Open Data Link

A dataset search engine for open data

Paul Ouellette and Justin Fargnoli

Open Data Link

- Dataset search engine for open data.
- Search methods:
  - Semantic keyword search
  - Joinable table search
  - Unionable table search

Motivation

- Governments and other organizations publish a lot of open data, but discovery is still difficult.
- Data scientists can identify ways to integrate datasets.
- Data publishers can see the wider context of their data.

Demo

Outline

System overview

Joinable table search

Unionable table search

Semantic keyword search

Future work

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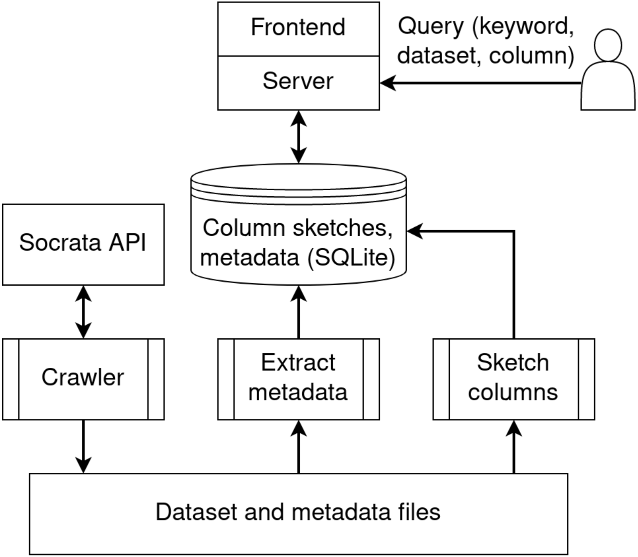
Frontend
Server
Query (keyword, dataset, column)
Column sketches, metadata (SQLite)
Socrata API
Crawler
Extract metadata
Sketch columns
Dataset and metadata files

Dataset crawl

- 10k of 42k datasets on Socrata.
- 172k columns.
- Most datasets are small.
- Largest datasets have over 100 million rows.

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Minhash[2]

- Data sketch for estimating Jaccard similarity of sets.

$$J(S,T) = \frac{|S \cap T|}{|S \cup T|}$$

- A minhash signature is composed of the results of a number of minhashes.
- The probability that the minhashes for two sets are the same equals the Jaccard similarity of the sets[1].
- Minhash LSH hashes similar signatures to the same bucket.

[1] Mining of Massive Datasets, Chapter 3.

[2] A. Broder, "On the Resemblance and Containment of Documents", Compression and Complexity of Sequences 1997.

LSH Ensemble[3]

- Set containment is a better measure for computing joinability.

$$C(Q, X) = \frac{|Q \cap X|}{|Q|}$$

- We can convert Jaccard similarity to containment, given the sizes of the domains.
- The size of the indexed domain is not constant, so domains are partitioned by cardinality.
- A minhash LSH index is constructed for each partition.

[3] Erkang Zhu, Fatemeh Nargesian, Ken Q. Pu, Renée J. Miller, "LSH Ensemble: Internet-Scale Domain Search", VLDB 2016.

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Unionable table search

- The LSH Ensemble index is queried for each column of the query table.
- Candidate tables are those that appear in $\geq 40\%$ of the joinability queries.
- Candidates are ranked by alignment: the fraction of candidate columns that are unionable with a query column.

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Overview

- FastText: words -> vectors
- SimHash: vectors -> bit vectors
- LSH: similarity search on bit vectors

FastText

- Vectors represent the semantics of words
- Closer a pair of vectors, closer the semantics of the two words
- closeness or similarity of vectors := Cosine-Similarity

Simhash

- Vector of floats -> Vector of bits

hash := an array of length H For vector with dimension d: Compute wether it is above or below d hyperplanes H times

SimHash LSH

- L hash tables of bit vectors
- Query each L hash table for M candidates
- Compute cosnine similarity of unhashed vectors to return top-M results

LSH Forest

- Prefix Tree of bit vectors
- Variable length hash in tree solves tunability probelm
- Query L Prefix Trees (the LSH Forest) for M candidates
- Compute cosnine similarity of unhashed vectors to return top-M results

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- Organizing datasets into a directory structure for navigation.
- Use semantic similarity of attribute names in unionable table search.
- Similar dataset search based on metadata similarity.
- Keyword search over data values.