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Analysis of Children's Literature Works based on Intelligent Image text Recognition

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Abstract.

In order to improve the analysis effect of children's literary works, this paper builds an analysis system of children's literary works based on intelligent image text recognition technology. Moreover, this paper proposes a retrieval method with rotation, scale, and displacement invariance. For more abstract hand-drawn sketches, this paper proposes to use classification to identify the categories of sketches and to assist the retrieval process based on the similarity information of the tags.In order to improve the demand for the analysis of literary works, this paper uses images as the identification object to construct a system framework and process.In addition, in order to avoid the impact of speed on the accuracy of corner recognition, this paper performs isometric resampling of strokes in the preprocessing stage, and introduces an image structure feature recognition system.Finally, this paper designs experiments to test the system. From the test results, it can be seen that the system basically meets the analysis needs of children's literature and can be applied to practice.

Keywords: Intelligent image recognition; text recognition; children's literature; work analysis

1.INTRODUCTION

Regarding the value of children's literature, the famous children's literature expert Jiang Feng summarized it as: education, aesthetics, pleasure, and reproduction of life.The value of children's literature is divided into four categories: literary standard value, individual value, social value and Chinese language value. Among them, the literary standard value includes aesthetic non-utilitarian, aesthetic image shaping, aesthetic emotion expression and child standard. Individual values include: providing the pleasure of reading, developing imagination, psychological compensation, improving critical thinking skills, enriching personal experience, forming good self-efficacy, and increasing knowledge.Social value mainly includes the formation of virtue, the formation of scientific literacy, and the cultivation of social communicative competence. Chinese language knowledge mainly includes: promoting the ability of listening, speaking, reading, and writing, and cultivating Chinese language emotions. In these levels, the literary standard value is the core and foundation of the literary value system, which regulates and restricts the other three value attribute forms [1].

Children's literature is first of all literature, which is the aesthetic ideology that appears in the discourse implied. Like other literary works, aesthetics is its noumenal attribute, and aesthetic value is its noumenalvalue.When we read literary works, study literary works, and study literary works, we do not have a utilitarian vision as we treat explanatory texts.We use an aesthetic attitude to feel the emotions revealed in the work, and appreciate the style of the work, so that our soul can be beautifully reconciled and our spirit can be unexpectedly comforted.Hegel believes that “only when the usefulness of art is to improve human beings, it is the highest purpose of art.” In the unity of multiple functions centered on aesthetics, we should shift our focus from utilitarianism to aesthetics.Children's literature works are created by children's literature creators using aesthetic principles based on children's age characteristics and aesthetic characteristics, which reflect children's real life and spiritual world and improve children's aesthetic ability [2].

As an important literary category, children's literature has not been paid enough attention to its disciplinary status. In the category of literature, its uniqueness has been concealed for a long time.Since the new era, with the development of my country's children's literature, through the joint efforts of Chinese children's literature writers and researchers, my country's children's literature has achieved great development in creation and research, and this discipline is also steadily advancing on the glorious thorny road [3].

Since the beginning of the new century, the literary and art circles have shifted from literary research to cultural research, and the field of literary research has been expanding during this transition. For children's literature, research generally starts from the history of children's literature, writers' works, and views on children.However, looking at children's literature since the turn of the century, the characteristics of entertainment, typology, and visualization have become increasingly obvious. Pure literary research, especially the study of text content, cannot fully satisfy the current developmental characteristics of children's literature.The intervention of cultural studies is necessary. In particular, it is imperative to conduct research based on visual culture and image theory in the phenomenon of "pictures" in the texts of children's literature.

1. Related work

The text image recognition method follows the traditional image classification mode, that is, the corresponding manual features are extracted from the text image and sent to the classifier for classification.Some common manual features mainly include directional gradient histogram, scale-invariant feature transformation, and shape context features.The literature [4] used an improved HOG description feature, namely gradient field HOG (GF-HOG) to describe the relevant features of text images.The literature [5] combined SIFT features with bag-of-words model for image representation. The literature [6] dynamically selected the shape feature points and counted the number of target shape feature points in different area blocks to construct a histogram of contour feature points.However, these kinds of manual features are specially designed for natural images and are not completely suitable for the understanding and feature expression of text images.The literature [7] proposed a low-dimensional perceptually symmetric rotation invariant descriptor for text images. The literature [8] used the relationship between local feature representation and global structure to deal with local and global changes.The literature [9] used image deformation model combined with SVM classifier to recognize text images. The above-mentioned text image recognition methods basically only use one feature descriptor. The literature [10] proved that the use of multi-core learning and fusion of different local features can help improve the accuracy of recognition.The literature [11] introduced the Fisher vector into the model, and obtained high recognition performance by using the good local invariance of FV. At the same time, it also includes some other image recognition methods, such as: image entropy-based method [12], edge feature-based method [13], contour feature-based method [14], etc.The biggest drawback of the above-mentioned methods is that they rely on manual feature extraction, which not only consumes a lot of manpower, material resources and energy, but also may be unobjective and inaccurate.Therefore, these identification methods have gradually been eliminated. After that, the field of deep learning ushered in a new round of explosive period.From the A1exNet successfully won the first place in the hna96Net recognition competition to the deep learning experts such as Hinton and Lecun that the local extreme value of the loss function has almost no effect on the deep network, to the creation of DeepResidualNet network structure, etc., they fully illustrate the powerful computing power of deep learning and the unimaginable feature expression ability [15].Deep neural networks have achieved impressive results in many fields. In particular, the rapid development of convolutional neural networks has pushed machine learning to a climax. However, when the convolutional network is first proposed, it is only suitable for solving small-scale problems.The main reason why its practical application is limited by the bottleneck is the high computational cost when the number of classified categories is too large or the amount of training data is too large.Fortunately, with the rapid progress of GPU technology, this bottleneck has been eased to a large extent. In the field of text image recognition, the literature [16] used two very classic convolutional neural network structures, and used text image data sets to fine-tune the parameters.In contrast, theliterature [17] trained a new convolutional neural network model by training from scratch instead of fine-tuning on the basis of the existing model. Moreover, it found that compared with the classic settings for natural image recognition, increasing the size of the receptive field area of the convolution kernel of the first convolution layer can improve the generalization performance of the model and achieve better recognition results.Theliterature [18] used a deeper convolutional neural network to count image characteristics to help text image recognition and similarity search. Theliterature [19] proposed a multi-scale and multi-channel deep neural network framework, which uses a large amount of training data to obtain a good text image recognition effect.However, these methods ignore a key feature of the image, that is, the text image is essentially composed of an ordered sequence of strokes, which are ordered and continuous.In psychological research, people have long recognized that this sort of order is an important clue in human image recognition.

2.IMAGE MATCHING METHOD BASED ON CONTOUR IMAGE

Contour-based direct matching is the earliest contour image retrieval method. Optimizations such as the structure of the hitmap index greatly speed up the retrieval speed and improve the retrieval accuracy. This section will introduce the representative methods of Chamfer matching in turn.The earliest Chamfer matching is a kind of distance transformation.

Due to the limitation of the computer's computing power at that time, Chamfer directly replaced the calculation of the square root, which was more computationally expensive, with an integer approximation. Therefore, the actual distance does not change smoothly.

In the initial situation, only the position correIn Chamfer matching, the feature matrix is generated through two cycles of the matrix. The first loop is a forward loop[20]:

$$f_{i,j} = \min\left(f_{i,j}, f_{i-1,j} + 2, f_{i,j-1} + 2, f_{i-1,j-1} + 3, f_{i+1,j-1} + 3 \right) \quad (1)$$

Among them, $f_{i,j} \in F$ is the distance value corresponding to coordinate (i, j) in the feature matrix. The second loop is a reverse loop:

$$f_{i,j} = \min\left(f_{i,j}, f_{i+1,j} + 2, f_{i,j+1} + 2, f_{i+1,j+1} + 3, f_{i-1,j+1} + 3 \right) \quad (2)$$

In the first loop, the distance is gradually transferred to the lower right, and in the second loop, the distance is transferred to the upper left. When two contour images need to be matched, the feature matrix of one of the images can be calculated.

(a) (b)

(c)

Figure 1 Chamfer matching feature matrix

As shown in Figure 1, the left image is the original contour image. The middle image is the result of the logarithmic approximation of the Chamfer matching feature matrix. The darker the color, the greater the distance. The right image is the true Euclidean distance from each pixel to the nearest contour of another image. It can be seen that, although affected by the times, Chamfer uses numerical approximation to speed up the calculation and two cycles to reduce space consumption, but the distance in the characteristic matrix is not very different from the actual one.When defining the matching distance of Chamfer later, it is generally defined as:

$$d_{cham}^{(D,Q)}(l)=\frac{1}{|Q|}\sum_{p\in Q}\min_{q\in D}\left\|\left(l_p+l\right)-l_q\right\|_2 \quad (3)$$

Chamfer matching will inevitably be affected by the geometric deformation of the image content. For more accurate matching, only using Chamfer matching itself requires a lot of repetitive calculations. So currently, Chamfer matching is rarely used directly, and most of them are improvements to Chamfermatching.In the original Chamfer matching process, the direction of the pixels on the contour is not considered, but this problem is considered in OCM (Oriented Chamfer Matching). The nearest point q found by point P on the query image is:

$$A_D(l)=\arg\min_{q\in D}\left\|l-l_q\right\|_2 \quad (4)$$

Then, the distance in the direction of Chamfer matching is:

$$d_{orient}^{(D,Q)}(l)=\frac{1}{|Q|}\sum_{p\in Q}\left|\phi\left(l_p\right)-\phi\left(A_D\left(l_p+l\right)\right)\right| \quad (5)$$

The final distance of OCM is the weighted sum of two distances:

$$d_{\lambda}^{(D,Q)}(l)=(1-\lambda)\cdot d_{cham}^{(D,Q)}(l)+\lambda\cdot d_{orient}^{(D,Q)}(l) \quad (6)$$

Each point can have an adaptive weight:

$$w(i,j)=\frac{1}{N_i}\exp\left(-\frac{(i,j)^2}{\sigma_s^2}\right)\exp\left(-\frac{\left(\theta_i-\theta_j\right)^2}{\sigma_r^2}\right) \quad (7)$$

As shown in Figure 2, the points on the corners usually have a smaller weight.

Figure 2 Adaptive weights of different pixels

Edgel index optimizes Chamfer matching in terms of running speed and accuracy.In terms of speed,Edgel index uses the structure of hitmap index. However, in terms of accuracy, because human image text recognition inevitably has irregular deformations, the accurate Chamfer distance cannot describe the gap between two image texts well.

The basic Chamfer matching distance is:

$$Dist_{D\to Q} = \frac{1}{|D|}\sum_{p\in D}\min_{q\in Q}\left\|x_p - x_q\right\|_2 \quad (8)$$

The above formula finds a nearest pixel point for each point as a match. In practice, if the image lines in the data set are particularly rich, then the corresponding closer matching point can always be found during the matching process, and the two images may not match.To avoid this problem, a symmetric Chamfer distance should be used at the same time:

$$Dist_{Q,D} = \frac{1}{2}\left(Dist_{Q\to D} + Dist_{D\to Q}\right) \quad (9)$$

The Chamfer distance considering the pixel direction is as follows:

$$Dist_{D\to Q} = \frac{1}{|D|}\sum_{\theta\in\Theta}\sum_{p\in D\&\theta_p=\theta}\min_{q\in Q\&\theta_q=\theta}\left\|x_p - x_q\right\|_2 \quad (10)$$

That is to find the nearest pixel in the same direction. Because of the irregular deformation problem mentioned earlier, the distance between matching pixels is redefined in the Edgel index:

$$Hit_Q(p) = \begin{cases} 1 & \exists q\in Q\left(\left\|x_q - x_p\right\|_2 < r \,\&\, \theta_p = \theta_q\right) \\ 0 & otherwise \end{cases} \quad (11)$$

Then, it is considered that the more pixels the two images match, the more similar the images are:

$$Sim_{D\to Q} = \frac{1}{|D|}\sum_{p\in D} Hit_Q(p) \quad (12)$$

$$Sim_{Q,D} = \left(Sim_{Q\to D}\cdot Sim_{D\to Q}\right)^{1/2} \quad (13)$$

As shown in Figure 3, due to the influence of irregular deformation, the Chamfer distance of the two images is not zero. The redefined distance eliminates the influence of this irregular deformation and can match the two lines.

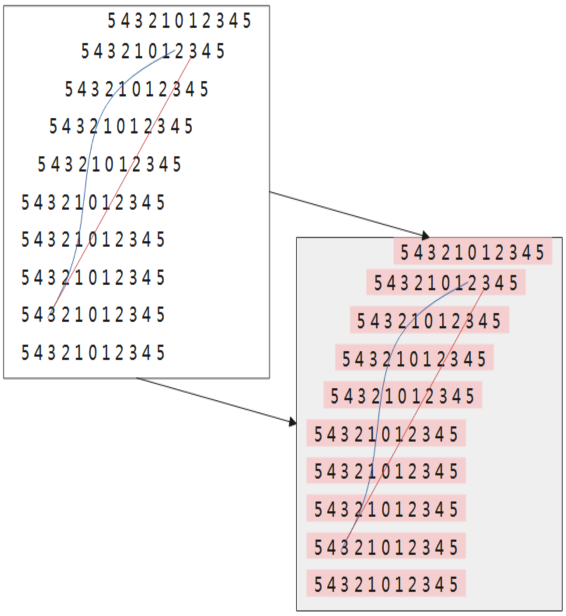


Figure 3 Chamfer distance and Edgel index

In order to speed up the matching, Edgel index uses hitmap index.The attribute of each edgelis $p=(x,y,\theta)$. In the Edgel index, each image is first scaled to 200×200 size, the direction is quantized into 6 intervals of 30° interval length, and an index table is established for each quantized direction.As shown in Figure 4, similar to the morphological dilation process, all positions within the tolerance radius are marked as having values. In this way, another image only needs to query the corresponding position of the hitmap to know whether there is a matching pixel within the tolerance radius.

An outline image can be divided into different components, and each stroke in the user's drawing process is an independent part. If Q contains N parts $\{Q_1,Q_2,K,Q_N\}$, the geometric mean can be used to make the matching result structure more continuous:

$$Sim_{Q\to D}^{SSM}=\left(\prod_{i=1}^{N}Sim_{Q_i\to D}\right)^{1/N} \quad (14)$$

$$Sim_{Q,D}^{SSM}=\left(\prod_{i=1}^{N_Q}Sim_{Q_i\to D}\right)^{1/2N_Q}\left(\prod_{j=1}^{N_D}Sim_{Q_i\to D}\right)^{1/2N_D} \quad (15)$$

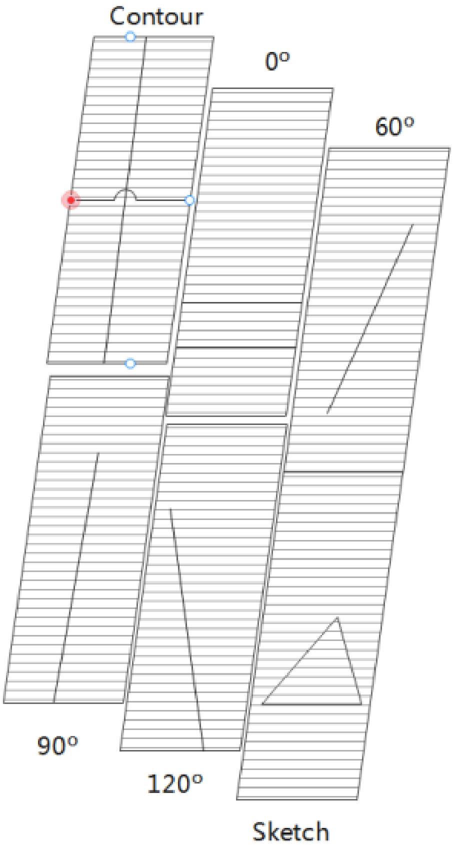


Figure 4 Edgelindex Hitmap in different directionsp

ShapeWords after the Edgel index uses a structure similar to the Edgel index.In ShapeWords, each image is decomposed into line segment $L=(x,y,l,\theta)$ and arc $C=(x,y,r,\theta_1,\theta_2)$.Through the matching of the shape, it is searched in the image library according to the inverted index.

Edgel index is also affected by changes in scale, displacement, and rotation. This is a problem that is difficult to avoid using hitmap, but it has a good advantage in retrieving approximate matching.

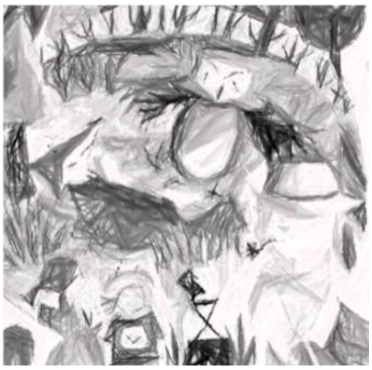
When Histogram of Oriented Gradients (HoG) was first proposed, it was mainly used for pedestrian detection. The SIFT feature is essentially a gradient histogram of the local area of the image.Since the lines of the hand-drawn image have no texture changes, the gradient histogram is very suitable for the extraction of contour image features.

The preprocessing of the gradient histogram is similar to the edge detection. First, the magnitude G and direction Θ of the gradient of the image must be obtained, and then the image is divided into blocks.For each image block, the gradient direction is quantized into several bins. For the statistics of the gradient magnitude of each bin, Euclidean distance can be used when matching.

Table 1 Coding of the main direction in BHoG

Direction	coding							
1	1	1	1	1	1	1	1	1
2	0	2	0	2	0	2	0	2
3	0	3	0	3	0	3	0	3
4	0	4	0	4	0	4	0	4
5	0	5	0	5	0	5	0	5
6	1	6	1	6	1	6	1	6
7	1	7	1	7	1	7	1	7
8	1	8	1	8	1	8	1	8
0	0	0	0	0	0	0	0	0

In BHoG (BinaryHoG), the magnitude information of the gradient is ignored, and only the direction of the maximum gradient is concerned.We assume that the largest and second largest gradient amplitudes in the histogram are h_1 and h_2, respectively.If $h_1 > \alpha h_2$, it can be considered that the current image block has a main direction, otherwise it can be considered that the current image block has no direction.Among them, α is a constant greater than 1.HoG uses the feature of binarization. Each main direction corresponds to an 8-bit binary code, and the main direction is quantized to 8 directions. The corresponding binary code is shown in Table 1, where 0 means no main direction. At the same time, because of the use of binary coding, the storage space required for each image is very small, and the Hamming distance of binary coding during the matching process can also speed up the matching.



(a)

(b)

(c)

Figure 5 Space division of PHoG

On the other hand, PHoG (PyramidofHoG) considers the spatial information under different division levels.The similarity of the two images is:

$$K(S_I, S_J) = \sum_{l \in L} \alpha_l d_l (S_I, S_J) \quad (16)$$

HELO (Histogram ofEdgeLocalOrientations) and S-HELO (Soft-HELO) are similar to HoG, but they use different orientation definitions. The squared gradient is defined as:

$$\begin{bmatrix} G_{sj} \\ G_{si} \end{bmatrix} = \begin{bmatrix} G_j^2 - G_i^2 \\ 2G_j G_i \end{bmatrix} \quad (17)$$

To count the accumulated value of the first item and the accumulated value D of the second item, you can use:

$$A := A + 2\alpha \cdot \sin\theta \cdot \cos\theta \quad (18)$$

$$D := D + \alpha \cdot \left(\cos^2\theta - \sin^2\theta\right) \quad (19)$$

The direction in the final area is:

$$\beta = 0.5 \cdot a\tan 2(A, D) \quad (20)$$

There are many variations of direction-based histogram statistics, but they are essentially the same.Because contour image lines are usually relatively concise, HoG features have advantages in matching similar lines, but they may be affected by complex lines.

2. CONSTRUCTION OF AN ANALYSIS SYSTEM FOR CHILDREN'S LITERATURE BASED ON INTELLIGENT IMAGE TEXT RECOGNITION

An analysis system of children's literature works based on intelligent image text recognition is constructed. In order to avoid the impact of speed on the accuracy of corner recognition, stroke isometric resampling is performed in the preprocessing stage. After sampling, the Euclidean distances between adjacent points in the sequence of strokes are all equal, which is no longer limited by the user's drawing speed and at the same time gives the user the greatest degree of freedom in drawing.On the other hand, through experiments, it is found that the rotation angle of the stroke point sequence near the corner point changes greatly. This feature is used to detect the corner point, and it is also associated with the plane geometry. The curvature of the curve at a certain point can be expressed as the rate of change of the inclination angle of the tangent in a minimal neighborhood of the point with the arc length, as shown in Figure 6.

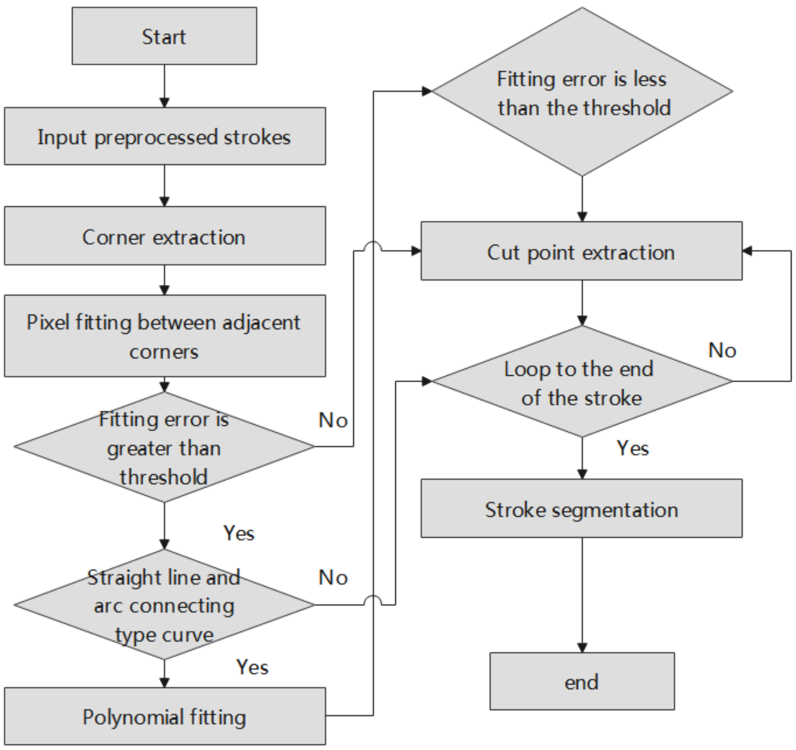


Figure 6 Feature point extraction process

In the analysis system of children's literature, a recognition system for the structural features of the image is introduced. Pattern recognition based on structural features is also called syntactic pattern recognition. Syntactic pattern recognition first recognizes primitives, and then recognizes its sub-patterns from bottom to top, and finally achieves the purpose of recognizing complex patterns at the top level, A syntactic pattern recognition system generally includes: preprocessing, pattern decomposition, pattern description, primitive selection, method inference, and syntax analysis.as shown in Figure 7:

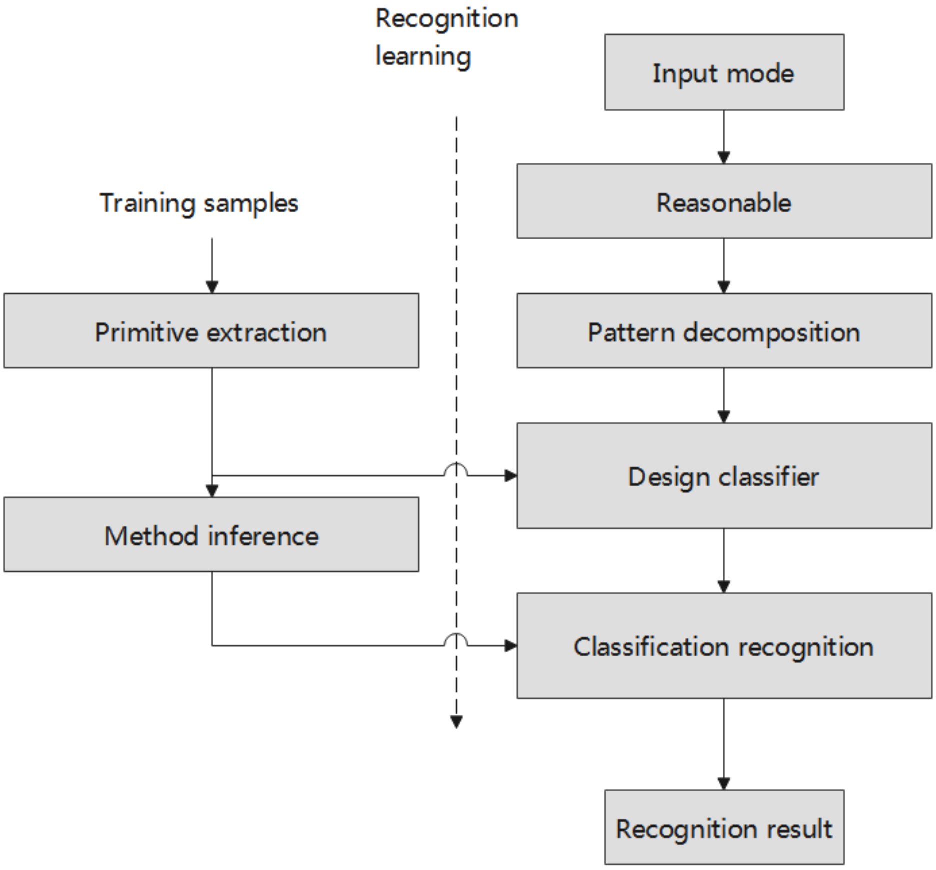


Figure 7 Analysis system of children's literatureworks

3.PERFORMANCE TEST OF THE ANALYSIS SYSTEM OF CHILDREN'S LITERATURE WORKS BASED ON INTELLIGENT IMAGE TEXT RECOGNITION

Based on the construction of an intelligent image-based text recognition system, this paper conducts a performance test on the system constructed in this paper.Combining with needs analysis, the system constructed in this article needs to perform image recognition on children's literature works, and can recognize the meaning of the text and picture book pictures in the image, and then analyze the works on this basis.This paper collects a large number of children's literature works through the Internet and makes it into a test database. First, image and text recognition are performed on the database. A total of 90 sets of tests are set up, and each test group has a total of 1,000 children's literature works.Moreover, these literary works are repetitive. On this basis, the research is carried out, and the accuracy of text recognition is analyzed first, and the results are shown in Table 2 and Figure 8.

Table 2 Statistical table of the accuracy rate of text recognition of the analysis system of children's literature worksbased on intelligent image text recognition

Experiment number	Text recognition accuracy(%)	Experiment number	Text recognition accuracy(%)	Experiment number	Text recognition accuracy(%)
1	99.2	31	97.7	61	96.1
2	96.3	32	98.2	62	94.9
3	97.1	33	98.3	63	98.3
4	96.1	34	95.5	64	98.0
5	96.6	35	97.0	65	94.8

6	97.6	36	95.9	66	98.5
7	96.4	37	97.8	67	95.0
8	97.5	38	95.2	68	98.1
9	95.8	39	95.8	69	99.7
10	98.2	40	95.2	70	99.9
11	99.6	41	95.8	71	98.9
12	97.7	42	98.2	72	96.2
13	98.1	43	96.0	73	99.9
14	97.2	44	96.7	74	95.9
15	95.6	45	98.0	75	96.8
16	98.0	46	95.2	76	95.7
17	95.3	47	96.9	77	98.6
18	98.9	48	97.6	78	96.5
19	98.7	49	99.3	79	97.4
20	94.8	50	99.0	80	97.9
21	98.8	51	96.8	81	97.6
22	97.3	52	97.4	82	97.7
23	98.0	53	97.3	83	98.7
24	96.9	54	99.4	84	98.4
25	98.0	55	96.3	85	96.5
26	96.9	56	97.5	86	98.9
27	97.0	57	99.3	87	99.4
28	97.1	58	99.8	88	98.0
29	98.1	59	99.3	89	97.9
30	96.5	60	98.4	90	98.7

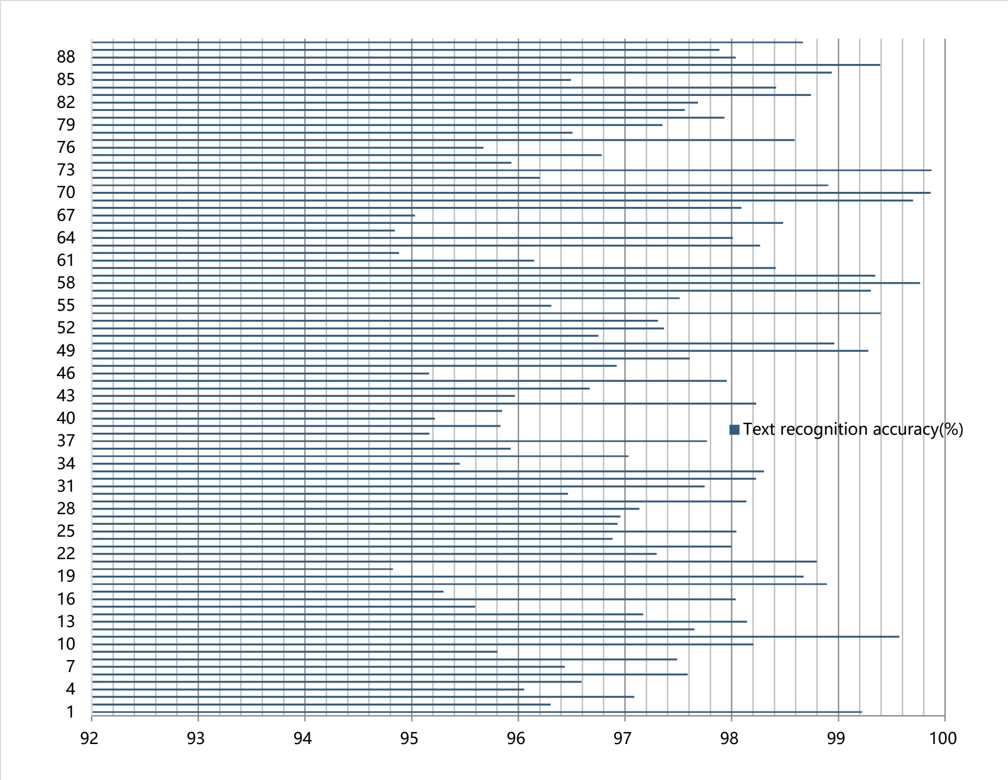


Figure8 Statistical table of the accuracy rate of text recognition of the analysis system of children's literature worksbased on intelligent image text recognition

According to the above statistics, the analysis system of children's literature works based on intelligent image text recognition performs well in text recognition.Next, this paper evaluates the effect of the analysis of children's literature works. The evaluation is mainly carried out by human scoring method. A total of 88 groups of evaluations are conducted. The results are shown in Table 3 and Figure 9.

Table 3 Statistical table of the utility score of the analysis system of children's literature works based on intelligent image text recognition

Experiment number	Work analysis score	Experiment number	Work analysis score	Experiment number	Work analysis score
1	79	31	84	61	78
2	87	32	77	62	87
3	85	33	75	63	76
4	90	34	91	64	86
5	81	35	82	65	89
6	77	36	85	66	87
7	85	37	80	67	75
8	86	38	79	68	81
9	86	39	88	69	79
10	75	40	77	70	85
11	84	41	90	71	86
12	78	42	88	72	86

13	88	43	75	73	78
14	81	44	90	74	86
15	89	45	81	75	88
16	85	46	80	76	87
17	88	47	75	77	90
18	84	48	85	78	75
19	86	49	91	79	88
20	89	50	76	80	80
21	81	51	86	81	88
22	87	52	81	82	89
23	90	53	90	83	84
24	87	54	77	84	83
25	85	55	91	85	85
26	79	56	75	86	88
27	76	57	77	87	75
28	75	58	89	88	81
29	80	59	75		
30	88	60	87		

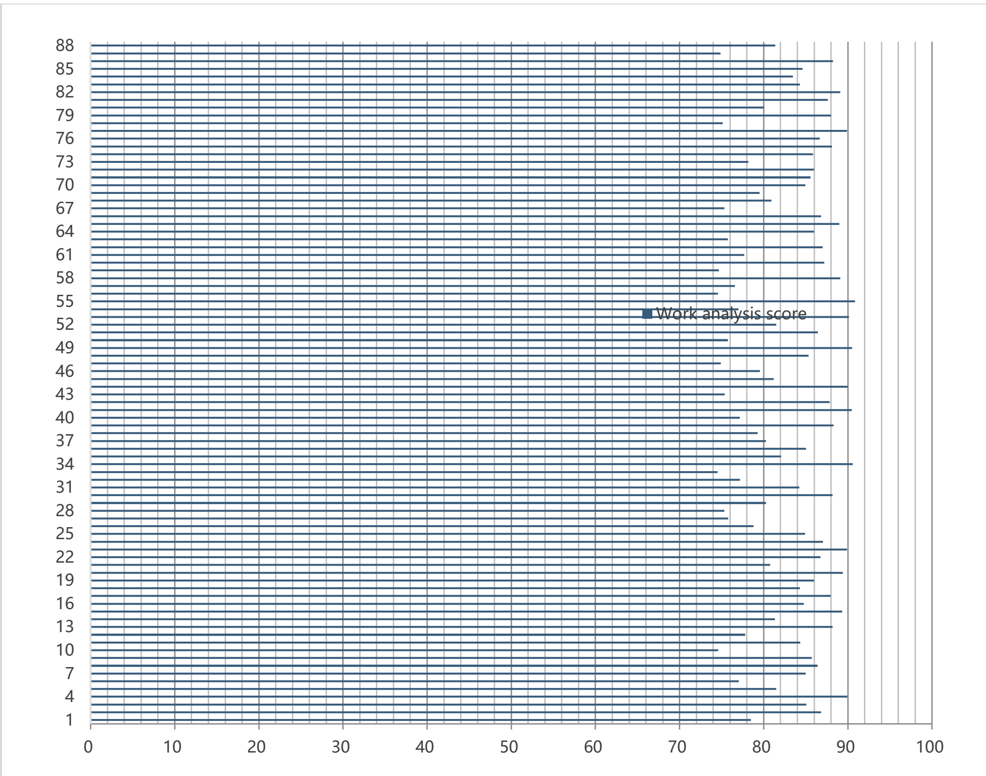


Figure9 Statisticaldiagram of the utility score of the analysis system of children's literature works based on intelligent image text recognition

Through the above analysis, we can see that the analysis system of children's literature works based on intelligent image text recognition constructed in this paper performed well in the process of literary works analysis and basically met actual needs.

4.CONCLUSION

Image is an important role that cannot be ignored in the era of visual culture. The envelopment and infiltration of images have caused unprecedented impact on people's thinking, writing, and reading habits.These have quietly promoted the "new changes" in children's literature, and have also brought many problems to children's literature.The recognition of image text is a hot issue in the field of computer vision and human-computer interaction. Although many results have been achieved, there are still many problems to be solved due to factors such as user habits and the complexity of image text.Based on this, this paper improves the current image text stroke segmentation and recognition algorithm, and conducts an experimental analysis on the proposed method, and applies it to the recognition of children's literatureworks. Through the experimental research results, we can see that the model constructed in this paper has certain effects.

REFERENCES

[1]. Tommasel A , Godoy D . A Social-aware Online Short-text Feature Selection Technique for Social Media[J], Information Fusion, 2017, 40(1):1-17.
[2]. Nayak M , Nayak A K . Odia Running Text Recognition Using Moment-Based Feature Extraction and Mean Distance Classification Technique[J], Advances in Intelligent Systems & Computing, 2015, 309(3):497-506.
[3]. Ramalakshmi E , Golla S . An Advanced Fuzzy Constructing Algorithm for Feature Discovery in Text Mining[J], International Journal of Computer Applications, 2015, 127(17):30-34.
[4]. Gissel S T . Scaffolding Students' Independent Decoding of Unfamiliar Text with a Prototype of an eBook-feature[J], Journal of Information Technology Education Research, 2015, 14(2015):439-470.
[5]. Takuro Oki. Scene Text Localization Using Object Detection Based on Filtered Feature Channels and Crosswise Region Merging[J], growth & change, 2015, 21(3):61-76.
[6]. Kamble R R , Kodavade D V . Relevance Feature Search for Text Mining using FClustering Algorithm[J], International Journal of Computer Sciences & Engineering, 2018, 6(7):223-227.
[7]. MaruthuPandi, Vimala Devi K. Rajendran. Efficient Feature Extraction for Text Mining[J], advances in natural & applied sciences, 2016, 10(4):64-73.
[8]. Wu G , Zhao M , Han L . A Fingerprint Feature Extraction Algorithm based on Optimal Decision for Text Copy Detection[J], International Journal of Security & Its Applications, 2016, 10(11):67-78.
[9]. Soleymanpour M , Marvi H . Text-independent speaker identification based on selection of the most similar feature vectors[J], International Journal of Speech Technology, 2016, 20(1):1-10.
[10]. Aghdam M H , Heidari S . FEATURE SELECTION USING PARTICLE SWARM OPTIMIZATION IN TEXT CATEGORIZATION[J], Journal of Artificial Intelligence & Soft Computing Research, 2015, 5(4):38–43.
[11]. Al-Tahraw M M . Polynomial Neural Networks versus Other Arabic Text Classifiers[J], Journal of Software, 2016, 11(5):418-430.
[12]. De Li, XueZhe Jin, LiHua Cui. Text recognition algorithm based on text features[J], International Journal of Multimedia & Ubiquitous Engineering, 2016, 11(5):209-220.
[13]. Hu Y , Milios E E , Blustein J . DOCUMENT CLUSTERING WITH DUAL SUPERVISION THROUGH FEATURE REWEIGHTING[J], Computational Intelligence, 2016, 32(3):480-513.
[14]. Kumar, Ganesh, Vivekanandan, K. Intelligent Model View Controller Based Semantic Webservice Call Through Mishmash Text Featuring Technique[J], Journal of Computational & Theoretical Nanoscience, 2017, 14(4):2021-2029.
[15]. Mohammad Mojaveriyan, HosseinEbrahimpourkomleh, SeyedjalaleddinMousavirad. IGICA: A Hybrid Feature Selection Approach in Text Categorization[J], International Journal of Intelligent Systems Technologies & Applications, 2016, 8(3):42-47.

[16]. Shi B , Bai X , Yao C . An End-to-End Trainable Neural Network for Image-Based Sequence Recognition and Its Application to Scene Text Recognition[J], ieee transactions on pattern analysis & machine intelligence, 2017, 39(11):2298-2304.
[17]. Tehseenzia, Muhammad Pervez Akhter, Qaiser Abbas. Comparative Study of Feature Selection Approaches for Urdu Text Categorization[J], malaysian journal of computer science, 2015, 28(2):93-109.
[18]. Tehseen Zia, Qaiser Abbas, Muhammad Pervez Akhtar. Evaluation of Feature Selection Approaches for Urdu Text Categorization[J], international journal of intelligent systems technologies & applications, 2015, 07(6):33-40.
[19]. Yan K , Li Z , Zhang C . A New multi-instance multi-label learning approach for image and text classification[J], Multimedia Tools & Applications, 2016, 75(13):7875-7890.
[20]. Zahra Robati, MortezaZahedi, NajmehFayazi Far. Feature Selection and Reduction for Persian Text Classification[J], International Journal of Computer Applications, 2015, 109(17):1-5.