Research of Online Illustration Communication Platform

Chengxia Liu(✉)

Computer School, Beijing Information and Technology University, Beijing 100101, China
cecilia7812@163.com

Abstract. In the information age, there are more and more kinds of information. As a form of recording visual information, illustration has become an important means of network communication to assist text understanding. This paper mainly studies how to create, search and exchange illustrations online. On this platform, illustration search can be realized by fuzzy search through the average hash of image content, or can also be realized by keywords search with tags. In addition, users can evaluate each other's illustrations and collect their favourite illustrations. Finally, an illustration communication platform model is implemented for testing and follow-up research.

Keywords: Average hash · Fuzzy search · illustration communication platform

1 Introduction

The research shows that more than 80% of the information obtained by human beings comes from visual information. In today's information age, as the carrier of visual information, graphics and images are widely used in many fields, such as cartoons, animations, small videos, etc. Illustrations, as a more intuitive form of language understanding, play an important role in these fields.

There are many related platforms and websites for illustration communication abroad, such as Pixiv, deviantart, Pinterest, IbiStain, etc.. But most of their services require registration and payment. In China, there are also many websites, such as Zhanku, Drawyo, Illustrator Home, Hulai, and some comprehensive social platforms, which can also exchange illustration works. Most of these platforms are more focused on their social functions but not the illustration communication functions. In order to highlight the communication of the illustration, the research of illustration communication platform is necessary and meaningful for users.

2 Function Design of Illustration Communication Platform

As an illustration communication platform, there are two types of users, registered users and ordinary tourists. Registered users can create, upload, search and collect works after logging in. Ordinary tourists can only search and browse works. The functions of the platform are shown in Fig. 1.

C. F. Peng et al. (Eds.): EIMT 2023, AHSSEH 8, pp. 662–668, 2023.
https://doi.org/10.2991/978-94-6463-192-0_86

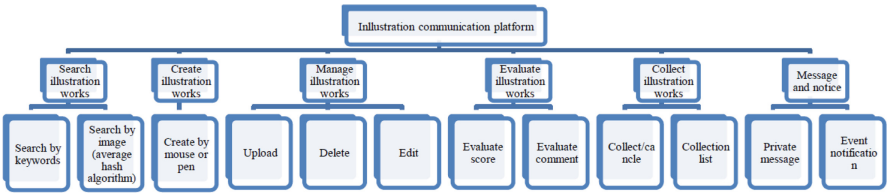


Fig. 1. Functions of Illustration Communication Platform

3 Image Search Algorithm and Its Implementation

When users want to search for an image similar to an image, they can first calculate the fingerprint of the image. When searching, the calculated fingerprint value will be compared with the fingerprint records of the existing works in the database. If the Hamming distance between the two comparison objects does not exceed the threshold, they will be considered as similar works.

The core of the search process is how to obtain the fingerprint of the image. Among them, perceptual hash algorithm [1, 2], average hash algorithm [3, 4] or difference hash algorithm [5] and various improved algorithms [6–8] can be used to extract file features and generate fingerprints that can be used for comparison, and then compare and retrieve media resources such as pictures and videos. The average hash algorithm is a hash algorithm based on low-frequency signals, which is fast and easy to implement, and is also the algorithm used in this paper.

3.1 Frequency Reduction Processing of High Frequency Signal

The basic principle of the average hash algorithm is to reduce the frequency of the image to obtain the hash value that can be used as the image fingerprint. Generally, high-frequency signal refers to the signal that changes rapidly. For example, in a colour image, the place at the edge of the object (the brightness or gray level changes sharply compared with the surrounding environment) is high-frequency relative to other parts. Generally speaking, the high-frequency components in the image determine the specific details, such as colour, brightness, transparency, etc., while the low-frequency components determine the overall structure of the image. As shown in Fig. 2.

Fig. 2. High Frequency Information is Gradually Lost from Left to Right

(a)Original image (b)After high frequency reduction (c) Grayscale image (d) Average hash fingerprint

Fig. 3. Step Results graph of Average Hash Algorithm

3.2 The Process of Average Hash Algorithm

(a) Reduce the size of the image to 8 * 8, remove the high-frequency components of the image, and avoid the differences that may be caused by the size of the original image in the next calculation.

(b) Convert the reduced image into a grayscale image, so far the original image will only retain the basic information of brightness and structure. In actual development, you can first convert the original image into a bitmap (bmp format) file, and then obtain the color of each pixel from left to right, from top to bottom, and convert it into grayscale color according to the gray formula Gray = R * 0.299 + G * 0.587 + B * 0.114 and save it in byte form. Finally, you will get a byte array with a length of 64.

(c) Calculate the average gray value of the current 64 pixel image. Calculate the average value after summing the byte array obtained in the previous step.

(d) Compare the gray value of each pixel in the figure with the average value obtained above. If it is greater than or equal to the average value, it is recorded as 1; If it is less than the average value, it is recorded as 0. Finally, the 0 and 1 obtained from the comparison will be combined to form a 64-bit data, which can represent the fingerprint record of the detected image. If the content of the string is re-converted to a 64-pixel image of 8 * 8 according to the rule that 0 is black and 1 is white, a binary black-and-white image describing the structure of the thumbnail of the original image will be obtained. The results of the above four steps are shown in Fig. 3.

After obtaining the fingerprint of the image, only the Hamming distance between the fingerprints of each image needs to be calculated when searching. If the Hamming distance is within a certain threshold range, it is considered as a similar image, otherwise it is considered as a different image.

3.3 Implementation of Average Hash Algorithm

With the steps in 3.2, the implementation of average hash algorithm is shown in Fig. 4.

The conversion of grayscale image is to remove the color information of the image. The code on the right of Fig. 4 is the reference. The code on the left side of Fig. 4 is the comparison mean fingerprint process. When fingerprint comparison is required, it will be determined whether the two images are similar according to the difference between the two comparison objects. That is, count the different bits between two 64 strings, and the result will be the Hamming distance between them. Finally, judge whether the two images are similar according to whether the Hamming distance exceeds the threshold.

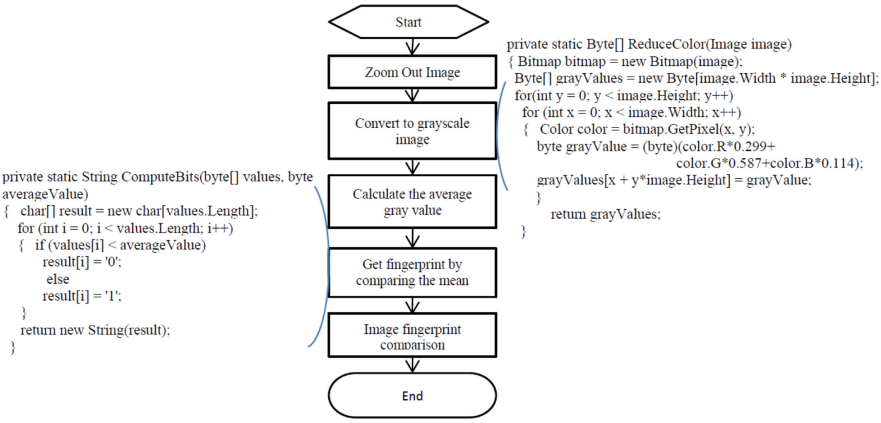
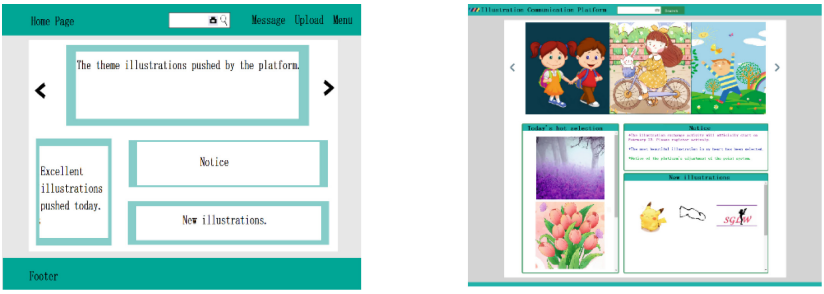


Fig. 4. Image Search Flow Chart



(a)Home Page of Design (b)Home Page Implemented

Fig. 5. Home Page Layout and Actual Home Page of the Platform

4 Implementation of Illustration Communication Platform

4.1 Home Page of Illustration Communication Platform

Because the illustration communication platform is for the general public, the design of the platform should be simple and clear. The layout of the main interface of the platform is shown in Fig. 5 (a), and the actual effect is shown in Fig. 5 (b).

4.2 Search Function of Illustration Communication Platform

When selecting image search, select a local image, first get the fingerprint of the image, and then compare it with the image in the library to search for similar images. As shown in Fig. 6.

In addition to using the average hash algorithm for image search, the platform can also search by keyword. That is, search in the title and label of the illustration works according to the entered keywords, and perform fuzzy search on the data. When the

Fig. 6. Search of Illustration Works

works containing keywords in the title or label are retrieved, the record will be included in the results and sorted according to the settings, and finally the sorting results will be output to the search page.

4.3 Online Drawing Function of Illustration Communication Platform

The creator can upload his own illustration works to the platform, and the creator can describe the works for identification when uploading the works. The creators can also create illustration works online through canvas. When creating the illustration works, the canvas is needed to draw on it. The entire canvas is composed of two layers of canvases. One layer of canvases is used to support the preview of brush action, which will be cleared and redrawn after each operation. The other layer is used to save the actual image state, and the final image to be presented will be obtained from the canvas of this layer. All operations on the first layer of canvas will be saved to the second layer of canvas, and the first layer of canvas will clear its contents after saving. Initialization program of the two-layer canvas is shown in Table 1.

When the mouse is pressed in the canvas area, the drawing state started. When the mouse starts to move on the canvas, different feedback will be given on the canvas according to the selected tool. Take drawing a line as an example. Move the mouse while holding down the left mouse button, and the line will extend from the coordinates when the left mouse button is initially pressed to the current cursor position. The program of using the mouse to draw on the canvas with the line tool is shown in Table 1.

In addition to online creation, you can also load the created works and overwrite the original works after editing. Other functions of the platform will not be described one by one.

Table 1. Relevant codes of online drawing function.

(a) Initialization program of the two-layer canvas

```
initCanvas() {
        drawing =
document.getElementById("drawing");
        drawing.width = canvasWidth;
        drawing.height = canvasHeight;
        if (drawing.getContext)
{
          context = drawing.getContext("2d");
        }
        canvasTop = $(drawing).offset().top;
        canvasLeft = $(drawing).offset().left;
        drawing_bak =
document.getElementById("drawing_bak");
        drawing_bak.width = canvasWidth;
        drawing_bak.height = canvasHeight;
        if (drawing_bak.getContext)
{
          context_bak = drawing_bak.getContext("2d");
        }
    }
```

(b) Drawing program using the mouse tool

```
$("#drawing_bak").mousemove(function (e) {
      var x = e.pageX - canvasLeft;
      var y = e.pageY - canvasTop;
      if (graphType == "line") {
        if (canDraw) {
          context_bak.beginPath();
          clearContext();
          context_bak.moveTo(startX, startY);
          context_bak.lineTo(x, y);
          context_bak.stroke();  }    }    }
$("#drawing_bak").mouseup(function (e) {
    if (canDraw) {
      canDraw = false;
      var image = new Image();
      if (graphType != "eraser") {
        image.src = drawing_bak.toDataURL();
        image.onload = function ()
{context.drawImage(image,0,0,image.width,
      image.height, 0, 0, canvasWidth, canvasHeight);
        clearContext(); }    }    }    }
```

5 Conclusion and Expectation

This article introduces a communication platform specially designed for illustration, which aims to communicate with illustration works. The average hash algorithm is used for image search in the platform, which is simple and fast, but not stable enough. In the future, the algorithm can be further improved to make the search function faster and more stable.

Acknowledgments. This work was financially supported by the Key projects of Beijing Humanities and Social Sciences Fund(No.19JYA001) .

References

1. Ling Du, Anthony T.S. Ho and Runmin Cong 2020 Perceptual hashing for image authentication: A survey *Signal Processing(Image Communication)* vol 81 doi: https://doi.org/10.1016/j.image.2019.115713
2. Du Ling and Chen Zhen 2019 Survey on Image Tamper Detection with Perceptual Hashing *Journal of Frontiers of Computer Science and Technology* Vol 13 pp722-741

3. L. Yan, X. Liu, J. Ren, W. Shi and J. Dong 2021 Research on Thangka Image Retrieval Algorithm Based on Mean Hashing *5th International Conference on Automation Control and Robots (ICACR)* Nanning China pp 12–17
4. Yao Yong-ming, Yang Chun, Wu Ling-yan and Shen Ye 2016 Research and Application of the Image Hash Algorithm *Journal of Xi'an University (Natural Science Edition)* Vol 19 pp30-33
5. Liu Fan, Wang Ying, Yan Guoyu and Jang Suiping 2021 Image perceptual hashing based on image differential *Computer Engineering and Design* Vol 42 pp782-789
6. X. Yao, M. Wang, W. Zhou and H. Li 2022 Hash Bit Selection With Reinforcement Learning for Image Retrieval *IEEE Transactions on Multimedia* doi: https://doi.org/10.1109/TMM.2022.3213476
7. XIA Yuxuan, QU Haicheng and GUAN Qianwen 2022 An improved hash algorithm for image similarity calculation *Intelligent Computer and Applications* Vol 12 pp110-120
8. Huang Jiaheng, Li Xiaowei, Chen Benhui and 2017 Yang Dengqi A Comparative Study on Image Similarity Algorithms Based on Hash *Journal of Dalianligong University* Vol 2 pp32-37