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Information Discovery in E-commerce

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ABSTRACT

Electronic commerce, or e-commerce, is the buying and selling of goods and services, or the transmitting of funds or data online. E-commerce platforms come in many kinds, with global players such as Amazon, Airbnb, Alibaba, Booking.com, eBay, and JD.com and platforms targeting specific geographic regions such as Bol.com and Flipkart.com. Information retrieval has a natural role to play in e-commerce, especially in connecting people to goods and services. Information discovery in e-commerce concerns different types of search (e.g., exploratory search vs. lookup tasks), recommender systems, and natural language processing in e-commerce portals. The rise in popularity of e-commerce sites has made research on information discovery in e-commerce an increasingly active research area. This is witnessed by an increase in publications and dedicated workshops in this space. Methods for information discovery in e-commerce largely focus on improving the effectiveness of e-commerce search and recommender systems, on enriching and using

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knowledge graphs to support e-commerce, and on developing innovative question answering and bot-based solutions that help to connect people to goods and services. In this survey, an overview is given of the fundamental infrastructure, algorithms, and technical solutions for information discovery in e-commerce. The topics covered include user behavior and profiling, search, recommendation, and language technology in e-commerce.

1

Introduction

1.1 Motivation

Over the past 20 years, we have seen an explosive growth of e-commerce portals, such as Alibaba, Amazon, eBay, and JD.com. These developments have reshaped people's shopping habits. An increasing number of customers now prefer to spend more time shopping online, generating billions of user requests per day. As part of the process of serving customer requests, large volumes of multi-modal data, including user search logs, clicks, orders, reviews, images, and chat logs, etc., are being generated. From an information retrieval point of view, discovering and employing pertinent information from the sheer volume of e-commerce data so as to enhance the performance of e-commerce services presents interesting challenges, both for academic and industrial researchers. In this survey we describe those challenges and the solutions that the community has so far proposed.

The topics of information discovery in e-commerce can be divided into several main directions:

- e-commerce presentation and users;
- user behavior and profiling;
- search in e-commerce;

- recommender systems in e-commerce; and
- question answering and dialogue systems in e-commerce.

Each of these areas comes with its own set of research challenges. For example, in e-commerce search there may be no hypertext links between products, thus excluding an important type of ranking signal that is often used in the setting of web search. But with click streams and order streams we have two parallel sources of ranking signal, a characteristic e-commerce feature that is absent from more traditional search scenarios.

E-commerce information discovery problems are wide in scope as the underlying discovery tasks concern a broad range of interaction modalities. There is a growing body of established methods in the e-commerce, aimed at developing algorithms for analyzing user behavior, for product search, for recommender systems, and for question answering and dialogue systems. These areas, and the methods developed, form the core around which most ongoing research efforts concerning information discovery for e-commerce are organized. The time is right to organize this material and to present it to a broad audience of interested information retrieval researchers, whether junior or senior, whether academic or industrial (Tsagkias *et al.*, 2020).

1.2 Aims of this Survey

A key aim of this survey is to bring together, and offer a unified perspective on, the large number of methods for e-commerce information discovery available today. To achieve this, we describe the basic architecture used for information discovery in e-commerce, algorithms for e-commerce information discovery, and evaluation principles. We supplement this with an account of available datasets and software based on these. We also introduce e-commerce applications accompanied by examples.

The survey targets practitioners and researchers from academia and industry and aims to present them with the challenges, state-of-the-art approaches, and the most urgent open questions in information discovery for e-commerce. Specifically, in terms of content, the objectives of the survey are as follows:

- To introduce tasks that constitute the information discovery problem in e-commerce, and to explain the difference between e-commerce information discovery and related work in other domains;
- To describe e-commerce information discovery algorithms in a unified way, i.e., using common notation and terminology, so that different models can easily be related to each other;
- To explain how to analyze the performance of e-commerce information discovery algorithms and why it is worth the effort;
- To present appropriate experimental and evaluation methodologies for e-commerce information discovery in both synthetic and real world settings; and
- To discuss future directions of research in e-commerce information discovery.

1.3 Outline

Information discovery aims to distill pertinent information from datasets with various modalities; it plays a role in many areas, ranging from web search to academic search and medical search. What is different about the e-commerce setting is that many traditional ranking features are either not present or present in a different form (Degenhardt *et al.*, 2017). Instead, discovery processes need to be supported based on structured information, semi-structured information, or information that might have facets such as price, ratings, title, description, seller location, etc.

1.3.1 Topics covered

We break the e-commerce information discovery problem down into five research directions: (i) e-commerce information presentation and users, (ii) user behavior and profiling in e-commerce, (iii) search in e-commerce, (iv) recommendation in e-commerce, and (v) question answering and dialogue systems in e-commerce. Below, we briefly describe each of these five directions.

The first direction concerns preliminaries about e-commerce information presentation and users. E-commerce portals provide various

modalities of information to users, e.g., rankings of products, product titles, descriptions, tips, and user reviews, etc. Multiple genres and types of text analysis can be employed to enhance e-commerce services, e.g., review filtering, review analysis, and normalization of production descriptions. User characteristics in e-commerce, e.g., browsing modules, clicks, purchases, and dwell time, generate multiple patterns for e-commerce scenarios. These two factors play fundamental roles in e-commerce information discovery. In this survey, we summarize recent work on both e-commerce information presentation and user characteristics.

The second direction concerns user behavior modeling and user profiling. Tracking and profiling users' behavior on e-commerce portals are important prerequisites for many e-commerce services, such as recommender systems, search, and online advertising. In this survey, we summarize recent work on user behavior modeling in e-commerce and introduce solutions to profiling users of e-commerce services.

The third direction of this survey concerns search in e-commerce, which examines approaches for product search scenarios on e-commerce portals. Just like, e.g., traditional web search, the target of this task is to satisfy users' needs. However, product search in e-commerce sites should be realized with different types of features than, e.g., web search, with the availability of a large number of products, query attributes, and engagement features. Moreover, calculating relevance in product search faces challenges regarding gaps between users and products. The target corpora can be structured, semi-structured, or unstructured, or a mixture of these; semantic search against such diverse sources raises interesting research challenges.

The fourth direction concerns recommendations in e-commerce. In contrast to traditional research on recommender systems that focuses on rating prediction, e-commerce recommender systems aim to tackle three challenges: the huge volume of products, sparsity, and data richness. Due to the existence of a very large number of candidate items in e-commerce portals, of which only a small fraction will attract a user's attention, e-commerce recommendation methods usually follow a two-stage recommendation framework with (i) candidate retrieval, and (ii) candidate ranking. The first phase of candidate retrieval goes through

the whole product catalog, and selects a small set of products that might match the information need. The second phase of candidate ranking ranks the candidates to present the final top-K products to the user. Given structured user behavior logs and semi-structured data about product features, e-commerce knowledge bases can be created to assist the candidate generation step. And the candidate ranking procedure ranks the retrieved candidate items for a better conversion rate or click-through rate, based on various machine learning models.

The fifth and final direction of this survey concerns question answering and dialogue systems in e-commerce. We survey recent work on e-commerce question answering and dialogue systems that have attracted increased attention. For dialogue systems, we describe both task-oriented dialogue systems, aimed at helping users complete a task in an e-commerce setting, and non-task-oriented dialogue systems aimed at generating fluent and engaging responses.

For the directions listed above, our ambition has been to cover related work up to the spring of 2023.

1.3.2 Topics not covered

E-commerce impacts large parts of our economy and society, including markets and retailers, supply chain management, and employment. With the development of data science, business intelligence studies on e-commerce marketing, e.g., sales volume forecasting and time series analysis, are receiving an increasing amount of attention. All of these areas are important, scientifically challenging, and deserving of attention from the information retrieval community. However, our focus will be limited to information discovery within the context of e-commerce. Specifically, we will not address topics such as computational advertising approaches that are irrelevant to search and recommendation, marketing strategies, forecasting, or information management in e-commerce.

1.3.3 Structure of the survey

The remainder of this survey is organized as follows. Section 2 provides key definitions and background related to e-commerce information discovery, drawing from user modeling, search, recommender systems,

question-answering, and dialogue systems. Section 3 describes preliminaries of e-commerce presentations as well as e-commerce users, including user behavior characteristics, and relevant language technologies and their use in e-commerce applications. Section 4 details user behavior modeling and user profiling approaches in e-commerce, including click behavior tracking, post-click tracking, purchase behavior modeling, and user profiling in e-commerce. Section 5 describes recent approaches proposed for e-commerce search, which we organize along two lines: research about the matching problem in e-commerce search, and about ranking strategies for e-commerce search. Section 6 presents algorithms and solutions for recommender systems in e-commerce. After introducing the two-stage recommendation framework in e-commerce portals, we organize the e-commerce recommendation studies into two groups: candidate retrieval models and candidate ranking models. We survey e-commerce question answering and dialogue systems in Section 7, where we introduce recent studies on e-commerce question answering and dialogue systems, respectively. In Section 8 we conclude this survey and identify emerging research directions and issues for future work.

1.4 Our Readers

We expect this survey to be useful to both academic and industrial researchers who either want to develop e-commerce information discovery methods, use them in their own research, or apply the methods described in the survey to improve product performance in e-commerce services. The intention is to help our audience acquire domain knowledge and to promote information discovery research activities in e-commerce.

To be able to benefit from this survey, we expect the reader to have a background in information retrieval, natural language processing, or machine learning. We recommend that readers read the material that we offer from start to finish, in the order that we offer it. However, readers who have a specific interest in search, or in recommender systems, or in conversational technology in e-commerce should read Sections 3 and 4 first before skipping ahead to Sections 5, 6, or 7, respectively.

Appendix

Datasets

In this appendix, we list benchmark datasets that are relevant for studying information discovery in e-commerce. We follow the topical organization of our sections, and divide the datasets into five types: e-commerce infrastructures, e-commerce user modeling, e-commerce search, e-commerce recommendation, and e-commerce QA & dialogues.

A.1 Datasets for E-commerce Infrastructures

To begin, we list benchmark datasets about e-commerce interfaces and users:

- **Taobao short title dataset** (Sun *et al.*, 2018a): This dataset contains 411,246 title-product pairs in 94 categories. Each item in the dataset is represented as a triple $\langle Q, K, S \rangle$, where Q denotes the products' original titles, K refers to the background knowledge about the products, and S represents the human-written short titles.
- **eCOM-C2C dataset** about product categories and titles (Wang *et al.*, 2018a): This dataset takes advantage of realistic data from a well-known C2C website in China. The dataset contains 185,386 triplets in the Women's Clothes category. Each item in the dataset is represented as a triple $\langle S, T, Q \rangle$, where S refers to a product's original title, T denotes a handcrafted short title, and Q is a successful transaction-leading search queries.

- **Walmart product summarization dataset** (Mukherjee *et al.*, 2020): The dataset includes 40,445 top-selling Walmart grocery products during the calendar year 2018, together with their product titles and corresponding human-generated summaries. There are also descriptions, brand names, and category information of the products.
- **Taobao multi-modal title dataset** (Miao *et al.*, 2020): The dataset contains 114,278 original titles with corresponding short titles and product images. The short titles are manually written by professional editors, whereas the images are selected by the seller.
- **Walmart e-commerce product dataset** (Mukherjee, 2021): The dataset contains five parts: D-search includes the top 12 million product search queries on Walmart.com and their frequencies over a one year period. D-product includes 250,000 top-selling Walmart products over a six month period. D-com-human includes 40,445 human-generated title compressions from the Walmart catalog across eight different product categories. D-meta-auto contains 40,000 meta-training examples. And D-meta-human is a dataset consisting of 16,000 human-generated 1-shot title compression examples.
- **LESD4EC dataset** (Gong *et al.*, 2019): The dataset consists of 6,481,623 pairs of original and short product titles in a module in Taobao named "Youhuashuo." Each product in this dataset includes a long product title and a short title summary written by professional writers, along with a high-quality image and attributes tags.

Table A.1 summarizes the key statistics of the datasets listed above.

A.2 Datasets for E-commerce User Modeling

Next, we list benchmark datasets about e-commerce user modeling:

- **Taobao Tianchi consumer dataset** (Kim *et al.*, 2021): The dataset includes responses of users to advertisements of inventory in the user profile and advertising information. The time length of the data is eight days, and the dataset is divided into four ta-

Table A.1: Statistics of datasets about e-commerce infrastructures.

Datasets	Statistics					References
	#Dataset size	#Number of category	#Avg.length of original titles	#Avg.length of short titles	#Avg.length of background knowledge	
Taobao short title dataset	453,138	94	25.34	7.73	5.92	(Sun *et al.*, 2018a)
eCOM-C2C dataset	185,386	1	25.1	7.5	8.3	(Wang *et al.*, 2018a)
Walmart product summarization dataset	40,445		4/10/35	1/2/5		(Mukherjee *et al.*, 2020)
Taobao multi-modal title dataset	114,278					(Miao *et al.*, 2020)
Walmart e-commerce product dataset	40,000 + 16,000	4				(Mukherjee, 2021)
LESD4EC dataset	6,481,623		12	5		(Gong *et al.*, 2019)

bles: advertisement features, user profiles, past shopping behavior that users engaged in, and who received the advertisement with responses.[2]

- **Instacart.MB dataset** (Sheng *et al.*, 2021): The Instacart Market Basket (Instacart.MB) dataset is anonymized and contains a sample of over 3 million grocery orders from more than 200,000 Instacart users. For each user in the dataset, there are between 4 and 100 of their orders, with the sequence of products purchased in each order.[3]
- **Bing advertising service dataset** (Lian *et al.*, 2021): The dataset contains user click logs within a two week period from the Bing Native Advertising service. It also includes users' online behavior history before their corresponding clicks. The user behavior sequences are truncated to 100 in the dataset.
- **Feeds user dataset** (Yi *et al.*, 2021): The feeds dataset is collected on Microsoft News App from August 1, 2020 to September 1, 2020. It contains 643,177 news items, over 10,000 users, 320,925 impressions, and 970,846 clicks.
- **JD user profiling dataset** (Chen *et al.*, 2019f): This dataset is collected from one of the largest e-commerce platforms in China. In this dataset, users, items, and attributes reflect real-world e-commerce consumers, products, and words in the titles of the products respectively. The profiles of users are the age and gender labels.
- **Twitter user behavior dataset** (Al Zamal *et al.*, 2012): Each attribute dataset consists of approximately 400 labeled Twitter users, 200 with one label (e.g., "female") and 200 with a second label (e.g., "male"). In addition, all of the friends of these labeled users are identified; for each of these labeled and neighbor users, the most recent 1,000 tweets generated by the user were collected.
- **UCL social media user profiling dataset** (Liang *et al.*, 2017): This dataset was collected by UCL's Big Data Institute. The data set includes 1,375 active Twitter users chosen randomly and their

[2] https://tianchi.aliyun.com/dataset/dataDetail?dataId=56
[3] https://www.kaggle.com/c/instacart-market-basket-analysis/data

tweets from the time they registered until May 31, 2015. The dataset has 3.78 million tweets in total. The length of a tweet is 12 words on average.

- **CALL dataset** (Dong *et al.*, 2014): The dataset is extracted from a collection of more than 1 billion (i.e., 1,000,229,603) call and text-message events from an anonymous country, which spans from August 2008 to September 2008. The data does not contain any communication content.
- **W-NUT dataset** (Han *et al.*, 2016): This is a user-level dataset of the geolocation prediction shared task released at the W-NUT workshop in 2016. The dataset consists of over 1 million training users, 10,000 development users, and 10,000 test users. The ground truth location of a user is decided by majority voting of the closest city center.
- **Facebook user profiling dataset** (Farnadi *et al.*, 2018): This is a re-collected dataset based on Facebook's MyPersonality project dataset.[4] The dataset includes information about each user's demographics, friendship links, Facebook activities (e.g., number of group affiliations, page likes, education, and work history), status updates, profile picture, and Big Five Personality scores (ranging from 1 to 5).

Table A.2 summarizes the key statistics of the datasets listed above.

A.3 Datasets for E-commerce Search

We list benchmark datasets about e-commerce search as follows:

- **QUARTS e-commerce search dataset** (Nguyen *et al.*, 2020): This is a human-labeled dataset of query-item pairs, obtained from an e-commerce search platform. There are in total 3.2 million pairs of which only a small fraction are mismatches. About 100,000 labeled pairs are used as a separate test set. Another 3 million query-item pairs are deemed "matched" by considering items that are purchased frequently in response to those queries from the search logs.

[4] http://www.mypersonality.org

Table A.2: Statistics of datasets about e-commerce user modeling.

Datasets	Statistics					References
	#Users	#Items	#Interactions	#Avg.seq.len	TimeSpan	
Taobao Tianchi consumer dataset	1,140,000			26,000,000	20170506-20170513	(Kim *et al.*, 2021)
Instacart.MB dataset	11,464	42,207	7,764,043	677.25		(Sheng *et al.*, 2021)
Bing advertising service dataset	748,000	409,000		74		(Lian *et al.*, 2021)
Feeds user dataset	10,000	643,177	970,846			(Yi *et al.*, 2021)
JD user profiling dataset	54,161	203,712				(Chen *et al.*, 2019f)
Twitter user behavior dataset	400	400,000		1,000		(Al Zamal *et al.*, 2012)
UCL social media user profiling dataset	1,375	3,780,000		12	time of registration-20150531	(Liang *et al.*, 2017)
CALL dataset	1,090,000				200808-200809	(Dong *et al.*, 2014)
W-NUT dataset	1,020,000	13,000,000				(Han *et al.*, 2016)
Facebook user profiling dataset	5,670	49,372				(Farnadi *et al.*, 2018)

- **SCEM product search dataset** (Bi *et al.*, 2020b): The dataset contains three category-specific datasets, namely, "Toys & Games," "Garden & Outdoor," and "Cell Phones & Accessories," from the logs of a commercial product search engine spanning ten months between years 2017 and 2018. The datasets include up to a few million query sessions containing several hundred thousand unique queries.
- **Walmart product search dataset** (Karmaker Santu *et al.*, 2017): This is a subset obtained from Walmart's online product catalog. The dataset consists of more than 2,800 randomly selected product search queries and a catalog of around 5 million products. For each query, the top 120 products are retrieved.
- **Walmart query log dataset** (Magnani *et al.*, 2019): This is a large query log dataset on shoe segments during a six-month window from May 2018 to October 2018 on Walmart.com. Historical data of the extra features such as clicks and orders are collected from the query log six months before May 2018. The dataset is composed of more than 100 million query and product pairs, of which there are more than 1 million unique queries and more than 1 million unique item titles.
- **Bestbuy dataset** (Duan *et al.*, 2013b): The dataset consists of a full crawl of the "Laptop & Netbook Computers" category of Bestbuy.com. In total, there are 864 laptops in the database, each entity has 44 specifications on average. And 260 laptops have user reviews. The annotated datasets contain 40 queries, on average, there are 2.8 keywords per query and 3.8 keywords per query for the hard queries.
- **Amazon product dataset** (Bi *et al.*, 2021; McAuley *et al.*, 2015): The Amazon product dataset is a well-known benchmark for product search and recommendation. It contains information for millions of customers, products and associated metadata, including descriptions, reviews, brands, and categories.[5]
- **Etsy product search dataset** (Wu *et al.*, 2018a): The dataset contains 4 weeks worth of search log data with clicks and purchases

[5] http://jmcauley.ucsd.edu/data/amazon

from Etsy.[6] In total, there are 334,931 search sessions with 239,928 queries and 6,347,251 items. In total, 270,239 buyers and 550,025 sellers are involved in the transactions, whereas 631,778 keywords are used by sellers to describe their items.

Table A.3 summarizes the key statistics of the datasets listed above.

A.4 Datasets for E-commerce Recommendations

Next, we list benchmark datasets about e-commerce recommender systems:

- **Amazon product dataset** (He and McAuley, 2016b; McAuley *et al.*, 2015): For e-commerce recommendations, the Amazon product dataset is split by top-level product categories in amazon and is notable for its high sparsity and variability. This dataset contains product reviews and metadata from Amazon, including 142.8 million reviews spanning May 1996–July 2014. This dataset includes reviews (i.e., ratings, text, helpfulness votes), product metadata (i.e., descriptions, category information, price, brand, and image features), and links (i.e., substitutive/complementary relations).
- **Amazon soc dataset** (McAuley *et al.*, 2015): A large-scale database of 230,000 users; each data sample includes a user's profile, user feedback on a product, and social relationship among users. More specifically, the user's profile includes gender, income, age, and hobby. User feedback includes the user's comments and browsing history.
- **AliExpress dataset** (Ahmed *et al.*, 2021): This dataset is collected from an online retailer service owned by the Alibaba group. There are about 2,260,923 records from AliExpress, the data for about fourteen months from January 1, 2019 to February 23, 2020. The dataset contains 1,506,850 users that submitted reviews against 49,221 items in 205 different categories, such as electronics, entertainment, education, house, and garden, etc., and the items are rated from 1 to 5 scale.

[6] https://www.etsy.com

Table A.3: Statistics of datasets about e-commerce search.

Datasets	Statistics					References
	#Queries	#Products	#Pairs	Product title length	Vocabulary size	
QUARTS e-commerce search dataset			3,200,000			(Nguyen *et al.*, 2020)
SCEM product search dataset						(Bi *et al.*, 2020b)
SCEM-Toys&Games				13.14±6.46	381,620	
SCEM-Garden&Outdoor				16.39±7.38	1,054,980	
SCEM-CellPhones&Accessories				22.02±7.34	194,022	
Walmart product search dataset	2,800	5,000,000				(Karmaker Santu *et al.*, 2017)
Walmart query log dataset	1,000,000+	1,000,000+	100,000,000+			(Magnani *et al.*, 2019)
Bestbuy dataset	40	864				(Duan *et al.*, 2013b)
Amazon product dataset						(Bi *et al.*, 2021; McAuley *et al.*, 2015)
Etsy product search dataset	239,928	6,347,251		26.5		(Wu *et al.*, 2018a)

- **Instacart orders dataset**: This is an anonymized dataset collected from the Instacart site.[7] It contains a sample of over 3 million grocery orders from more than 200,000 Instacart users. For each user, 4 and 100 of his/her orders are provided, with the sequence of products purchased in each order. There are also the week and hour of the day the order was placed and a relative measure of time between orders.[8]
- **Movielens dataset** (Harper and Konstan, 2015): This is a widely used benchmark dataset collected from https://movielens.org. The dataset contains user ratings and timestamps for the movie. There is side-info of users and movies. According to the year and the size of the dataset, there are multiple specific versions.[9]
- **Yoochoose dataset** (Ben-Shimon *et al.*, 2015): This dataset is collected from the 2015 recommender systems challenge (RecSys Challenge 2015). The dataset includes six months of user activities for a large European e-commerce business that sells various consumer goods, including garden tools, toys, clothes, electronics, and more. There are 33,040,175 records in the click file and 1,177,769 records in the buys file. The training set consists of 9,512,786 unique sessions, and the test file consists of 2,312,432 click sessions.
- **Alibaba Cloud/TIANCHI dataset** (Zhu *et al.*, 2018): The dataset was randomly selected from Taobao; it contains about 1 million users with their behavior, which includes clicks, purchases, adding items to the shopping cart, and item favoring from November 25 to December 3, 2017. The dataset is organized in a very similar form to MovieLens-20M, i.e., each line represents a specific user-item interaction, which consists of user ID, item ID, item's category ID, behavior type, and timestamp, separated by commas.[10]

Table A.4 summarizes the key statistics of the datasets listed above.

[7] https://www.instacart.com
[8] https://www.instacart.com/datasets/grocery-shopping-2017
[9] https://grouplens.org/datasets/movielens/
[10] https://tianchi.aliyun.com/dataset/dataDetail?dataId=649&userId=1&lang=en-us

Table A.4: Statistics of datasets about e-commerce recommendations.

Datasets	Statistics					References
	#Users	#Items	#Records	#Categories	TimeSpan	
Amazon product dataset	20,980,320	5,933,184	143,663,229	11		(He and McAuley, 2016b; McAuley *et al.*, 2015)
Amazon soc dataset	230,000					(McAuley *et al.*, 2015)
AliExpress dataset	1,506,850	49,221	2,260,923	205	20190101-20200223	(Ahmed *et al.*, 2021)
Instacart orders dataset	200,000+	3,000,000				Instacart dataset[a]
Movielens-ML100K	943	1,682	100,000		199709-199804	
Movielens-ML1M	6,040	3,706	1,000,209		200004-200302	(Harper and Konstan, 2015)
Movielens-ML10M	69,878	10,681	10,000,054		199501-200901	
Movielens-ML20M	138,493	27,278	20,000,263		199501-201503	
Yoochoose dataset	9,249,729	52,739	34,154,697			(Ben-Shimon *et al.*, 2015)
Alibaba Cloud/TIANCHI dataset	1,000,000	4,023,451	100,934,102	9,378	20171125-20171203	(Zhu *et al.*, 2018)

[a] https://www.instacart.com/datasets/grocery-shopping-2017

A.5 Datasets for E-commerce QA and Dialogues

Next, we list benchmark datasets about e-commerce question answering and dialogue systems:

- **JD product question answering** (Gao *et al.*, 2019b): This dataset consists of online product-aware QA pairs. Each QA pair is associated with the reviews and attributes of the corresponding product. The corpus covers 469,953 products and 38 product categories. The average length of the question is 9.03 words, and the ground truth answer is 10.3 words. The average number of attributes is 9.0 key-value pairs.
- **Taobao question answering dataset** (Chen *et al.*, 2019e): This dataset is collected on Taobao. The dataset includes 4,457 and 47,979 products under the category Cellphone and Household Electrics, respectively. For each product, the associated question-answering pairs and user reviews are included. After preprocessing, Cellphone/Household Electrics products have 356,842 and 798,688 QA-pairs in two subsets, respectively.
- **Amazon complex question/answer dataset** (McAuley and Yang, 2016): This dataset was collected from Amazon, including reviews and descriptions of products and QA data. This dataset contains 1.4 million answered questions on 191 thousand products and 13 million related reviews.
- **Hierarchical product review corpus** (Yu *et al.*, 2011): This corpus contains consumer reviews on 11 popular products in four domains. These reviews were crawled from several prevalent forum websites, including cnet.com, viewpoints.com, reevoo.com, and gsmarena.com. All of the reviews were posted between June 2009 and September 2010. The aspects of the reviews, as well as the opinions on the aspects, were manually annotated.
- **Amazon question answering dataset** (Deng *et al.*, 2020): This dataset is constructed by combining Amazon Question Answering Dataset (McAuley and Yang, 2016) and Amazon Product Review Dataset (He and McAuley, 2016b) by matching the product ID. In this dataset, each QA sample contains a question, a reference answer, the answer opinion type label, and a set of relevant re-

view snippets with corresponding ratings. After collecting the final dataset, each QA sample contains a question, a reference answer, the answer opinion type label, and a set of relevant review snippets with corresponding ratings. There are three categories, namely Electronics, Home & Kitchen, and Sports & Outdoors, with 193,960 (Electronics), 90,269 (Home & Kitchen), and 50,020 pairs (Sports & Outdoors).

- **JDDC e-commerce dialogue dataset** (Chen *et al.*, 2020c): JDDC is a large-scale real scenario Chinese E-commerce conversation corpus, with more than one million multi-turn dialogues, 20 million utterances, and 150 million words, which contains conversations about after-sales topics between users and customer service staffs in an e-commerce scenario. JDDC was updated with multi-modal customer service information in 2021 (Zhao *et al.*, 2021a).
- **E-commerce dialogue corpus dataset** (Zhang *et al.*, 2018d): The dataset is collected from the real-world conversations between customers and customer service staff on Taobao. It contains over five types of conversations (i.e., commodity consultation, logistics express, recommendation, negotiation, and chitchat) based on over 20 commodities.[11]

Table A.5 summarizes the key statistics for the datasets listed above.

[11] https://drive.google.com/file/d/154J-neBo20ABtSmJDvm7DK0eTuieAuvw/view?usp=sharing

Table A.5: Statistics of datasets about e-commerce question answering and dialogues.

Datasets	Statistics					References
	#Products	#Q-A pairs	#Categories	#Avg.length of questions	#Avg.length of ground truth	
JD product question answering	469,953		38	9.03	10.3	(Gao *et al.*, 2019b)
Taobao question answering dataset	4,457/47,979	356,842/798,688	2	9/8	13/13	(Chen *et al.*, 2019e)
Amazon complex question/answer dataset	191,185	1,447,173	8			(McAuley and Yang, 2016)
Hierarchical product review corpus	11		4			(Yu *et al.*, 2011)
Amazon question answering dataset		334,249	3			(Deng *et al.*, 2020)
	#Dialogues	#Utterance	#Total words	#Avg.length of utterances	#Avg.length of dialogues	
JDDC e-commerce dialogue dataset	1,024,196	20,451,337	150,716,172	7.4	20	(Chen *et al.*, 2020c)
E-commerce Dialogue Corpus dataset	1,000,000 (Train) 10,000 (Valid) 10,000 (Test)			7.02 (Train) 6.99 (Valid) 7.11 (Test)	5.51 (Train) 5.48 (Valid) 5.64 (Test)	(Zhang *et al.*, 2018d)

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