Reading the Tea Leaves: How Humans Interpret Topic Models

Chang, Graber, Gerrish, Wang, & Blei

NIPS 2009

Presenter: Robert Thorstad

Topic Modeling

People's documents usually organized around topics

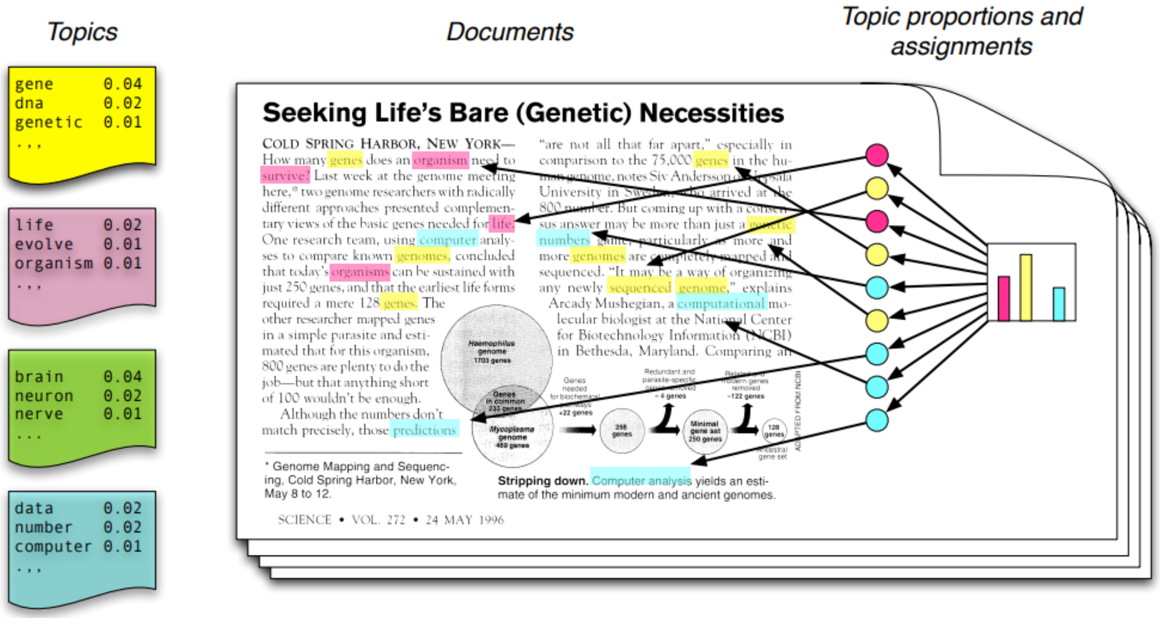


Figure: personal website of David Blei

Topic models reverse this inference: observe documents → infer topics

How know a topic is good?

Measure how well they fit new data:

Predictive Likelihood: How well do topics predict words unobserved posts?

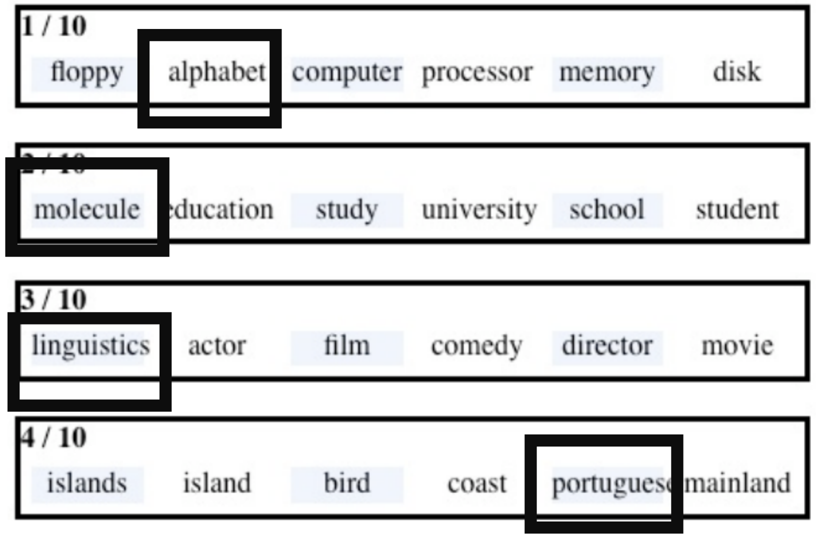
Coherence: How much do top words in a topic "go together" in unobserved posts? (e.g. Roder, Both, & Hinneburg, 2015)

Good topics? Humans should think:

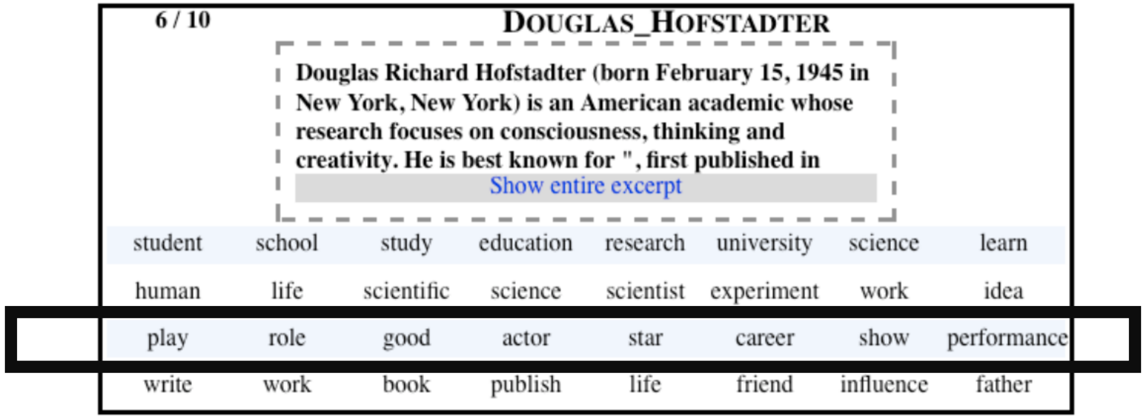
Words in a topic go together

Topics well describe document

Word Intrusion



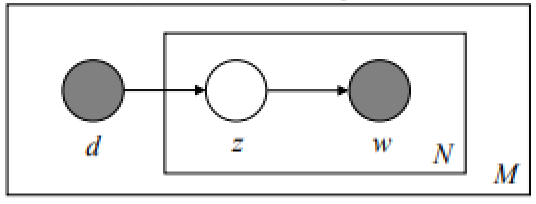
Topic Intrusion



Studied 3 topic models

Probablistic Latent Semantic Indexing (pLSI):

1 topic / document

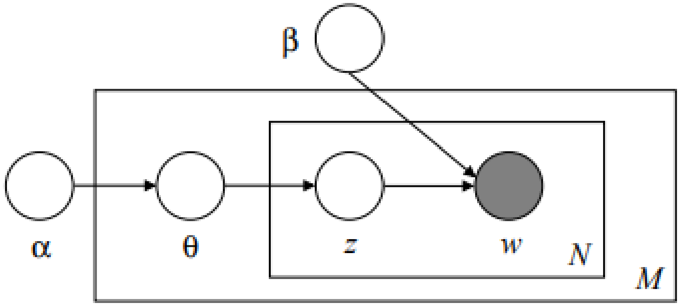


(c) pLSI/aspect model

(Hoffman, 1999; Figure from Blei, 2003)

Latent Dirichlet Allocation (LDA):

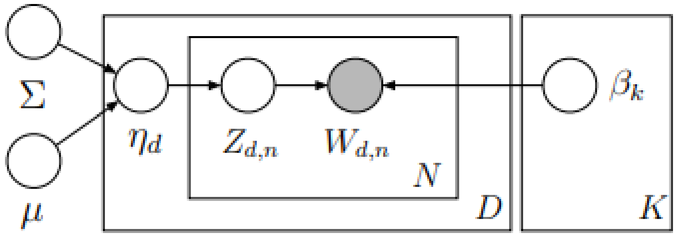
(Potentially) many topics/document



(Blei, 2003)

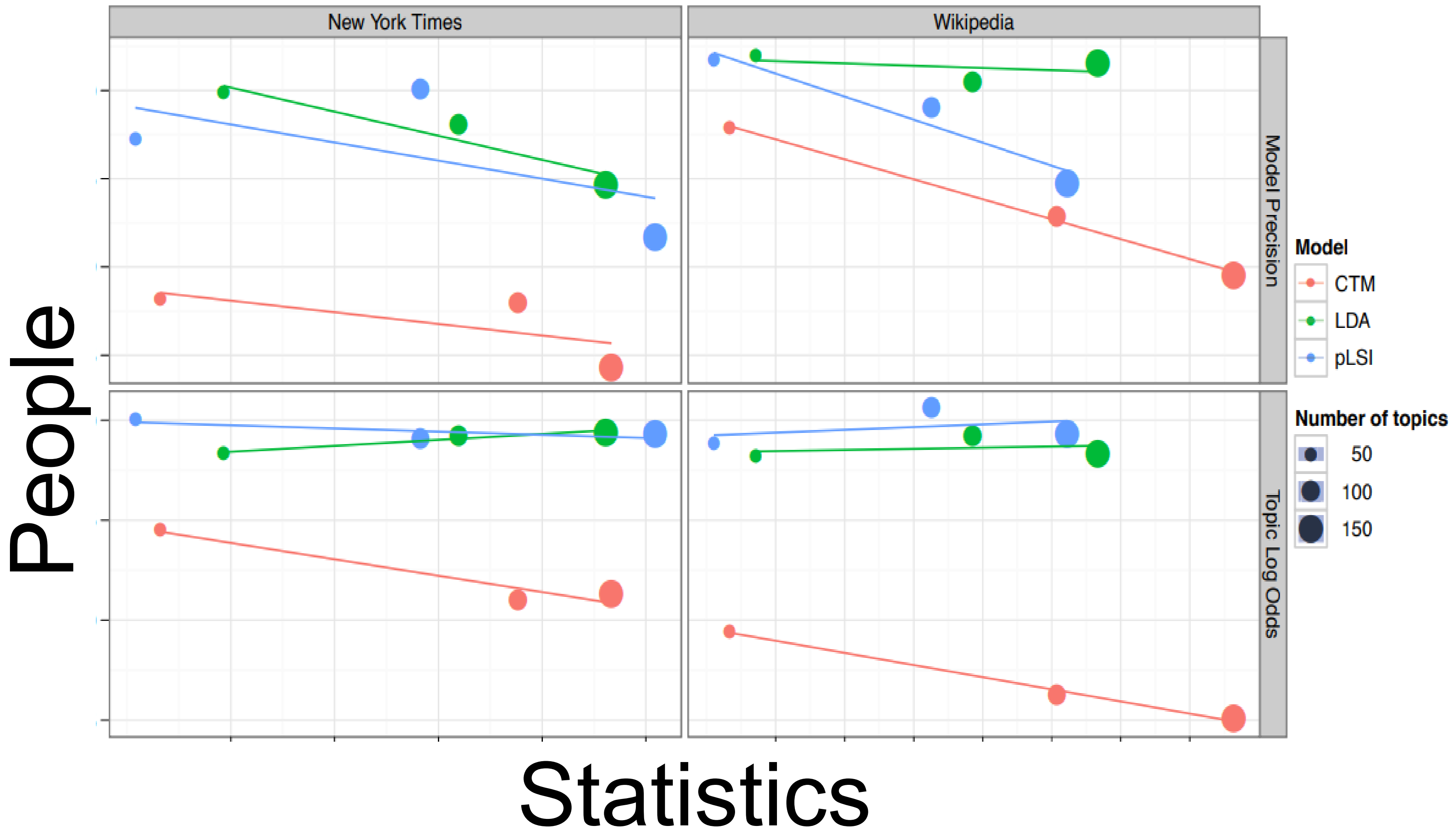
Correlated Topic Model (CTM)

Topics can be correlated



(Blei & Lafferty, 2006)

Statistics negatively correlate with human judgments!



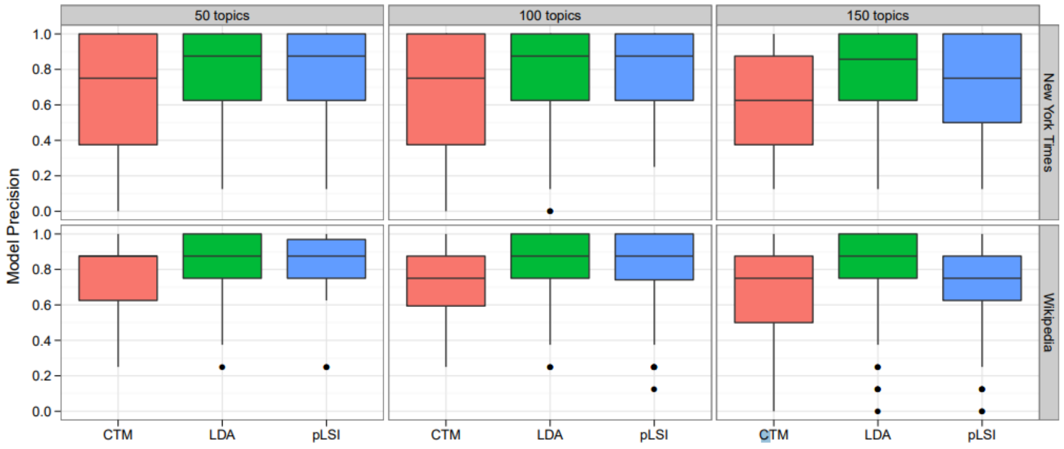
Statistically, CTM was best

Log odds:

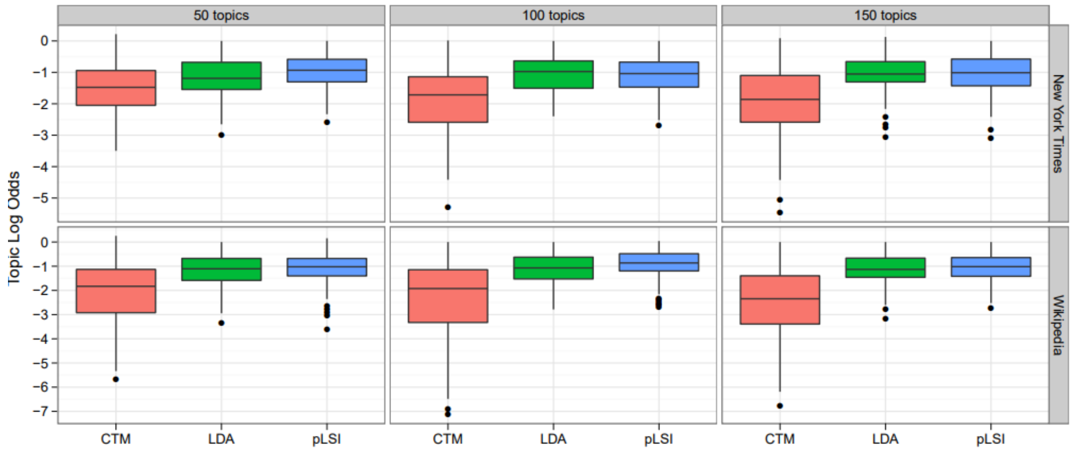
Corpus	Topics	LDA	CTM	pLSI
New York Times	50	**-7.3214 / 784.38**	-7.3335 / 788.58	-7.3384 / 796.43
	100	-7.2761 / 778.24	**-7.2647 / 762.16**	-7.2834 / 785.05
	150	-7.2477 / 777.32	-7.2467 / **755.55**	**-7.2382** / 770.36
Wikipedia	50	**-7.5257** / 961.86	-7.5332 / **936.58**	-7.5378 / 975.88
	100	-7.4629 / 935.53	**-7.4385 / 880.30**	-7.4748 / 951.78
	150	-7.4266 / 929.76	**-7.3872 / 852.46**	-7.4355 / 945.29

But, people liked LDA best

Word intrusion



Topic intrusion



Which measures agree with people?

Topic coherence

		Name	C_V	C_P	C_{UMass}	$C_{one\text{-}any}$	C_{UCI}	C_{NPMI}	C_A
coherences		$\mathcal{S}$	$\mathcal{S}^{one}_{set}$	$\mathcal{S}^{one}_{pre}$	$\mathcal{S}^{one}_{pre}$	$\mathcal{S}^{one}_{any}$	$\mathcal{S}^{one}_{one}$	$\mathcal{S}^{one}_{one}$	$\mathcal{S}^{one}_{one}$
		$\mathcal{P}$	$\mathcal{P}_{sw(110)}$	$\mathcal{P}_{sw(70)}$	$\mathcal{P}_{bd}$	$\mathcal{P}_{bd}$	$\mathcal{P}_{sw(10)}$	$\mathcal{P}_{sw(10)}$	$\mathcal{P}_{cw(5)}$
		$\mathcal{M}$	$\tilde{m}_{cos(nlr,1)}$	m_f	m_{lc}	m_d	m_{lr}	m_{nlr}	$\tilde{m}_{cos(nlr,1)}$
		Σ	σ_a	σ_a	σ_a	σ_a	σ_a	σ_a	σ_a
using corpus		20NG	0.665	0.756	0.395	0.563	0.312	0.486	0.563
		Genomics	0.671	0.652	0.514	0.549	0.624	0.630	0.632
		RTL-Wiki	0.627	0.615	0.272	0.545	0.527	0.573	0.542
		Movie	0.548	0.549	0.093	0.453	0.473	0.438	0.431
		average	0.628	0.643	0.319	0.528	0.484	0.532	0.542
using the Wikipedia	$N = 10$	20NG	0.859	0.825	0.562	0.822	0.696	0.780	0.739
		Genomics	0.773	0.721	0.442	0.452	0.478	0.594	0.530
		NYT	0.803	0.757	0.543	0.612	0.783	0.806	0.747
		average	0.812	0.768	0.516	0.629	0.652	0.727	0.672
	$N = 5$	RTL-NYT	0.728	0.720	0.106	0.438	0.631	0.678	0.687
		RTL-Wiki	0.679	0.645	0.350	0.499	0.558	0.606	0.602
		Movie	0.544	0.533	0.143	0.454	0.447	0.452	0.465
		average	0.650	0.633	0.200	0.464	0.545	0.579	0.585
		average	**0.731**	0.700	0.358	0.546	0.599	0.653	0.628

Table 2: Coherence measures with strongest correlations with human ratings.

(Roder, Both, & Hinneburg, 2015)