1 Explicit Feedback

For explicit feedback, we assume that a pair of purchase and click $< w, l >$ is the result that (1) w is superior than l on the most pertinent aspect $g_k = 1$ and (2) w at least ties with l on other aspects.

We have the following equation:

$$p(< w, l > |\Theta, g) = \prod_{k=1}^{K} \frac{w_k}{w_k + \theta l_k}^{g_k} \frac{\theta w_k}{v_k + \theta w_k}^{1-g_k},$$ (1)

where g the hidden variable is sampled from u, $\Theta = \{\theta, w_k, l_k, u\}$ is the parameter space.

The likelihood over all sessions is defined by

$$p(D|\Theta) = \prod_{u} \prod_{d \in D(u)} \Sigma_k (\prod_{w \in W(d)} \prod_{l \in L(d)} p(< w, l > |\Theta, g) p(g|u))$$ (2)

Due to the summation part, the log-likelihood can not be analytically optimized. To maximize the log-likelihood, we follow the EM framework.

E-step

$$p(g|d) \propto p(g|u) \prod_{k=1}^{K} \frac{w_k}{w_k + \theta l_k}^{g_k} \frac{\theta w_k}{v_k + \theta w_k}^{1-g_k}$$ (3)

2 Implicit Feedback