Extended Topic Models with Numerical Features

Gökhan Çapan, Ali Caner Türkmen

March 21, 2016

Introduction

- Unsupervised learning, recover *latent* topics in documents
- Can be thought of as clustering. Loosely equivalent to link prediction.

Latent Dirichlet Allocation

- (Blei et al., 2003)

Comparison of Topic Models

- (Blei et al., 2003)

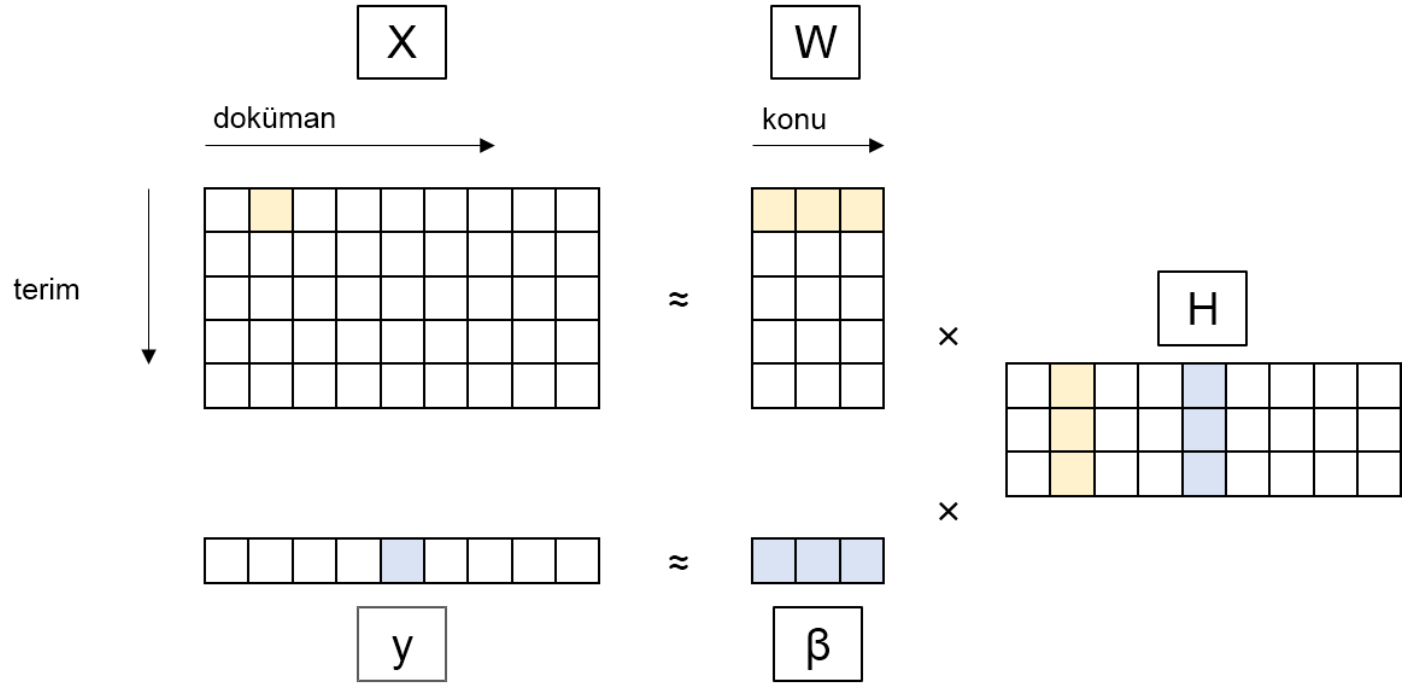
Coupled Topic Model Applications

- Gokhan lit survey

LDA $\equiv$ Bayesian NMF up to parameterization

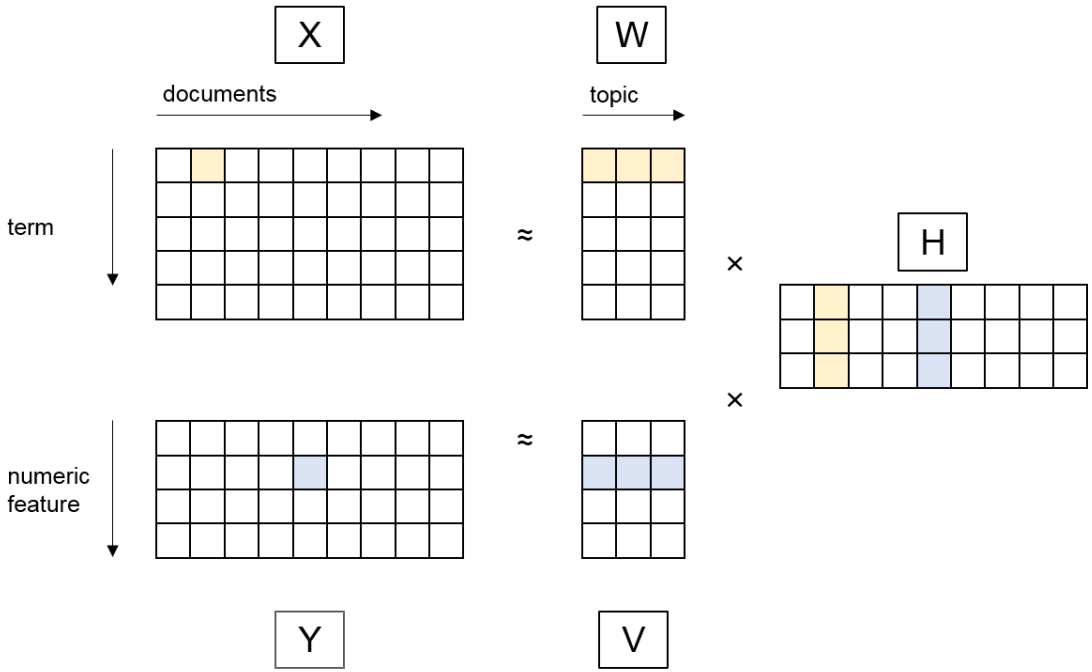
- (Jordan Blei) (Cemgil, 2009)

Coupled Matrix Factorization for Recovering Topics



- Represent data with well-known algebraic structures
- Jointly guide topic assignments from multimodal datasets, in a probabilistically sound framework
- Easily extensible to semi-supervised learning, kernel methods
- (T. and Cemgil, 2016)

Extended Coupled NMF for Topic Learning with Count Features



- $y_{ij}|W, H \sim GPO(\sum_t w_{it} h_{tj}, \phi)$
- $x_{kj}|V, H \sim GPO(\sum_t v_{kt} h_{tj}, \gamma)$
- Guide topic modeling with numeric count data
- Can assume priors $p(W), p(H), p(V)$ for Bayesian learning

Data Set and Features

- **Data Set:** News articles sampled from Anadolu Agency website. 1337 documents (can be expanded), 3000 tokens after adjusting for document frequency.
- **Features:** Complexity features such as word count, sentence count, average sentence length, comma count. (TBD)
- **Novel Features:** Etymological counts. Count the number of words from their etymological origins. Number of Arabic, Farsi, French words, etc. Source: TR Wiktionary Database Dump.

Learning

- EM-like updates with multiplicative NMF update rules
- Gibbs sampling assuming appropriate priors (tentative, out of scope for this project)

Conclusion

We propose two key contributions

- Put the topic modeling problem in a coupled NMF framework, extending with numerical features
- Use etymological counts for the Turkish language