Design Mining for Learning Color Semantics

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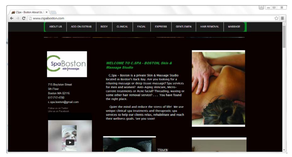
MOTIVATION

Scenario 1: You search for a “massage therapy” website, and you get these two designs, which one gives you a better first impression?



Scenario 2: You wish to design a media piece that conveys “techy-fashion”, what color palette would you choose?

Idea: Learning from professionals

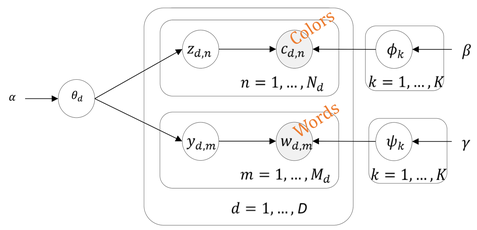
DESIGN COLLECTION

Magazine cover dataset: at a glance

About 3000 magazine covers
71 titles
12 genres
Transcribed cover lines (words) to text

MINING PROBLEM

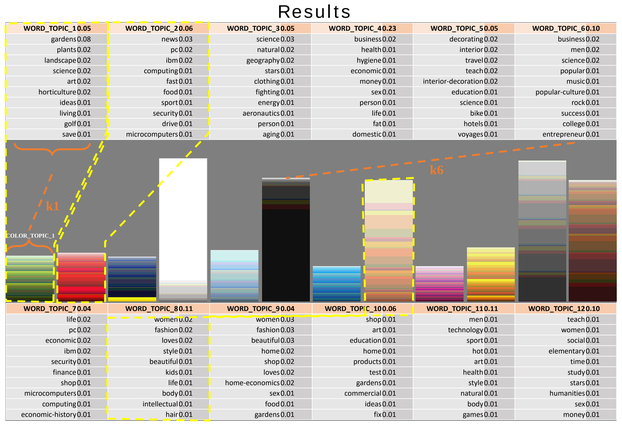
Adopting an extension of LDA topic modeling



$$p(\phi, \psi, \theta, z, y | c, w) = \frac{p(\phi,\psi,\theta,z,y,c,w)}{p(c,w)}$$

Pr(color-word topics, proportions, assignments | colors, words)

Results



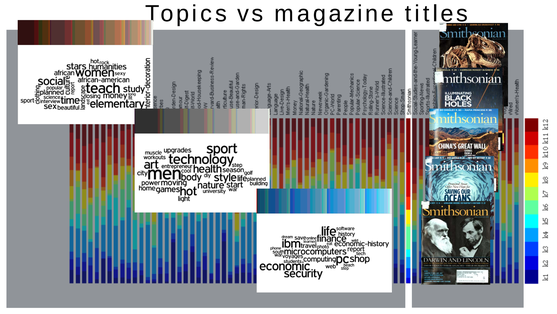
WORD_TOPIC_1 0.05	WORD_TOPIC_2 0.06	WORD_TOPIC_3 0.05	WORD_TOPIC_4 0.23	WORD_TOPIC_5 0.05	WORD_TOPIC_6 0.10
gardens 0.08	news 0.03	science 0.03	business 0.02	decorating 0.02	business 0.02
plants 0.02	pc 0.02	natural 0.02	health 0.01	interior 0.02	men 0.02
landscape 0.02	ibm 0.02	geography 0.02	hygiene 0.01	travel 0.02	science 0.02
science 0.02	computing 0.01	stars 0.01	economic 0.01	teach 0.02	popular 0.01
art 0.02	fast 0.01	clothing 0.01	money 0.01	interior-decoration 0.02	music 0.01
horticulture 0.02	food 0.01	fighting 0.01	sex 0.01	education 0.01	popular-culture 0.01
ideas 0.01	sport 0.01	energy 0.01	person 0.01	science 0.01	rock 0.01
living 0.01	security 0.01	aeronautics 0.01	life 0.01	bike 0.01	success 0.01
golf 0.01	drive 0.01	person 0.01	fat 0.01	hotels 0.01	college 0.01
save 0.01	microcomputers 0.01	aging 0.01	domestic 0.01	voyages 0.01	entrepreneur 0.01

WORD_TOPIC_7 0.04	WORD_TOPIC_8 0.11	WORD_TOPIC_9 0.04	WORD_TOPIC_10 0.06	WORD_TOPIC_11 0.11	WORD_TOPIC_12 0.10
life 0.02	women 0.07	women 0.03	shop 0.01	men 0.01	teach 0.01
pc 0.02	fashion 0.02	fashion 0.03	art 0.01	technology 0.01	women 0.01
economic 0.02	loves 0.02	beautiful 0.03	education 0.01	sport 0.01	social 0.01
ibm 0.02	style 0.01	home 0.02	home 0.01	hot 0.01	elementary 0.01
security 0.01	beautiful 0.01	shop 0.02	products 0.01	art 0.01	time 0.01
finance 0.01	kids 0.01	loves 0.02	test 0.01	health 0.01	study 0.01
shop 0.01	life 0.01	home-economics 0.02	gardens 0.01	style 0.01	stars 0.01
microcomputers 0.01	body 0.01	sex 0.01	commercial 0.01	natural 0.01	humanities 0.01
computing 0.01	intellectual 0.01	food 0.01	ideas 0.01	body 0.01	sex 0.01
economic-history 0.01	hair 0.01	gardens 0.01	fix 0.01	games 0.01	money 0.01

VISUALIZING RESULTS

Color palette extraction from: S. Lin and P. Hanrahan, “Modeling how people extract color themes from images,” in ACM Human Factors in Computing Systems (CHI), 2013.

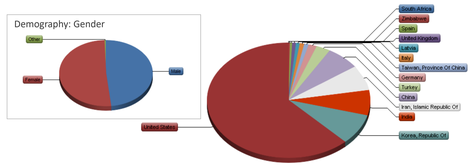
Topics vs magazine titles



CROWDSOURCING

Demography of 859 participants

487 (56.69%) females	367 (42.72%) males, 5 others
70 countries	66 native languages
US (59.84%)	348 (40.51%) lived in more than one country
352 (40.97%) college degrees, 55 other degrees	451 (52.50%) graduate degrees
716 (83.35%) are non-designers	130 (15.13%) designers, with 3 or more years of experience



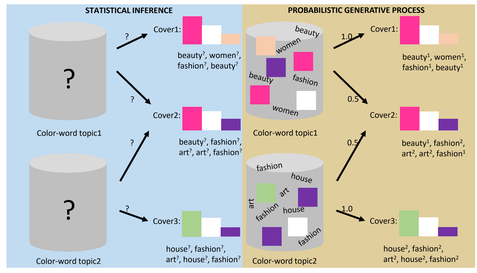
Relevance matrix of responses

R^1	w_1	w_2	w_3	w_4	w_5	w_6	w_7	w_8	w_9	w_{10}	w_{11}	w_{12}
c_1	2.14	0.33	1.39	0.39	0.49	0.38	0.26	0.38	0.31	0.81	0.43	0.30
c_2	0.57	0.28	0.56	0.62	1.18	0.38	0.35	1.76	1.87	0.71	0.68	1.45
c_3	0.14	1.27	1.53	0.84	0.89	0.89	1.18	0.54	0.30	0.67	1.04	0.34
c_4	0.03	1.62	1.13	1.28	0.71	1.19	1.68	0.12	0.28	0.63	1.43	0.30
c_5	0.38	1.23	1.44	1.09	1.45	1.05	1.61	0.43	0.36	0.93	1.12	0.53
c_6	0.74	0.99	1.08	0.74	0.53	1.85	0.99	0.26	0.10	0.59	1.02	0.40
c_7	0.13	1.33	1.23	1.03	1.12	1.01	1.63	0.29	0.48	0.38	1.04	0.48
c_8	0.51	0.33	0.61	0.41	1.49	0.40	0.34	1.79	1.32	1.01	0.46	1.07
c_9	0.43	0.03	0.10	0.30	1.30	0.07	0.10	1.96	2.07	0.61	0.34	1.18
c_{10}	1.05	0.25	0.73	0.57	1.80	0.34	0.18	1.53	0.99	1.43	0.61	1.17
c_{11}	0.30	1.68	0.93	1.41	0.48	1.23	1.52	0.23	0.23	0.74	1.38	0.37
c_{12}	1.01	0.49	1.56	0.93	0.89	1.53	0.63	0.57	0.63	1.08	1.06	0.59

Values: relevance between color palettes and word clouds

APPLICATIONS

LDA is generative



Color palette recommendation

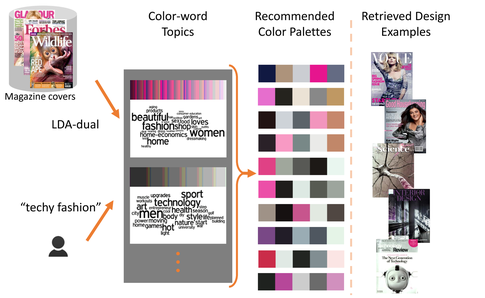


Image retrieval using color semantics

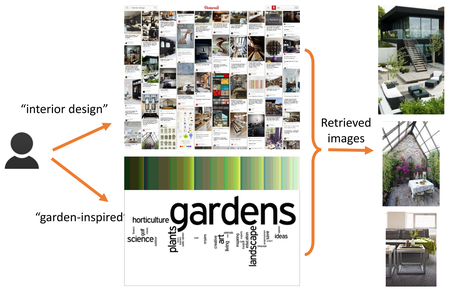


Image color selection using semantics

colors that contribute to “travel” and “shop”

Image recoloring using semantics

“science” “shop” “sports” + “men”

Colored by S. Lin, D. Ritchie, M. Fisher, and P. Hanrahan. Probabilistic Color-by-Numbers: Suggesting Pattern Colorizations Using Factor Graphs. In *ACM SIGGRAPH* 2013.