Research on a colorization support for converting photos into black and white comic

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Abstract. It is able to create the black and white comic using photos and it can be useful to write the past down as same as the photo album, home video and the several kinds of micro blogs. On the other hand, the Japanese black and white comics which is commonly called as "MANGA" are garnering attention around the world and people interested in creating the original story comic. In this work, the framework to support the colorization on the black and white comic stylized photos is proposed and its evaluations of the visibility are reported.

Keywords: image processing, black and white comic, colorization

1   Introduction

The black and white comic can be created from photos. Such media can be useful to write the past down as same as the photo album, home video and the several kinds of micro blogs. "Comic Life [1]" is a kind of software to create the original comic from the photos. It converts our original photos into comics and it gives us to enjoy making original story.

The Japanese comics called "MANGA" are garnering attention around the world especially among youth. The MANGA is distinctive from the traditional western comics in presenting fine details using color. The MANGA in color can express in more detail than in black and white. The costs for color printing can be solved by digital distribution [2]. By the way, there are a lot of people prefer to black and white monotone comic [3]. This is important factor for MANGA.

The comic-like-images created from the photos sometimes loose the details of the original photos, because the image posterization is necessary to create the comic-like-image such as MANGA. It leads to make us difficult to understand the scene of it. By the image processing of posterization, a region of the interest in a focused frame of MANGA is not always segmented perfectly and also the contour lines of the object are not always extracted. It leads to be impossible to understanding a scene of the created comic. On the other hand, the comic-like-image includes notable characteristics in terms of the entertainment as both for creating the original black and white MANGA and for using the story comic as a kind of media for communication

and/or writing the past down. In either case, it is necessary to understand every frame of MANGA. This paper has two points of view. The one is the present colorization support for scene understanding, where the colorization process has been done just for regions of interest in a frame. The other is to evaluate the visibility of the proposed method.

In the next section, the proposed support method is briefly introduced. Section 3 describes the overview of experiment to evaluate the visibility. Section 4 shows the results and discussions. Section 5 concludes this paper.

2   A colorization support for converting photos into black and white comic

The most important factor is to understand the scene of each frame. The overview of our procedure is illustrated in Fig.1 and is described in more detail in Ref [4]. At first, the user prepares the both of photos and original story for the MANGA from photos. In the procedural step of "MANGA effect", the input image such as one of the prepared photos becomes the black and white comic-like-image and the pixel values of the input image are posterized into four gray levels. The mid two levels are replaced by different image such as the screen-tones. After that, if the users care the processed image impossible to understand, they should proceed to the next step "region processing". Depending on both a result image of MAGA effect and a scene of it, the users can utilize the colorization process shown as "region processing" in Fig1. In this procedural step, there are two ways to decide the region which should be colored for the scene understanding. One is the automatic way. It is convenient to operate the colorization support especially for the small screen devices like smartphones and other tablet computers. The saliency map [5] is used for the region detection in this automatic method. "Frequency-tuned method [6,7]" is used to compute the saliency map in this work.
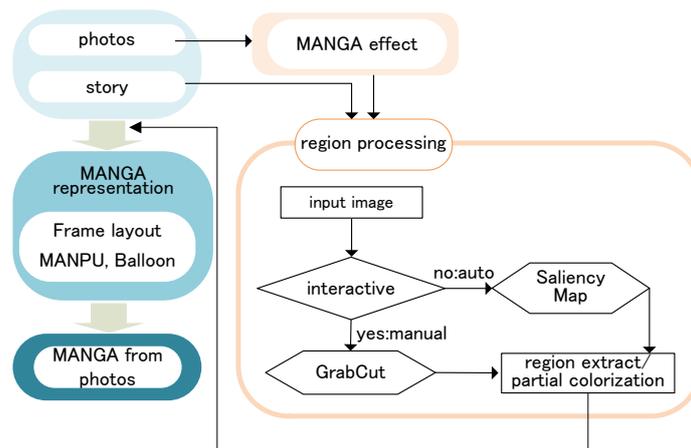

Fig. 1. Framework of the proposed method.

On the other hand, the interactive way can be used. "Grabcut [8]" is adopted for the segmentation of the region of interests.

The region of interest is not always consistent in the region which is detected by using saliency map in automatic method. The present interactive function is useful in this case. Fig.2 shows the results image of both methods.

After the step of the region processing, the process proceeds "MANGA representation". The frame layout, the MANPU such as intensive lines and onomatopoeic words and cartoon balloons are given in this step. After that, the users can complete the MANGA from photos.
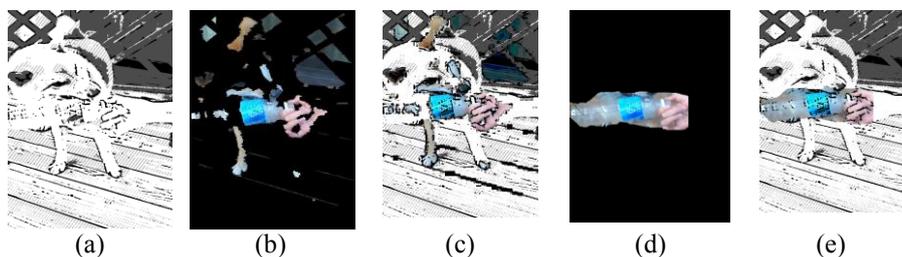

(a)	(b)	(c)	(d)	(e)

Fig. 2. Comparison of the automatic method using saliency map and the interactive method using Grab cut. (a) image before partially colorization, (b)region extracted by saliency map,(c) image after automatic colorization, (d) region extracted by Grabcut, (d) image after interactive colorization.

3. Overview of experiment

To investigate the effects of the proposed method, we conducted the experiment to evaluate the visibility of the test images as seen in Fig2. Fig2(a) is one of the sample images including unclear details such that it's impossible to know what the dog holds in his mouse. This unclear frame and the other two frames which were partially colored by both the procedures of automatic and interactive as shown in Fig.2 were presented to the research participants one by one. The TFT monitor which size is 21 inch was used and it was set up 70cm away from the participant. The participants described the scene mentioned above for each three cases (Fig.2(a),(c),(e)). In addition to the above, to investigate the size dependency of the frame, the experiment was conducted by dividing the participants into two groups.

4. Results and discussion

The frequency of correct answers of all participants in experiment for different two frame size is shown in Fig3. The level of scene understanding was improved by using partially colorization. Especially, the case in interactive method is the most effective among three cases. The larger size of the frame gives better understanding level, but it causes to lose its relish coming from the layout of frames in black and white MANGA.

While the page layout in MANGA leads to the representation of temporal change, the large frame size is better to read it on small screen such as a smartphone or a tablet PC in the viewpoint of the visibility.

5. Conclusion

In this paper, we proposed the framework to support partially colorization on the black and white comic stylized still photos and its evaluations as for the visibility of the processed image. The entertainment of the comics includes not only reading but also creating by oneself. Furthermore, there are quite a few people to relish a simple black and white comic. The comic-like-image has disadvantage such as degradation due to the image processing based on the posterization of pixel value. The results obtained in this work show that our proposed method is effective on the scene understanding. These results may lead to solve such a conflicting problem considering the above and make us possible to adopt this framework to the mobile application.
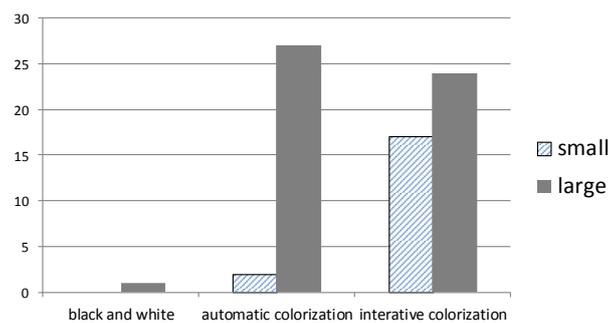

Fig. 3. The frequency of correct answers of all participants in experiment for different two frame size.

References

1. comic life (http://www.comiclife.com)
2. Y.Qu, T.Wong and P.Hen,"Manga Colorization,"ACMTrans.onGaphics (SIGGRAPH 2006), Vol. 25, No. 3, July 2006, pp. 1214-1220.
3. T.Matsui,The Research Institute of Economy, Trade and Industry, BBL July 2009, (http://www.rieti.go.jp/jp/events/bbl/09071301.html)
4. Y.Maemura,"A colorization support sysrem for the black and white comic stylized still pictures", Journal of the Faculty of Global Communication,No.15,pp47-52,2014.
5. Itti:L.Itti,C.Koch, and E. Niebur,"A model of saliency-based visual attention for rapid scene analysis,"IEEE Trans, Pattern Anal. March. Intell., vol.20,no.11,pp.1254-1259,1998.
6. Achanta2:R.Achanta, S.Hemai, F.Estrada,and S.usstrunk, "Frequency-tuned salient region detection," Proce.IEEE CVPR, pp.1597-1604

7. Frequency-tuned salienct region detection[Ach1,Ach2],(http://ivrgwww.epfl.ch/supplementary_material/RK_CVPR09/)
8. C. Rother, A. Blake, and V. Kolmogorov,"GrabCut interactive foreground extraction using iterated graph cuts," ACM Trans. on Graphics, Vol. 23, No. 3, pp. 309-314, 2004.