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A Multidimensional Comparison of Search Engines and ChatGPT in Terms of Information Needs

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Abstract: Search engines are an important tool for accessing information today. However, it isn't easy to understand how they process different types of information needs, such as General, Navigational, and Transactional and how their results are relevant to each other. This research compares four widely used search engines such as Google, Bing, DuckDuckGo, and Brave along with a most popular AI tool ChatGPT. The primary objective is to evaluate how effectively these platforms fulfil various information needs. Each search engine and ChatGPT was tested using the same questions to compare how well they work. Their performance was checked based on a few important things like relevance, accuracy, speed, precision, recall and user privacy. Traditional search engines like Google and Bing use keywords meaning they look for exact words the user types. On the other side, ChatGPT is an AI tool that understands natural language and gives answers based on the meaning and context of the question, not just the exact words. The results from all platforms were divided into two types relevant and irrelevant. These results were shown that each search engine and AI tool has strengths and weaknesses. Google and Bing provided accurate answers, Brave and DuckDuckGo delivered faster results, while DuckDuckGo and ChatGPT offered better user privacy protection. This research also highlights the challenge of understanding how various platforms address different information needs. This study helps improve search technologies to make users more satisfied, improve accuracy, and make information retrieval more efficient.

Keywords: Search Engine; Precision; Recall; Relevant Retrieval Result; Quires; Internet

1. Introduction

The term "search engine," as used by the average citizen of the World Wide Web, encompasses a wide variety of services providing Internet access [1]. The history of search engines started in 1945; initially, in the 1990s, Archie was the first search engine to search the File Transfer Protocol (FTP) files, while the first text-based search engine to be developed was Veronica [2][3] .With the growth of the Internet, search engines have significantly evolved [4, 6]. In 1994, the World Wide Web Worm (WWWW) became one of the first web search engines. It was introduced with an index of 110,000 Web pages and Web-accessible documents [4]. The early search engines were simple directories, but modern engines like Google have evolved, and search on mobile devices has increased significantly [5]. The motivation of this research is that nowadays people use search engines and AI tools for all kinds of information. Everyone wants quick and accurate answers. That's why we want to understand how these tools work and which one gives better results. Today, search engines and AI tool has become the important tool for finding information [6]. Whenever we need important information on the Internet, we use search engines to find the information. These search engines use algorithms to process user queries and provide relevant results. It traverses billions of web pages available on the World Wide Web, so the search engines display

the results and sort them based on their relevance. A SE is a web-based tool that scans websites, documents, images, videos, and files for keywords or phrases entered by the user, and then displays the results as clickable links to relevant web pages. SEO (Search Engine Optimization) is basically a method that improve the relevance of web pages on search engine.

These methods can help increase the visibility of web pages and, thus, their ranking [2]. However, understanding how these algorithms rank results and provide the best response for each query can be challenging. So far, not much research has been done on how search engines and AI tools (like ChatGPT) handle difficult questions asked in natural language. This study fills that gap and compares both tools to find out which one is more accurate, relevant, and effective[7]. In recent years, AI tools like ChatGPT have become popular as a new way to get information. Unlike search engines, ChatGPT understands natural language, meaning it can know what we are asking, even if we write in full sentences or ask complicated questions. ChatGPT doesn't search the internet live. Instead, it uses the knowledge it learned during its training to give helpful answers in a human-like way. This research focuses on understanding how different search engines handle user queries and which algorithms deliver accurate and relevant results most effectively. It also examines the effectiveness of both search engines and AI tools by analyzing their efficiency and performance. This study looks at the features that search engines and AI tools like ChatGPT use in their algorithms and how these features affect the search results when people look for different types of information. Then, it compares how traditional search engines (like Google) and AI tools (like ChatGPT) answer various questions. The research tries to see which tool gives better answers in terms of accuracy, relevance, and performance. We describe the literature review in Section 2, methodology in section 3 and present their result in section 3 and the section 4 is discussion and next section 5 is conclusion of our research paper.

2. Literature Review

The Materials and Methods the internet is growing rapidly, and search engines have become essential in helping people find information quickly and easily. Most famous search engines like Google, Bing, Brave and Duckduckgo play a key role in this process. Each has its way of providing information. For example, Google focuses on websites and specific areas like academic, medical, and business searches [8], [9]. Bing collects data from multiple sources to give more complete results. This difference in how search engines work helps them meet the needs of different users and manage the large amount of information on the web [4]. Search engine optimization (SEO) improves search engines' ability to find and rank web pages. There are two main types of SEO: On-page SEO enhances a webpage's content, Meta tags, headers, and URLs, making it more search-engine friendly. Off-page SEO works on building external links to increase the webpage's ranking. Both types of SEO are important for helping webpages show up higher in search results [10] . Although thousands of search engines are available, Google, Brave, Duckduckgo and Bing are among the most popular. They stand out because of their advanced techniques, which provide users with the most relevant and accurate results. These search engines smartly combine information and connections to improve the accuracy and efficiency of their results [11]. Researchers have studied how search engines work and what makes them effective. Vaughan and Theimer (2004) explained that users turn to search engines with specific purposes, so the results must be relevant and useful. Baeza-Yates and Ribeiro-Neto (2011) identified different types of search engines, such as general web search engines, vertical search engines focusing on specific topics, and specialized search engines. These types help meet different user needs. All search engine's core features include indexing, ranking algorithms, and filtering results. Jansen (2006) pointed out that improving these features helps search engines provide better-quality results. Metrics like precision (how accurate the results are) and recall (how many relevant results are retrieved) are used to measure search engine performance [12]. Hawking (2004) suggested that search engines balance these two metrics to give users the best results. While earlier research focused on ranking and indexing, this study explores more advanced techniques. These include using machine learning, semantic analysis, and caching methods to make results more relevant and speed up searches [13].

On the other side, AI tools like ChatGPT have become new ways of retrieving information, which are quite different from traditional search engines. All Search engines mostly work based on keywords. But ChatGPT tries to understand the queries in natural language and gives answers based on the meaning and context of your queries [14]. This makes ChatGPT more useful for complex, detailed, or conversational

questions. It's helpful in tasks like generating ideas, summarizing content, and writing professionally. However, there are also some problems. Sometimes, it gives incorrect or made-up information (called hallucination), and it doesn't search queries on internet in real time. It relies on old data it was trained on. Because of this, it may not be very reliable for navigational (like finding a website) or transactional (like buying something) queries. More research is needed to understand how well ChatGPT handles different information needs like informational, navigational, and transactional and how its performance compares to traditional search engines [7].

This research paper explores the limitations of various search engines and AI tools based on findings from multiple research studies. Search engines like Google, Bing, DuckDuckGo, and ChatGPT each have specific limitations that impact their performance. This paper will provide a detailed limitation of different search engine with Chatgpt that are given below [15].

One big problem with Google is that it shows page search results, so users have to keep clicking to see more results. This can feel slow and boring. Studies also show that most people don't even go past the first or second page. Another problem is that Google tracks user data and shows personalized ads, which can hurt user privacy [16]. While Google's apps like Gmail and Drive work very well together, Google is a closed-source company, so users cannot change or customize it much. Also, because Google makes money from ads, it sometimes shows sponsored content first, making real, useful results harder to find [7], [17], [18].

DuckDuckGo has a smaller database than Google, so it sometimes gives fewer results. Because DuckDuckGo mainly focuses on privacy, it doesn't offer extra features like live flight tracking or bill payments as Google. DuckDuckGo lets users customize things like instant answers, but the quality can be uneven because the community builds these features. DuckDuckGo also doesn't have Google's huge servers and computer power, so sometimes it may be slower. Finally, because DuckDuckGo doesn't collect personal data, it can't offer personalized search results, which some people might find less helpful [15].

Brave says it protects your privacy when you browse in private mode, but it doesn't fully clear everything. Forensic experts found that after using Brave, some information, such as websites you visited, search keywords, images, and even email addresses, can still be found in the computer's memory (RAM) and a system file called pagefile.sys. Even after you close the browser, special tools like Win Hex, Internet Evidence Finder (IEF), and Autopsy can recover this data. Although Brave doesn't save your session on the hard drive because it uses Chromium (like many other browsers), it still leaves some information in RAM for a while. This means that if someone has access to your device, they could find your private information. Brave suggests shutting down the computer to clear RAM, but in real life, most people don't always turn off their devices. So, there's a gap between what Brave promises about privacy and what happens, especially if someone uses live memory forensic tools[19], [20].

The biggest problem with Bing is that it finds fewer useful results than Google. Its recall score is only 0.19, while Google's is 0.81, meaning Google brings back much more relevant information. Bing is good at handling searches with two or more words and gives accurate results. However, Bing doesn't do well for simple one-word searches. Its accuracy drops, and it finds few correct results. The study also shows that Bing's performance is not steady. Depending on the type of search, it sometimes does well and sometimes doesn't, which shows its search system is inconsistent. Bing also shows more useless results for simple one-word searches; 36% of the results are not helpful and waste users' time. Even though Bing tries to improve its searches using smart techniques, it still has a smaller database and is less able to find complete information than Google [21], [22].

ChatGPT has some important problems. Sometimes, it accepts wrong information and repeats it, like when someone asks about bad dates, and ChatGPT gives the wrong answer [23]. People also trust ChatGPT answers too much in one study, 70% of users believed a wrong answer without checking. ChatGPT can also give different answers to the same question if you ask it many times, which makes it less reliable. It is good at answering simple questions, but Google works better for specific tasks like giving a flight booking link. Also, a user's education level does not make much difference when using ChatGPT, while with Google, more educated people usually get better results. Finally, because ChatGPT talks in a friendly way, people can easily believe its answers without checking, which can spread wrong information [7].

This study investigates how search engines and AI tools can enhance user experience through personalized results, creating user experience models, and learning from impacted users. It aims

to offer practical ideas for improving search engines by combining them. Developers and researchers can use these insights to build search engines that are faster, more accurate, and easier for people to use [24].

3. Methodology

This study examines how different web search engines work and perform well. Most search engines have the same basic parts: a crawler (also called a spider), an indexer, and a search box or query interface. When someone types in a search, the crawler goes out and collects web pages. The indexer then reads those pages and lists important words and phrases and how they are arranged. Each search engine has its special method (algorithm) to decide which results are most useful [25].This research chose a mix of popular and less-known search engines and AI tool, including Google, Bing, Duckduckgo, Brave, and Chatgpt[26]. ChatGPT works differently from search engines. It does not use crawlers or indexers. Instead, it is trained on much data from books, websites, and articles. ChatGPT understands the meaning using natural language processing when a user asks a question and generates a response based on patterns learned during training. It focuses more on understanding the context of the question and giving a complete, conversational answer instead of just giving website links [27]. This paper helped better compare how each search engine and AI tool works and how accurate their results. The detail flow diagram is given below

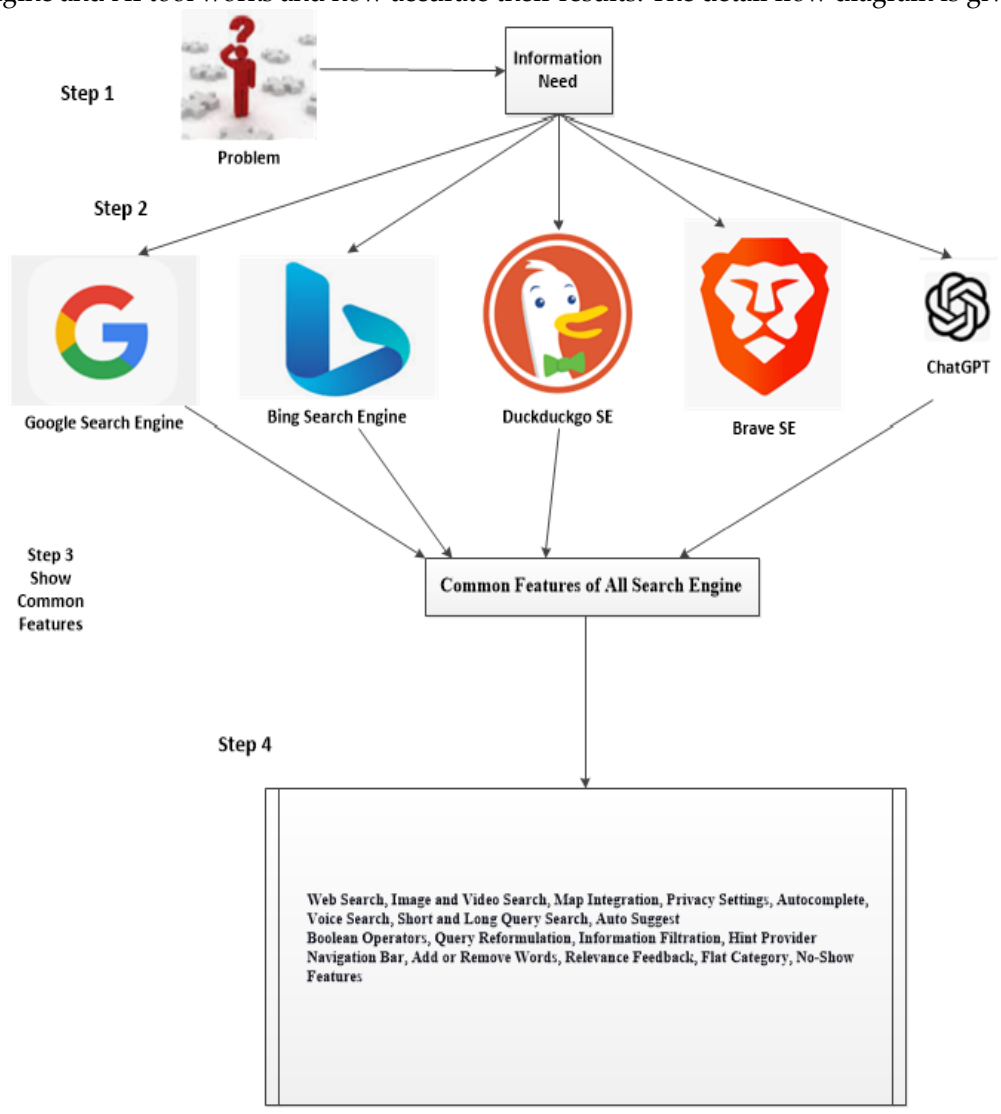

Figure 1. Research design

This diagram of search engine and Chatgpt is divided into four steps.

3.1. Problem Identification and Query Formation:

The first step in finding information starts with a problem Orientation. Users realize they need information like something they don't know or want to learn. This need feels like a problem in their mind. To solve it, they turn the problem into a question or a statement called a query or an information need.

3.2. Query Classification:

After identifying the information need, we divided it into three parts (General, Navigation, and transaction) then convert the information need into these parts. In this paper, we have taken these queries [28].

General Type: What is Database

Navigation Type: Sql in Database

Transection Type: Download Sql database book free

1-General (Informational) Queries:

Purpose: To give general information or knowledge about a topic.

Example: "What is a database?"

2-Navigational Queries

Purpose: To find a specific website or page.

Example: "Sql is in the database. Give me the link."

3-Transactional Queries

Purpose: To act, such as purchasing or signing up for a service.

Example: "Download Sql database book free."

After choosing these specific information need. We searched these different queries into five search engines (Google, Bing, Duckduckgo, Brave, and ChatGPT) and then analyzed the searching algorithm and response time of all search engines.

3.3. Common Features Extraction of Search Engines and ChatGPT:

In this step we extract the Common features of all search engine and Chatgpt. Search engines and AI tools like ChatGPT share several common features identified in different research papers.

3.4. Functional Capabilities of Search Engines and ChatGPT:

3.4.1. Web Search:

This is the basic and most important feature of search engines and AI tools. It allows users to enter a question or topic and receive results from web-based sources. While search engines provide links to websites, AI tools like ChatGPT summarize or generate text-based answers based on training data [25], [29].

3.4.2. Autocomplete:

Search engines like Google suggest popular or commonly searched phrases to help you complete your question more quickly and easily. In the same way, AI tools like ChatGPT try to understand what you're trying to say and guess your following words, making the conversation feel more natural and smoother.

3.4.3. Auto Suggest:

Both systems help you explore related topics. For example, a search engine might suggest similar search phrases, while ChatGPT can offer follow-up questions or ideas based on your original input.

3.4.4. Boolean Operators (AND, OR, NOT):

Search engines use keywords like AND, OR, and NOT to better filter your results. For example, "cat AND dog" shows results that include both. ChatGPT doesn't use these exact words, but you can still tell it what to include or leave out, like saying, "Compare cats and dogs, but don't talk about behavior."

3.4.5. Flat Category System:

Search engines and ChatGPT usually show results in a plain list, not sorted into complex groups. This simple layout helps users quickly read and understand the answers without confusion.

3.4.6. No-Show Features:

Tools like word trees, mind maps, or Venn diagrams are not shown in the basic version of search engines or ChatGPT. You must use extra tools or special software to see that visual information.

3.4.7. Voice Search:

Most search engines, like Google Assistant , now provide a voice search option. AI tools also add voice input, allowing users to ask questions or give commands through speaking. This is especially helpful for people who have accessibility needs and can't type easily.

Support for Short and Long Queries means that both search engines and AI tools can handle all types of questions whether they are short and simple, like "What's the weather today?" or long and complex, like "How does climate change affect marine biodiversity?"

3.4.8. Add or Remove Words:

In search engines, users can manually include or exclude terms (e.g., "cats -dogs"). In ChatGPT, users can ask to exclude topics (e.g., "Explain World War II without talking about Germany").

3.4.9. Hint Provider:

Systems suggest tips to improve searches, like using quotes or keywords. ChatGPT can explain how to write better prompts or structure questions for better answers.

3.4.10. *Privacy Settings:*

Both platforms allow some level of privacy control. Search engines offer options to limit tracking and store or delete history. Depending on the platform (like ChatGPT), AI tools offer data control through account settings or anonymized interactions [19].

4. Results

This While comparing search engines and ChatGPT, several unique features were observed that distinguish these platforms. These features were identified while testing a set of common queries across all platforms. Based on this analysis, **Figure 2** below highlights the features of each engines and AI tools.

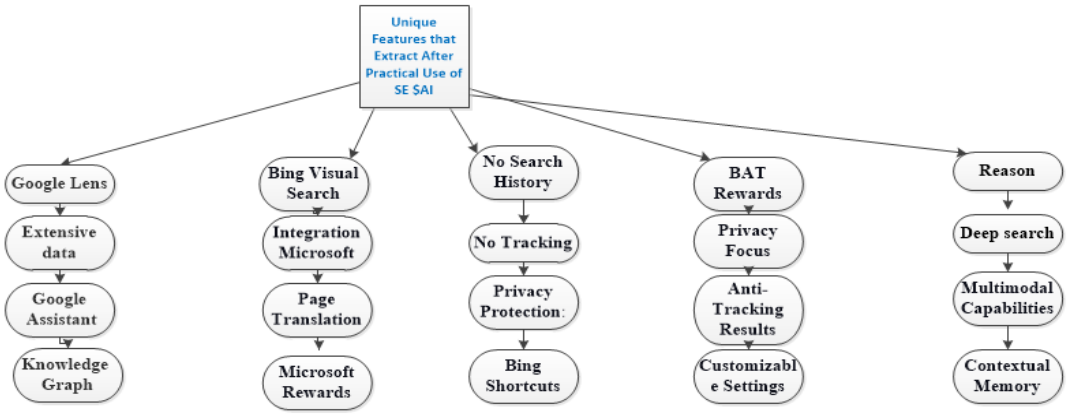

Figure 2. Unique Feature of Search Engine & AI

The figure above shows the unique features identified in each search engine and ChatGPT during query testing.

4.1. Google Unique Features

Google Lens: An image recognition tool that uses your phone's camera to identify objects, text, and areas and provide information or search results related to what you see.

Extensive: Google collects data from millions of websites, images, and videos and uses it to provide search results and personalized recommendations.

Google Assistant: A virtual assistant integrated with Google services that can answer questions, ma nage smart devices, manage calendars, and more.

Knowledge Graph: This graph displays important information right in your search results, includin g facts, images, and links to other topics.

4.2. Bing Unique Features:

Integration with Microsoft: Bing works well with Microsoft apps like Windows, Edge, and Office, making it easy to search without leaving those apps.

Bing Visual Search: You can search using pictures instead of typing. Just upload a photo, and Bing will find similar items or give information about it.

Page Translation: Bing can easily translate full web pages into different languages so you can read them easily.

Microsoft Rewards: By using Bing, you earn points, which you can exchange for gift cards, donations, or other rewards.

4.3. Brave Unique Features

BAT Rewards: Brave gives you tokens (BAT) for watching ads. You can use these tokens to support creators or get rewards.

Privacy Focus: Brave doesn't track what you search for or collect your data, keeping your searches private.

Anti-Tracking Results: Brave blocks ads and trackers so no one can follow you online, and your search results are clean and unbiased.

Customizable Settings: You can easily change Brave's search settings, like language, region, or safe search, to suit your needs.

4.4. Duckduckgo Unique Features

No Search History: DuckDuckGo doesn't save what you search, so your searches stay private.

No Tracking: It doesn't follow you around the internet or track what you do.

Privacy Protection: DuckDuckGo blocks trackers and keeps your searches anonymous.

Bing Shortcuts: You can use quick commands (like Bing) to search on Bing or other websites directly [15].

4.5. ChatGPT Unique Features

Natural Language Understanding: ChatGPT understands and talks like a human, making conversations easy.

Multimodal Capabilities: It can handle text and images, so you can share pictures and get helpful replies.

Contextual Memory: It remembers what you said earlier in the chat to give better answers.

Base Context Generator: ChatGPT can explain things clearly by using its knowledge to add helpful details [23].

This research involved the analysis of multiple search engines with AI tool (Google, Bing, DuckDuckGo, Brave, and ChatGPT) by inputting various queries and analyzing their response times, algorithms, features, total retrieved results, Relevant Results, Irrelevant results, per-page results, and no of per page result.

Table 1. Show the Comparative Analysis of Five search engine

Query Specification	Google Chrome	Brave	Bing	Duckduckgo	ChatGPT
Short query Accept	Yes	Yes	Yes	Yes	Yes
Long query Accept	Yes	Yes	Yes	Yes	Yes
Boolean operator accepts	Yes	Yes	Yes	Yes	Yes
Double Quatsino accept	Yes	Yes	Yes	Yes	Yes
Filtering information provide	Yes	Yes	Yes	Yes	No
Search Box	Yes	Yes	Yes	Yes	Yes
Category shows	No	Yes	Yes	No	No
Provide Hint What Type of Information put	Yes	Yes	Yes	Yes	No
Auto Complete	Yes	Yes	Yes	Yes	No
Auto Suggest	Yes	Yes	Yes	Yes	No
Both Shot and Long query accept	Yes	Yes	Yes	Yes	Yes
Navigation Bar	Yes	Yes	Yes	Yes	No
Retrieval Result					
Provide Surrogate	Yes	Yes	Yes	Yes	Yes
Show Publish date	No	Yes	No	No	No
Author name	No	Yes	No	NO	No
Blind Retrieval	Yes	Yes	Yes	Yes	Yes
Universal Retrieval	Yes	No	Yes	Yes	Yes

High light term	Yes	Yes	Yes	Yes	Yes
Query Reformulation					
Reformulate Query	Yes	Yes	Yes	Yes	Yes
Auto Spelling	Yes	Yes	Yes	Yes	Yes
Auto Complete	Yes	Yes	Yes	Yes	Yes
Add or Remove words	Yes	Yes	Yes	Yes	Yes
Automated Reformulate	Yes	Yes	Yes	Yes	Yes
Relevance feedback	Yes	Yes	Yes	Yes	Yes
Organized Search Result					
Flat Category	Yes	Yes	Yes	Yes	Yes
Super Book	No	No	No	No	No
Hierarchy Result	No	No	No	No	No
Clustering Result	Yes	Yes	Yes	Yes	No
Visualization In search Result					
show Venn Diagram	No	No	No	No	No
Show VQuery	No	No	No	No	No
Show color Title Bar views	No	No	No	No	No
Show bar chart or scatter plant	No	No	No	No	No
Show Thumbnail's	No	No	No	No	No
Show Visual WordNet	No	No	No	No	No
Show word Tree	No	No	No	No	No

By examining the common features and unique strengths of different search engines, we found that some are better for web search, others for finding images and videos or specialized sites, and some focus on voice search. Each search engine has its benefits and limitations, depending on what you're looking for.

Table 2. Results of general queries among Search Engine and ChatGPT

Searching	Google	Bing	Brave	Duckduckgo	ChatGPT
Total Page	10	6	10	1	1
Per page result	10	Change 11,13	Change 07,11	More and More	1
Total Result	100	105	92	100	1
Relevant	91%	90%	56%	51%	0.80
Irrelevant	9%	4%	8%	27%	0.15
Partial Relevant	0	9%	28%	22%	0.10
Video	6%	18%	0	YouTube	0
Duplicate	0	2%	24%	25%	0.5

In General Queries Table 2, we analyzed more than 10 pages of results for each search engine. We checked the results on each page and also noted the total results provided by each search engine. To classify the results as Relevant, Irrelevant, or Partially Relevant, we set a threshold value between 0 and 1.

Additionally, we checked each search engine for video content and duplicate results. Based on results found from table 2 calculated the precision and recall in table 3.

In General Queries we find Precision or Recall of all search engine because the **Precision** and **Recall** are two metrics used to evaluate the performance of search engines.

Precision $= \frac{Relevant\ Result\ Retrived}{Total\ Result\ Retrived}$, **Recall** $= \frac{Relevant\ Result\ Retrived}{Total\ Relevant\ Retrived}$

Google

Precision $= \frac{85}{100} * 100 = 85\%$, **Recall** $= \frac{85}{91} * 100 = 93\%$

Bing

Precision $= \frac{76}{105} * 100 = 73\%$, **Recall** $= \frac{76}{90} * 100 = 85\%$

Brave

Precision $= \frac{32}{92} * 100 = 35\%$, **Recall** $= \frac{32}{56} * 100 = 57\%$

Duckduckgo

Precision $= \frac{26}{100} * 100 = 26\%$, **Recall** $= \frac{26}{51} * 100 = 50\%$

Chatgpt

Precision $= \frac{0.7}{1} * 100 = 70\%$, **Recall** $= \frac{0.7}{0.8} * 100 = 87\%$

Use this formula and find the Precision and recall of each search engine result.

Table 3. Precision and Recall of search engine and ChatGPT

Search Engines	Precision	Recall
Google	85%	93%
Bing	73%	85%
Brave	35%	57%
Duckduckgo	26%	50%
ChatGPT	70%	87%

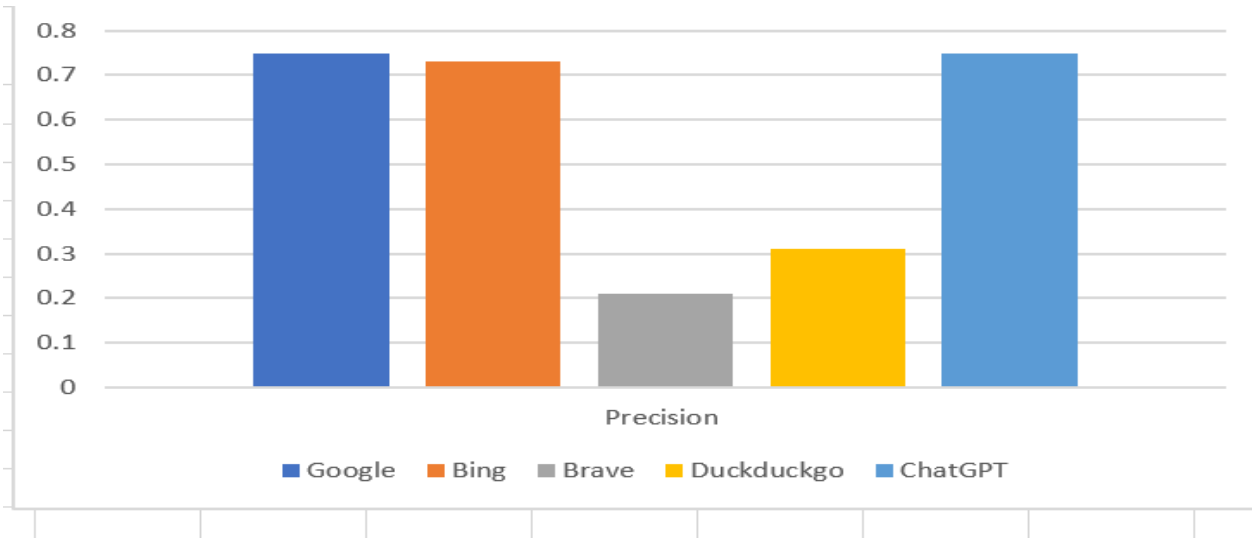

Figure 3. Graphical representation of average precision of search engine and chatGPT

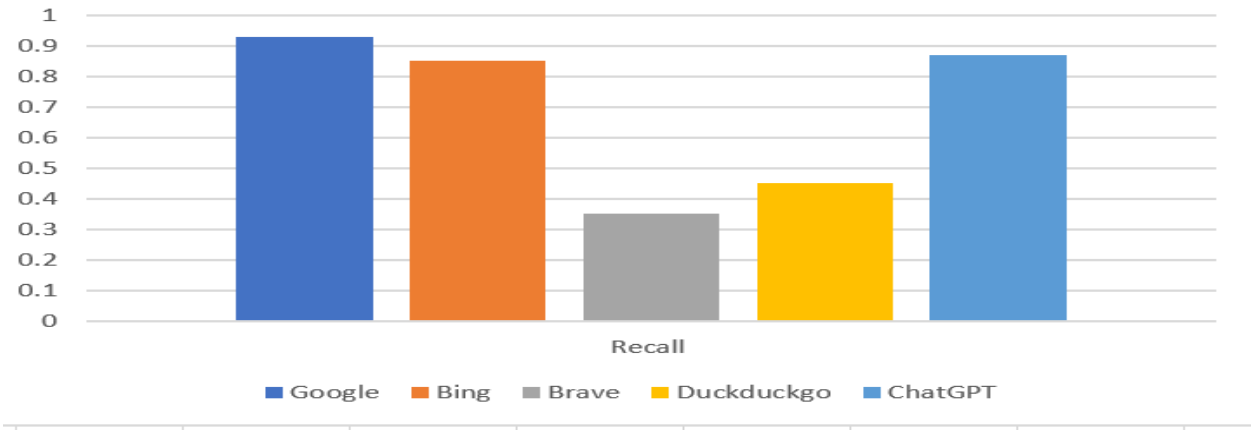

Figure 4. Graphical representation of average recall of search engine and ChatGPT

Table 4. Results of Navigational Queries among All search engines and ChatGPT

Searching	Google	Brave	Bing	Duckduckgo	ChatGPT
Total Page	10	6	10	1	1
Per page	10	Change 11,13	10	More and More	1
Total Result	100	102	100	100	1
Relevant	53%	62%	47%	40%	1%
Irrelevant	30%	12%	16%	33%	0
Partial Relevant	17%	20%	31%	27%	4%
Video	7%	4%	2%	YouTube	0
Duplicate	4%	8%	24%	21%	0

In Navigational Queries Table 3, we analyzed more than 10 pages of results for each search engine. We checked the results on each page and also noted the total results provided by each search engine. To classify the results as Relevant, Irrelevant, or Partially Relevant, we set a threshold value between 0 and 1. Additionally, we checked each search engine for video content and duplicate results.

Table 5. Results of Transactional Queries among search engines and ChatGPT

Searching	Google	Brave	Bing	Duckduckgo	ChatGPT
Total Page	10	6	10	1	1
Per page	10	Change 11,13	10	More and More	1
Total Result	100	102	100	100	1
Relevant	43%	51%	46%	27%	1%
Irrelevant	25%	15%	38%	35%	0
Partial Relevant	32%	13%	16%	8%	0
Video	1%	2%	0	YouTube	0
Duplicate	4%	13%	10%	28%	0
Link	13%	11%	10%	20%	0

In Transactional Queries Table 4, we analyzed more than 10 pages of results for each search engine. We checked the results on each page and also noted the total results provided by each search engine. To classify the results as Relevant, Irrelevant, or Partially Relevant, we set a threshold value between 0 and 1. Additionally, we checked each search engine for video content and duplicate results.

Table 6. Response time of search engines and ChatGPT

Sr:	Search Engine	Response time	Results
01	Google	1.24	10

02	Bing	1.40	10
03	Duckduckgo	10.46	10
04	Brave	1.62	10
05	Chatgpt	1.34	10

In this table of 5, we compared the response time and results of each search engine**.** Only Google provide the shortest response time between all the other search engine. And the second shortest response time after the google is ChatGPT. And the third shortest response time after the Google and Chatgpt is Bing. The fourth shortest response time after the Google, ChatGPT, and Bing is Brave. And the fifth longest response time of among all search engines is Duckduckgo.

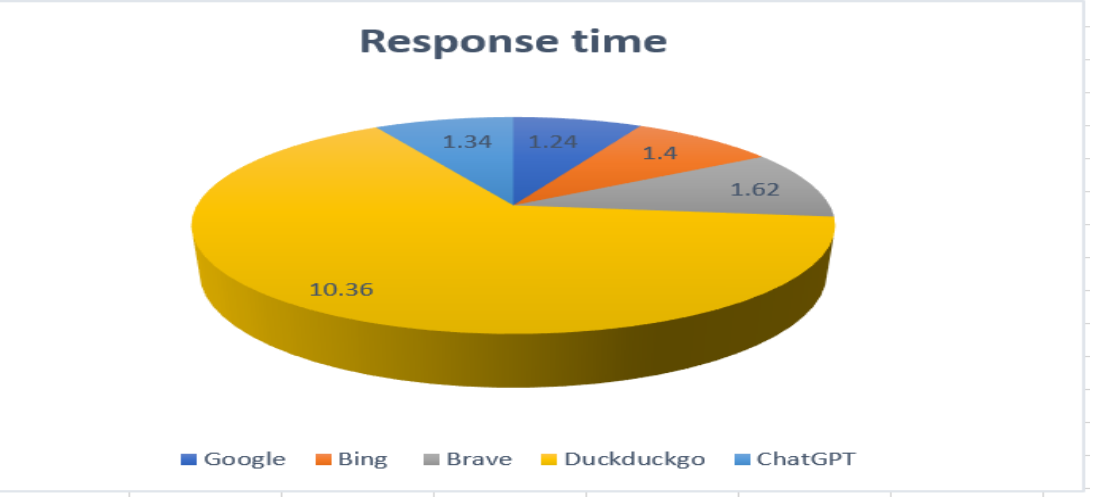

Figure 5. Graphical representation of response time of search engine and ChatGPT

In my opinion, Google is the better search engine in terms of response time. This research confirms that there is no single best search engine for all types of queries, as each engine has its own advantages and disadvantages. Google is still the leader in speed and providing personalized result s based on user profiles. It is efficient, user friendly, and essentially anonymous to the user's personal search results.

5. Discussion

The discussion of this study was to compare traditional search engines (like Google, Bing, Brave, DuckDuckGo) with an AI tool like ChatGPT. We looked at how well these tools handle different types of information needs (like general, navigational, or transactional). Our research is different from past studies because we looked at more details. While other studies only checked the first 5 pages of results, we examined the first 10 pages, which gave us a better and more realistic view of how each tool works. Based on precision and recall scores, Google performed the best, with a precision of 0.85 and recall of 0.93, which is a very good score. This shows that Google provides the most accurate and relevant results. Bing had a decent recall (0.85), but its precision was a bit lower than Google's (0.73), meaning Bing returns more results, but some of them may be irrelevant. ChatGPT, though not a live search engine, performed well (precision: 0.75, recall: 0.85), excelling at understanding complex questions and giving context-based answers. DuckDuckGo and Brave performed weaker, indicating limitations in their algorithms and indexing. From a quality perspective, we found several major problems and areas for improvement. Google's paging system makes the user experience slow and boring, which could be improved by using infinite scrolling. DuckDuckGo has a smaller index size and lacks real-time features, which could be addressed by expanding its index and adding third-party integrations. Brave browser's privacy claim isn't fully effective because some data stays in RAM and system files, so Brave needs to improve its privacy model to delete this data completely. Bing has a lower recall score than Google and shows more irrelevant

results, so it needs to improve its algorithms and search index. ChatGPT sometimes accepts wrong information and doesn't verify it. It can be improved by adding better fact-checking systems and real-time data sources and encouraging users to verify the responses. In the end, each tool has its own strengths and weaknesses, and how well they work depends on the kind of question the user asks.

6. Conclusion

The result of this research shows the performance analysis of search engine and AI tool such as Google, Brave, Bing, DuckDuckGo and ChatGPT in handling different information needs likes (General, Navigational, and Transactional). Google gave the better results, showing the most correct and useful answers for all types of searches. Brave and Bing also did a good job, but sometimes showed some unrelated information. DuckDuckGo which focuses on privacy and conversation, had trouble with searches where users wanted to do something, like buy or book. But ChatGPT handles general (informational) queries well, such as understanding something, explaining it, or simplifying complex topics. Its strength lies in handling follow-up questions and providing multi-step explanations. However, when it comes to navigational (reaching a specific website) or transactional (buying something or making a booking) queries, ChatGPT becomes weak because it cannot provide real-time links or execute transactions. However, ChatGPT and search engines do not replace each other. They complement one another. ChatGPT is strong in explanations and conversation, but weak in real-time and action-based tasks. In the future, hybrid systems should be explored where chatbots and search engines work together. This study also shows that checking things like accuracy and how many correct results are found is important to understand how is good a search engine. Each search engine uses algorithms that directly affect the relevance of results. This means that users should choose a search engine based on their specific information needs. In the future, research should include more diverse and complex queries such as multi-step research tasks, sensitive topics, or multimedia searches and examine user behavior through click patterns and feedback. Evaluations should also consider the impact of personalization, privacy practices, AI integration, and voice or image-based search. In addition, more detailed search engine evaluations should be conducted using user reviews. This research gives a solid foundation for understanding and improving search engine algorithms, making the process of finding relevant information more efficient and effective for users.

Future research may focus on integrating real-time search functionalities into AI tools such as ChatGPT, enhancing their ability to deliver up-to-date and contextually relevant information. Another good research idea is to create hybrid search systems that combine the ability to understand AI (like language and context) with the strong searching power of regular search engines. Such systems could become more accurate, relevant, and useful for users.

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