MIS772

Predictive Analytics

Workshop: Data Clustering

k-Means clustering, optimisation of clustering, cluster visualisation with PCA

Workshop Plan

Objectives:

Your task is to create a cluster model of people coming to a shopping mall, based on information collected via a survey. While we will utilise a k-means cluster model, with some adaptations the tasks are applicable to other clustering methods as well, e.g. k-medoids.

Data Set:

Marketing-Keel.zip
Use file "marketing.csv"

Original Data from KEEL:

https://sci2s.ugr.es/keel/dataset.php?cod=163

Method:

Attend the workshop, follow the tutor's demo and instructions, take notes. Note that the class and online seminar will be recorded and their videos linked to the CloudDeakin topic for later access and study.

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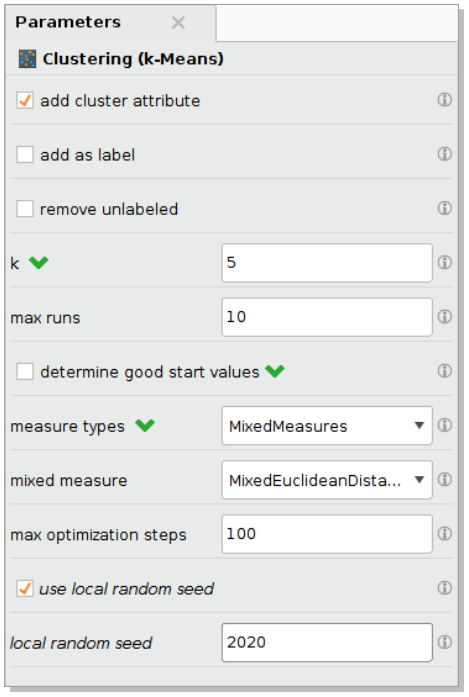
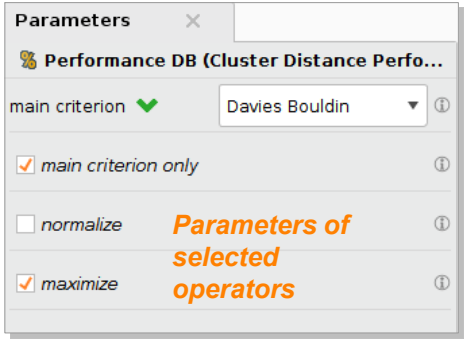
1. **Acquire data for clustering**
   (a) Load the data and unzip
   (b) Read and explore the data set, and store
2. **Create a k-means clustering model**
   (a) Select all attributes
   (b) Normalise and replace missing values
   (c) Add k-means with default parameters
   (d) Daisy chain cluster performance operators
   (e) Experiment with different number of clusters k, save
3. **Optimise the cluster model**
   (a) Adapt the previous process for cluster optimisation
   (b) Use grid optimisation to monitor k-means k
   (c) Log all performance criteria while changing k
   (d) Plot performance and find optimum k, save
4. **Further analysis**
   (a) Use the first process
   (b) Enter the optimum k into k-means
   (c) Add cluster visualiser
   (d) Run, interpret cluster visualiser results, save
   (e) Discuss your insights in class
   (f) Challenge: Use PCA to plot and diagnose clusters

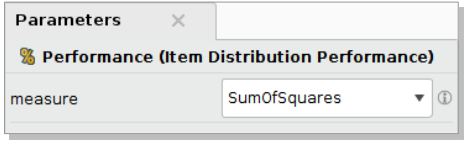
K-Means Clustering

First, we will create a process responsible for data preparation and clustering. Use k-Means with defaults. Daisy-chain two performance operators to find *Davis-Bouldin* (DB) and *Within Sum of Squares* (WSS) measures.
Set k-means k. Run the process. Observe results and the clustering performance. Save.



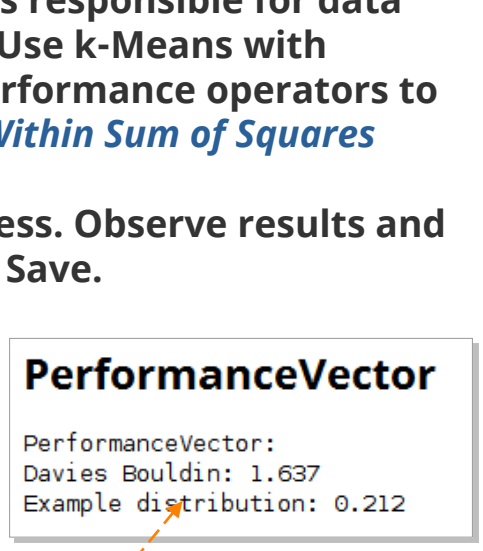
Experiment with the number of k-means clusters and observe changing performance.

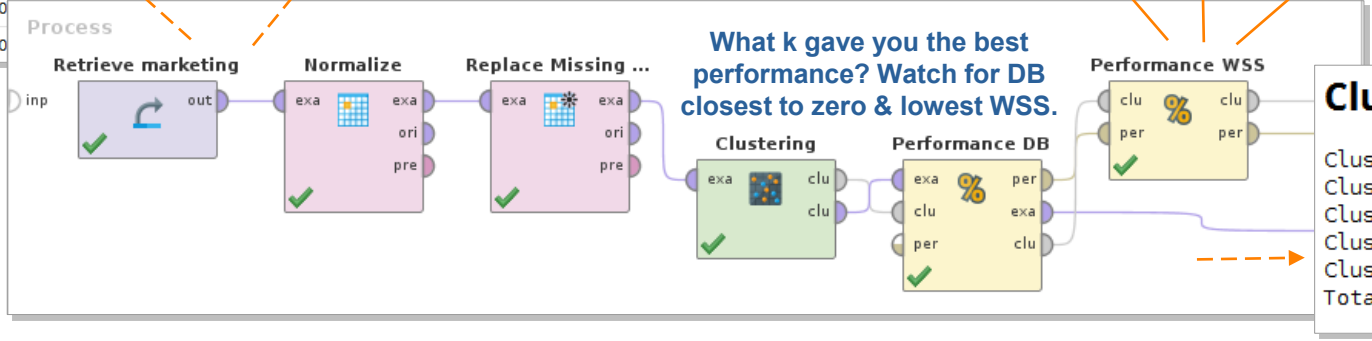




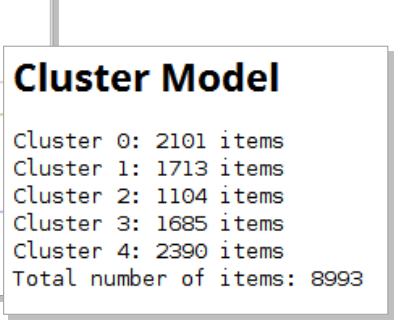
id	cluster	Sex	Marit...	Age	Educat
1	cluster_0	1	0	0.667	0.600
2	cluster_3	0	0	0.667	0.800
3	cluster_0	1	0	0.333	0.800
4	cluster_2	1	1	0	0.200
5	cluster_2	1	1	0	0.200
6	cluster_3	0	0	0	
7	cluster_4	0	1	0	

Cluster IDs indicating categorisation of examples





What k gave you the best performance? Watch for DB closest to zero & lowest WSS.



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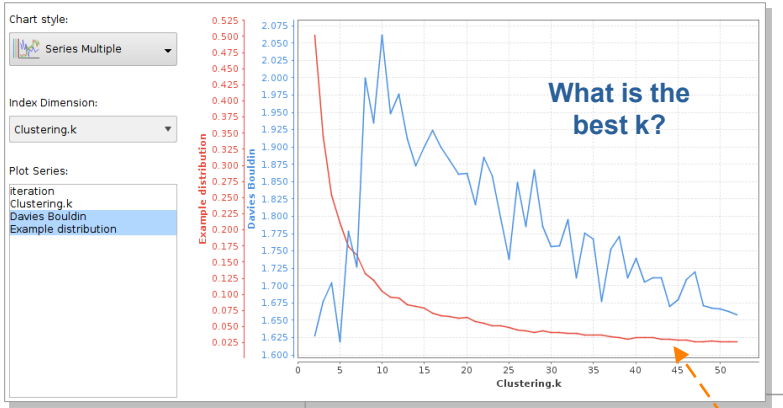
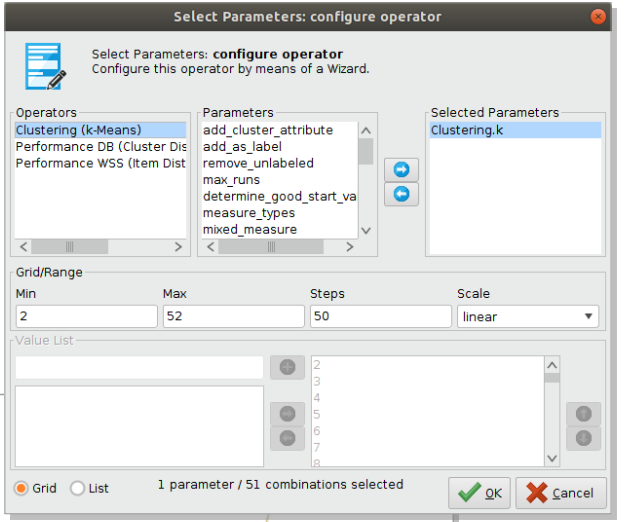
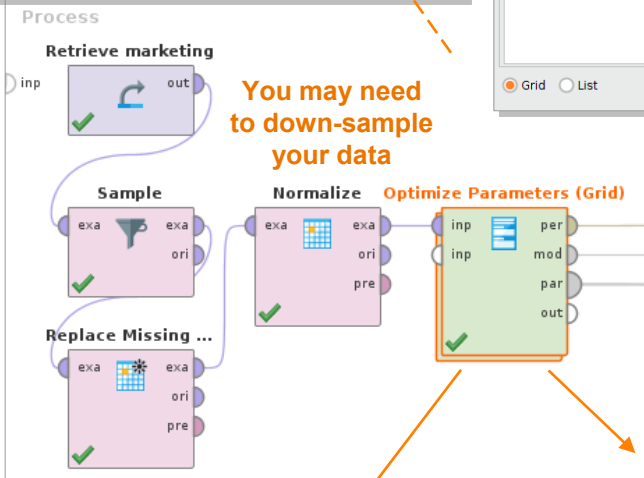
K-Means Optimisation

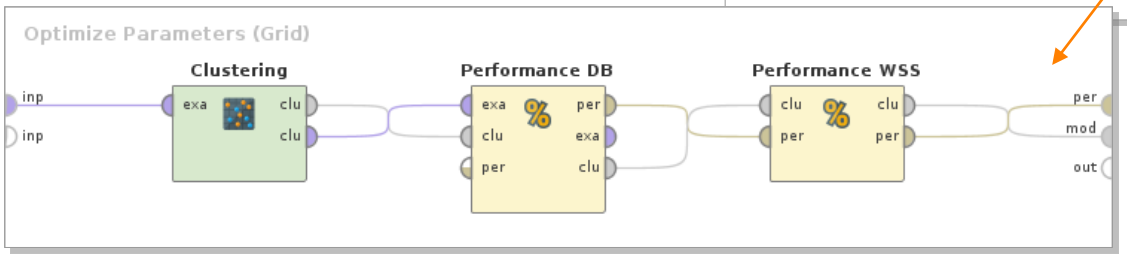
Set up an experiment to identify the best number of k-means clusters k within a range 2..52. Save.

Use Cluster Distance Performance (with a single criterion *Davis-Bouldin*) and Item Distribution Performance (with *within SumOfSquares*, or *WSS*). As in the previous process, daisy-chain two performance operators. Ensure that the optimisation grid logs performance of all tracked criteria. Select the best k using Davis-Bouldin index. Also, apply the "elbow" method to WSS.

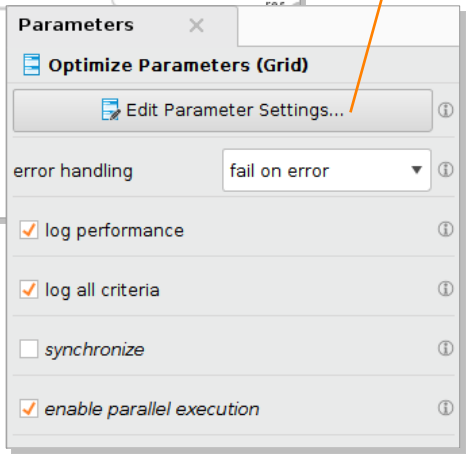








The grid is likely to get confused when using DB. Why?



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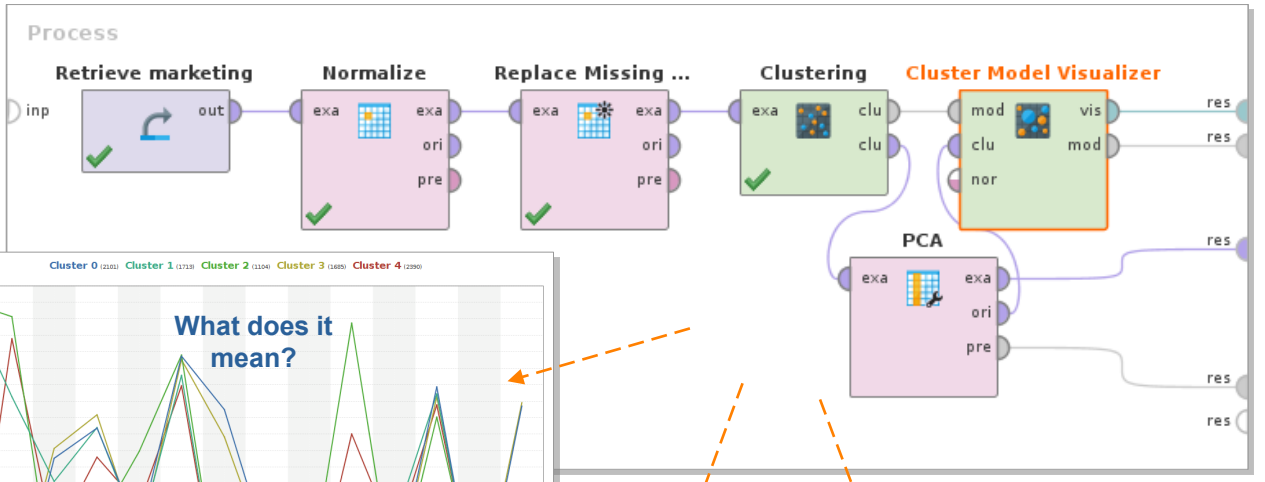
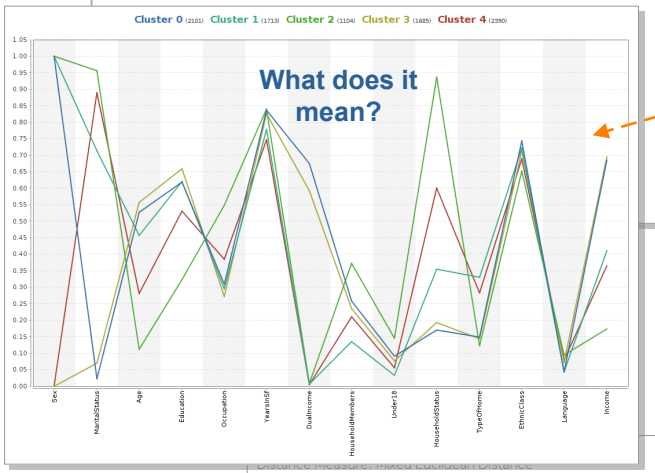
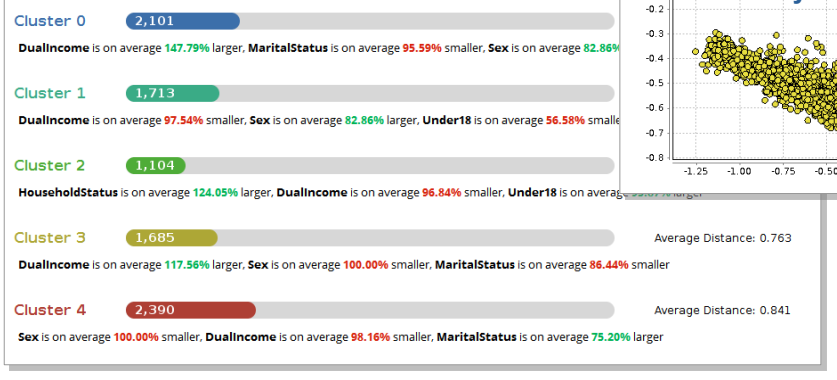
Further Analysis

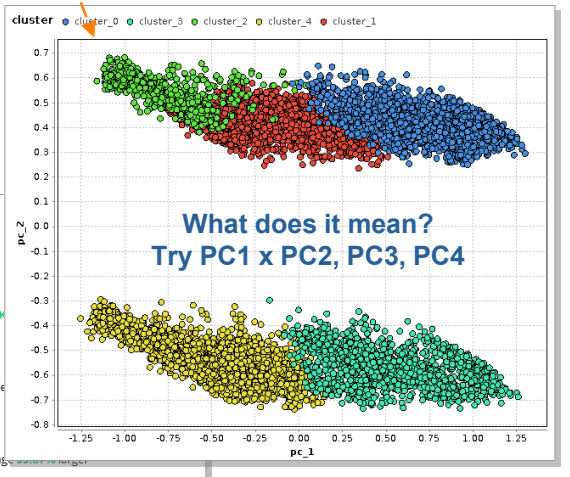
Take the first clustering process and alter its cluster operator by entering the best k (from optimisation).
Modify the process by adding cluster visualisation.
Run. Interpret results. Save.
Share your insights.

Challenge: Plot and diagnose clusters with PCA. Inspect the cumulative variance plot. Experiment with PCs.









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