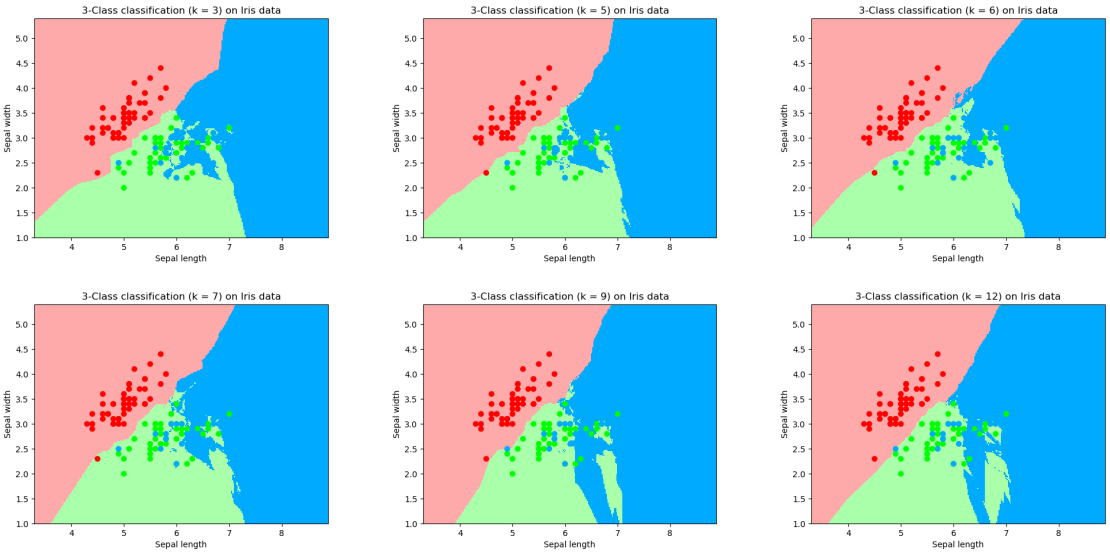
Problem 1

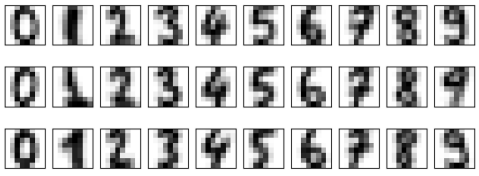
Figure 1: KNN decision boundary graphs with different k value



According to **Figure 1**, when k value increases the decision boundary becomes more and more complex. For example in the fifth graph where $k = 9$, there emerges a green area inside the blue area. And with a bigger k value, the boundaries begins to mix together since more data points that doesn't belongs to the class begin to influence the result.

Problem 2

Figure 2: K-means cluster graph for **digits** dataset



Problem 3

For **Decision Tree classifier**, the max node depth in the test never exceeds 20, thus there's no need to tune *max_depth* parameter.

Tune **KNN classifier** with different k value:

	fishiris	digits
$k = 4$	96.0%	97.31%
$k = 6$	98.0%	97.47%
$k = 8$	98.0%	97.81%
$k = 10$	98.0%	97.31%

Table 1: Tuning Knn classifier

Tune **K-Means classifier** with different k(algorithm usually converges after less than 20 iterations so there seems no need to tune max_iter):

	fishiris	digits
$k = 3$	94.0%	96.3%
$k = 5$	96.0%	96.63%
$k = 7$	96.0%	96.46%
$k = 9$	96.0%	97.98%

Table 2: Tuning Knn classifier