Investigating Fine-grained Usefulness Perception Process in Mobile Search

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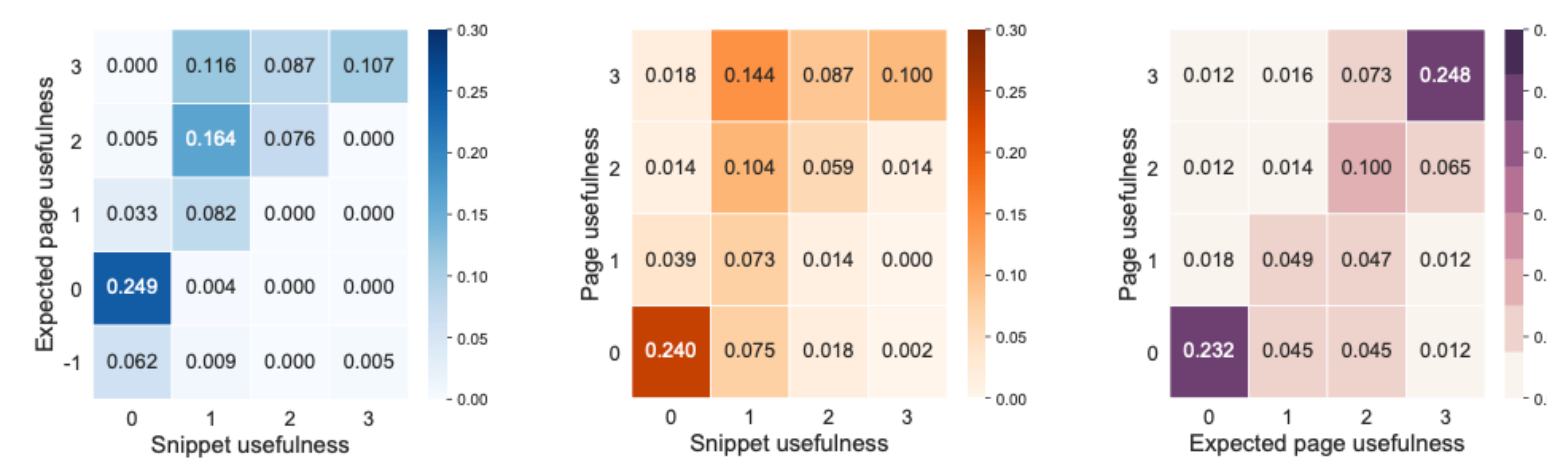yiqunliu@tsinghua.edu.cn

Abstract

• With the development and popularization of smartphones, search on mobile devices has become more and more popular in recent years. Existing research found that users' search interaction patterns in the mobile environment are different from those in the desktop environment. As we know, there are a number of vertical results and richly informative snippets in the ranked lists of mobile search engines. Users can perceive useful information from both the snippet and the landing page of a result. Therefore, we consider that it is necessary to investigate how users interact with mobile search engine result pages and their fine-grained usefulness perception processes. In this paper, we collected fine-grained usefulness annotations for mobile search results in a user study dataset. With the user behavior information in the dataset, we investigate the patterns of users' examination and click behavior and propose a user model for the fine-grained usefulness perception process in mobile search. Our research sheds light on improving user models in mobile search evaluation metrics and other mobile search-related applications.

Research Background and Motivations

• Todays' mobile search engines tend to provide users with their demanded information from the results' snippets.
• Users in mobile search perceive useful information in a fine-grained manner.

• The user models of most existing search evaluation metrics don't take consideration of this interaction pattern.
• We consider that these traditional user models model users' information perception process in a rather coarse granularity.

Data Collection

• The Tiangong-Mobile dataset was constructed on the basis of a mobile search-related user study, consisting of the task data, user behavior data, multiple crowdsourcing annotations and etc.

| #Users	#Tasks	#Valid sessions	#Unique results	#Unique clicks
13	55	439	550	727

• We annotate three kinds of usefulness for each search result respectively according to the corresponding snippet screenshot and content of landing pages:
  • Snippet usefulness
  • Expected page usefulness
  • Page usefulness

Behavior Analysis

• The larger the accumulated gain is, the more likely she is to stop examining the ranked list.

Maximum utility	0	1	3	7
Continuation prob.	1.000	0.970	0.904	0.751
#Cases	447	165	354	1403

• No matter how useful the snippet is, the results with the same expected page usefulness attract similar user attention.
• The higher expected page usefulness a result has, the more attention it receives from users.

Reading time	U^s			
EU^p	0	1	2	3
-1	820.5 / 1.220	1029.9 / 2.217	-	1957.5 / 3.048
0	812.7 / 2.130	834.0 / 0.979	-	-
1	1036.7 / 2.274	982.4 / 2.103	-	-
2	1259.2 / 2.479	1302.0 / 2.519	1292.7 / 2.634	-
3	-	2128.3 / 3.401	2075.1 / 3.140	2202.7 / 2.995

• Higher snippet usefulness and higher expected page usefulness of a result usually lead to a higher click probability.
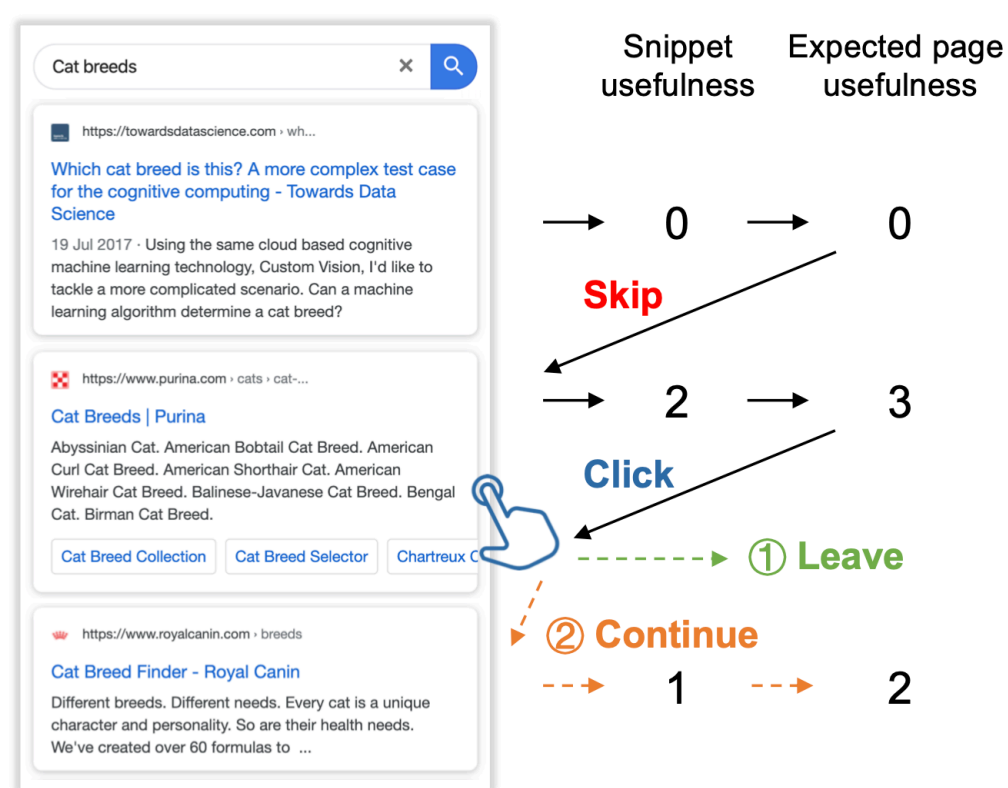
$P(C|U^s, EU^p, Rank)$		(U^s, EU^p)					
		(3, 3)	(2, 3)	(1, 3)	(2, 2)	(1, 2)	Others
Rank	[1, 2]	0.796	0.895	0.844	0.550	0.595	0.139
	[3, 4]	0.846	0.735	0.641	1.000	0.556	0.306
	≥ 5	0.867	0.500	0.556	0.400	0.577	0.274
	[1, 10]	0.806	0.786	0.757	0.529	0.580	0.251

User Model
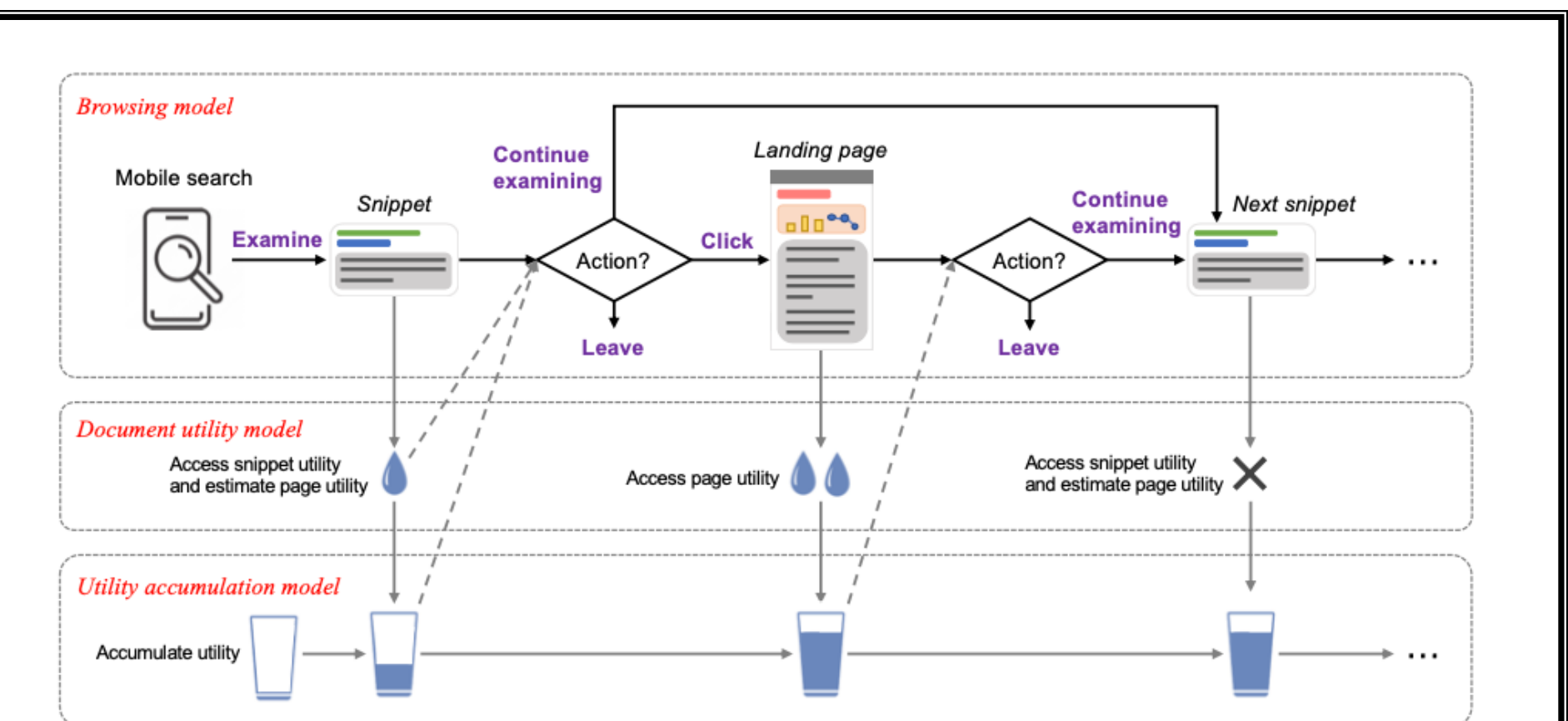
• The user model follows the C/W/L framework.
• Users generally follow a top-down order to examine SERPs in mobile search scenarios.
• The user accesses the whole utility of the snippet and landing page once she examines them.
• The user's clicks are also biased by the snippet utility, expected page utility and result rank.
• Compared to user models in existing search evaluation metrics, this proposed user model takes the finer-grained utility (or usefulness) perception process into account.