Assigment 2 in EH2745 Computer Applications in Power Systems

June 10, 2017

Choosing the starting points

The starting points for the clustering are k randomly chosen points out of the Learning states. Several different starting points are compared to each other and the one with the lowest cost will be used. The sum of the average distance to each point is used as cost criteria.

Choosing k

We want to choose a k, where the cost is low. In figure 1 we can see the costs for different ks. There we have a local minimum at $k = 4$ and higher costs for all $k < 100$, so we don't have an imported improvement of the clustering there. For higher k the costs gets lower again, but there each state get his on k, so we don't have an an real clustering anymore. Therefore for this learning set $k = 4$ seems to be optimal, also a deeper analysis shows that with higher k only the set get divided in smaller sets of the sets at $k = 4$.

Choose the labels

Shut down of generator for maintenance

If a generator fails, we can assume that we don't have an power flow between the busbar where this generator is and the next busbar. In the GUI you can see a plot of the minimal power flow between the generator buses. You can see that plot also in figure 2. We can see that Cluster 3 (53 Learning states) has almost no power flow for each Measurement.

High load rate during peak hours

During high loads the voltage normally drops. The GUI and figure 3 show an plot with the average Voltage over the the average angle of all busbars at one time. We can see that Cluster 2 (49 Learning states) has an much lower average Voltage as the other sets, therefore we can assume this is the set with High Load.

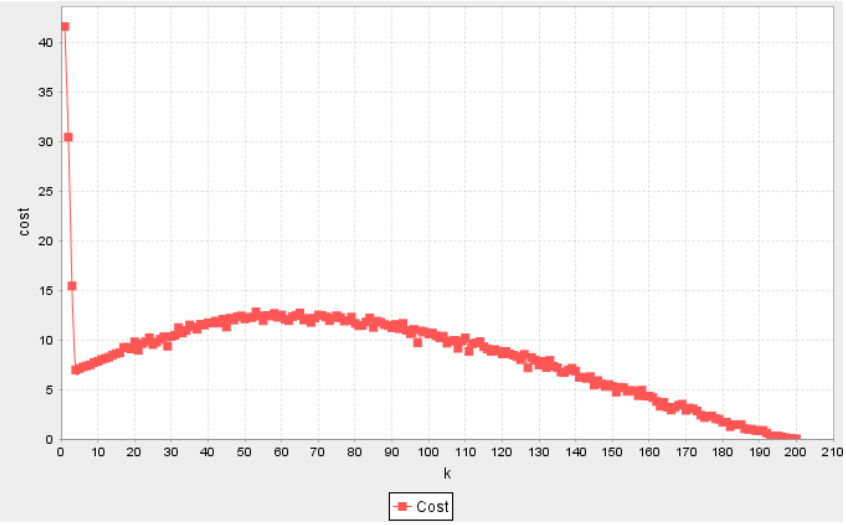

Figure 1: Cost for different k

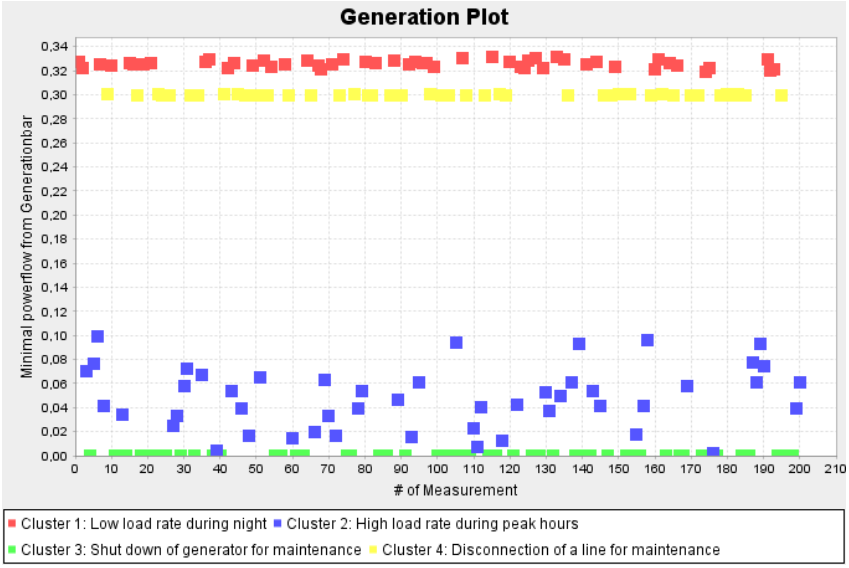

Figure 2: Power flow between the generation busbar and the next busbar

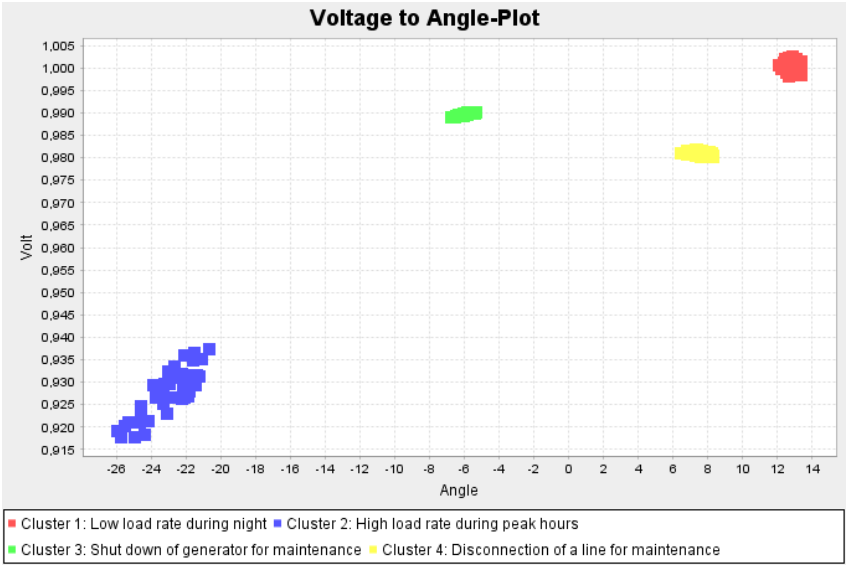

Figure 3: Average Voltage and angle of all busbars

Low load rate during night

During low load the voltage increases, with the same plot as above we can see that Cluster 1 (51 Learning states) is the Low Load case.

Summary

	# Learning states	operational states
Cluster 1	51	Low load rate during night
Cluster 2	49	High load rate during peak hours
Cluster 3	53	Shut down of generator for maintenance
Cluster 4	47	Disconnection of a line for maintenance