Distributed Machine Learning

Application Driven

Yi Wang

Goal

- Aim before fire!
- Recommender systems
- Search engine
- Online advertising

Problem

- What is the real problem behind applications?
  - semantic understanding

欢迎 | LDA Inference Demo

https://ywdxvpn.tencent.com:8443/prx/000/http/10.168.132.140/charlieyan/lda.py/lda?query=%

Activity | Community | Persons | Company | Computer Science | Computer Engineer | Hobby | MobileDe

query:

红酒木瓜汤

Submit

---

tokens:

红酒(0.589038) 木瓜(0.582175) 汤(0.560452)

---

topics:

id(rank)	weight	topic_words
6147(3672)	0.904523	丰胸(0.170997) 产品(0.080866) 减肥(0.067258) 木瓜(0.048380) 效果(0.036604) 红
6338(325)	0.301545	糖尿病(0.081618) 血糖(0.033829) 高血压(0.028768) 孕妇(0.021932) 血压(0.021665
8009(3430)	0.301511	奇迹(0.247384) 世界(0.081658) 加点(0.037639) 木瓜(0.037639) mu(0.036604) 战士
8443(1)	0.000121	游戏(0.268936) 下载(0.059112) 单机(0.057830) 双人(0.015077) 在线(0.010757) 网
9127(5)	0.000111	美女(0.077413) 视频(0.057143) 偷拍(0.045182) 做爱(0.043915) 自拍(0.037817) 图
5114(9)	0.000111	美女(0.112125) 丝袜(0.086679) 性感(0.064582) 视频(0.043439) 图片(0.040112) 视

欢迎 | LDA Inference Demo

https://ywdxvpn.tencent.com:8443/prx/000/http/10.168.132.140/charlieyan/lda.py/lda?query=%C6

Activity | Community | Persons | Company | Computer Science | Computer Engineer | Hobby | MobileDev

query:

苹果

Submit

---

tokens:

苹果(1.000000)

---

topics:

id(rank)	weight	topic_words
4998(1487)	0.833025	苹果(0.234488) 手机(0.126480) iphone(0.025499) 电脑(0.017440) 价格(0.015992)
6261(1002)	0.439990	范冰冰(0.115817) 苹果(0.086757) 电影(0.059883) 视频(0.034893) 佟大为(0.031876)
5642(601)	0.243490	iphone(0.167452) 手机(0.070935) 3gs(0.039899) 苹果(0.033342) 3g(0.029012) 软
2134(2601)	0.093624	千克(0.203649) 苹果(0.080570) 重量(0.027625) 大米(0.020498) 水果(0.015943) 面粉
4926(452)	0.084451	蜂蜜(0.080695) 牛奶(0.043052) 面膜(0.030612) 好处(0.025836) 鸡蛋(0.024024) 孕妇
4754(84)	0.065861	上网(0.094976) 无线(0.087973) 3g(0.051667) 手机(0.051194) 电信(0.040308) 上网卡
8787(202)	0.056435	水果(0.097108) 蔬菜(0.076698) 批发(0.059384) 市场(0.050257) 价格(0.027530) 北京

欢迎 | LDA Inference Demo | Login

https://ywdxvpn.tencent.com:8443/prx/000/http/10.168.132.140/charlieyan/lda.py/lda?query=%C

Activity | Community | Persons | Company | Computer Science | Computer Engineer | Hobby | MobileDev

query:

苹果大尺度

Submit

---

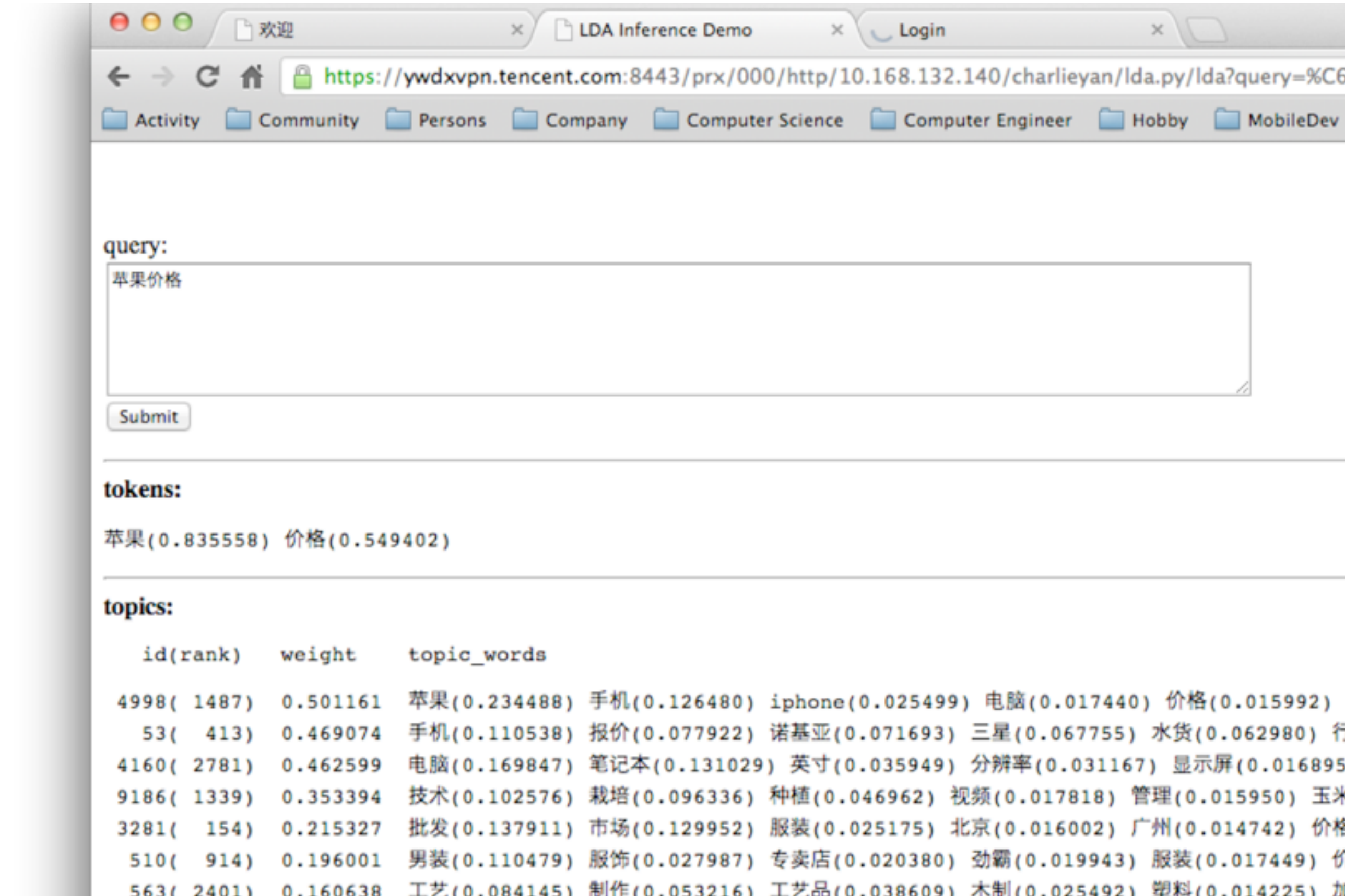
tokens:

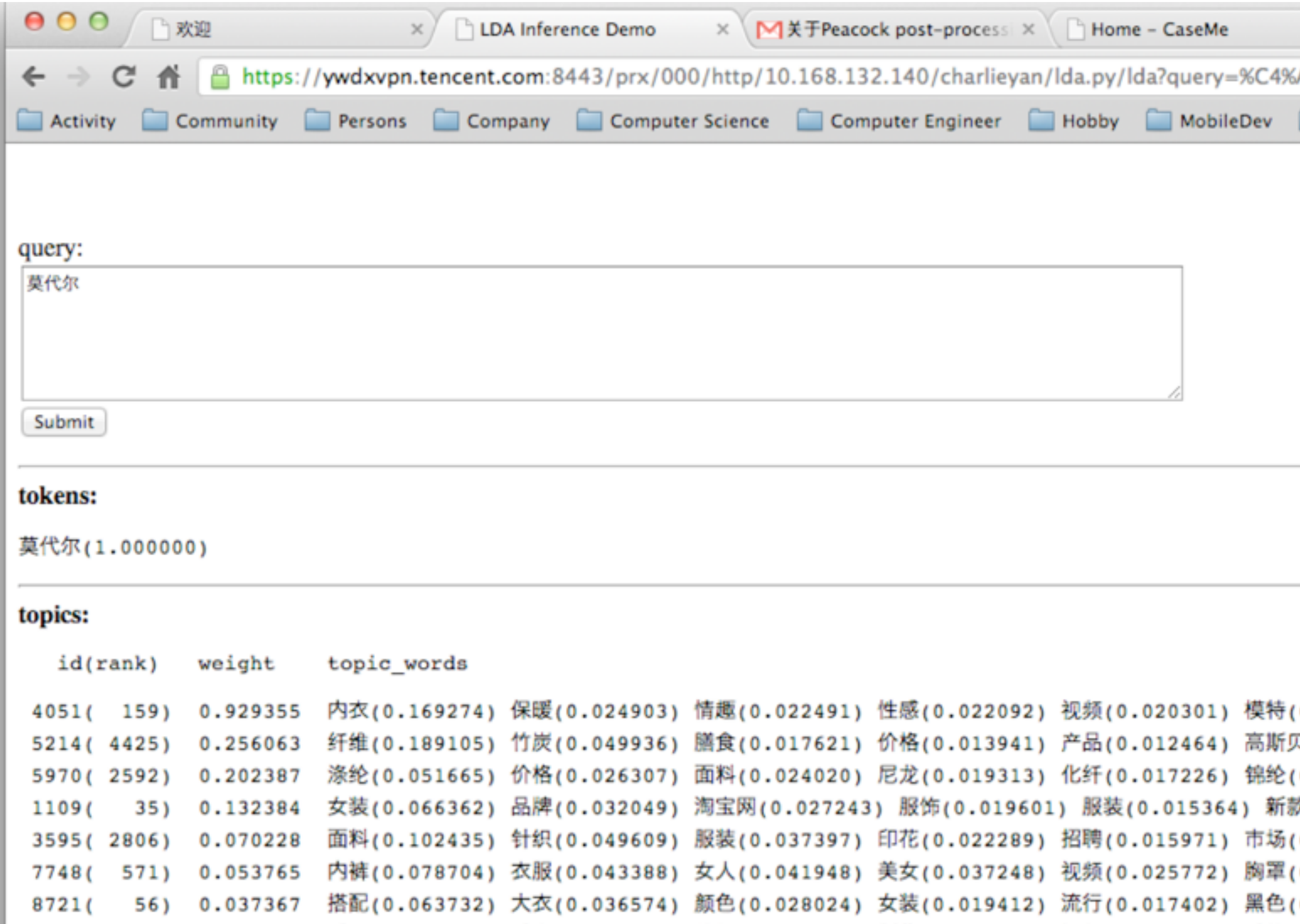
尺度(0.852807) 苹果(0.479783) 大(0.206226)

---

topics:

id(rank)	weight	topic_words
6261(1002)	0.995250	范冰冰(0.115817) 苹果(0.086757) 电影(0.059883) 视频(0.034893) 佟大为(0.031876)
5089(1730)	0.066110	沙发(0.174840) 真皮(0.030333) 图片(0.022596) 家具(0.020159) 价格(0.018055) 布
6528(2373)	0.061118	风格(0.075817) 设计(0.051258) 图片(0.031166) 欧式(0.030241) 客厅(0.029511) 田
6984(1353)	0.021215	尺寸(0.200698) 标准(0.052568) 规格(0.026346) 照片(0.022821) 大小(0.014162) 公
5275(1996)	0.021211	价值(0.199099) 药用(0.113664) 收藏(0.026221) 人生(0.015753) 植物(0.011953) 取
2743(7012)	0.011226	把握(0.176789) 机会(0.074915) 作文(0.018805) 教材(0.017101) 分析(0.016370) 人


欢迎
LDA Inference Demo
Login
https://ywdxvpn.tencent.com:8443/prx/000/http/10.168.132.140/charlieyan/lda.py/lda?query=%C6
Activity
Community
Persons
Company
Computer Science
Computer Engineer
Hobby
MobileDev
query:
苹果价格
Submit
tokens:
苹果(0.835558) 价格(0.549402)
topics:
id(rank) weight topic_words
4998(1487) 0.501161 苹果(0.234488) 手机(0.126480) iphone(0.025499) 电脑(0.017440) 价格(0.015992)
53(413) 0.469074 手机(0.110538) 报价(0.077922) 诺基亚(0.071693) 三星(0.067755) 水货(0.062980)
4160(2781) 0.462599 电脑(0.169847) 笔记本(0.131029) 英寸(0.035949) 分辨率(0.031167) 显示屏(0.016895
9186(1339) 0.353394 技术(0.102576) 栽培(0.096336) 种植(0.046962) 视频(0.017818) 管理(0.015950)
3281(154) 0.215327 批发(0.137911) 市场(0.129952) 服装(0.025175) 北京(0.016002) 广州(0.014742)
510(914) 0.196001 男装(0.110479) 服饰(0.027987) 专卖店(0.020380) 劲霸(0.019943) 服装(0.017449)
563(2401) 0.160638 工艺(0.084145) 制作(0.053216) 工艺品(0.038609) 木制(0.025492) 塑料(0.014225)

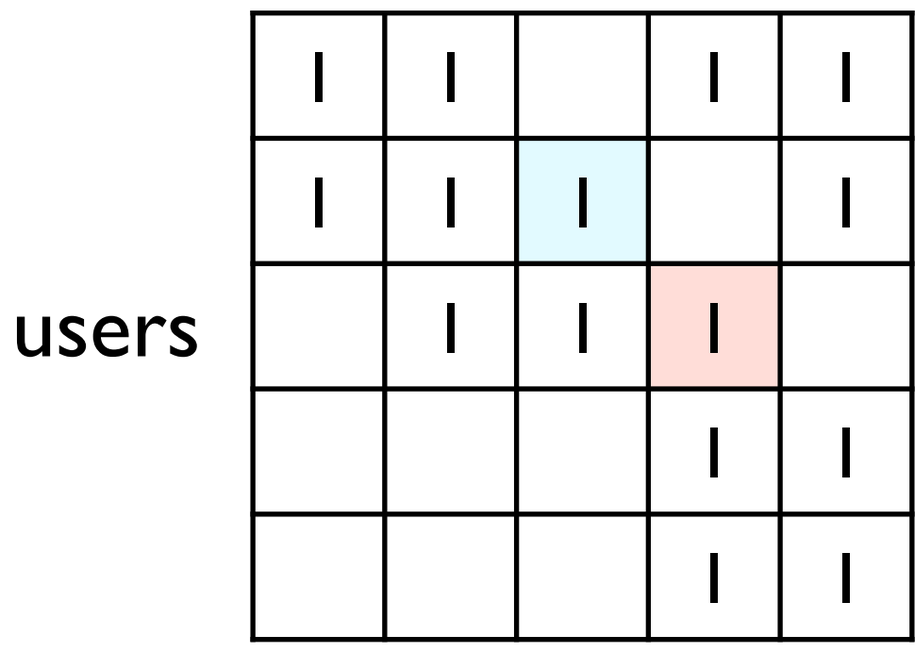

欢迎
LDA Inference Demo
关于Peacock post-process
Home - CaseMe
https://ywdxvpn.tencent.com:8443/prx/000/http/10.168.132.140/charlieyan/lda.py/lda?query=%C4%
Activity
Community
Persons
Company
Computer Science
Computer Engineer
Hobby
MobileDev
query:
莫代尔
Submit
tokens:
莫代尔(1.000000)
topics:
id(rank) weight topic_words
4051(159) 0.929355 内衣(0.169274) 保暖(0.024903) 情趣(0.022491) 性感(0.022092) 视频(0.020301) 模特(
5214(4425) 0.256063 纤维(0.189105) 竹炭(0.049936) 膳食(0.017621) 价格(0.013941) 产品(0.012464) 高斯贝
5970(2592) 0.202387 涤纶(0.051665) 价格(0.026307) 面料(0.024020) 尼龙(0.019313) 化纤(0.017226) 锦纶(
1109(35) 0.132384 女装(0.066362) 品牌(0.032049) 淘宝网(0.027243) 服饰(0.019601) 服装(0.015364) 新款
3595(2806) 0.070228 面料(0.102435) 针织(0.049609) 服装(0.037397) 印花(0.022289) 招聘(0.015971) 市场(
7748(571) 0.053765 内裤(0.078704) 衣服(0.043388) 女人(0.041948) 美女(0.037248) 视频(0.025772) 胸罩(
8721(56) 0.037367 搭配(0.063732) 大衣(0.036574) 颜色(0.028024) 女装(0.019412) 流行(0.017402) 黑色(

Applications

- Recommendation
- Search engines
- Online advertising
- Business analytics

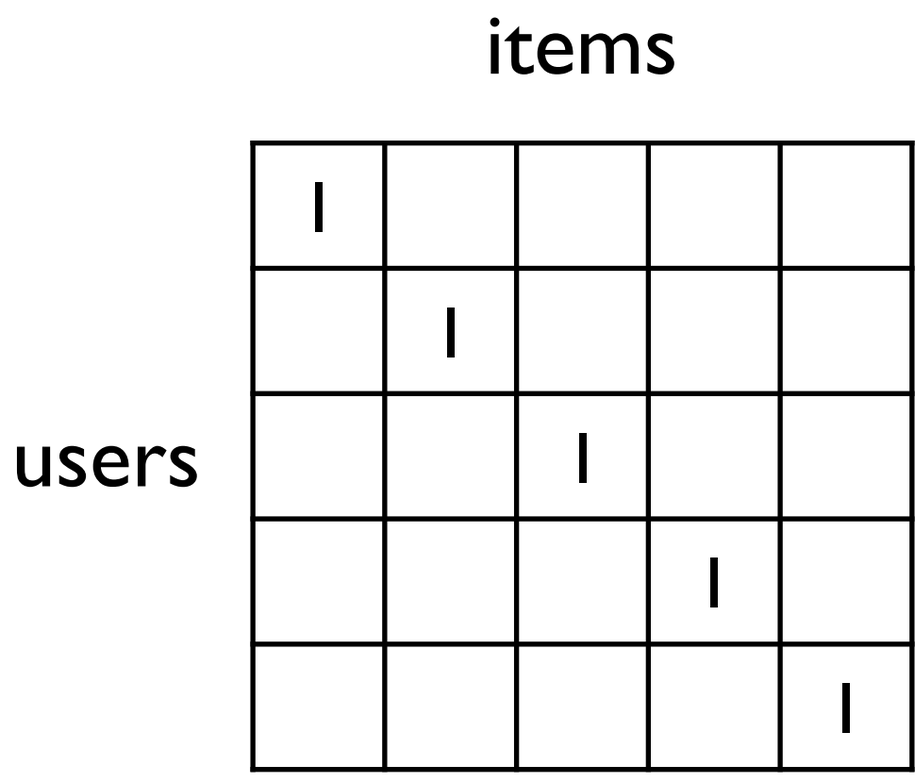
Recommendation

- Collaborative filtering



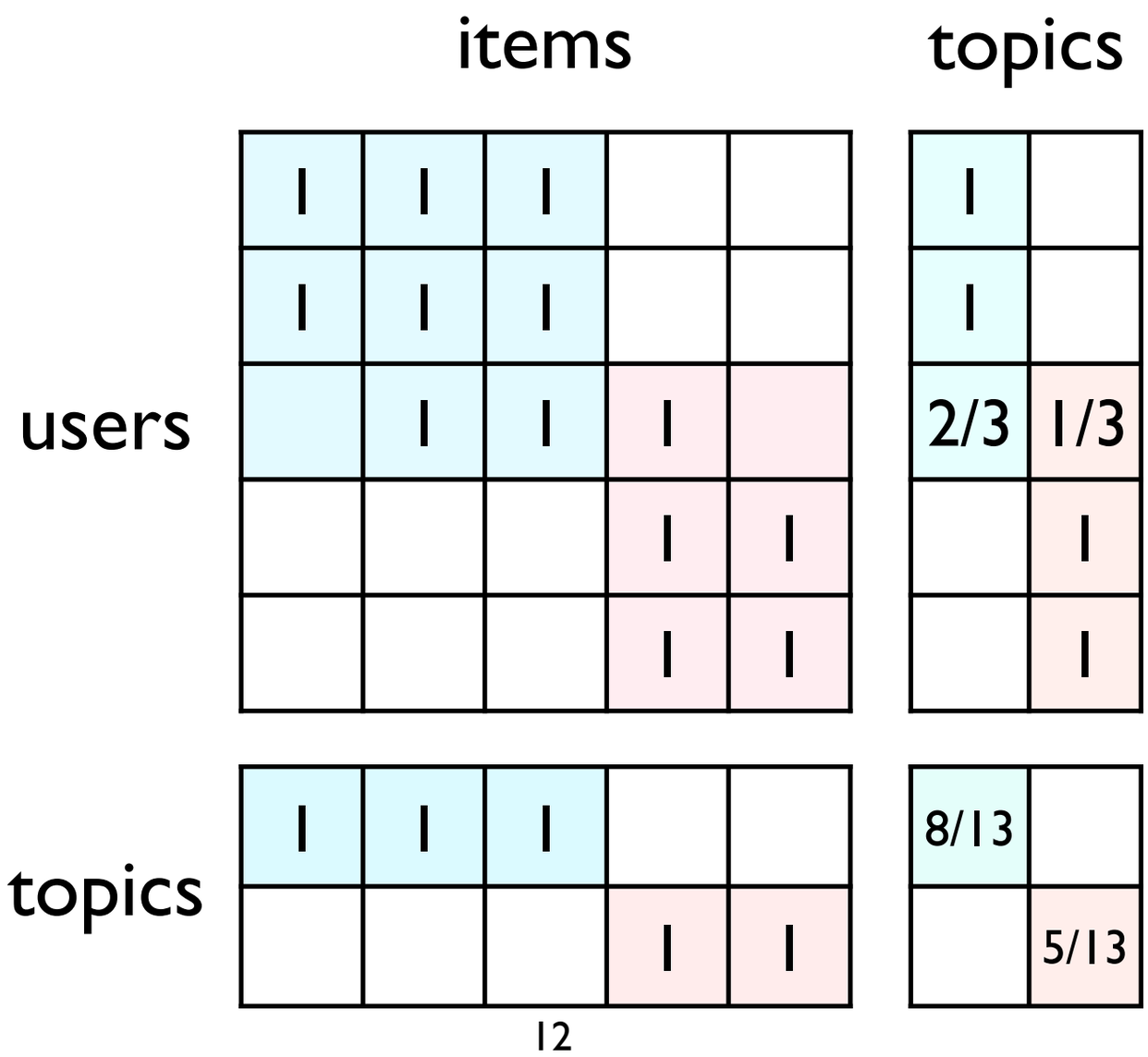
Recommendation

- Uniqueness



Recommendation

- Commonality



Search Engine

- Text similarity

words

text	Bill	Gates	Microsoft						
			Microsoft	Windows					
					Steve	Jobs			
					Steve	Jobs	Apple		
							Apple	iPhone	
							Apple		iPad

Search Engine

- Text similarity

words

text	Bill	Gates	Microsoft						
			Microsoft	Windows					
					Steve	Jobs			
					Steve	Jobs	Apple		
							Apple	iPhone	
							Apple		iPad

Search Engine

- Text similarity

words

Bill	Gates	Microsoft						
		Microsoft	Windows					
				Steve	Jobs			
				Steve	Jobs	Apple		
						Apple	iPhone	
						Apple		iPad

text

Business Analytics

3,665,078
companies

110,613,701
members

members
follow
companies

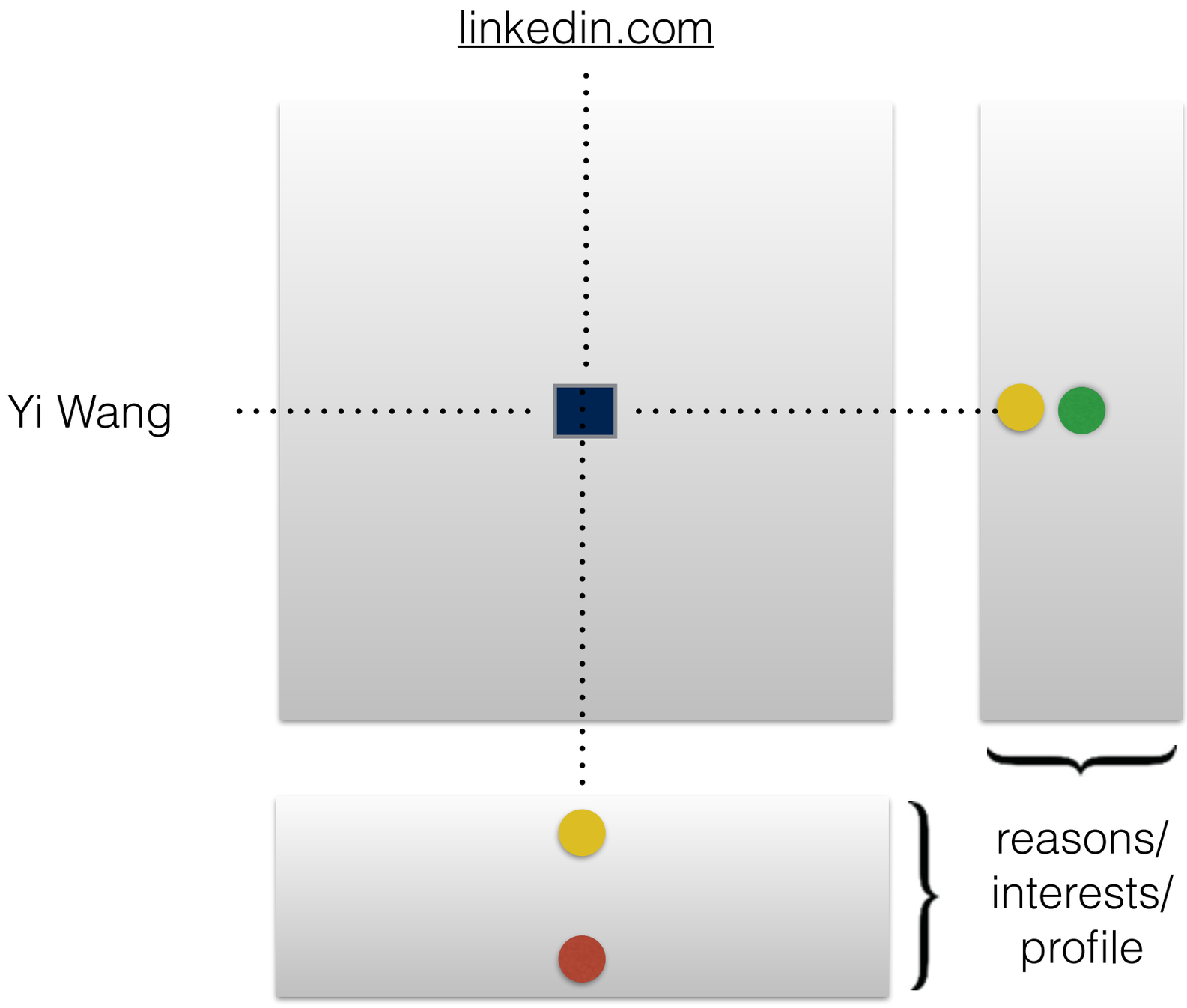
Business Analytics

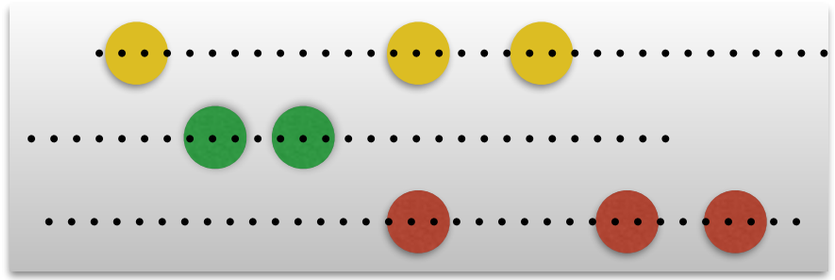
linkedin.com

Yi Wang

what is linkedin.com?
why this guy follows it?

Business Analytics





reason x

reason y

reason z

```
972699  castille-resources      www.castilleresources.com : 757
129068  radio-express   www.radioexpress.com : 586
618186  radio-clyde     www.clyde1.com : 585
162345  air-america-media       www.airamerica.com : 583
142998  east-coast-fm   www.eastcoast.fm : 581
601948  milwaukee-radio-alliance        http://www.milwaukeeradio.com/
225498  envision-radio-networks www.goenvisionnetworks.com : 568
85314   radioworks      http://radioworks.co.uk : 566
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58288   cdc-designs     www.cdcdesigns.com : 759
2023497 interiors-&-sources-magazine    www.interiorsandsources.com : 7
825203  interior-design-now-    http://www.interiordesign-now.com : 739
2322839 360-interiors   www.360-interiordesign.co.uk : 737
1404172 sfa-design      www.sfadesign.com : 710
451886  cada-design-group       http://www.cada.co.uk : 686
872706  lux-design_2    www.luxdesign.ca : 673
2003156 iidee-interior---design www.iidee.eu : 669
378767  susan-fredman-design-group      www.fredmandesigngroup.com : 66
746935  boss-design-limited     www.bossdesigngroup.com : 642
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861039  phantom-industries-inc. http://www.silkshosiery.com/ : 813
620844  stylehop        http://www.StyleHop.com : 791
781573  kazo-fashion-ltd        www.kazo.in : 775
104816  matthew-williamson       : 763
300226  my-fashion-database-inc.        www.myfdb.com : 753
1136170 style-incorporated      www.styleincorporated.com : 752
1403486 project-global-tradeshow        www.projectshow.com : 747
1076630 fashion-trendsetter     http://www.fashiontrendsetter.com/ : 74
281063  yohji-yamamoto-inc.     http://www.yohjiyamamoto.co.jp : 736
2229582 fashionnonstop-aps      www.fashionnonstop.dk : 720
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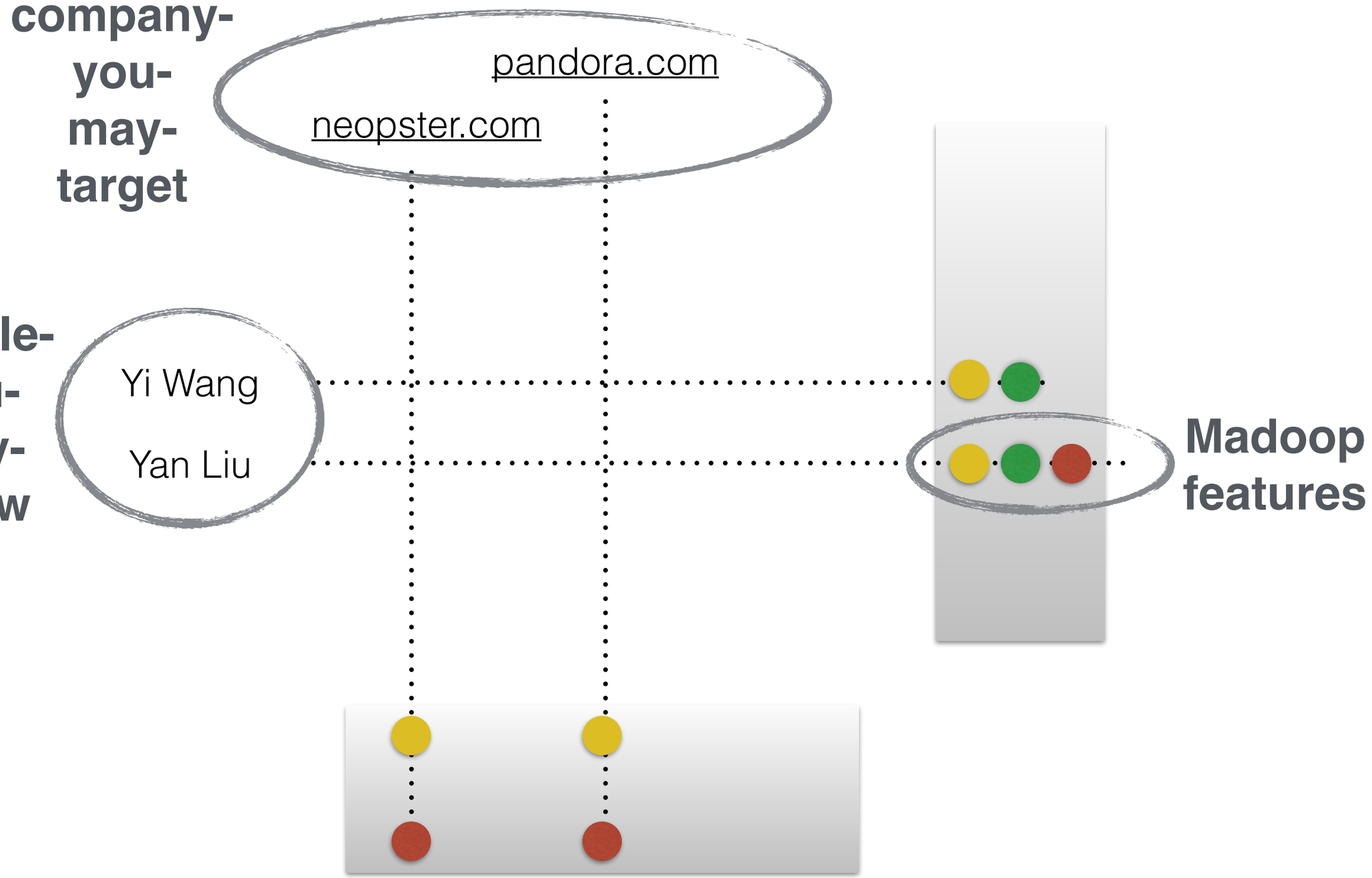
Business Analytics



All Problems are Same!

- Semantics = commonalities = co-occurrences
- All methods in the history are finding co-occurrences

Prior Work

- What does prior work do?
  - unsupervised: collaborative filtering, matrix factorization, probabilistic latent semantic analysis
  - supervised: categorization and classification
  - human labour: tags

Unsupervised

- Frequent itemset mining
- collaborative filtering
- LSA - SVD decomposition of text matrix
- NMF - constraint SVD
- pLSA - probabilistic version of LSA
- LDA - smoothed pLSA
- GaP - A re-modeling of LDA
- RBM - A re-modeling of LDA
- HDP - extending LDA to infinite #semantics

All Methods are Same!

- Methods are equivalent to each other under conditions.
  - On the equivalence between Non-negative Matrix Factorization and Probabilistic Latent Semantic Indexing http://users.cis.fiu.edu/~taoli/pub/NMFpLSIequiv.pdf
  - On an Equivalence between PLSI and LDA http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.14.6893
  - Replicated Softmax: an Undirected Topic Model papers. http://nips.cc/paper/3856-replicated-softmax-an-undirected-topic-model.pdf

Use It!

- Behind search engine, recommender systems, and online advertising:
  - Relevance: information retrieval
  - Ranking: click-through rate prediction