Algorithms for Mining Distance-Based Outliers in Large Datasets

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Outliers

„An outlier is an observation that deviates so much from other observations as to arouse suspicions that it was generated by a different mechanism”

- Douglas M. Hawkins

Problem

- Finden von Outliers
- Effizienz
- Dimensionen

Existierende Lösungen

- Sehr viele
- Distribution-based ($k = 1$)
- Depth-based ($k \leq 2$)
- Clustering-Algorithmen

Lösung

- Distance-based outlier detection
- $DB(p, D)$
- 4 Algorithmen

Beispiel

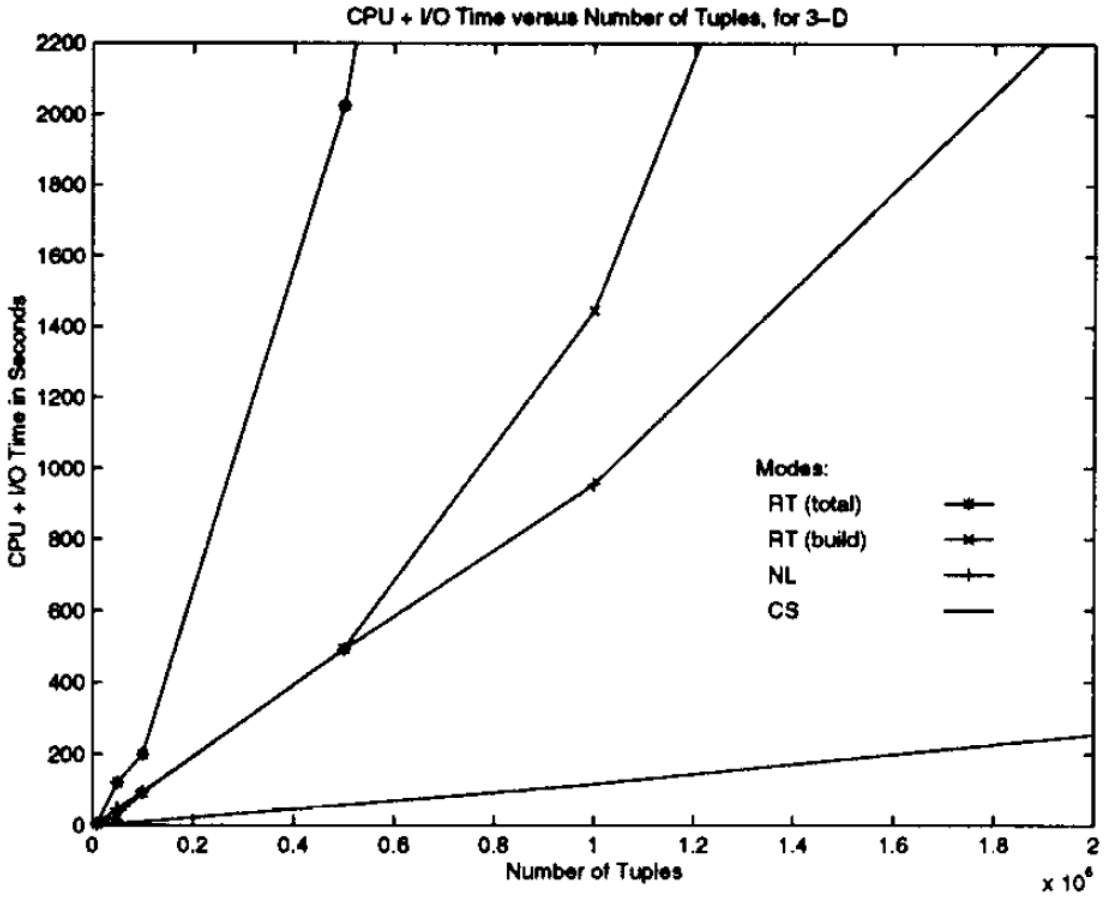
Algorithm FindAllOutsM

1. For $q \leftarrow 1, 2, \ldots m, \quad Count_q \leftarrow 0$
2. For each object P, map P to an appropriate cell C_q, store P, and increment $Count_q$ by 1.
3. For $q \leftarrow 1, 2, \ldots, m, \quad$ if $Count_q > M$, label C_q *red*.
4. For each *red* cell C_r, label each of the L_1 neighbours of C_r ***pink***, provided the neighbour has not already been labelled *red*.
5. For each non-empty *white* (i.e., uncoloured) cell C_w, do:
   a. $Count_{w2} \leftarrow Count_w + \sum_{i \in L_1(C_w)} Count_i$
   b. If $Count_{w2} > M$, label C_w ***pink***.
   c. else
      1. $Count_{w3} \leftarrow Count_{w2} + \sum_{i \in L_2(C_w)} Count_i$
      2. If $Count_{w3} \leq M$, mark all objects in C_w as outliers.
      3. else for each object $P \in C_w$, do:
         i. $Count_P \leftarrow Count_{w2}$
         ii. For each object $Q \in L_2(C_w)$, if $dist(P, Q) \leq D$:
            Increment $Count_P$ by 1. If $Count_P > M$, P cannot be an outlier, so goto 5(c)(3).
         iii. Mark P as an outlier.

Rechtfertigung

- Komplexitätsbetrachtungen
- Messungen
- Variierung von
  - Dimensionen
  - Datensetgröße

Ergebnispräsentation



Ergebnispräsentation

N	CS	NL	KD
20000	0.32	1.02	3.14
40000	0.54	4.26	20.49
60000	0.74	9.64	33.08
80000	1.04	17.58	54.66
100000	1.43	27.67	104.28

Anwendungsgebiete

- E-Commerce
- Kreditkartenbetrug
- Leistungsanalyse von professionellen Athleten

Checkliste

- Stimmt das Resultat?
- Erkenntnisgewinn?
- Neue Ideen?
- Problem wichtig?
- Ergebnis relevant?

Kritikpunkte

- Pseudo-Code
- Datenset
- Ansonsten…