Scientific domains of *mistrust*

Query expansion for *mistrust* using matrix decomposition & neural embeddings in the JSTOR digital library

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Outline

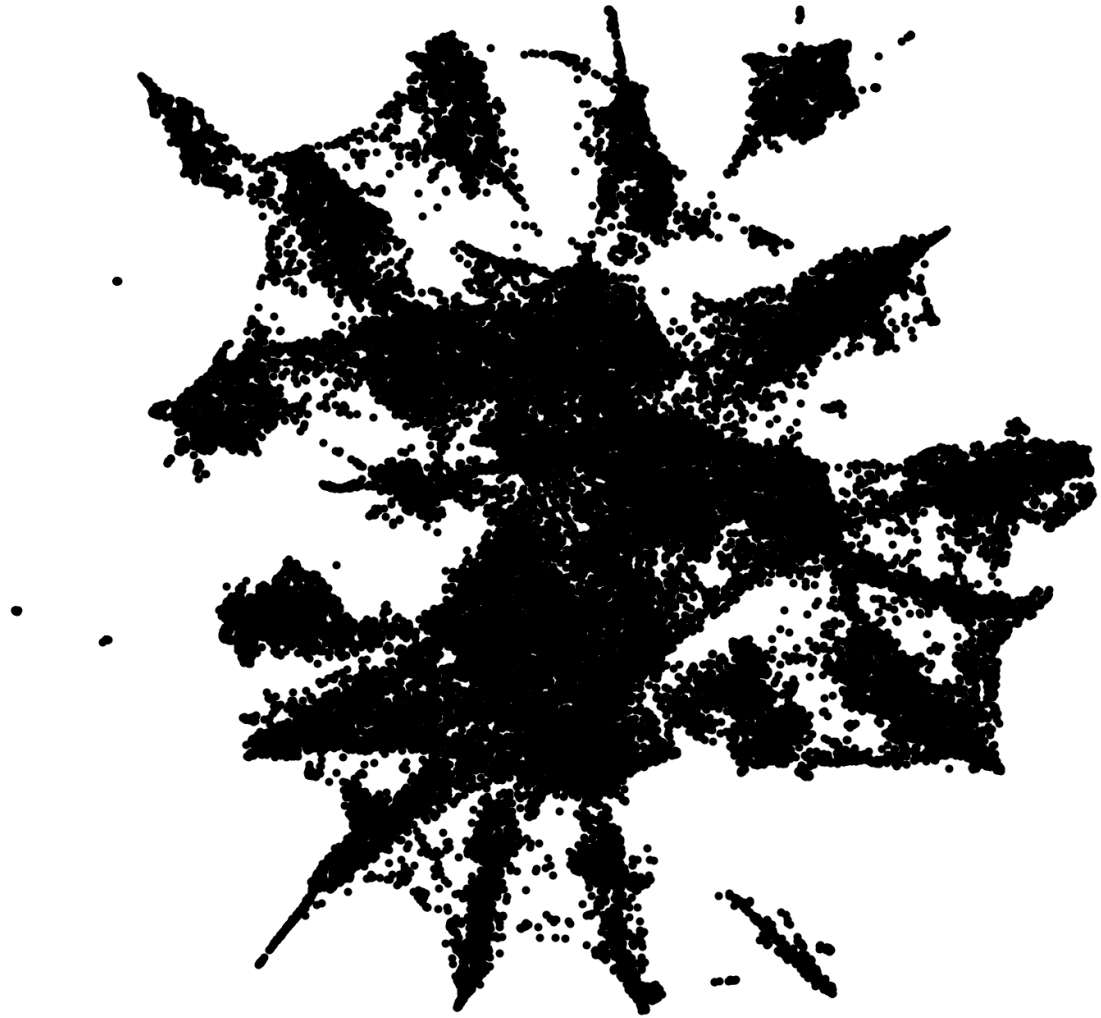

Figure 1: JSTOR Data For Research, $n = 43,802$, $\sim$ 400m words, Eng*, Fr, Ger.

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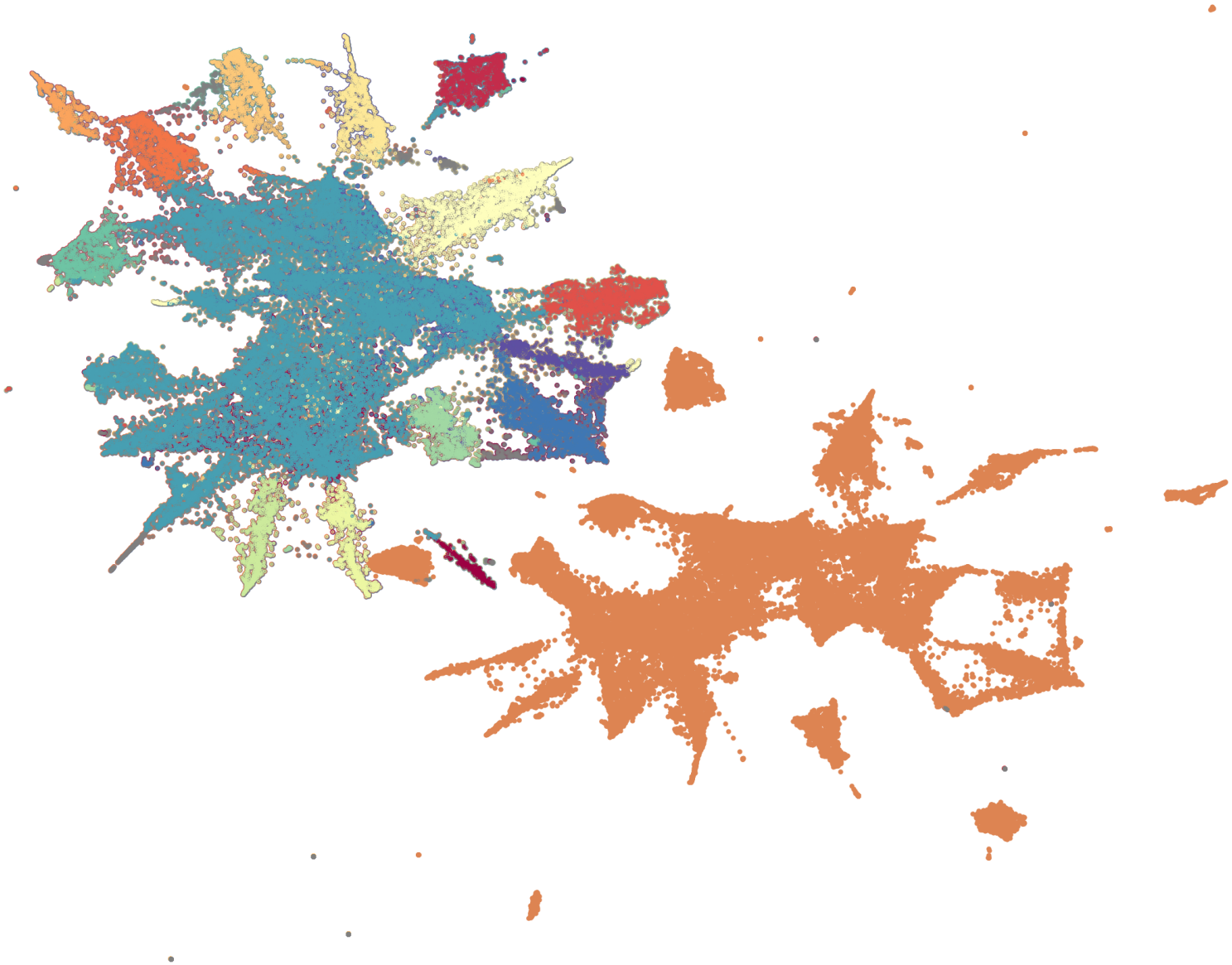

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Matrix decomposition of *TD* matrix

For bag-of-words representation X w. documents in columns and words in rows, such that each entry X_{ij} is the ith word in the jth column, we solve

$$\underset{W,H}{\operatorname{argmin}} \parallel X - WH \parallel_F^2 \quad s.t.\ W, H \geq 0$$

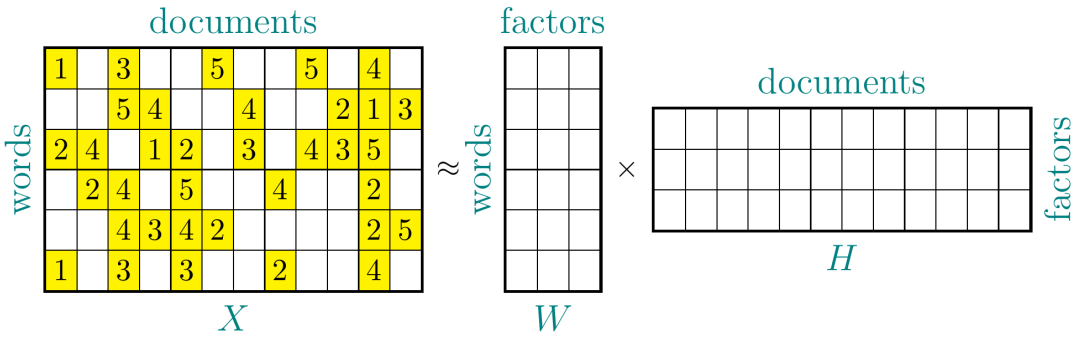

Figure 2: Non-negative matrix factorization of *TD* matrix X

WH is a low-rank approximation of the data (++fewer factors than documents and words) and each document is the weighted sum of columns in W, "document factors" $\sim$ themes or topics

[NOTE] because the data set was seeded with *MISTRUST*, the model is de facto seeded

Keyword sets for *MISTRUST*

```
1  * social research science trust amp theory group model data individual
2  man say life think love thing world god word human
3  * health patient medical care service treatment public mental report dr
4  woman female gender male sexual man sex marriage mother wife
5  court law supra id legal justice lawyer federal note criminal
6  la le les et des que en du french paris
7  student school teacher education educational college teach program university class
8  war military peace united british american international states foreign army
9  soviet russian russia union communist europe policy western foreign west
10 china chinese japan japanese asia asian relation east foreign communist
11 book history pp chapter century author reader text university review
12 black african white africa racial american race south americans ethnic
13 church religious catholic god religion christian faith muslim century england
14 india indian pakistan muslim asia south country asian native region
15 community local land city area environmental water village people forest
16 german und der germany die vo des europe french european
17 israel jewish arab jew muslim peace east al middle conflict
18 political party government democracy election politics democratic social power public
19 child family parent mother father school social amp marriage young
20 film image art narrative director story character media american production
21 poem love literary language line reader write word text read
22 economic market country policy price economy trade bank industry investment
23 music art performance play style voice hear culture movement popular
24 worker union labor employee management labour industrial social company industry
25 nuclear weapon security arm energy pakistan military strategic international treaty
```

*) factors used to subset the jstor data

Distributed word representation

For a discrete input $w_0, w_1, ..., w_n$, we train a simple feedforward network such that

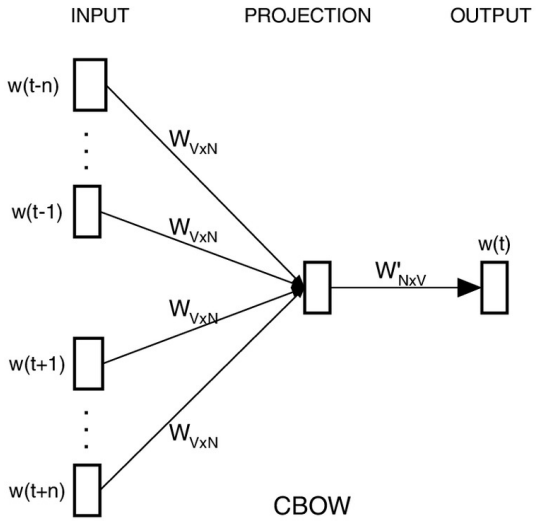

Figure 3: CBOW architecture for learning neural embeddings at the word level

$$\frac{1}{T}\sum_{t=1}^{T}\sum_{-n\leq j\leq n}\log p(w_t|w_{t+j}), \quad j\neq 0$$

Semantic similarity between any two word embeddings, A and B, can then be measured as their angular similarity

$$1-\frac{\cos^{-1}\left(\frac{A\cdot B}{\|A\|\,\|B\|}\right)}{\pi},$$

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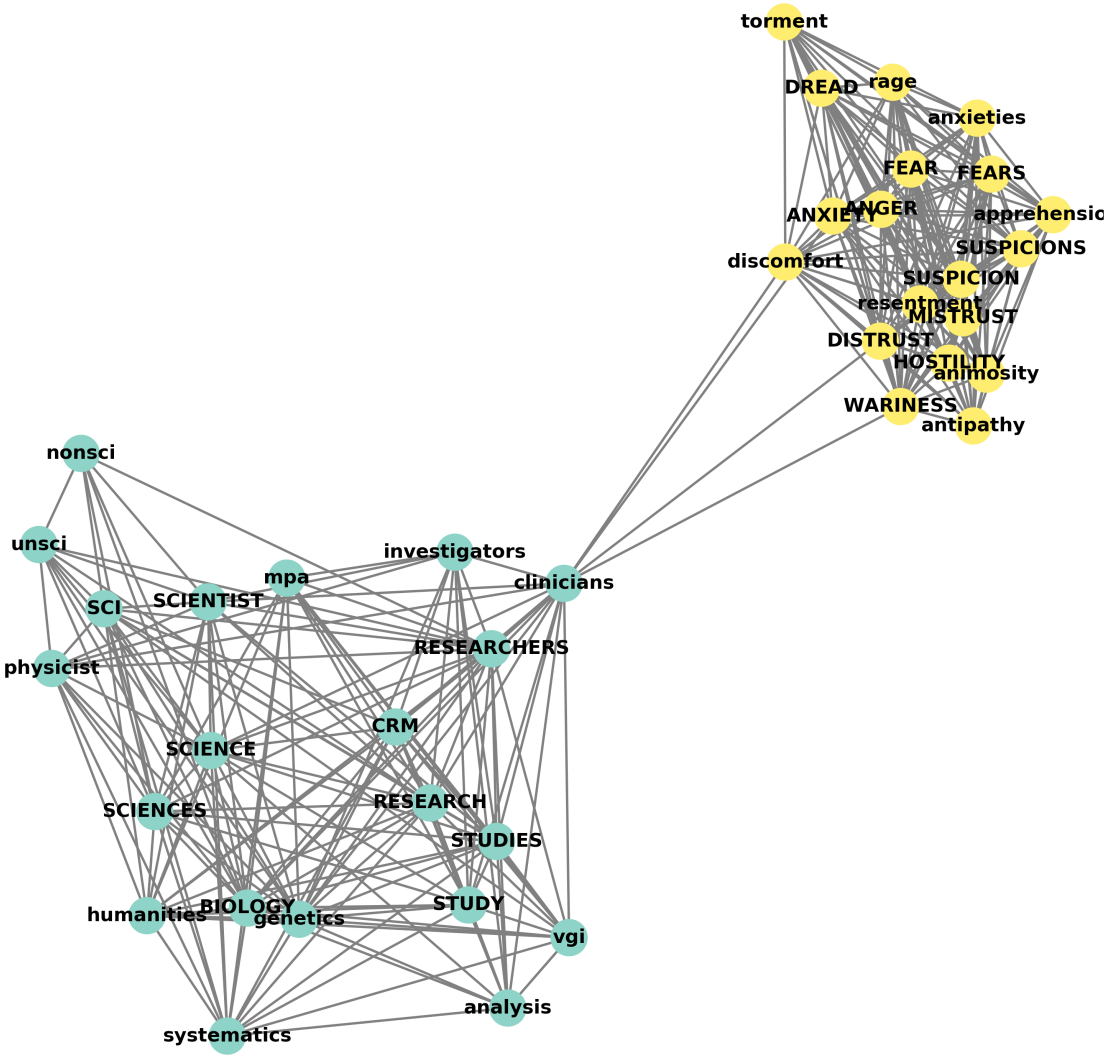

Figure 4: Sparse query graph for MISTRUST and SCIENCE

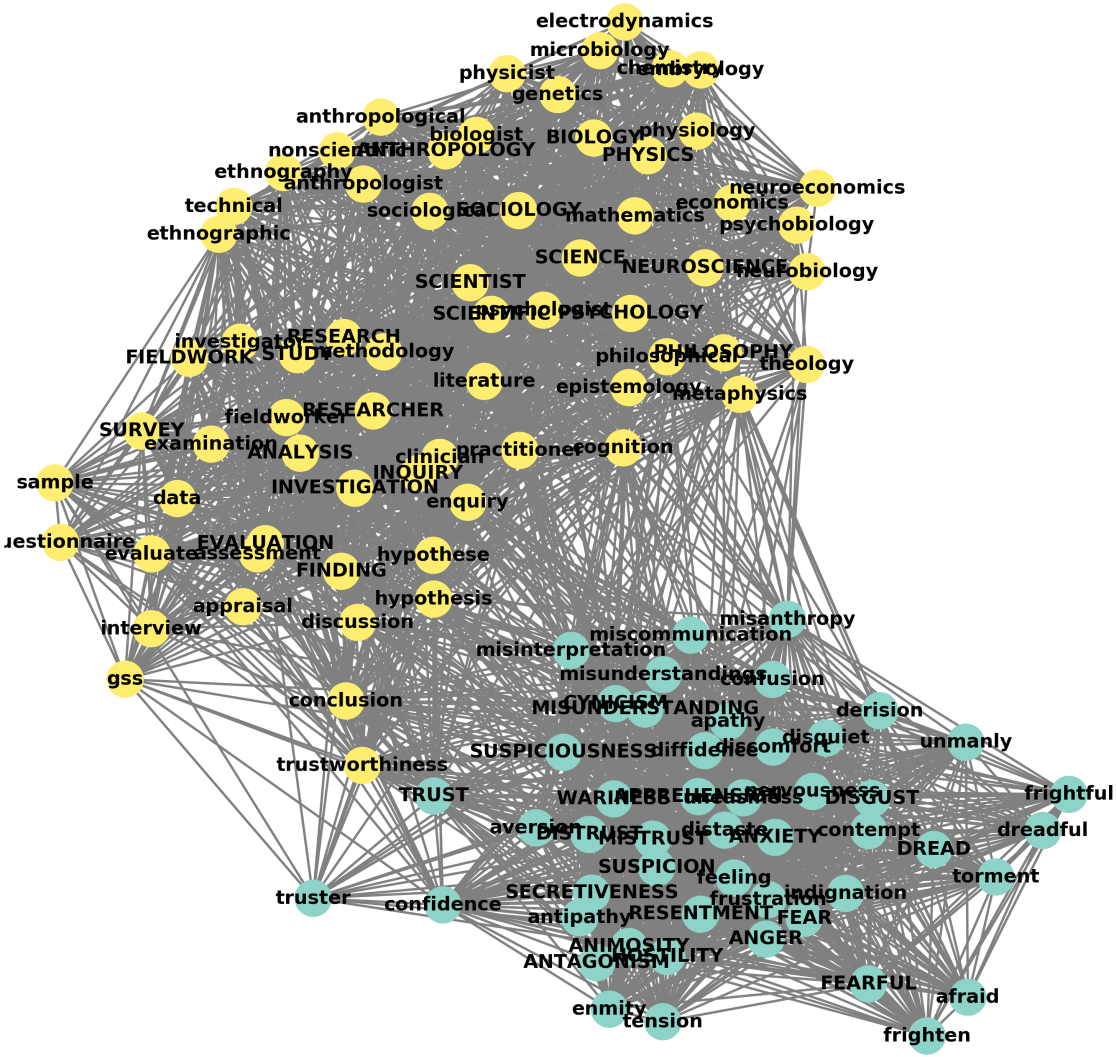

Figure 5: Dense query graph for MISTRUST and SCIENCE

Thank you for your attention

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slides: http://knielbo.github.io/files/kln_mistrust_query.pdf