Similarity vs. Relevance: From Simple Searches to Complex Discovery

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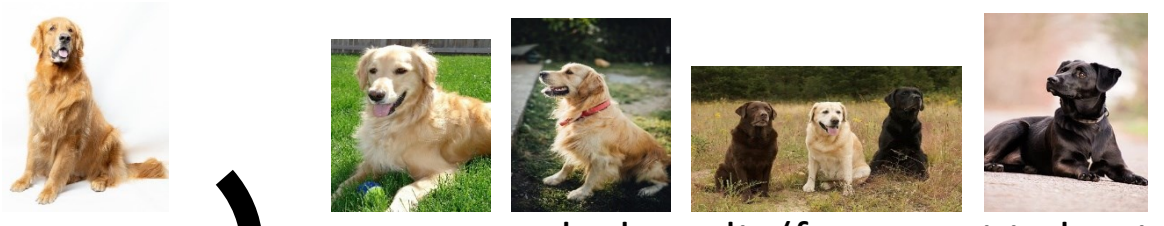
direct similarity d(.,.) + query-by-example (QbE) + kNN

paradox of the basic model



query → ranked results (from most to least similar)

actually, the best result is the query (example)! d(Q,Q) = 0

→ limited expressive power of direct similarity (effectiveness)

Data-transitive similarity

$$\hat{d}^{\odot,n}_{\biguplus}(\mathbf{x},\mathbf{y}) = \bigodot_{(i_1,\ldots,i_n)\in\mathcal{D}^n} \biguplus \left(d(\mathbf{x},i_1), d(i_1,i_2), \ldots, d(i_n,\mathbf{y})\right)$$

$\mathrm{sum}(\delta_0,\delta_1,\ldots,\delta_n) = \sum_{j=0}^{n}\delta_j$
$\min(\delta_0,\delta_1,\ldots,\delta_n) = \min\{\delta_0,\delta_1,\ldots,\delta_n\}$
$\max(\delta_0,\delta_1,\ldots,\delta_n) = \max\{\delta_0,\delta_1,\ldots,\delta_n\}$
$\mathrm{prod}(\delta_0,\delta_1,\ldots,\delta_n) = \prod_{j=0}^{n}\delta_j$
$\mathrm{iprod}(\delta_0,\delta_1,\ldots,\delta_n) = 1-\prod_{j=0}^{n}(1-\delta_j)$

Examples of inner aggregation $\biguplus$.

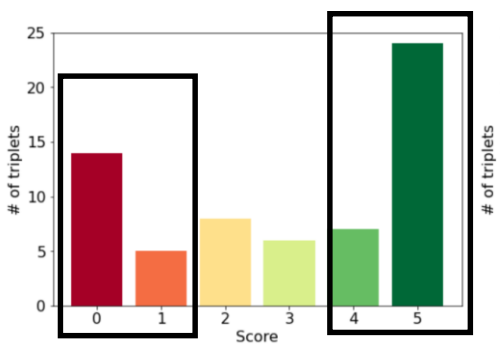
non-metric similarity,
extends relevancy beyond direct similarity

- dataset-dependent (*D*), meta-model: ground distance d(.,.) needed
- aggregation over chains of *n* similar objects from *D*
- self-explainable similarity (the winning chain)

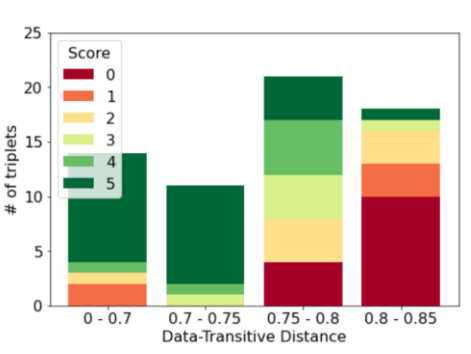
usable in standard QbE searches

Application in dataset discovery

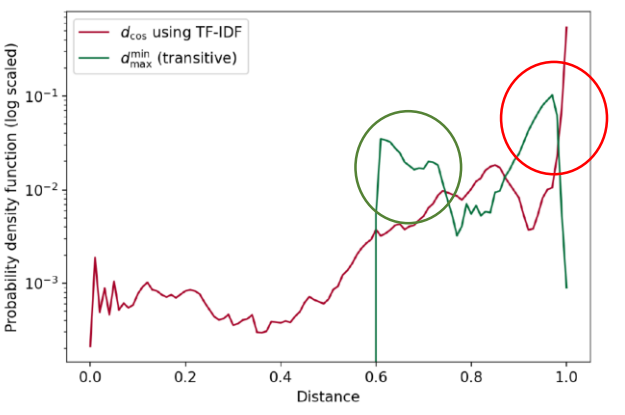
$$\hat{d}^{\min}_{\max}(\mathbf{x},\mathbf{y}) = \min_{\forall i\in\mathcal{D}} \max\{d(\mathbf{x},i), d(i,\mathbf{y})\}$$



78% scores consistent,
57% relevant



complies with
relevance=similarity



	Title Keywords	Description
Q	*Floods in the 19th century* **Floods, Environment, GIS**	Flooded areas in a 19th century flood in the Pilsen region.
I	*5-year water* **GIS, Floods, Environment**	Flooding areas of n-year water in the Pilsen region.
R	*Water reservoirs under the management of the river basin and the forest of the Czech Republic under the territorial jurisdiction of the river Vltava* **water tanks, water management**	The shp file contains points representing water reservoirs whose permitted volume of buoyant or accumulated water exceeds 1 000 000 m3 or to which the Forests of the Czech Republic, p. The registers are updated continuously, the dataset only once a year. The current data can be viewed on the water information portal VODA – www.voda.gov.cz.