

# Browser Extension for Intelligent Query

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## 1. Introduction

The built-in find (ctrl-f) function in popular browsers such as Safari and Chrome only allows for exact query matching, i.e., words in the webpage are highlighted only if they agree with the query text word-for-word in the same order and ignoring word case. Such a functionality is probably satisfactory for matching a query containing a few keywords only since the chance of exact matching diminishes with more keywords. Furthermore, the user should have accurate prior knowledge of the keyword(s) for exact match to work well. Some use cases where exact match may not be sufficient are the following:

- Searching for text units (sentences, text nodes etc.) containing some/all multiple keywords that may appear in different orders and may not appear continuously in the webpage
- Searching for text units containing not just the keyword(s) but any synonym of the keyword(s)

Intelligent Browsing is a Chrome Extension that extends exact match and caters to the above use cases by ranking text units in a webpage based on a query text and/or enhancing the query text with synonyms of each query word.

## 2. Software Usage

Video link: [YouTube \(https://youtu.be/N04czZ6tjzQ\)](https://youtu.be/N04czZ6tjzQ)

### 2.1 Requirements

Google Chrome and Python 3 with the Python libraries listed in `requirements.txt` located in the `flask` folder such as `flask`, `gensim`, `nltk`, `numpy` and `pandas` are required.

The Python packages can be installed by executing the following command in the terminal with `flask` as the current directory:

```
pip3 install -r requirements.txt
```

The code has been tested with Python 3.7 and Google Chrome Version 96.0. Newer versions of Python 3 such as 3.8 and 3.9 are also expected to work.

## 2.2 Installation

Start the `flask` server by running the Python script `main.py` with `flask` as the current directory:

```
python3 ./main.py
```

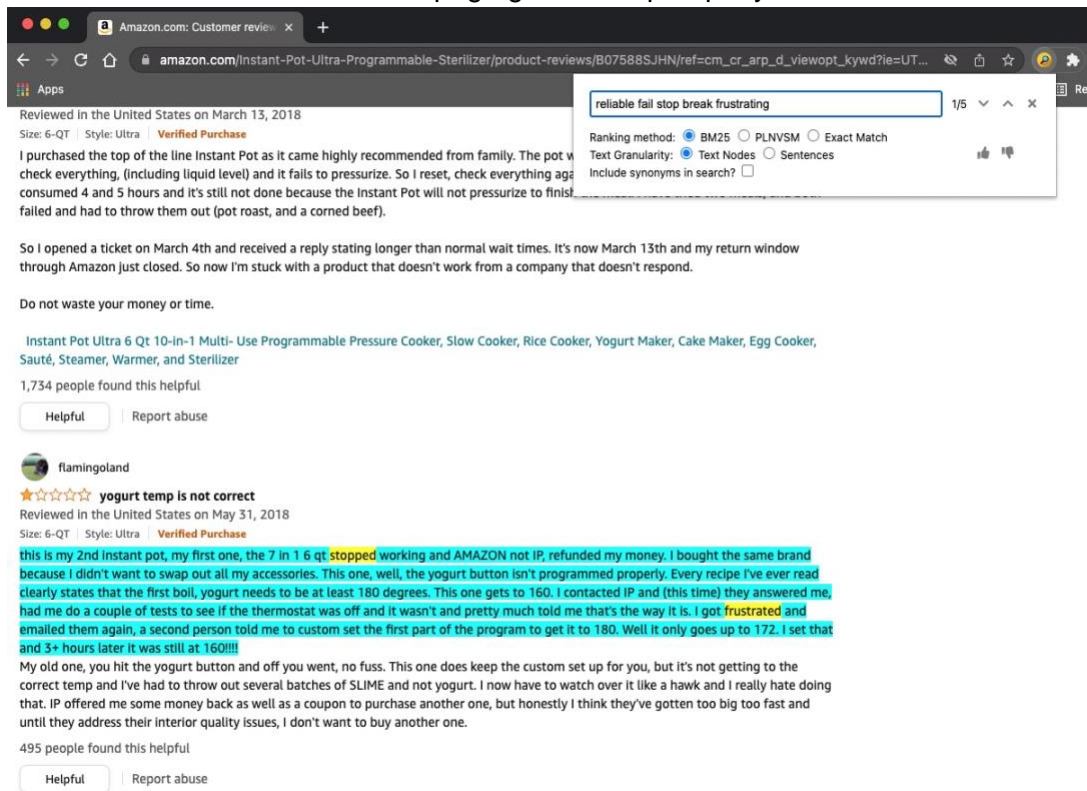
To load the extension, go to the URL `chrome://extensions/` in the Chrome browser. Make sure to toggle "Developer Mode" in the top-right corner so it is enabled. Click "Load unpacked" and select the extension directory. Click the Extensions icon to the right of the URL bar and the Bookmark icon. The Intelligent Browsing extension should be visible. You may pin the extension to facilitate access. By design, Chrome does not allow extensions to remain open when Chrome is no longer viewing the current window.

## 2.3 How to Use the Extension?

Type any query text (word, multiple keywords, phrases or sentences) in the search bar and press "return". By default, each text node is considered a distinct document (text unit) for ranking. There is also an option for the user to set each sentence as one distinct text unit. The extension shows the highest rank text unit first, which is highlighted in cyan with matching words highlighted in yellow. As the down arrow is clicked, the browser scrolls to the next highest rank text unit. Previous text unit can be reached with the up arrow. BM25 [1] is the default ranking method. Pivoted Length Normalization Vector Space Model (PLNVSM) [2] or exact match is also available to the user.

## 2.4 Use Cases

### 1. Rank text nodes of a webpage given multiple query words



Amazon.com: Customer review

amazon.com/Instant-Pot-Ultra-Programmable-Sterilizer/product-reviews/B07588SJHN/ref=cm\_cr\_ar\_p\_d\_viewopt\_kywd?ie=UTF...

reliable fail stop break frustrating 1/5

Ranking method: ☒ BM25 ☐ PLNVM ☐ Exact Match  
Text Granularity: ☒ Text Nodes ☐ Sentences  
Include synonyms in search? ☐

Reviewed in the United States on March 13, 2018  
Size: 6-Qt | Style: Ultra | **Verified Purchase**

I purchased the top of the line Instant Pot as it came highly recommended from family. The pot works great, (including liquid level) and it fails to pressurize. So I reset, check everything again, consumed 4 and 5 hours and it's still not done because the Instant Pot will not pressurize to finish. I failed and had to throw them out (pot roast, and a corned beef).

So I opened a ticket on March 4th and received a reply stating longer than normal wait times. It's now March 13th and my return window through Amazon just closed. So now I'm stuck with a product that doesn't work from a company that doesn't respond.

Do not waste your money or time.

Instant Pot Ultra 6 Qt 10-in-1 Multi-Use Programmable Pressure Cooker, Slow Cooker, Rice Cooker, Yogurt Maker, Cake Maker, Egg Cooker, Sauté, Steamer, Warmer, and Sterilizer

1,734 people found this helpful

Helpful Report abuse

flamingoland

☆☆☆☆☆ **yogurt temp is not correct**

Reviewed in the United States on May 31, 2018  
Size: 6-Qt | Style: Ultra | **Verified Purchase**

this is my 2nd instant pot, my first one, the 7 in 1 6 qt stopped working and AMAZON not IP, refunded my money. I bought the same brand because I didn't want to swap out all my accessories. This one, well, the yogurt button isn't programmed properly. Every recipe I've ever read clearly states that the first boil, yogurt needs to be at least 180 degrees. This one gets to 160. I contacted IP and (this time) they answered me, had me do a couple of tests to see if the thermostat was off and it wasn't and pretty much told me that's the way it is. I got frustrated and emailed them again, a second person told me to custom set the first part of the program to get it to 180. Well it only goes up to 172. I set that and 3+ hours later it was still at 160!!!!

My old one, you hit the yogurt button and off you went, no fuss. This one does keep the custom set up for you, but it's not getting to the correct temp and I've had to throw out several batches of SLIME and not yogurt. I now have to watch over it like a hawk and I really hate doing that. IP offered me some money back as well as a coupon to purchase another one, but honestly I think they've gotten too big too fast and until they address their interior quality issues, I don't want to buy another one.

495 people found this helpful

Helpful Report abuse

Multiple query words for searching through customer reviews text nodes-by-text nodes.

## 2. Rank sentences of a webpage given multiple query words

The screenshot shows an Amazon product page for the Instant Pot Ultra. A search overlay is active in the top right corner, displaying the query "reliable fail stop break frustrating" and search settings: Ranking method (BM25 selected), Text Granularity (Sentences selected), and Include synonyms in search? (unchecked). The page content includes two customer reviews. The first review, by Marley L., is titled "Do not buy this cooker." and describes a burn error code and a message that the pressure cooker won't cook. The second review, by Respect Privacy, is titled "Instant Pot Ultra fails to seal reliably" and describes a leaking issue where the pressure never builds up. A search bar at the bottom of the page is labeled "Search through customer reviews sentence-by-sentence using multiple keywords".

Amazon.com: Customer review

amazon.com/Instant-Pot-Ultra-Programmable-Sterilizer/product-reviews/B07588SJHN/ref=cm\_cr\_arp\_d\_viewopt\_kywd?ie=UTF...

495 people found this helpful

Helpful Report abuse

Marley L. Top Contributor: Baby

☆☆☆☆☆ **Do not buy this cooker.**

Reviewed in the United States on April 5, 2018

Size: 6-Qt | Style: Ultra | **Verified Purchase**

I am not new to pressure cooking or electric pressure cooking. This pressure cooker was supposed to be an upgrade for me but it is terrible. It has ruined two meals now. It keeps giving me a burn error code. The pot has been more than halfway full of liquid on both occasions, I have painstakingly deglazed the pot multiple times during both dinners. To make it worse, it only gives this message after a twenty minute warm up. There are no instructions regarding this error message in the manual. It sure does look nice but what good is a pressure cooker if it won't pressure cook?

Update: I ordered the Cosori 6qt pressure cooker and haven't had any issues at all!

501 people found this helpful

Helpful Report abuse

Respect Privacy

☆☆☆☆☆ **Instant Pot Ultra fails to seal reliably**

Reviewed in the United States on January 4, 2018

Size: 6-Qt | Style: Ultra | **Verified Purchase**

Doesn't work. **It fails to reliably form a seal because the lid, pot and silicone sealing ring are too loose, causing leaks, as a result the pressure never builds up.** This has happened 2 out of the 3 times that I have tried to use the Ultra. When this happens not only is the meal ruined but the energy that would have been used to build pressure goes instead into scorching the food at the bottom of the pot causing an incredible mess. This is the second Instant Pot that I have owned. My DUO60 would do this sometimes too but I stupidly bought a newer model thinking that this problem must have been fixed. The Ultra is actually worse. When this problem occurs the pot blindly goes through its cooking cycle unaware that the pressure was never raised.

I have been using stovetop pressure cookers for decades for both cooking and canning and never had difficulty getting a pressure cooker to seal. I keep my pressure cookers scrupulously clean so I know it its not pilot error. In my opinion this is just a very poor design. I will never purchase an Instant Pot product again.

If you think my experience is abnormal I encourage you to google "instant pot not sealing" to see how widespread this problem is. (Of course none of the 'fixes' suggested actually fix the problem.)

Finally, I found the user interface to be overly complicated and difficult to read unless I bend over to look at it straight on. I would gladly give up all the bells and whistles on an electric pressure cooker for rock solid basic operation. The only must have feature for me is a saute function to brown meats so I will keep searching.

620 people found this helpful

Helpful Report abuse

Search through customer reviews sentence-by-sentence using multiple keywords

immunity antibody booster 3/83

Ranking method: ☒ BM25 ☐ PLNVSM ☐ Exact Match  
Text Granularity: ☐ Text Nodes ☒ Sentences  
Include synonyms in search? ☐

vaccine series. This is similar to the lower neutralization values for Delta compared primary vaccination with mRNA-1273.<sup>19</sup> Despite the lower titer against Delta, mRNA shown to be protective against hospitalization and death from infection from the Delta suggest that boosting with the original mRNA-1273 vaccine could maintain continuous variants of concern and comports with previous reports.<sup>13,14,21</sup> Data for the neutralization titers against Delta and Beta after Stage 2 and 3 boosts will soon be available.

Our study has limitations. It was not designed to directly compare responses between different booster regimens. The sample size is insufficient for inter-group comparisons, and the demographics of those studied are not representative of the US population. Volunteers were not randomized into groups, nor stratified with respect to population characteristics or interval from last vaccination. Similarly, the sample size and interim follow-up period were not sufficient to identify rare or late adverse events following booster vaccination, and the interval between completion of the primary series and the booster vaccination evaluated is shorter than the 6 months authorized for BNT162b2. The immunogenicity data are limited to immune responses through Study Day 29, and only serologic responses are reported. The different homologous and heterologous vaccination regimens may vary in terms of cellular and humoral immune responses as well as longevity of the response.

In summary, this preliminary report demonstrates that boosting with any of the three vaccines currently licensed or authorized for emergency use in the US will stimulate an anamnestic response in persons who previously received of the primary series of any of these vaccines. Homologous boosts provided a wide range of immunogenicity responses, with heterologous boosts providing comparable or higher titers. Reactogenicity and adverse events were similar across booster groups. **These data suggest that if a vaccine is approved or authorized as a booster, an immune response will be generated regardless of the primary Covid-19 vaccination regimen.**

Search through an online article sentence-by-sentence with multiple keywords

### 3. Rank text nodes/sentences with query and synonyms of query words

large 0/0

Ranking method: ☒ BM25 ☐ PLNVSM ☐ Exact Match  
Text Granularity: ☒ Text Nodes ☐ Sentences  
Include synonyms in search? ☐

Reviewed in the United States on May 31, 2018  
Size: 6-Qt | Style: Ultra | **Verified Purchase**

this is my 2nd instant pot, my first one, the 7 in 1 6 qt stopped working and AMAZON not IP, refused because I didn't want to swap out all my accessories. This one, well, the yogurt button isn't programmed clearly states that the first boil, yogurt needs to be at least 180 degrees. This one gets to 160. I contacted them and they said they had me do a couple of tests to see if the thermostat was off and it wasn't and pretty much told me that's the way it is. I got frustrated and emailed them again, a second person told me to custom set the first part of the program to get it to 180. Well it only goes up to 172. I set that and 3+ hours later it was still at 160!!!!

My old one, you hit the yogurt button and off you went, no fuss. This one does keep the custom set up for you, but it's not getting to the correct temp and I've had to throw out several batches of SLIME and not yogurt. I now have to watch over it like a hawk and I really hate doing that. IP offered me some money back as well as a coupon to purchase another one, but honestly I think they've gotten too big too fast and until they address their interior quality issues, I don't want to buy another one.

495 people found this helpful

Helpful | Report abuse

No result appears since the webpage does not contain the word "large."

Amazon.com: Customer review

amazon.com/Instant-Pot-Ultra-Programmable-Sterilizer/product-reviews/B07588SJHN/ref=cm\_cr\_arp\_d\_viewopt\_kywd?ie=UT...

Apps

Here are some of the items I have prepared with my Instant Pot Ultra and the setting used.

Pressure Cook - Apple Sauce, Garlic Mashed Potatoes, Macaroni and Cheese, Slumgullion/ American  
 Soup Broth - Split Pea Soup using dry split peas  
 Meat/Stew - Crack Chicken, Honey Garlic Chicken, Cranberry Brisket, Dr Pepper Ribs, Beef Bourgu  
 Bean/Chili - Black Beans and Smoked Turkey Sausage  
 Steam - Sweet Potato  
 Sauté - vegetables and meat for dishes above  
 Porridge - Steel Cut Oats  
 Cake - New York Cheese Cake, Pumpkin Cheesecake, Giant Pancake  
 Egg - Hard Boiled Eggs  
 Yogurt - Greek Yogurt with 2% milk  
 Ultra - Sous Vide Tuna Steaks, Tempered Chocolate for candy making.

Many people try to figure out which model is the one for them. If you are a cook or like cooking and know how to cook many items, then you are going to want the flexibility of the Ultra. It is worth every penny and not worth trying to save a few bucks going into the Duo model. Even if you don't not cook a lot or have a wide range of cooking skills, the LCD panel really takes the mystery out of the pressure cooking cycle which is not available on the Duo or Lux models. Maybe the extra settings will entice novice cooks to try new things.

Another thing I see commented in the forums is that people are afraid to start using their Instant Pot. Either they are afraid of pressure cooking in general or running the Instant pot is too complicated, so why try.

This is a computerized pressure cooker, The venting and pressure regulating system the Ultra is excellent. If you follow some basic rules then you will be cooking worry free for a long time.

1. Always have enough liquid in your recipe, The Instant Pot cannot generate pressure if there is not enough liquid.
2. Do not over fill the pot. The bottom of page 14 in your Ultra manual has a great explanation on how much you can put in your Instant Pot Ultra.
3. After each use, make sure to clean the lid and check to see if the venting system has any food that might block the venting system.

This is a computerized pressure cooker and that makes it light years ahead of your mother's or grandmother's pressure cooker. The flexibility that the programming creates for the user makes this one of the more versatile cooking gadgets you can have in your kitchen. The computer programming makes it a safer cooking system compared to a manual stove top pressure cooker.

My family is very typical, our kids have many after school activities, we get home late and no one wants to go through the hassle of cooking. We have a slow cooker, but if we forget to set it up in the morning before we leave the house, it still takes time to put together recipes when we get home. The Instant Pot has changed all that. The pressure cooking system cuts cook times dramatically. Additionally I don't have to sit over the stove monitoring my cooking food. Once I put all the food in the pot, put the lid on and hit start, I can get many other things done around the house.

Turning on the synonyms option allows the extension to find some text nodes with words matching any of the synonyms. In the above case, the extension returns a sentence containing "great," a synonym of "large."



Amazon.com: Customer review

amazon.com/Instant-Pot-Ultra-Programmable-Sterilizer/product-reviews/B07588SJHN/ref=cm\_cr\_ar... 2/8


Apps

T. Mackel

★★★★★ **Not new to pressure cooking but WOW!**

Reviewed in the United States on November 23, 2017

Size: 6-QT | Style: Ultra | **Verified Purchase**



Not being new to pressure cooking first thing I can say is WOW. I have to confess that I had a stove top pressure cooker a long time ago and have not used one in a while. I have been out of the loop on the Instant Pot electric pressure cookers too which is a blessing in that I followed my instincts and bought the Ultra without making the mistake of trying to save a few bucks for the Duo series.

Like going to the car dealer for a new car, think of the Instant Pot line of cookers the same way. The Lux is the base model, the Duo is the model up from the base and the Duo Plus two models up from the base and the Ultra is the fully loaded model. Just like the car dealer, - more features means more money. With a street price of \$149.00 for the Ultra, you can be patient and find them on sale from time to time. However, in any case \$149.00 is a good price for what this cooker can do for you. If you use this cooker you will make up the cost of in saving on not eating

out as much. The food you can cook is that good.

I have been cooking in this Instant Pot every day since I received it; sometimes twice a day. I have also made sure to make things that require me to use more than the manual setting that can be created under Pressure Cook or Ultra. Here are my Pros and Cons.

Pros:

- LCD display - one of the **big** things I hear in the discussion groups is "I pushed the button and it says "ON", but I don't know what is happening. The Ultra has a cooking graph that displays the progress through the preheat, cooking and warming phases so you know right where you are in the process. The LCD display is miles ahead of any of the control panels on any other model offered by Instant Pot.
- Venting, Quick release and the Pressure Regulator are improved. The vent/regulator now is controlled by a separate button - the Quick Release button. Push the button into the locking position and it pops the Vent up to release the pressure, turn the quick release knob and unlock the Vent so it drops back down and stops the pressure from releasing.
- Ultra Program You can set the exact Temp, as low as 104 degree and as high as 208 degrees.
- Set your Altitude and the programming on the Ultra will make the adjustments.
- Aesthetics - It is much more attractive with the LCD panel than the other models

In the above case, the extension returns a sentence containing "big", a synonym of "large."

## 2.5 Ratings (Optional)

To compare performance of different ranking functions, one can indicate the relevance (rating) of a current result with the like or dislike button. More details are available in Section 3.5.

## 3. Implementation Details

There are two source folders: `extension` and `flask`. The `extension` folder contains the frontend scripts to create the GUI of the Chrome extension, extract text nodes from a web page, and present results from the backend model. The `flask` folder contains Python scripts to create a backend server and model and handle user feedback. The model takes the text nodes and query text from the frontend, splits the text nodes into sentences, and ranks the sentences based on the query text.

### 3.1 Frontend

The structure of the `extension` folder follows the standard format of Chrome extensions [3]. Within this folder, the `manifest.json` is a required configuration for an extension that specifies various properties, including the name and version of the extension, as well as

information about where Chrome can find the icons of the extension as well as the files related to the popup user interface of the extension (pictured above).

The popup UI is handled by the `popup.html`, `popup.css`, and `popup.js`. The HTML file contains the markup of the UI elements in the popup, and the CSS (Cascading Style Sheet) file adds styling to each of the elements and the overall popup. The core logic of the extension lives in `popup.js`. Within this file, event handlers are set up to listen for user interactions with the search box, search button, navigation arrows, and like/dislike buttons in the popup.

Upon receiving a user interaction to search for text, the handler for the search button, `onSearch`, will execute a script on the currently displayed page to gather up all the visible text nodes within the document, and will execute an asynchronous HTTP (AJAX) request to the backend server to obtain the rankings of the text nodes. Subsequently, the handler will execute another script on the currently displayed page to highlight the relevant text nodes accordingly.

Highlighting of search results is handled in `dom.js`. The `highlight()` function iterates through the offsets provided from the backend. The text node containing a match is split up into separate text nodes based on the provided offsets, then reinserted as new `<span>` elements into the DOM that are styled with a background color using a CSS. Since inserting these elements involves removing existing text from the current text node, and we want to highlight in a single pass, care must be taken to keep track of the already consumed offset positions. This is achieved by using the `subtracted` variable for tracking.

When executing a new search, or dismissing the search box, the `clearHighlights()` function is called to remove all highlights from the document. This finds all highlight spans created by `highlight()` and simply merges their text node content back into their parent nodes.

In order to navigate between ranked search results in the document, the extension keeps track of all the inserted `<span>` elements in an array, and the current position, and uses the `Element.scrollToView()` API to ensure the element containing the text node is visible in the browser viewport.

## 3.2 Backend server protocol

The server endpoint, `POST /search` expects the body to be a JSON object like this:

```
{
  "search_text": "some",
  "doc_content": {
    "text_nodes": [
      "some text",
      "another text"
      "this is something some"
    ]
  }
}
```



```
}
```

`text_nodes` is the `nodeValue` of all non-whitespace DOM text nodes in the document, in the order in which they appear, and `search_text` is the text the user is searching for.

The response from the endpoint is a JSON array containing indexes from `text_nodes` that match, and the offsets of matching text within those nodes. It can optionally also contain a `wordOffsets` array that gives the index of words within each match.

```
[
  {
    "index": 0,
    "offsets": [0, 4]
  },
  {
    "index": 2,
    "offsets": [0, 30]
    "wordOffsets": [
      [8, 12],
      [18, 22]
    ]
  }
]
```

### 3.3 Text preprocessing

`intelligentMatch.py` in the `flask` folder contains the class `IntelligentMatch`, which includes methods to preprocess the incoming text nodes and query text. Those methods use built in functions available from the Gensim package [4]. Depending on the user selection, each text node is treated as a document or split into multiple sentences, each corresponding to a document. Words in each document are first tokenized to remove white space characters and create a list of words. Any stop word given by those in the file `stopwords.txt` is removed from the document tokens. This is followed by word stemming. Next, a dictionary is built using the resulting words from all documents. Finally, each document is represented by a bag of words (BoW) using the dictionary. A query is subject to the similar preprocessing as each document. The query BoW is created with the dictionary obtained from the documents. An option to add synonyms of each query word to the query text has also been implemented using the Natural Language Toolkit (NLTK) package [5]

### 3.4 Document (text unit) ranking

Ranking of the documents is implemented as a method in `IntelligentMatch`, which calls ranking functions in `rankingFunctions.py`. Two ranking functions are available: (i) BM25 [1] and (ii) PLNVSM [2]. For (i), we set  $k=k_1=1.5$  and  $b=0$ . For (2), we set  $b=0$ . It is also possible to perform exact matching with the extension.

- Pivoted Length Normalization VSM [Singhal et al 96]

$$f(q, d) = \sum_{w \in q \cap d} c(w, q) \frac{\ln[1 + \ln[1 + c(w, d)]]}{1 - b + b \frac{|d|}{avdl}} \log \frac{M + 1}{df(w)}$$

- BM25/Okapi [Robertson & Walker 94]

$$b \in [0, 1]$$

$$k_1 \in [0, +\infty)$$

$$f(q, d) = \sum_{w \in q \cap d} c(w, q) \frac{(k + 1)c(w, d)}{c(w, d) + k(1 - b + b \frac{|d|}{avdl})} \log \frac{M + 1}{df(w)}$$

6

### 3.5 Ratings (Optional)

The handlers for the like/dislike buttons, `onLike` and `onDislike`, will send AJAX requests to the backend to store a record of each result the user liked or disliked.

The backend server endpoint `POST /rate` expects the request body to contain a JSON object with the following fields:

```
{
  "url": "<the URL of the web page>",
  "query": "<the user-submitted query>",
  "result_index": "<the index of the result, based on its relevance ranking>",
  "liked": "<a boolean value indicating if the user liked or disliked the result>",
  "ranking_method": "<indicates the ranking method selected by the user>"
}
```

User ratings will be saved to a CSV file along with records of the average precision of the operation. The endpoint will respond with a JSON object indicating the success or failure of the operation:

```
{
  "status": "<success || failure>"
}
```

`ratings.py` contains the logic to store and process user ratings of the ranking results. The ratings together with website url, query, ranking function and rank are written to the file `ratings.csv` in a directory called `ratings`. Average precision and mean average precision are stored in the files `top3-avg-precisions.csv` and `top3-mean-avg-precisions.csv`. For each website, query and ranking function, the average precision is

defined as the number of relevant results divided by the rank of the last relevant result, and is calculated using the top-k results, where  $k=3$  by default. The mean average precision is calculated for each ranking method/function over all its recorded average precisions. Ability to output such information would allow for more rigorous comparison of different ranking functions and parameters in the future.

## Team Member Contributions

1. Marcus Hwai Yik Tan (htan8)
  - Leader
  - Responsible for most backend work
2. Omid Afshar (oafshar2)
  - Frontend
    - Add Like/Dislike buttons to extension pop-up for user to indicate relevance of result
    - Implement AJAX call to “/rate” route on server for user relevance feedback
    - Add “Ranking method” radio buttons to extension pop-up so user can toggle between ranking methods (BM25, PLNVSM, Exact Match)
    - Add “Text Granularity” option to extension pop-up so user can alter the text granularity (Text Nodes or Sentences)
    - Add option in extension pop-up for user to change search results to include/exclude synonyms
    - Add event handlers to ensure the extension reloads results on the fly when a user changes an option in the pop-up
  - Backend
    - Add “/rate” route to process user relevance feedback
    - Add USER\_RATINGS data structure to keep track of user ratings in-memory
    - Add “requirements.txt” to simplify dependency installation process
3. Xue Ying Lin (xylin2)
  - Frontend
    - Extension core code for button and popup
    - Search box and next / previous buttons
    - Extract text node content from the current document using DOM
    - Design the JSON protocol between extension and backend
    - AJAX calls to server for search
    - Highlighting of search results and navigation
    - Added highlighting of words within text node or sentence
    - Handle hidden DOM elements so that they don’t show up in results
  - Backend
    - Fake node.js backend for testing the protocol with extension

## References

[1] BM25

S. E. Robertson and S. Walker. Some simple effective approximations to the 2-Poisson model for probabilistic weighted retrieval, in Proceedings of the ACM SIGIR, 1994

[2] Pivoted Length Normalization Vector Space Model

A Singhal, C. Buckley and M. Mitra. Pivoted document length normalization, in Proceedings of ACM SIGIR, 1996

[3] Getting started with Chrome extension for developers

<https://developer.chrome.com/docs/extensions/mv3/getstarted/>

[4] Topic modeling library (Gensim)

<https://pypi.org/project/gensim/>

[5] Natural Language Toolkit (NLTK)

<https://www.nltk.org>