Bachelor Thesis

in Computer Science

Attention in Mixed-Type Clustering

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Declaration of Authorship

I hereby declare that the thesis submitted is my own unaided work. All direct or indirect sources used are acknowledged as references.
This paper was not previously presented to another examination board and has not been published.

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Abstract

This document serves as a model for the development of a thesis at the Department of Database Systems at the Institute for Computer Science at the LMU Munich. The abstract should not contain more than 300 words.

Contents

Chapter 1

Introduction

1.1 Clustering

Clustering is a unsupervised machine learning method that groups similar observations together. Due to its ability to find patterns in an unlabeled dataset, its an essential Task in Data Mining and Knowledge Discovery. A *cluster* is a group of similar observations that belong to a *centroid* (center point of a cluster). Distance-based clustering algorithms use distance measures such as Euclidean distance to calculate the similarity of datapoints. Hierarchical methods partition the observations and merge (agglomerative) or split them into bigger or smaller clusters. Many other methods exist, but this work focuses only on methods for clustering *mixed-type* data. [1]

1.1.1 k-means

The most well known distance-based clustering algorithm is k-means [2]. It is defined as follows: Suppose we have a finite set of n observations $S = p_1, p_2, ..., p_n \in \mathbb{R}^m$ for a dataset with m features, the goal of k-means is to find $k(\leq n)$ optimal centroids $B = b_1, b_2, ..., b_k \subseteq \mathbb{R}^m$ that minimize the sum of the squared Euclidean distance of each point in S to its nearest centroid:

$$\underset{B}{\arg\min} \sum_{i=1}^{k} \sum_{b \in B_i} d(b,)$$

d is the Euclidean distance from a point $p_i \in S$ to the nearest centroid in B

Finding the optimal centroids is a NP-hard problem, even for $d = 2$, as shown by Mahajan et al. [3].

Therefore, k-means uses an iterative algorithm to quickly approximate a local optimum.

1. Initialize

2. Zweiter Punkt

3. Erster Punkt

4. Zweiter Punkt

Bibliography

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[3] Meena Mahajan, Prajakta Nimbhorkar, and Kasturi Varadarajan. The planar k-means problem is np-hard. *Theoretical Computer Science*, 442:13–21, 2012. Special Issue on the Workshop on Algorithms and Computation (WALCOM 2009).