hw1.1

27 февраля 2017 г.

```
In [1]: %pylab inline
```

```
Populating the interactive namespace from numpy and matplotlib
```

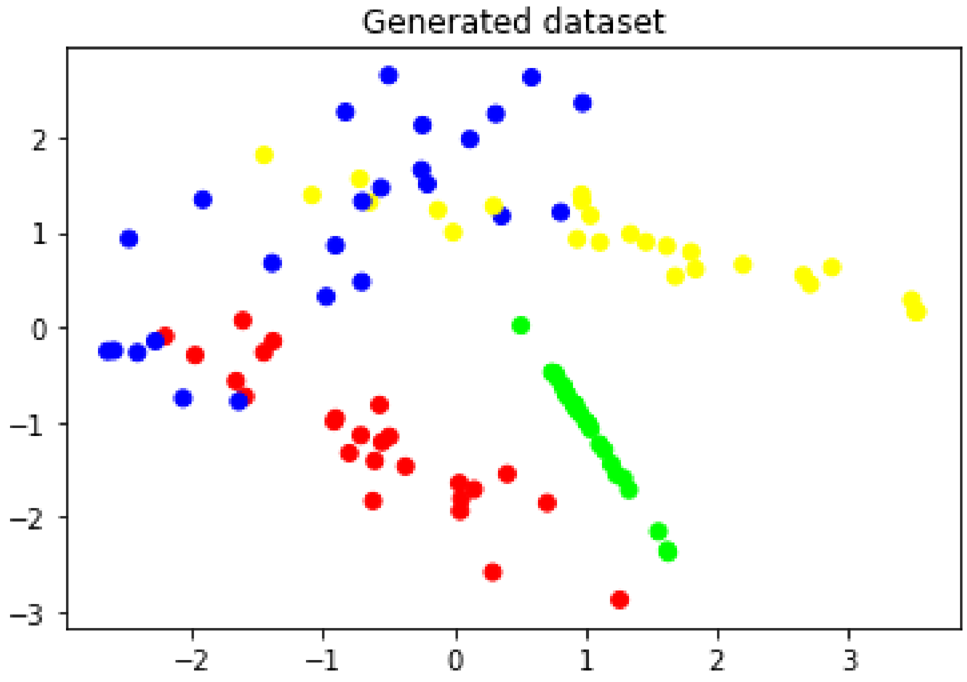
1 Generating dataset

```
In [2]: from sklearn import datasets
        from matplotlib.colors import ListedColormap

        pale = ListedColormap(['#FFCCCC', '#CCFFCC', '#CCCCFF', '#FFFFCC'])
        bright = ListedColormap(['#FF0000', '#00FF00', '#0000FF', '#FFFF00'])
```

```
In [3]: X, y = datasets.make_classification(n_classes=4, n_features=2, n_informative=2,
                                            n_redundant=0, n_clusters_per_class=1)
```

```
In [4]: plt.scatter(X[:,0], X[:,1], c = y, cmap=bright)
        plt.title("Generated dataset")
        plt.show()
```

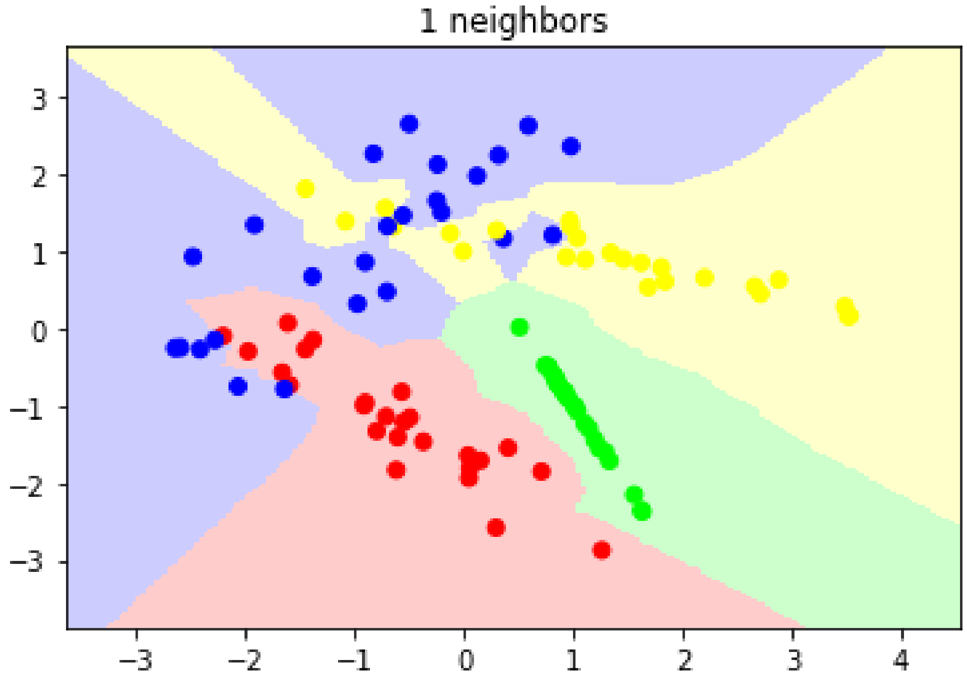


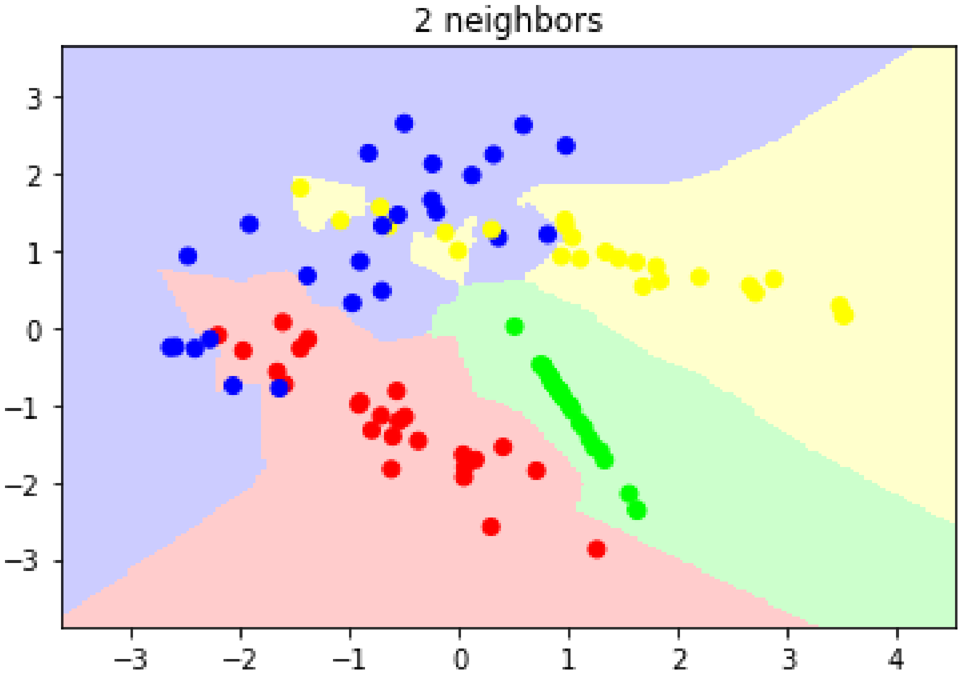
2 Decision boundaries

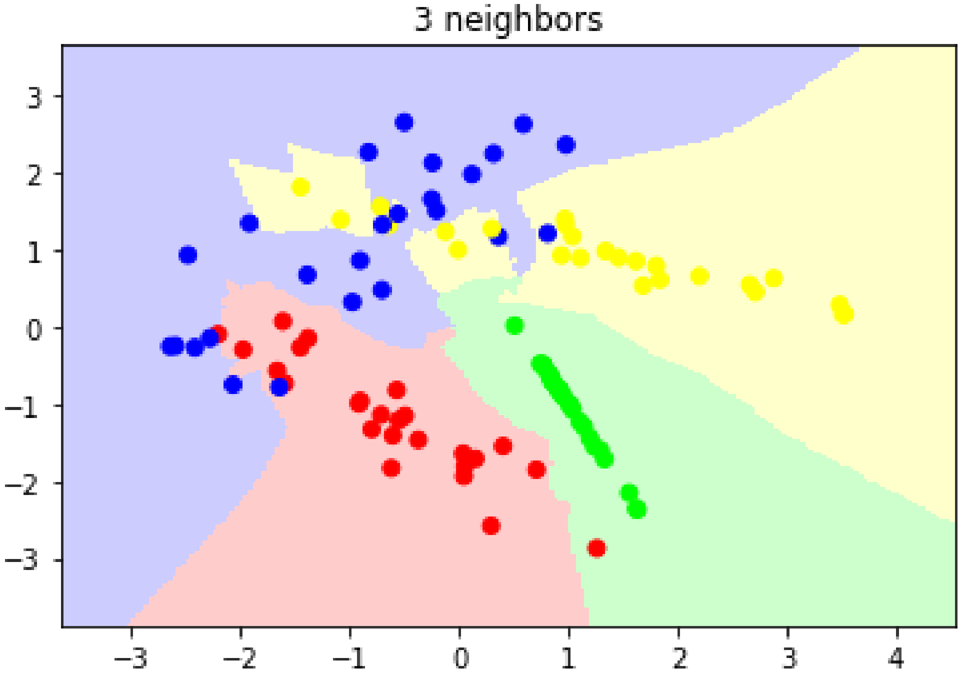
```
In [5]: from sklearn.neighbors import KNeighborsClassifier
```

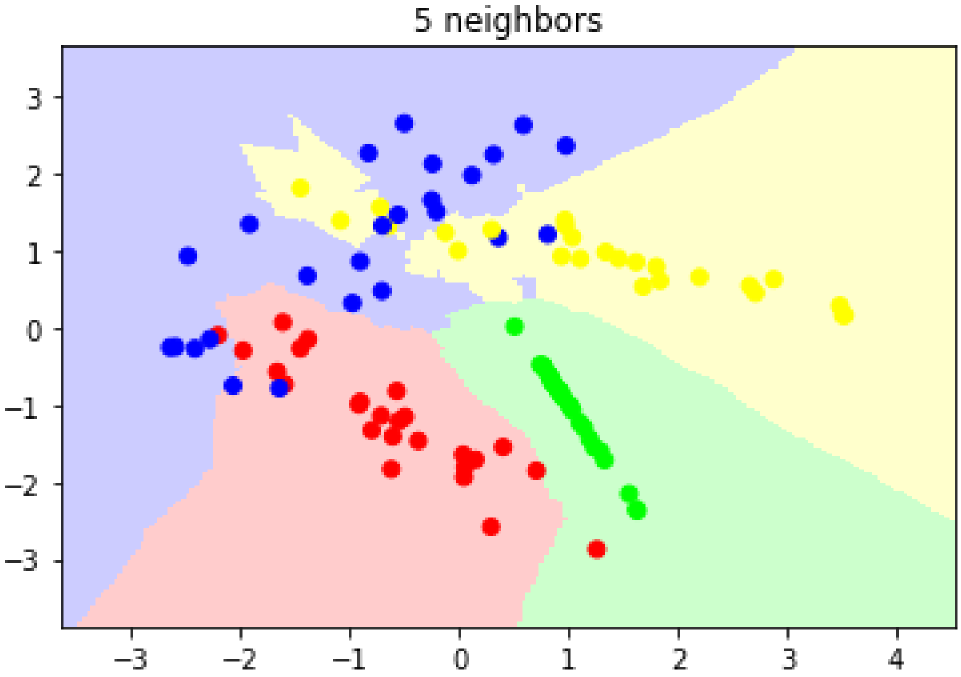
```
In [6]: def draw_boundaries(X, y, k):
            neigh = KNeighborsClassifier(n_neighbors=k)
            neigh.fit(X, y)
            x_min, x_max = X[:,0].min() - 1, X[:,0].max() + 1
            y_min, y_max = X[:,1].min() - 1, X[:,1].max() + 1
            xx, yy = np.meshgrid(np.linspace(x_min, x_max, 200),
                                 np.linspace(y_min, y_max, 200))
            col = np.array(neigh.predict(np.c_[xx.ravel(), yy.ravel()]))
            col = col.reshape(xx.shape)
            plt.pcolormesh(xx, yy, col, cmap=pale)
            plt.scatter(X[:,0], X[:,1], c=y, cmap=bright)
            plt.title("{} neighbors".format(k))
            plt.show()
```

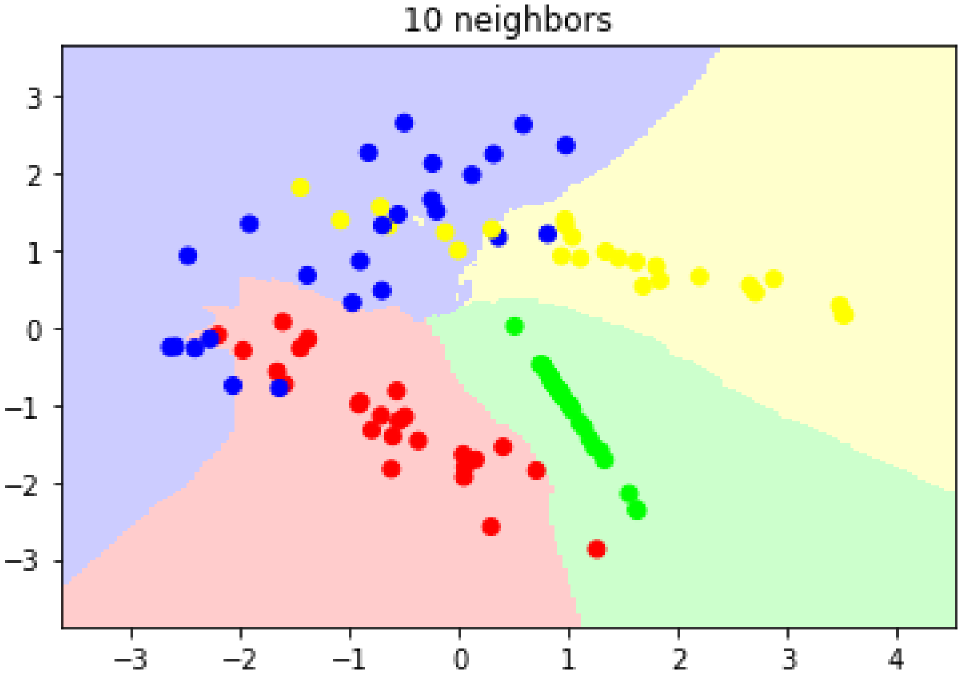
```
In [7]: for k in [1, 2, 3, 5, 10]:
            draw_boundaries(X, y, k)
```




2 neighbors
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3
4


3 neighbors
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3
4


5 neighbors
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3
4


10 neighbors
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3
4

3 KFold

Finding optimal *k* for kNN with KFold

```
In [8]: from sklearn.model_selection import KFold
        from sklearn.metrics import accuracy_score
```

```
In [9]: kf = KFold(n_splits=5)
```

```
In [10]: def calc_score(train_index, test_index, k):
             X_train, X_test = X[train_index], X[test_index]
             y_train, y_test = y[train_index], y[test_index]
             neigh = KNeighborsClassifier(n_neighbors=k)
             neigh.fit(X_train, y_train)
             y_pred = neigh.predict(X_test)
             score = accuracy_score(y_test, y_pred)
             return score
```

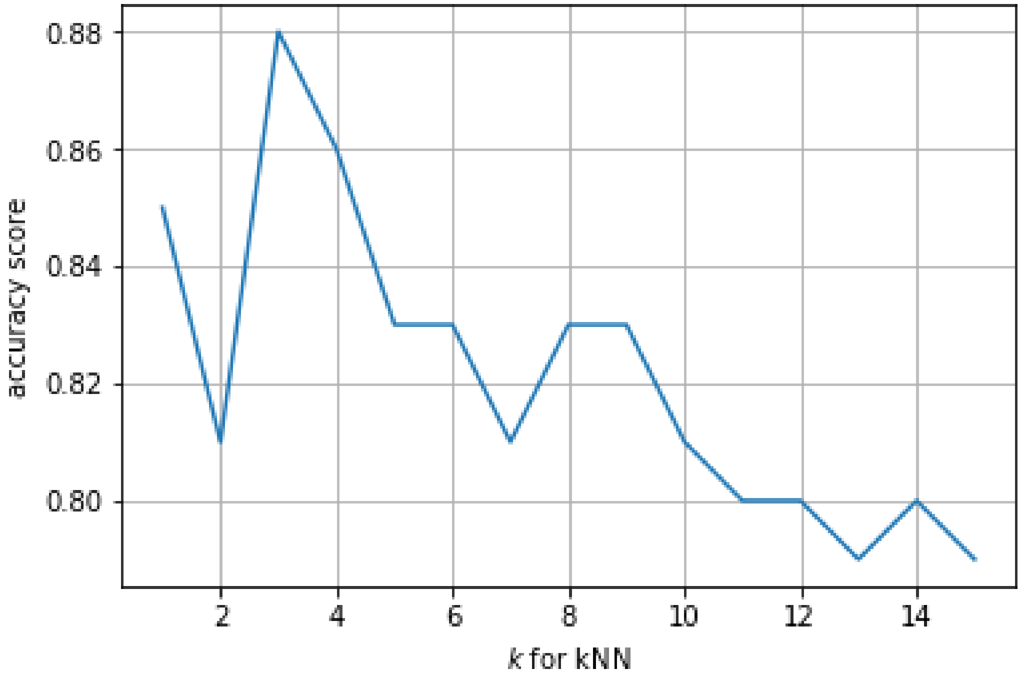
```
In [11]: best_k, best_score = -1, 0
         scores = np.zeros(15)
         for k in range(1, 16):
             score = 0
             for train_index, test_index in kf.split(X, y):
                 score += calc_score(train_index, test_index, k)
             score /= 5
             if best_score < score:
                 best_score, best_k = score, k
             scores[k - 1] = score
             print("mean accuracy for {} is {:.3}".format(k, score))
```

```
mean accuracy for 1 is 0.85
mean accuracy for 2 is 0.81
mean accuracy for 3 is 0.88
mean accuracy for 4 is 0.86
mean accuracy for 5 is 0.83
mean accuracy for 6 is 0.83
mean accuracy for 7 is 0.81
mean accuracy for 8 is 0.83
mean accuracy for 9 is 0.83
mean accuracy for 10 is 0.81
mean accuracy for 11 is 0.8
mean accuracy for 12 is 0.8
mean accuracy for 13 is 0.79
mean accuracy for 14 is 0.8
mean accuracy for 15 is 0.79
```

```
In [12]: print("best k is {} with score {:.3}".format(best_k, best_score))
```

```
best k is 3 with score 0.88
```

```
In [13]: plt.plot(np.arange(1, 16), scores)
         plt.xlabel("$k$ for kNN")
         plt.ylabel("accuracy score")
         plt.grid()
         plt.show()
```



```
In [ ]:
```