# Exercise 6 Classification, trees and clustering

In Appendix you will find a time series with a data record for each time step. This record or feature vector consists of three elements X1, X2 and Y= Alarm type. X1 and X2 specifies the observed value for a given alarm level. This data set is going to be your training set for classification.

Use a spreadsheet or similar to:

1. Calculate the average value for X1 and X2
2. Calculate the correlation between X1 and X2 (cross correlation)
3. Calculate the linear regression between X1 and X2. What are the weights (coefficients)?
4. What is the co-variance between X1 and X2?
5. Based on 3 and 4 how well could X1 serve as a predictor for X2?
6. Calculate moving average over span s= 3 for X1. Repeat the exercise for s= 6 for X1. Compare with the original time series for X1. How well can the moving average be used as a predictor?
7. Calculate the autocorrelation with a delay of t=1, t=3 and t=10 for X1. What does this tell you about seasonality? How can you use the autocorrelation to predict the value at t+1?
8. Use the K-NN method to predict the likely alarm state for time step 34-36 when the predicted outcome of X1 and X2 are:

|  |  |  |
| --- | --- | --- |
| 34 | 5 | 8 |
| 35 | 10 | 7 |
| 36 | 20 | 1 |

1. Use the K-means method to cluster the results according to state. Pick a prototype from each class to start with. Compare with actual states after 1 iteration.

Appendix:

|  |  |  |  |
| --- | --- | --- | --- |
| **t** | **x1** | **x2** | **Alarm state** |
| 1 | 7,5 | 8,5 | Pending |
| 2 | 2,2 | 7,3 | Pending |
| 3 | 3,2 | 4,3 | Small |
| 4 | 4,2 | 6,7 | Pending |
| 5 | 4,3 | 5,8 | Small |
| 6 | 4,5 | 3,5 | Small |
| 7 | 2,2 | 2,5 | Small |
| 8 | 2,7 | 3,7 | Small |
| 9 | 4,5 | 8,9 | Imminent |
| 10 | 8,5 | 5,6 | Pending |
| 11 | 9,6 | 4,6 | Pending |
| 12 | 7,5 | 4,9 | Pending |
| 13 | 4,5 | 12,2 | Imminent |
| 14 | 4 | 13,5 | Imminent |
| 15 | 8,6 | 13,2 | Imminent |
| 16 | 10,2 | 12,8 | Imminent |
| 17 | 12,2 | 17,8 | Imminent |
| 18 | 13,5 | 16,4 | Imminent |
| 19 | 15,6 | 12,2 | Imminent |
| 20 | 10,3 | 10,4 | Pending |
| 21 | 9,8 | 10,4 | Imminent |
| 22 | 8,3 | 11,3 | Imminent |
| 23 | 5,6 | 7,8 | Imminent |
| 24 | 7,8 | 5,6 | Imminent |
| 25 | 4,7 | 7,8 | Small |
| 26 | 7,8 | 4,6 | Pending |
| 27 | 13,3 | 8,9 | Imminent |
| 28 | 3,4 | 4,6 | Small |
| 29 | 5,6 | 6,6 | Small |
| 30 | 7,9 | 9,5 | Pending |
| 31 | 5,8 | 6,6 | Pending |
| 32 | 4,8 | 4,6 | Pending |
| 33 | 12,4 | 9,1 | Imminent |
|  |  |  |  |