A NPMI estimation

We define the probability of word i; $p(w_i)$, and the joint probability of two words w_i and w_j $p(w_i, w_j)$ occurring together as their relative frequency. Let N_i be the total number of documents where w_i is present and $N_{i,j}$ be the total number documents where w_i and w_j are both present:

$$p(w_i) = \frac{\sum_{n=1}^{N} \mathbb{1}\left[w_i \in x_n\right]}{\sum_{n=1}^{N} \mathbb{1}\left[x_n\right]} = \frac{N_i}{N} \tag{6}$$

$$p(w_i, w_j) = \frac{\sum_{n=1}^{N} \mathbb{1}\left[w_i, w_j \in x_n\right]}{\sum_{n=1}^{N} \mathbb{1}\left[x_n\right]} = \frac{N_{i,j}}{N} \tag{7}$$

NPMI is typically computed for top T words for a given topic. The formula for computing NPMI for a given word w_i is stated as:

$$\textit{NPMI}(w_i) = \sum_{j}^{T-1} \frac{\log \frac{p(w_i, w_j)}{p(w_i)p(w_j)}}{-\log p(w_i, w_j)} \tag{8}$$

In order to compute NPMI for a particular topic k, we compute this value for all T top words associated to that topic:

$$\textit{NPMI}_k = \frac{\sum_{i=1}^{T} \textit{NPMI}(w_i \in \textit{Topic}_k)}{T} \tag{9}$$

Finally, we compute the overall NPMI as the average of NPMIs for every topic:

$$\textit{NPMI} = \frac{\sum_{k=1}^{K} \textit{NPMI}_k}{K} \tag{10}$$

B Top Words

In Figure 7, we show the top 10 words for the datasets.

A_1			A_2			A_3		A_4	
cards	pockets	plantar	bra	wrist	buckle	watch	earrings	color	christmas
compartment	cold	fasciitis	boob	band	belt	watches	pendant	love	birthday
bag	warm	feet	underwire	strap	leather	casio	sterling	compliments	grandson
credit	weather	walk	breasts	plastic	brim	countdown	chain	brown	necklace
laptop	sleeved	arch	nipples	watch	belts	invitca	necklace	colors	gift
pocket	chilly	blisters	cups	leather	plastic	seiko	ring	purple	watch
carry	shirt	walking	straps	metal	loop	stopwatch	earring	blue	niece
zippered	pocket	pain	cleavage	buckle	velcro	solar	cz	gray	gifts
compartment	wear	shoes	muffin	velcro	stitching	atomic	diamonds	pink	nephew
pockets	sleeve	sole	fabric	rubber	stitched	battery	jewelry	black	halloween

A_1			A_2		A_3		A_4
dr	colordeau	dr	movie	blu	life	war	score
frankenstein	sorboone	paris	good	sdh	society	parenthetical	performance
grade	jacques	staci	dvd	audio	humans	khz	performances
self	dr	layne	watch	ray	world	soldiers	director
wow	universiy	february	film	criterion	people	poll	role
12	dauphine	self	just	ratio	man	troops	directed
mti	versailles	filmthe	like	grain	jesus	ship	oscar
enhancement	ninja	harp	time	dolby	christ	france	cinemtrpgaphy
06	pantheon	en	really	dvd	lives	pacific	filem
stangleove	turtles	grade	movies	transfer	earth	german	quot

Table 7: Top 10 words learned by VALTA for the best 4 aspects: clothing (top), and movies (bottom).