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Knowledge Discovery in Databases II
SS 2018

Exercise 3: Dimentionality Reduction

Exercise 3-1 χ^2-statistics

Calculate if there is a dependency between your chances of passing the KDD2 exam and visiting the Excercises.

Grade	took part	enjoyed summer
1	10	5
2	25	8
3	35	7
4	20	16
5	12	48

Exercise 3-2 Principal Component Analysis

Consider the following example on principal axis transformation.

Given:

$$X = \{(-3, -2), (-2, -1), (-1, 0), (0, 1), (1, 2), (2, 3),$$
$$(-2, -2), (-1, -1), (0, 0), (1, 1), (2, 2),$$
$$(-2, -3), (-1, -2), (0, -1), (1, 0), (2, 1), (3, 2)\}$$

(a) Calculate the covariance matrix M.

(b) Calculate eigenvalues and eigenvectors of M.

(c) Determine the smallest eigenvalue and remove its corresponding eigenvector. The remaining eigenvector is the basis of a new sub-space.

(d) Transform all vectors in X in this new sub-space by expressing all vectors in X in this new basis.

Exercise 3-3 Principal Component Analysis

Conduct a principal axis transformation on the following data set:

- $A(1, 0, 3), B(0, 0, 3), C(1, 0, 1), D(0, 0, 1)$

What problem comes up? How can it be solved?