Universität Bielefeld

CITEC / Faculty of Technology
Ambient Intelligence Group
Dr. Thomas Hermann

Sekretariat: S. Strunk
Office: CITEC-3.311
106-6891

Exercises of the lecture "Introduction to Data Mining"

WS 2017/2018 Excercise sheet 4

- Dimensionality reduction -

In the e-Learning space (Lernraum) of the ekVV you can find the data set `hand_postures.dat`. This includes 95 hand postures that were collected using a cyberglove. Each posture includes 20 joint angles: 4 angles $\theta_0, \ldots, \theta_3$ belong to each of the 5 fingers. The 20 features are those angles in a row for thumb (TH), forefinger (FF), middle finger (MF), ring finger (RF) and little finger (SF).

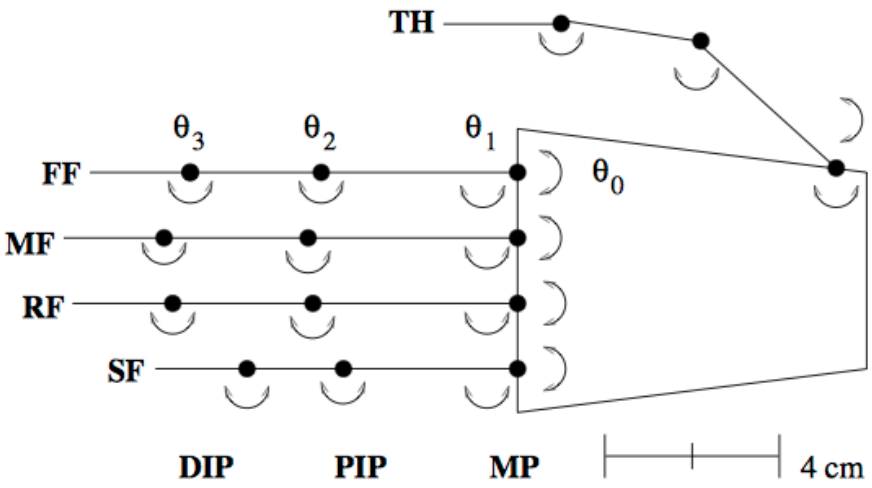
Also have a look at the `hand-model.png` in the e-Learning space (Lernraum) of the ekVV.

Problem 4.1, Correlation dimension

Do an analysis of the correlation dimension. What is the estimate that you get for the intrinsic data dimensionality.

Problem 4.2, PCA

Given is a data set of joint angles of a human hand, using the following hand model:



The columns of the data set are all joints, finger by finger, thumb to pinky finger, θ_0 to θ_3 each, in degrees.

a) Run a PCA on the hand posture data (SciPy offers for example the functions `mean` and `eig`).

- Sort the eigenvalues in order of size and plot the eigenvalue spectrum. What can be seen?
- Which percentage of the total variance remains after doing a dimension reduction on five principal components using the PCA? How big is the percentage of the two biggest eigenvectors?

b) Visualize the results of the PCA using `pylab.plot()` and compare them to other representations of high dimensional data, e.g. scatter plots.

c) The joint angles have different variances. Which eigenvectors do you get, if you norm the attributes x_i to $Var(x_i) = 1$ before running the PCA?

Thomas Hermann (thermann@techfak)

Lecture Wed 12-14, CITEC lecture hall

Tutorial Tue 12:15-13:45, V2-213

office building

Universität Bielefeld

Universitätsstraße 25

33615 Bielefeld

public transportation

light rail 4

from Bahnhof and Jahnplatz