Experiments in Analysis of Industry—Academia Collaboration and Research Trends

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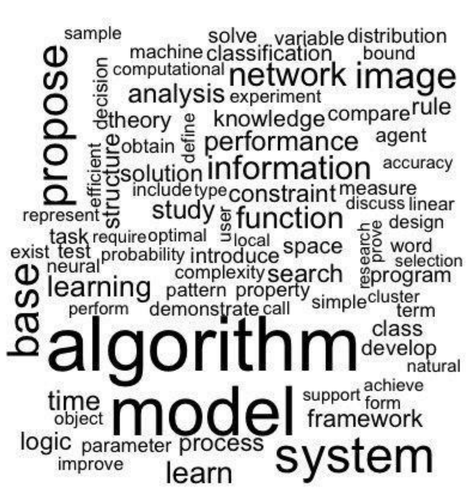
We present work-in-progress experiments in mix-method analysis of academic research papers and respective metadata.
The metadata accompanying research papers bounds together geospatial, linguistic and social network characteristics of the academic research.
Our experiments with abstracts and metadata reveal the properties of interinstitutional research and the collaboration of the industry and academy, so as some temporal properties of research trends.

RESEARCH TRENDS IN TIME

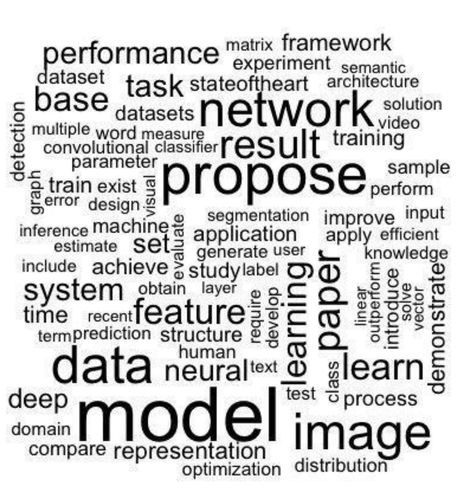
To analyze the evolution of the research ideas we first took a naive approach approximating the research trends at particular temporal interval with the most mentioned things.
The most straightforward intuition beyond this idea is to analyze the distribution of n-grams in the corpora at the particular time interval. We analyzed unigrams and selected n-grams.
The results give us the grounds to treat the n-grams distributions informative in the sense of research trends analysis.

Unigrams frequency analysis

We performed the frequency distribution analysis of tokens in the corpora for each year separately and then compared these distributions. One of the interesting findings is growth of the deep-learning-related tokens frequency after 2012. The two famous deep-learning papers were published nearly 2012: the AlexNet and the Word2Vec one. These marked the growth of the DL popularity in the CV and NLP fields respectively.
The before 2012 and after 2012 tokens frequencies distributions are on the wordclouds. 'Algorithm' hegemony disappeared and 'Model' becomes the new top 1.



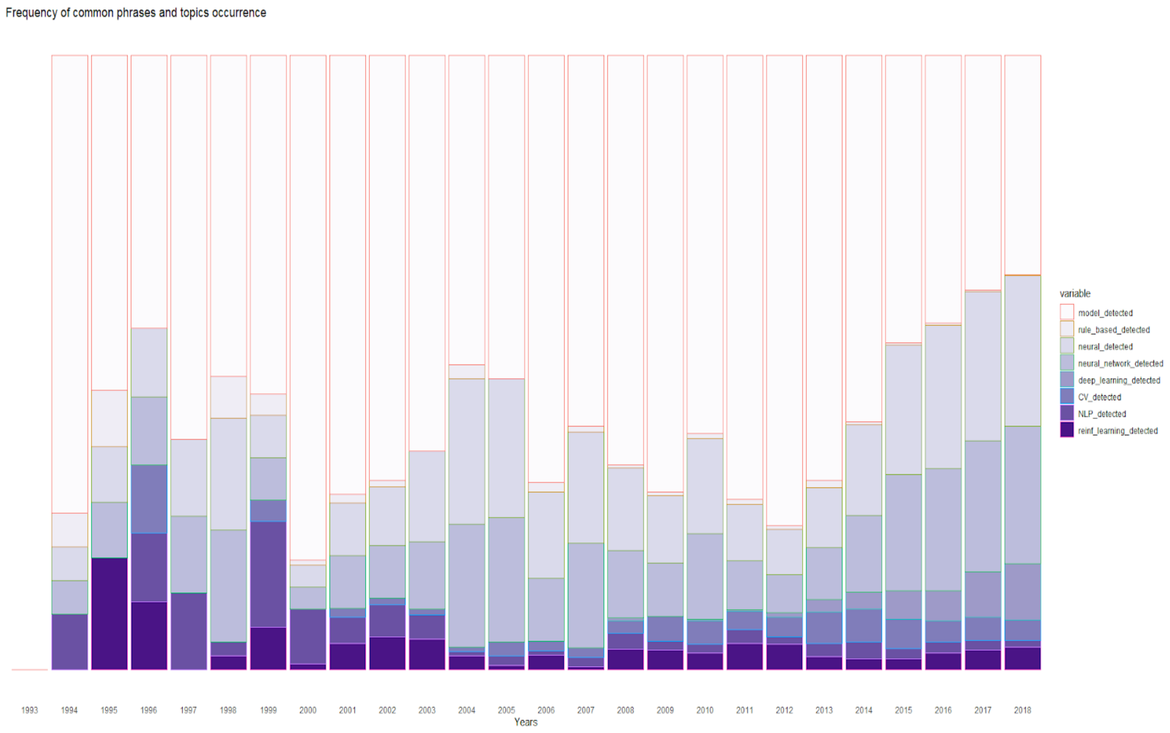
Before 2012



After 2012

Selected N-grams analysis

We also inspect some frequent n-grams relative distribution over time. One can see the downfall of the 'rule-based' term and the continuing arise of the DL-related n-grams since 2012.



DATA AND METHOD

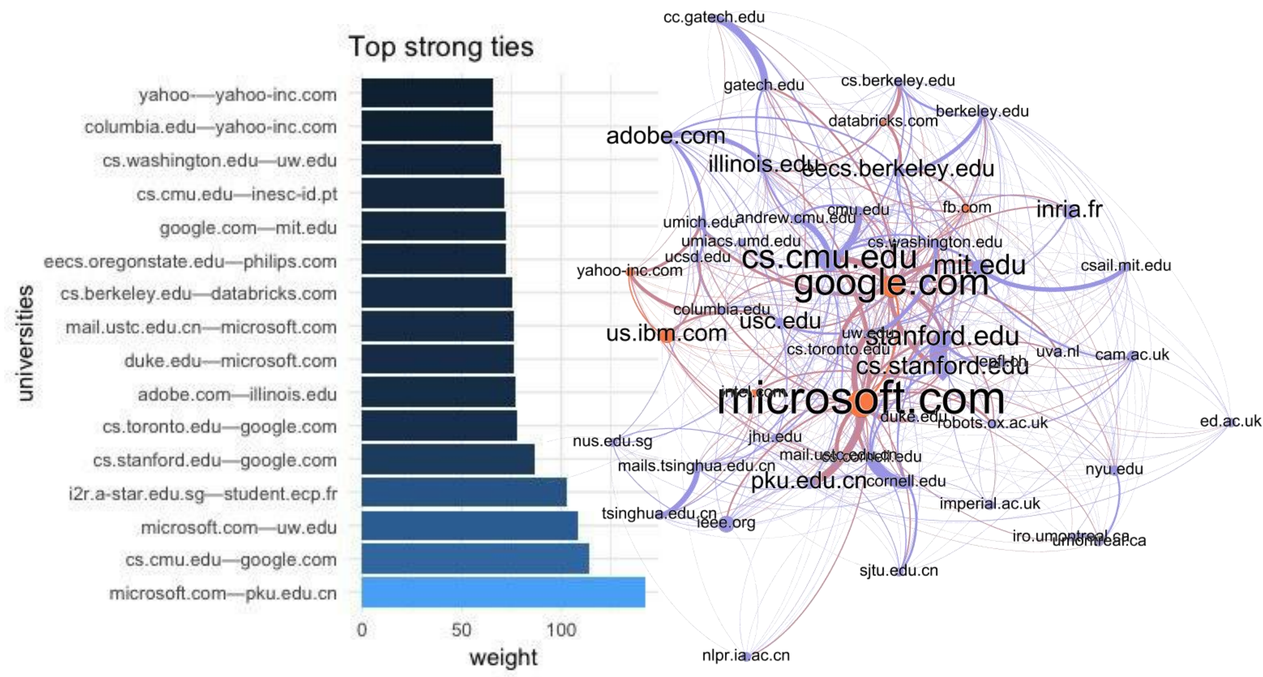
A corpus of **abstracts** and **metadata** for 31, 000+ papers from the arXiv.org e-prints archive on AI and Data Science research — from 1992 to 2018.

Metadata fields:

- authors names
- authors emails
- research field according to the arXiv.org classification

INDUSTRY—ACADEMIA COLLABORATION ANALYSIS

We extracted the domains of papers' authors emails and built an institutions' collaboration network treating the email domain as the label of the institution.
We filtered out the non-informative general-purpose domains such as gmail.com and intrainstitutional collaborations.



It turned out that there are two major industry giants collaborating with the academia: Google and Microsoft.
Both of them collaborate with Carnegie Mellon University. In the same time, while Google tends to collaborate with Stanford University (possibly because of the geographical proximity of the headquarters) Microsoft collaborates both with nearly located universities such as University of Washington and Chinese universities such as Beihang University and Peking University. In such terms one can treat Microsoft more international in the academic research.

The most frequent email domains collaboration pairs are present at the box plot.

FURTHER WORK

Since the topic modeling attempts on the whole corpora were not that promising, we plan to introduce the temporal clustering to the experiments as it was done with n-grams analysis. It also worth trying to involve more social networks analysis experiments analyzing particular graph metrics.

Digital version and source code available at GitHub