

Lab3: Information Retrieval

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Requirements of an Image Search Task

The current Image Search System provides a total of two search methods, which are divided into simple search and advanced search. The system will provide two pages, namely Simple Search Interface and Advanced Search Interface. These two methods can jump through a button. The difference between the two searches is mainly the restriction of **Category**, and more detailed information can be obtained in the later description. The search results will be displayed in `resultReviewInterface`, and the results display interface also provides a refinement operation function based on category.

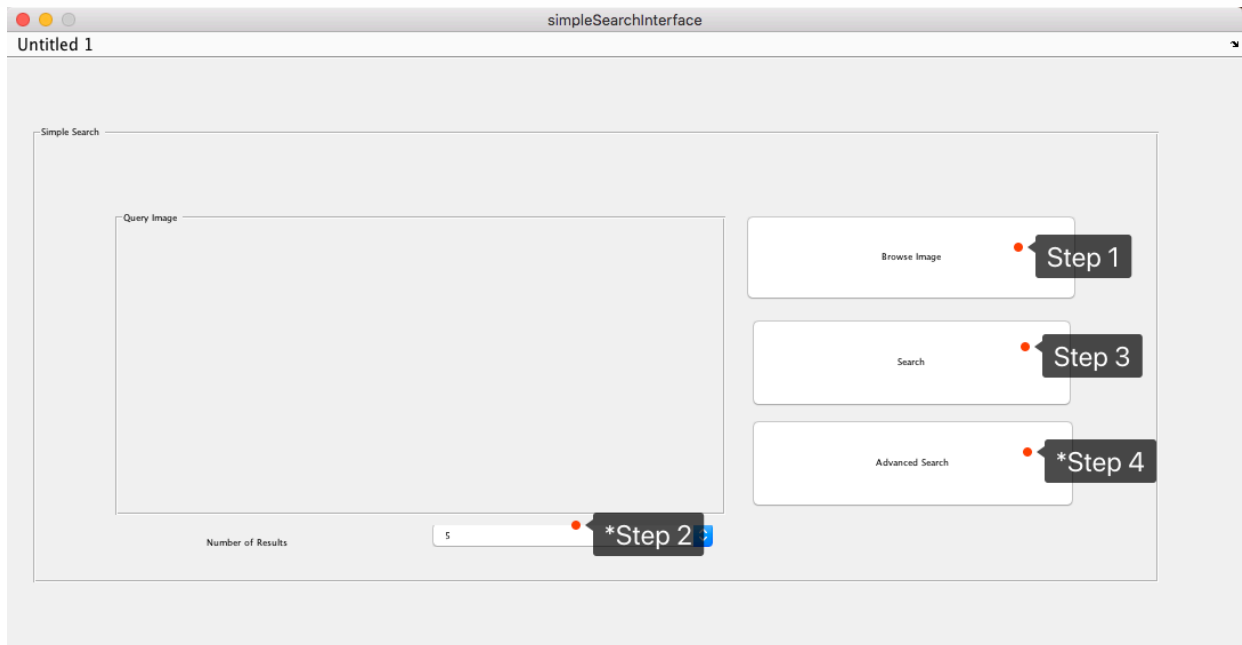
P.S. In the following description, i use * to indicate that the current step is optional and we can skip it.

Simple Search Section

In the simple search part, users only need to provide pictures to be searched. The operation process is as follows:

1. Click on the `Browse Image` button, and select the picture you want to search in the pop-up file selection box.
 - The system only accepts `.Jpg, .Png, and .Bmp` three formats.
 - After selecting pictures, the system will automatically display the selected pictures in the left Query Image picture display box.
2. *Under the picture display box, you can choose `Number of Results`.
 - This step is optional. If skipping, **5** matching images will be displayed by default as search results.
 - The current version of the system only has **5, 10 and 15** three options.
3. Click the **Search** button, and the system will automatically execute the search process.
 - Automatically close the current window after the search is finished, and jump to the result display interface to display the results.
4. *Click the `Advanced Search` button and jump to the advanced search interface.
 - This step is optional. If you want to proceed with advanced search, you can perform this step.
 - detailed use will be introduced in the next section.

Below is a simple search interface screenshot that can be used in conjunction with the above steps.

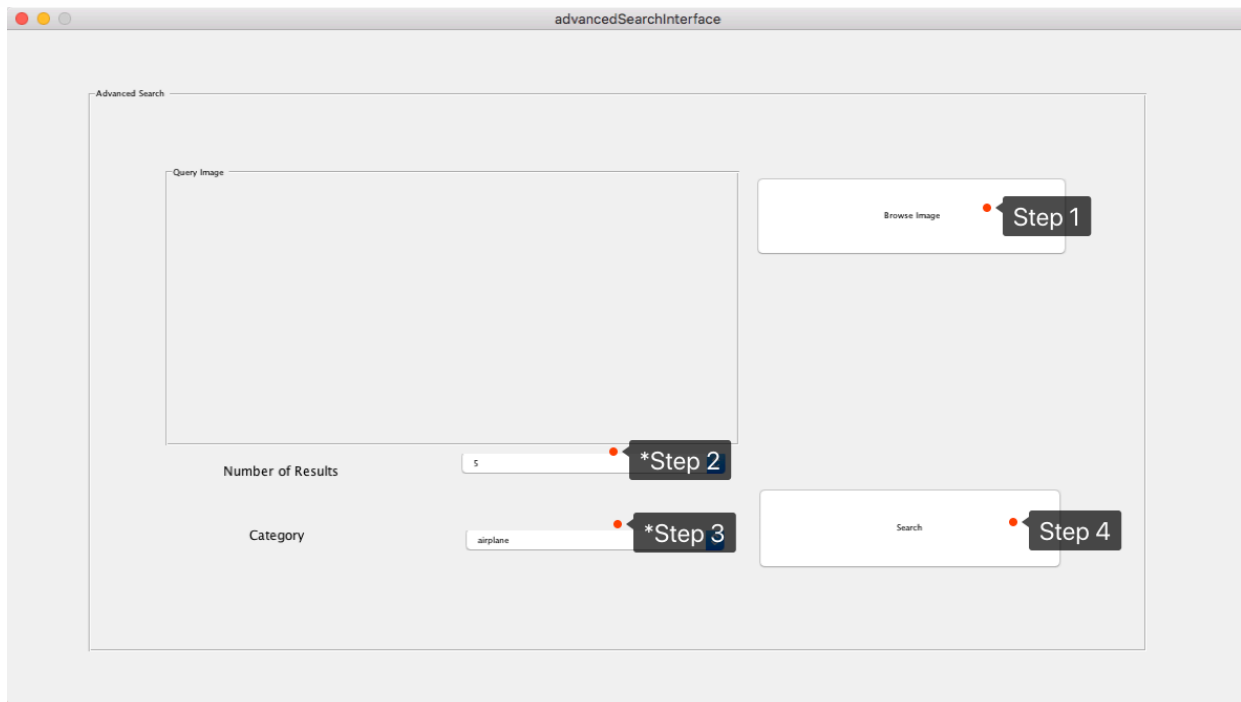


Advanced Search Section

In the advanced search part, users need to provide pictures to be searched and categories wanted. The operation process is as follows:

1. Click on the **Browse Image** button, and select the picture you want to search in the pop-up file selection box.
 - The system only accepts **.Jpg, .Png, and .Bmp** three formats.
 - After selecting pictures, the system will automatically display the selected pictures in the left **Query Image** picture display box.
2. *Under the picture display box, you can choose **Number of Results**.
 - This step is optional. If skipping, **5** matching images will be displayed by default as search results.
 - The current version of the system only has **5, 10 and 15** three options.
3. *Category can be selected below the result number selector, that is, the type of search result selection.
 - This step is optional, if skipping the most matching picture that displays the default **airplane** category as the search result.
4. Click the Search search button, and the system will automatically execute the search process.
 - Automatically close the current window after the search is finished, and jump to the result display interface to display the results.

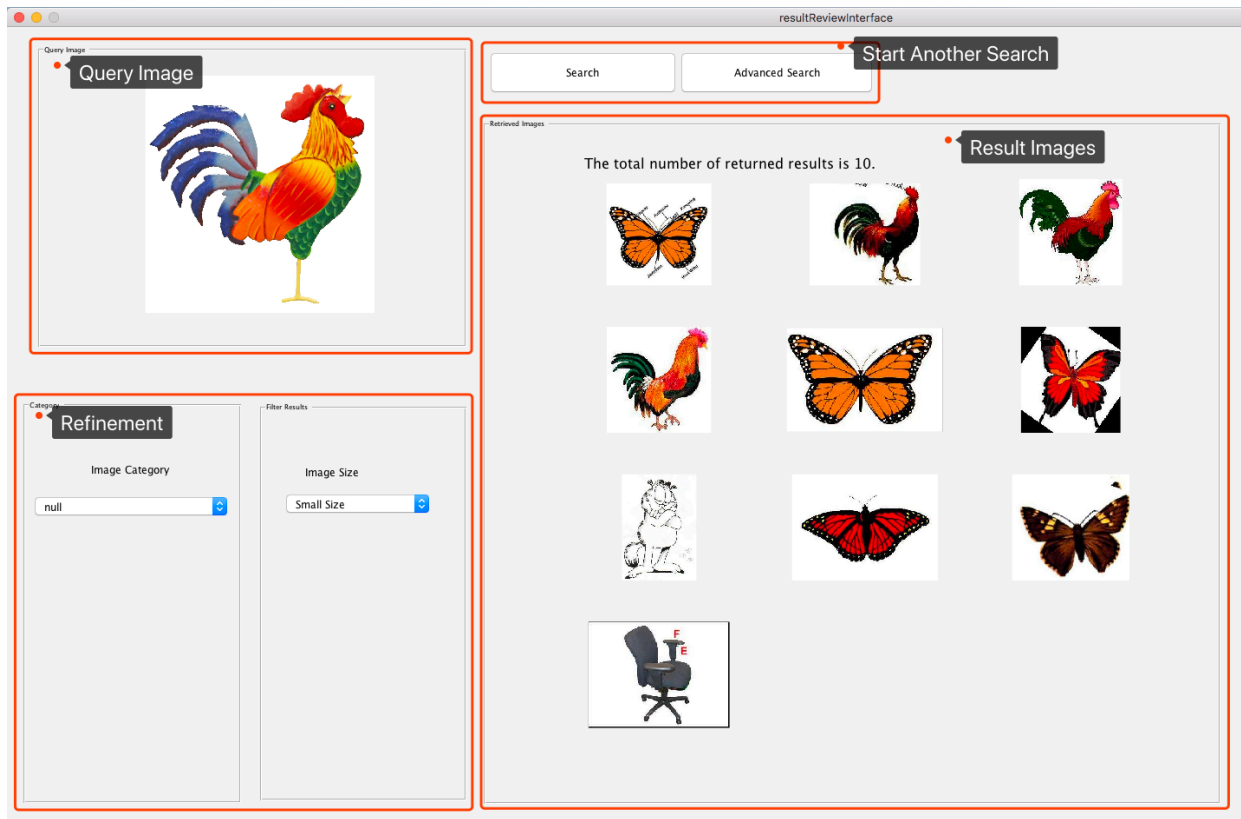
The following is a sketch map of the advanced search interface, which can be combined with the above steps.



Results Review Section

The search results mentioned in the two parts will be displayed in this section. In the introduction of this part, we will take **the simple search results** as an example. *P.S. if you haven't gone through the first two parts of the search process, please search first and then operate the current interface.*

1. *Choose the category in the lower left **Refinement** area and conduct two screening of the results.
 - This step is an optional step.
 - Based on category selection and size based selection, this operation has chosen category based. Therefore, the latter has no effect in this system, and the selection will not get responds.
2. *Conduct second searches, that is, change the picture for the next search.
 - Select the required search method in the **Start Another Search** area on the upper right corner.
 - Clicking the **Search** button will close the current page and jump to the simple search interface.
 - Clicking the **Advanced Search** button will close the current page and jump to the advanced search interface.



Designs & Features of The Image Search System

Simple & Advanced Search Interface

The most basic functions and related properties based on the two search interfaces have been mentioned in the previous section, so they are not mentioned here. I only choose a few parts that need extra implementation to make a brief introduction.

Image Automatic Filling

In order to automatically fill in the progress display box after selecting the pictures, and store picture information for subsequent search functions. I carried out the following operations:

- Use `axes(handles.imgPanel);` to create a coordinate system and display the picture in the display box.
- Use global variable `global queryImage;` to save picture information.

```

global queryImage;

[query_fname, query_pathname] = uigetfile('*.jpg; *.png; *.bmp', 'Select
query image');
axes(handles.imgPanel);
fpath=[query_pathname query_fname];% path + file name
queryImage=imread(fpath); % read in
imshow(queryImage);% display

```

Jump to Result Page With Changing Parameters & Close Current Page

- In order to display `query image` and `result images` in the subsequent display window, I pass the picture information to the `resultReviewInterface` with the address information tuple of the result picture and read and handle them in the script of the latter.
- At the same time, close the current window as required and open the next window. So call `close(gcf);` to close the current window.
 - `GCF` is the current window.

The parameter transfer code for **simple search** is as follows:

```

global queryImage;
global numberOfResults;
if(ischar(numberOfResults))
    numberOfResults = str2num(numberOfResults);
end
bestImages = imageSearch(queryImage,numberOfResults);
close(gcf);
resultReviewInterface(bestImages,queryImage);

```

The parameter transfer code of the advanced search is as follows:

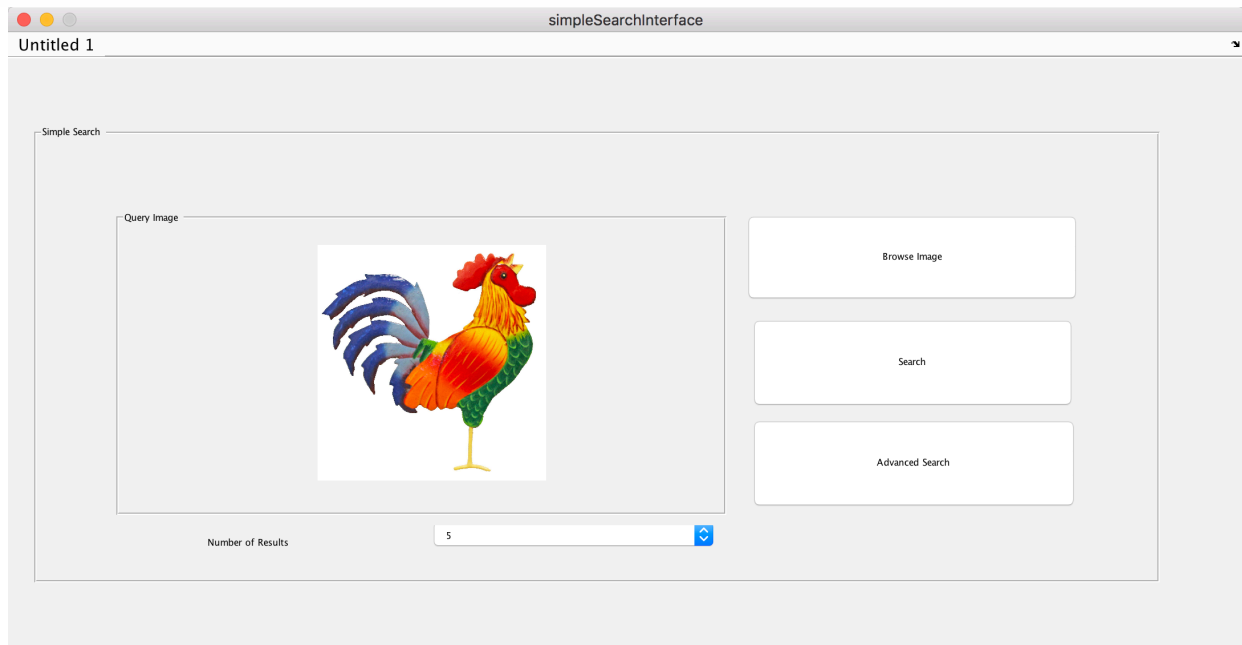
- The **imageSearchFilter** function is called in the following code, which is another script function that receives pictures, numbers, categories, and provides the result of advanced search. Detailed script content will be introduced in the next section.

```

global queryImage;
global numberOfResults;
global category;
if(ischar(numberOfResults))
    numberOfResults = str2num(numberOfResults);
end
bestImages = imageSearchFilter(queryImage,numberOfResults,category);

close(gcf);
resultReviewInterface(bestImages,queryImage,category);

```



Implementation of Simple Search

In this part, I modified the previous code, canceled the function of the part of the picture display of the original script, and saved the result as the return value and returned it. In fact, a simple search is to extract the highest pictures according to the score of pictures, and store them in `bestImages` tuples and return them as result.

- The operation of taking out the pictures' ID is as follows: `bestMatch = imageIDs(1:numberOfResults);`

```
[imageIDs, scores] = retrieveImages(queryImage, imageIndex); % search
database using the query image

resultsCount = length(imageIDs);
if resultsCount >= numberOfResults
    bestMatch = imageIDs(1:numberOfResults);
end

for i = 1:length(bestMatch)
    bestImage = imageIndex.ImageLocation{bestMatch(i)};
    bestImages{i} = bestImage;
end
```

Implementation of Advanced Search

In this part, I rewrote a `imageSearchFilter.m` script. The core idea is:

- Get the name of the picture. Through string matching, each item in the tuple is scored by the string matching.
 - If the name of the current picture contains a category substring, then store it in the result tuple.
 - Because it is a sequential search, that is, according to the order of grading. Therefore,

the first match must be a higher score, which ensures the correctness of the algorithm.

```
[imageIDs, scores] = retrieveImages(queryImage, imageIndex); % search
database using the query image

bestMatch = cell(1,numberOfResults);

resultsCount = length(imageIDs);
index = 1;
for i = 1:resultsCount
    if index<=numberOfResults
        tempStr = imageIndex.ImageLocation{imageIDs(i)};
        if size(strfind(tempStr,category),1)~=0
            bestMatch{index} = tempStr;
            index=index+1;
        end
    else
        break;
    end
end

if index==1
    bestMatch = cell(0);
end
```

It is important to emphasize that the implementation of the **refinement** in the follow-up display interface is very similar to the implementation of this part. Only a few small details are different, so the related introduction is omitted in the next part.

Results Review Interface

The result shows that the interface is divided into **four main regions**:

1. Query Image

- In the display box of this area, users will automatically display pictures added by users during the search phase.

2. Result Images

- The display box in this area displays the search results of users entering picture.
- The text in the above area shows the number of the results.
- The most matching pictures will be displayed in the below area. (the number is set by the user, in this case, **10**.)
- **If the user modifies and chooses categories in the **Refinement** part, the region will automatically update to the filtered results. (Displayed in the second diagrams in this part.)**

3. Refinement

- This region can select categories of search results through category selection drop-down menu.
- **If the result of the display comes from `Simple Search`, that is, there is no control category, then the current selection box will be automatically selected as `null`. (Display in the first diagram in this part.)**
- **If the result of the display comes from `Advanced Search`, that is, the category has been controlled, then the current selection box is automatically selected as the category selected in the search step. (Displayed in the third diagrams in this part.)**
- Based on the previous step, if the advanced search of the control category has been carried out, it is not recommended to choose the category again.
- **If the result of the selected category is empty, that is, if the number is 0, the image on the right display area will not be displayed. (displayed in the fourth diagrams in this part.)**
- The implementation of this part of the code is very similar to the screening implementation of the previous part of the advanced search. Only a few small details are different, so the introduction and presentation of the related code are omitted here.

4. Start Another Search

- You can start a new search by clicking the button in this area.
- Clicking the `Search` button will close the current page and jump to the simple search interface.
- Clicking the `Advanced Search` button will close the current page and jump to the advanced search interface.

