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Role of Autosuggest in e-commerce

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Abstract:

E-commerce has seen a dramatic increase in the last few years in most countries and industries. The number of products present in a platform's catalog also keeps rising as more and more users are moving towards e-commerce. The autosuggest service plays a major role in helping users discover products quickly and with lesser effort from this large catalog. This paper discusses the role autosuggest plays in e-commerce. It also explores how some of the recent advancements in auto-suggestion algorithms can be adopted by e-commerce platforms.

Keywords — **auto-suggest, auto-complete, e-commerce, m-commerce, digital commerce, query auto completion, search**

I. INTRODUCTION

With the constant rise in smartphone adoption, lowering of internet subscription prices and the recent nationwide or state-wide lock-down initiatives to fight the global pandemic, e-commerce platforms are seeing adoption numbers like never before. The number of e-commerce web-sites are also increasing. In order to be successful, these websites will need to continuously engage in improving the user experience provided by the website alongside other factors such as improving the quality of the products being sold, delivery speed, etc

One of the main components of an e-commerce platform which plays an important role in user experience is the product discovery component and out of the various product discovery components auto-suggest and auto-complete are one of the first services which the user interacts with to discover products present within the platform. In 2011, Bar-Yossef and Kraus referred to the functionality of taking a query as an input and showing suggestions based on the input query as query auto completion [1].

A 2019 benchmark test revealed that 96% of the major e-commerce websites provided auto-suggest feature, but they further state that 27% of these websites have severe usability issues [2].

A good implementation of Auto-Suggest can mean a saving of time and typing for the user, beyond this It can also provide the user inspiration and new ideas [3]. This paper aims to discuss the relevance of auto-suggest in ecommerce and explore how the autosuggest service can be improved using recent advancements in query completion algorithms.

II. LITERATURE SURVEY

This section discusses some of the prominent papers related to autosuggest and query autocomplete.

Mandl, Thomas & furtner, Katharina & womser-hacker, christa. Conducted a study on the effects of autosuggest on the usability of search and published a paper on the same [3] this study analysed the effects of auto-suggest implemented on mobile websites and applications on user's search in e-commerce platforms. The results showed that the

autosuggest service results in faster interaction with the website for most of the tasks on average. In the case of tasks which require more time, the additional time required is around 10% and, interestingly, does not result from more interaction steps.

Cai, Fei and Rijke, Maarten. Conducted a survey and published their findings in a paper titled. "A survey of query auto completion in information retrieval" [16] this survey reviews work on query auto completion and auto-suggestion that has been published before 2016. It mainly focuses on web based search and provides a scientific look at the query auto completion problem. It describes two approaches to the query auto completion problem, one which is based on heuristic models and the other based on learning to rank (LTR) approach. It also identifies prominent trends in published work on query auto completion

Guo Jiafeng, Cheng Xueqi, Xu Gu and Shen Huawei published a paper titled "a structured approach to query recommendation with social annotation data" [17]. This paper proposes to recommend queries in a structured way to better satisfy both search and the users interest to explore the available content. The paper introduces an approach which involves the construction of a query relation graph from available query logs and social annotation data which captures the two types of interests respectively. Using this newly constructed query relation graph, it recommends leveraging a modularity based approach to group top recommendations into individual clusters, and label each cluster with social tags.

Guo Jiafeng, Cheng Xueqi, Xu Gu and Zhu Xiaofei published a paper titled "intent-aware query similarity" [18]. This paper argues that query similarity should be measured based on search intents. The paper calls this search intent based similarity approach as intent-aware query similarity. By involving search intents in the calculation of query similarity, the paper claims that we can obtain more accurate and also descriptive similarity measures on queries which can be helpful in a variety of applications

Hofmann Kajta, Mitra Bhaskar, Radlinski Filip and Shokouhi Milad conducted a study using an eye tracker to understand how users interacted with query auto completion systems and published a paper titled "an eye-tracking study of user interactions with query auto completion" base on the results [19]. Study participants were asked to complete web search tasks, and during the experiment their interactions were recorded using eye-tracking devices and software logging. The study specifically focussed on the effects of query autocomplete ranking, by controlling the quality of the ranking shown to each subject.

III. ANATOMY OF A BASIC AUTOSUGGEST SYSTEM

Generally an autosuggest system consists of 4 main components which are:

1. Autosuggest corpus: a dataset of suggestions which is computed offline at fixed time everyday
2. Retrieval engine: which is used to retrieve suggestions from the autosuggest corpus
3. Ranking engine: which is used to order the retrieved suggestions
4. Client application: which is used to display the suggestions to the user, eg website or mobile application.

The autosuggest corpus is generally prepared using query logs after it is cleaned. but query logs are not always present and in those cases, Bhatia et al. [2011] propose a probabilistic approach for generating query suggestions from a corpus [4]. The generated corpus is stored in efficient storage/retrieval data structures such as tries(prefix trees) or finite state transducers(as seen in lucene [5])

When a user enters a prefix in the search box, based on a pre-built trie-based index [6], or a finite state transducer index [5] suggestions are retrieved. The retrieval engine can be configured to assign a higher weightage to some fields over others to suit business requirements. Ranking is usually done using two different algorithms, first a subset of the corpus is retrieved using a simple, computationally

efficient algorithm eg by computing TF-IDF scores and then the subset is sent to a more complex algorithm which ranks the document using a more computationally intensive and business specific ranking algorithm, this is termed as re-ranking [1].

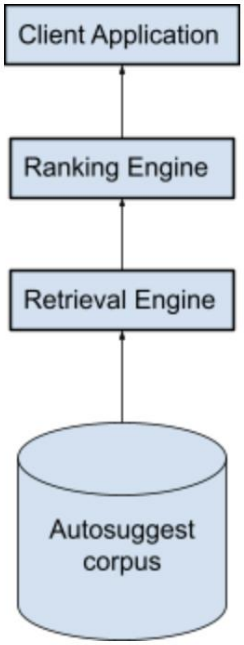

Fig 1: Components of an Autosuggest System

The final list of suggestions generated after re-ranking are sent to the client application which displays it to the users.

IV. AUTOSUGGEST IN E-COMMERCE

Autocomplete as we know it was first introduced by google in the year 2004 [7]. What started off as a passion project has now quickly become a service users have come to expect from every e-commerce and other websites which have a search bar to support. Interestingly as search is becoming more advanced, users' ability to find things and solve problems is getting weaker. This has been illustrated by the research published by Nielsen Norman group [8].

In the study conducted in [3], 30% of the test subjects claimed that they would leave a website without Auto-Suggest. And the remaining 70% claimed that they would continue using the website, but during the tests, 90% of the test subjects hesitated typing when there was no Auto-Suggest. This shows that Autosuggest is something now users have come to expect from e-commerce websites.

Fig 2 shows how Google Suggest originally looked on Google Labs [15].

Fig 2: Google Suggest as it originally looked on Google Labs

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A good implementation of autosuggest can bring several benefits to the e-commerce platform such as:

1. Speed up product discovery: the study conducted in [3] shows that using autosuggest can save up to 20% of the time required to search for the product, but the study further explains that this is only possible if the suggestions being shown are relevant, if the suggestions are of poor quality then autosuggest can potentially

increase the search time by confusing the user

2. Reduce the average number of keystrokes: the study in [3] also showed that using autosuggest could potentially reduce the number of keystrokes by approximately 28% on average (across different use cases). Decreasing the number of keystrokes greatly improves the user experience for users accessing the platform through a device having a smaller form factor such as a smartphone, which according to [9] accounts for 68% ecommerce traffic in the year 2020.
3. Promote exploration: autosuggest can help the users to find alternatives to the products they are looking for, or even additional items they might have forgotten about. For example a search for "shoe polish" could also suggest a "shoe polish brush" and other shoe related accessories while typing. It can also help correct spelling mistakes made by the user.
4. Manually boost specific products: a sophisticated site search service can provide the ability to boost specific products. this can be done by showing a specific product higher up in the suggestion list as [10] observed that suggestions higher up in the list experienced more clicks than the ones than the ones present lower in the list
5. Provide assurance: seeing the product or similar products being listed when a user starts searching for something can assure him that the product he is looking for is available on the platform.

V. IMPROVEMENTS TO AN AUTOSUGGEST SYSTEM

This section of the paper will cover how recent advancements in autosuggest can be used to further improve the autosuggest service provided by e-commerce platforms. Improvements can be achieved by targeting one of the four basic components of an autosuggest system. two possible improvements relevant to ecommerce have been discussed below

Personalized Auto-suggest: most e-commerce platforms use autosuggest services which mainly rely on popularity of the candidate suggestions when assigning ranks. However, just because a certain suggestion is popular does not mean that every user will be interested in it. Popularity of certain queries may vary drastically across different users and demographics. This is where personalization comes in. [11] introduces a supervised learning based method to personalize the suggestions being returned by the auto suggestion algorithm. It also introduces a labelling strategy to create a dataset for learning personalized rankers. [12] introduces a multi-view multi-task attentive framework to learn personalized query auto-completion models. It uses a transformer based encoder to learn different kinds of sequential behaviours which are viewed as multiple unique views of the user's search history. Finally a prefix to history attention mechanism is used to choose the most relevant information to form the final representation.

Introduction of seasonality: Seasonality is an important temporal feature which should be incorporated into the ranking function of an ecommerce platform. For example, during the month of diwali, for a query "di" showing diya is more appropriate than a suggestion like digital watch. Seasonality can operate on many scales of granularity, e.g. holidays occur on a yearly basis, people have different browsing habits on different days of the week, etc. [13] discusses how triple exponential smoothing can be used to model seasonality behaviour. [14] proposes a time-sensitive approach for query auto completion, instead of ranking suggestion candidates based on past popularity, it introduces a approach which uses a time series to rank candidates based on their forecasted frequency.

Context sensitive suggestions: the query formulation process is usually a continuous process, what this means is the user starts with one query and then continuously improves it by adding or removing words, this process is called query reformulation. To provide better suggestions in these cases it is a good idea to use the contextual

information like previous queries, item click history, and other widget interactions when ranking the suggestions. [1] discusses two methods which the authors call “nearest completion” and “hybrid completion” which use contextual information to provide better suggestions. [20] discusses a ranking algorithm which uses session information to provide more relevant suggestions.

VI. CONCLUSION

Auto-suggest is slowly becoming not only one of those features which users come to expect from the e-commerce website but also an essential feature which can let the user browse through the enormous catalog of products being sold on the website. Reducing the number of keystrokes required to search for products has become an essential requirement to ensure good user experience due to the rise in smartphone users. In this paper we have discussed the role autosuggest plays in e-commerce platforms, the benefits autosuggest has when implemented correctly. We have also discussed how the suggestions being shown can be improved by incorporating seasonality and by personalizing the suggestions.

We conclude that the role autosuggest plays will only continue to rise as the algorithms being used mature, the user base of e-commerce platforms start growing further and the number of products being sold online increases.

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