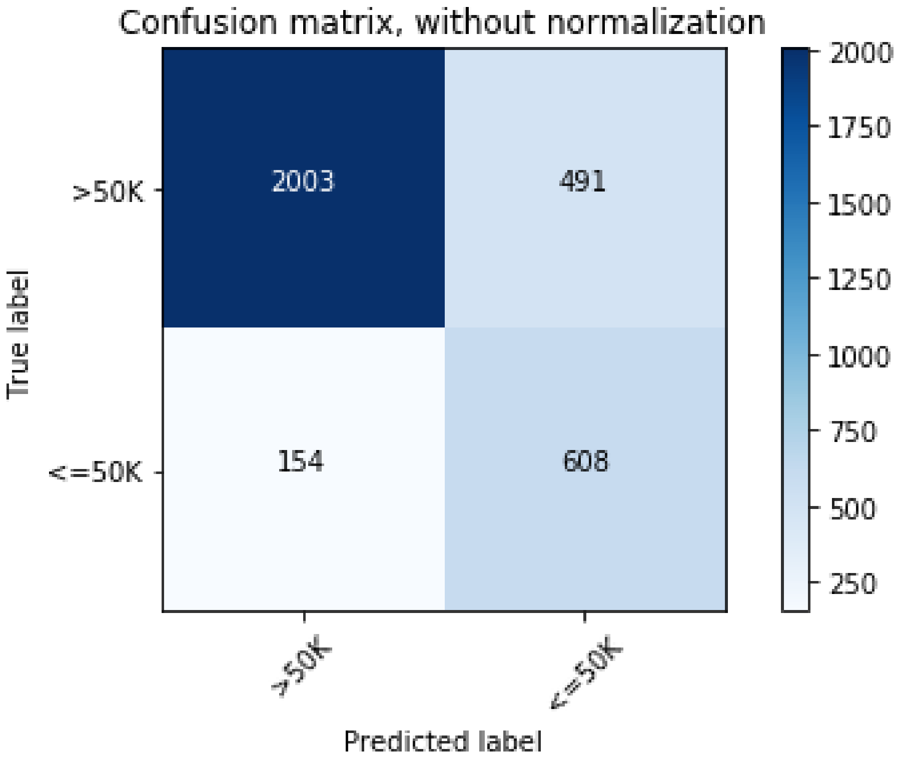
```
In [8]: from sklearn.model_selection import KFold
        from sklearn import tree
        from sklearn.metrics import accuracy_score
        class_names = [">50K", "<=50K"]
        print("\n")
        print("Decision Tree 10-fold cross validation")
        print("======================")
        clf = tree.DecisionTreeClassifier(random_state=222222, class_weight='balanced')
        """
        Untuk mendapatkan akurasi yang lebih tinggi, maka akan digunakan parameter class_weigh
        """
        kf = KFold(n_splits = 10, shuffle = False)
        print(kf)
```

```
i = 1
temp = 0
tempacc = 0
for train_index, test_index in kf.split(data):
    print("Fold ", i)
    print("TRAIN :", train_index, "\nTEST :", test_index)
    x_train = data.iloc[train_index]
    x_test = data.iloc[test_index]
    y_train = target.iloc[train_index]
    y_test = target.iloc[test_index]
    i += 1
    y_pred = clf.fit(x_train, y_train).predict(x_test)
    print("Number of mislabeled points out of a total %d points : %d" % (len(x_test),
    print("Accuracy : %.4f" % accuracy_score(y_test,y_pred))
    temp += (y_test != y_pred).sum()
    tempacc += accuracy_score(y_test,y_pred)
    # Compute confusion matrix
    cnf_matrix = confusion_matrix(y_test, y_pred)
    np.set_printoptions(precision=2)
    # Plot non-normalized confusion matrix
    plt.figure()
    plot_confusion_matrix(cnf_matrix, classes=class_names,
                          title='Confusion matrix, without normalization')
    plt.show()
tempacc = tempacc/10
print("Sum of mislabeled points : %d" % temp)
print("Mean of mislabeled points : %.4f" % float(temp/10))
print("Total accuracy : %.4f" % tempacc)
```

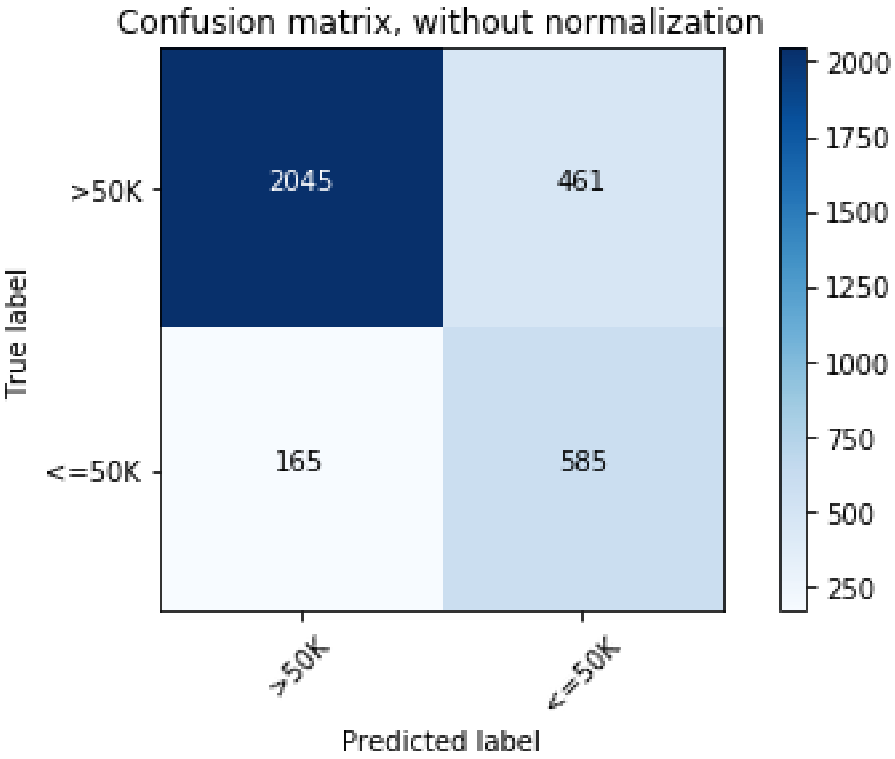
```
Decision Tree 10-fold cross validation
=======================
KFold(n_splits=10, random_state=None, shuffle=False)
Fold  1
TRAIN : [ 3257  3258  3259 ..., 32558 32559 32560]
TEST : [    0     1     2 ..., 3254 3255 3256]
Number of mislabeled points out of a total 3257 points : 640
Accuracy : 0.8035
Confusion matrix, without normalization
[[2004  443]
 [ 197  613]]
```



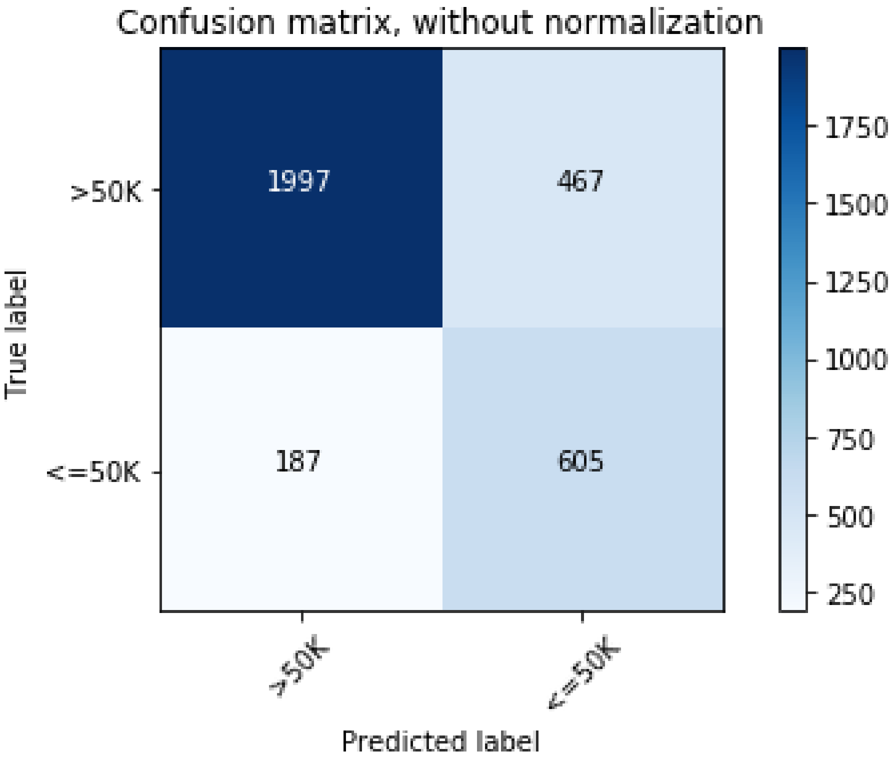
```
Fold  2
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [3257 3258 3259 ..., 6510 6511 6512]
Number of mislabeled points out of a total 3256 points : 645
Accuracy : 0.8019
Confusion matrix, without normalization
[[2003  491]
 [ 154  608]]
```



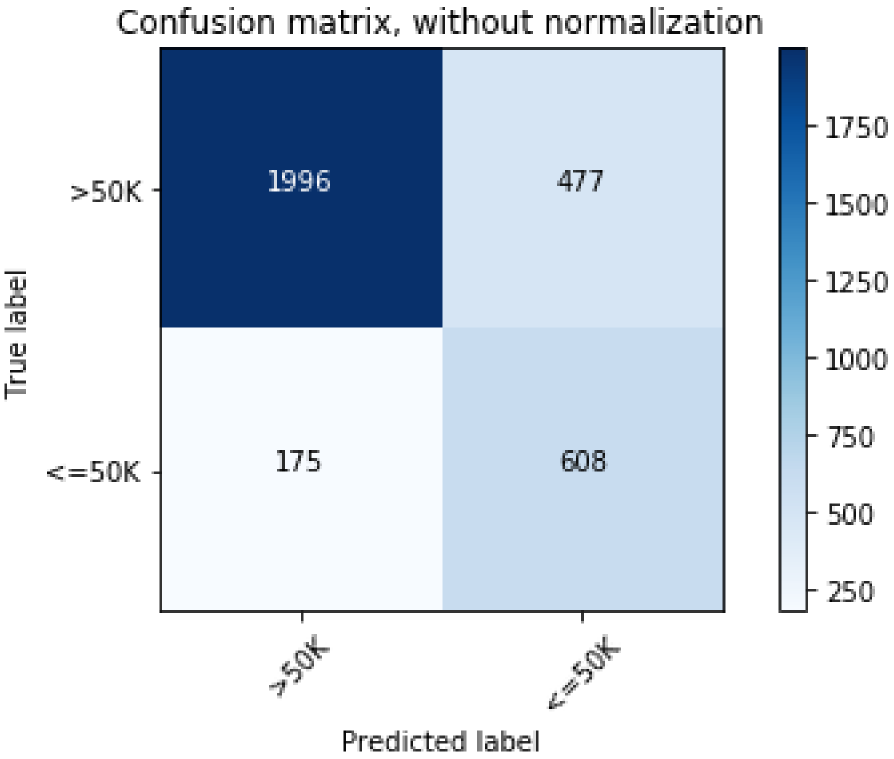
```
Fold  3
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [6513 6514 6515 ..., 9766 9767 9768]
Number of mislabeled points out of a total 3256 points : 626
Accuracy : 0.8077
Confusion matrix, without normalization
[[2045  461]
 [ 165  585]]
```



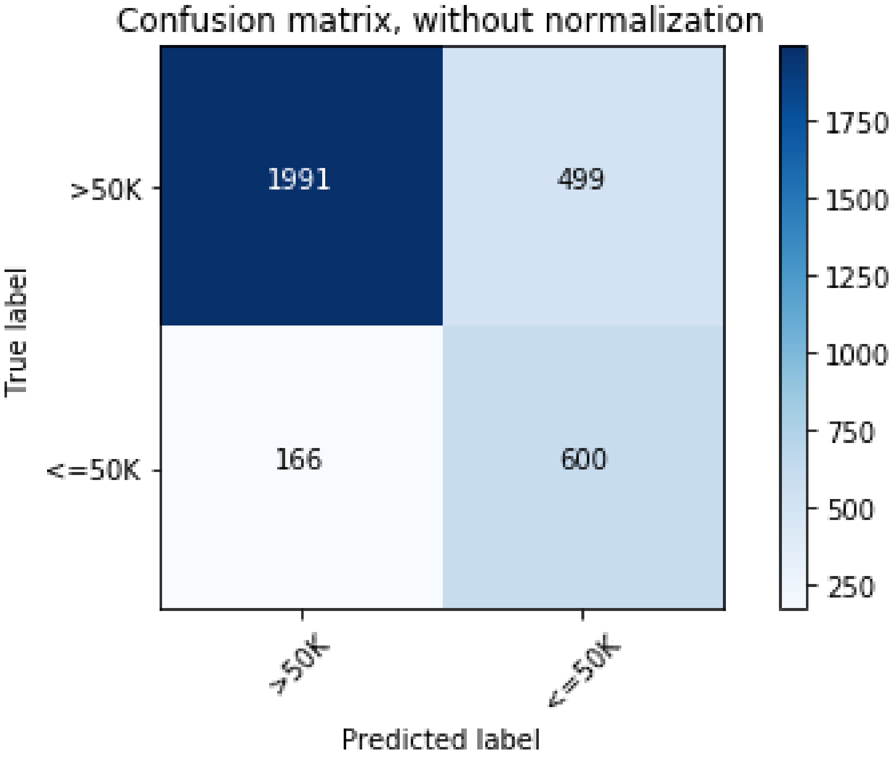
```
Fold  4
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [ 9769  9770  9771 ..., 13022 13023 13024]
Number of mislabeled points out of a total 3256 points : 654
Accuracy : 0.7991
Confusion matrix, without normalization
[[1997  467]
 [ 187  605]]
```



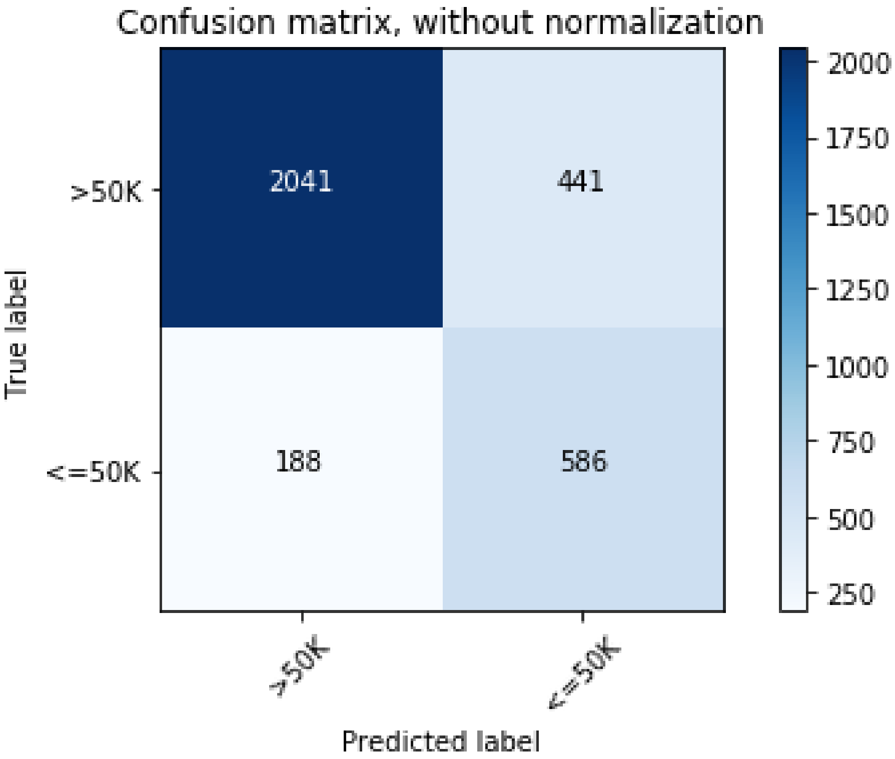
```
Fold  5
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [13025 13026 13027 ..., 16278 16279 16280]
Number of mislabeled points out of a total 3256 points : 652
Accuracy : 0.7998
Confusion matrix, without normalization
[[1996  477]
 [ 175  608]]
```



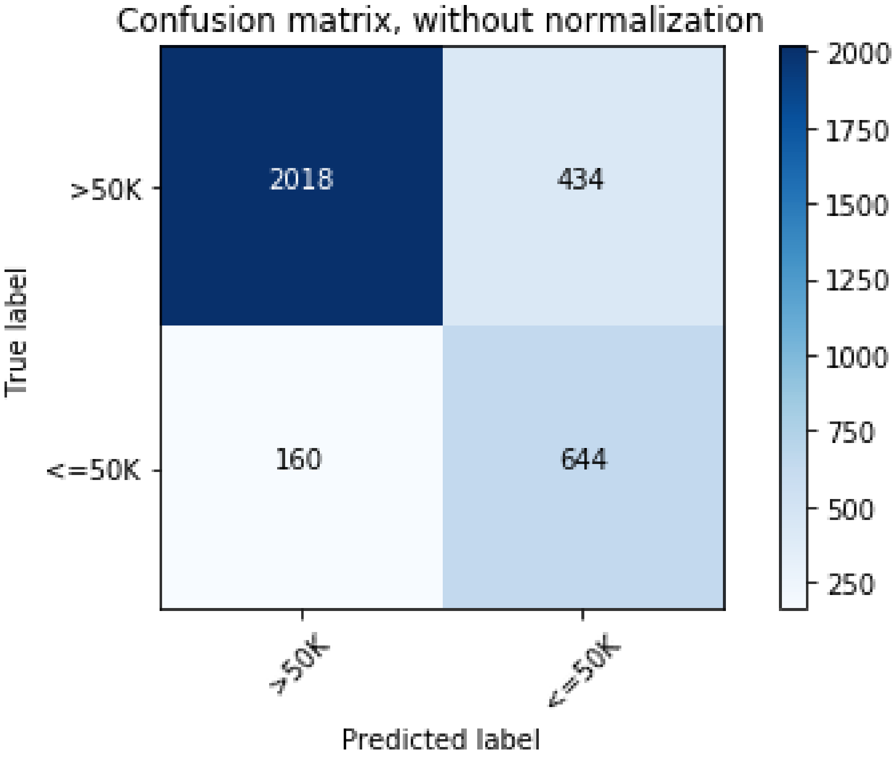
```
Fold  6
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [16281 16282 16283 ..., 19534 19535 19536]
Number of mislabeled points out of a total 3256 points : 665
Accuracy : 0.7958
Confusion matrix, without normalization
[[1991  499]
 [ 166  600]]
```



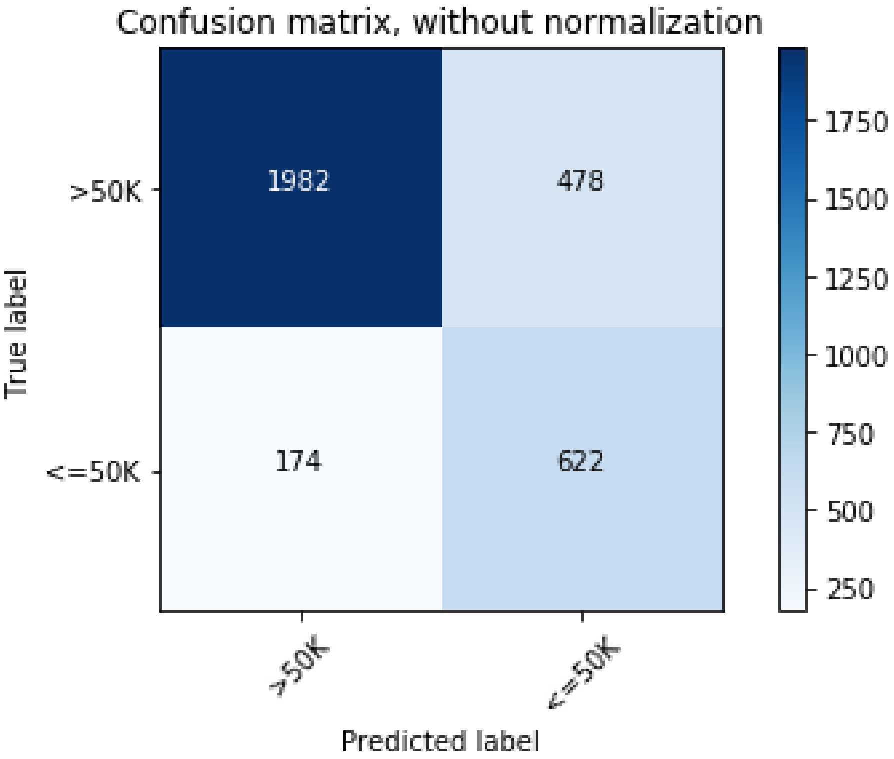
```
Fold  7
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [19537 19538 19539 ..., 22790 22791 22792]
Number of mislabeled points out of a total 3256 points : 629
Accuracy : 0.8068
Confusion matrix, without normalization
[[2041  441]
 [ 188  586]]
```



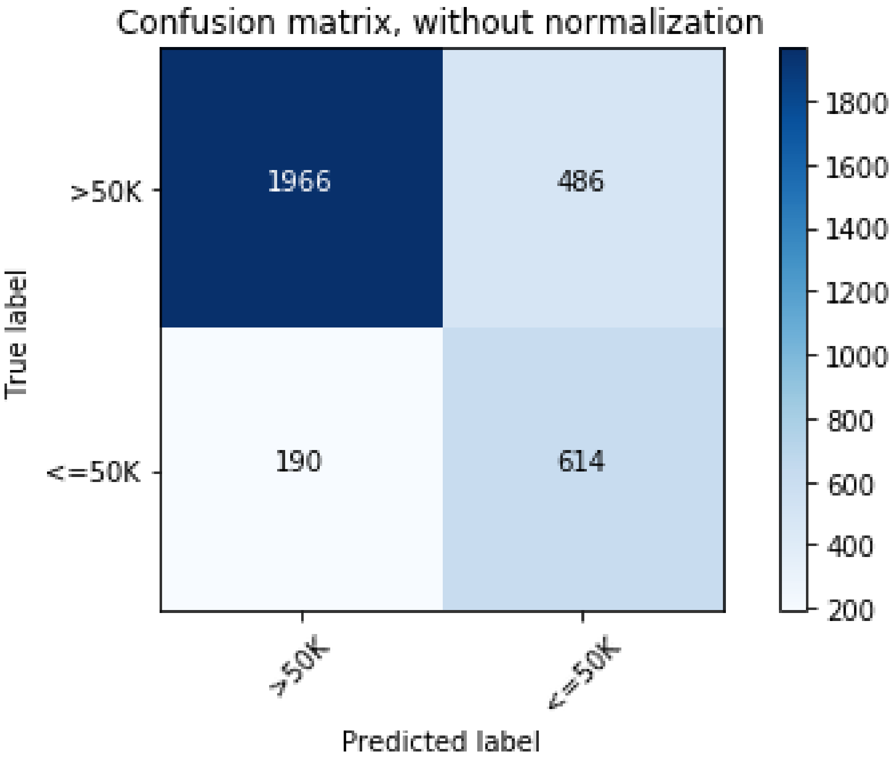
```
Fold  8
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [22793 22794 22795 ..., 26046 26047 26048]
Number of mislabeled points out of a total 3256 points : 594
Accuracy : 0.8176
Confusion matrix, without normalization
[[2018  434]
 [ 160  644]]
```



```
Fold  9
TRAIN : [    0     1     2 ..., 32558 32559 32560]
TEST : [26049 26050 26051 ..., 29302 29303 29304]
Number of mislabeled points out of a total 3256 points : 652
Accuracy : 0.7998
Confusion matrix, without normalization
[[1982  478]
 [ 174  622]]
```



```
Fold  10
TRAIN : [    0     1     2 ..., 29302 29303 29304]
TEST : [29305 29306 29307 ..., 32558 32559 32560]
Number of mislabeled points out of a total 3256 points : 676
Accuracy : 0.7924
Confusion matrix, without normalization
[[1966  486]
 [ 190  614]]
```



```
Sum of mislabeled points : 6433
Mean of mislabeled points : 643.3000
Total accuracy : 0.8024
```

## 2 3. Full Training

Dari nilai akurasi masing-masing 4 algoritma pembelajaran yang sudah dilakukan, didapatkan nilai akurasi tertinggi yaitu algoritma decision tree dengan akurasi 0.8143. Sehingga akan dilakukan full training menggunakan algoritma decision tree.

```
In [9]: knn = KNeighborsClassifier(n_neighbors=20, algorithm='ball_tree')
        y_pred = knn.fit(data, target).predict(data)

        print("Number of mislabeled points out of a total %d points : %d" % (data.shape[0], (ta
        print("Accuracy : %.4f" % accuracy_score(target,y_pred))
```

```
Number of mislabeled points out of a total 32561 points : 4467
Accuracy : 0.8628
```

# 3 4. Load Model

```
In [10]: from sklearn.externals import joblib
         filename = 'clf.sav'
         joblib.dump(knn, filename)
```

```
Out[10]: ['clf.sav']
```

```
In [11]:  hasil = joblib.load(filename)
```

```
In [12]: test = pd.read_csv("D:/CencusIncome.test.txt", names=attributeName)
         # GANTI PATHNYA ^^^^^^^^^^^^^^^^^^^^^

         test["capital-gain"] = test[["capital-gain"]].replace('?', test["capital-gain"].mean(
         test["capital-loss"] = test[["capital-loss"]].replace('?', test["capital-loss"].mean(
         test["hours-per-week"] = test[["hours-per-week"]].replace('?', test["hours-per-week"]

         test["workclass"] = test[["workclass"]].replace(' ?', " " + test["workclass"].mode()[
         test["education"] = test[["education"]].replace(' ?', " " + test["education"].mode()[
         test["marital-status"] = test[["marital-status"]].replace(' ?', " " + test["marital-s
         test["occupation"] = test[["occupation"]].replace(' ?', " " + test["occupation"].mode
         test["relationship"] = test[["relationship"]].replace(' ?', " " + test["relationship"
         test["race"] = test[["race"]].replace(' ?', " " + test["race"].mode()[0])
         test["sex"] = test[["sex"]].replace(' ?', " " + test["sex"].mode()[0])

         #DATA ENCODING
         cidata = test.as_matrix()

         cidata[:,1] = le1.transform(cidata[:,1])

         cidata[:,3] = le3.transform(cidata[:,3])

         cidata[:,5] = le5.transform(cidata[:,5])

         cidata[:,6] = le6.transform(cidata[:,6])

         cidata[:,7] = le7.transform(cidata[:,7])

         cidata[:,8] = le8.transform(cidata[:,8])

         cidata[:,9] = le9.transform(cidata[:,9])

         cidata[:,13] = le13.transform(cidata[:,13])

         cidata[:,14] = le14.transform(cidata[:,14])
         print(cidata)
```

```
[[25 4 226802 ..., 40 39 0]
 [38 4 89814 ..., 50 39 0]
 [28 2 336951 ..., 40 39 1]
 ...,
 [38 4 374983 ..., 50 39 0]
 [44 4 83891 ..., 40 39 0]
 [35 5 182148 ..., 60 39 1]]
```

```
In [13]: index = [str(i) for i in range(0, len(cidata))]
         test2 = pd.DataFrame(data=np.int_(cidata[:,:]), columns=attributeName, index=index)

         test_target = test2.loc[:,"salary"]
         test_data = test2.loc[:,"age":"native-country"]
         test_data = test_data.drop('education-num', axis=1)
         test_data = test_data.drop('fnlwgt', axis=1)
         test_data = test_data.drop('native-country', axis=1)
         test_data = test_data.drop('age', axis=1)
```

```
In [14]: test_pred = knn.predict(test_data)
         print(test_pred)

         print("Number of mislabeled points out of a total %d points : %d" % (test_data.shape[
         print("Accuracy : %.4f" % accuracy_score(test_target,test_pred))
```

```
[0 0 1 ..., 1 0 1]
Number of mislabeled points out of a total 16281 points : 2374
Accuracy : 0.8542
```

```
In [15]: import sys
         if sys.version_info[0] < 3:
             from StringIO import StringIO
         else:
             from io import StringIO
```