EH2745—Assignment II

Computer Applications in Power Systems

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Explanations for labelling of the clusters.

According to the tasks, we have a database of measurements developed from a sample 9 bus power system with 4 different operational states. The operational states are as follows:

- High load rates during peak hours

- Shut Down of Generators of generators for maintenance

- Low load rate during night

- Disconnection of a line for maintenance

In order to dertermine which state belongs to which cluster, we need to analyse what will happen under the different operatioal states first.

A. High load rates

In a power system, we know that if the load rate increases, then the transmisssion current will increase, thus the voltage drop between different nodes will increase. Thus, the voltage magnitude of each bus will decrease.

B. Shut down of generator

Assuming we shut down the generator in a power system, then there will be no power flow between some buses, then the voltage drop between the buses will be almost 0.

C. Low load rate

Contrary to the high load rate situation, when the load rate is low in a power system, the voltage magnitude of each bus will increase.

D. Disconnection of a line

If one line in the power system is disconnected, then the remaining buses will also be affected. The transmission current through the buses will increase dramatically, leading to a large voltage drop.

In the task, I get data from the 2 CSV files:'measurements' and 'analog-values'. In the

learning set, there are 200 time-steps with the name, substation, volateg and phase values for each bus. In a bid to simplify the classification problem, I take the average voltage magnitude and phase values for the 9 buses rather than consider them individually. After some normalization, it's easier to use the K-means clustering

method to cluster the data. Then I use the KNN classification method to identify the test data with 20 time-steps.

After clustering, I get 4 clusters with the final centroids.

Cluster Centroid 1	$0.98706, -5.90931°$
Cluster Centroid 2	$0.91496, -22.68660°$
Cluster Centroid 3	$0.99119, 12.90691°$
Cluster Centroid 4	$0.96641, 7.68781°$

According to the analysis above, it can be concluded that:

● Cluster 2——Disconnection of a line

The super large voltage drop can show.

● Cluster 3——Low load rate

The large average voltage magnitude can show.

● Cluster 4——High load rate

The relatively low voltage magnitude can show.

● Cluster 1——Shut down of Generator

The remaining one is Shut down of Generator, correspongding to nearly 0 power flow between buses.