

# Modified Cellular Neural Network Applying Bayer Arrangement

Yasuteru Hosokawa  
 Dept. of M. I. Systs.,  
 Shikoku University

Email: [hosokawa@keiei.shikoku-u.ac.jp](mailto:hosokawa@keiei.shikoku-u.ac.jp)

Yoshifumi Nishio  
 Dept. of E. E. Eng.,  
 Tokushima University

[nishio@ee.tokushima-u.ac.jp](mailto:nishio@ee.tokushima-u.ac.jp)

## I. INTRODUCTION

One of the famous application of CNN [1] [2] is an image processing. Many image processing methods using CNN have been proposed. These methods are based on a grayscale image. It is means that three systems for three primary colors are needed.

In this study, CNN applying Bayer arrangement [3] is proposed. The Bayer arrangement is an arrangement of a color filter which is applied image sensor for a digital camera. By applying Bayer arrangement, CNN can process a full color image with one layer.

## II. SYSTEM MODEL

A specification of processing by CNN is decided by a cloning template. The cloning template is corresponding to a configuration of a connection weight on neural networks. On CNN, all neurons called as cells including the connection have same connection weights. Thus, the connection weights are called as the cloning template. In this study, CNN is modified as shown in Fig. 1 for applying Bayer arrangement to the system.

## III. SIMULATION

In this section, some fundamental characteristics of the system are shown by some computer simulation results. Figure 2 shows a simulation result in case of extracting green. This result shows a procedure for color image processing of Bayer filter. At first, a color image as shown in Fig. 2(a) becomes a grayscale image as shown in Fig. 2(b) by Bayer filter. Next, the grayscale image is processed by the modified CNN. the processed image is shown in Fig. 2(c). Finally, by demosaicing, a demosaic image as shown in Fig. 2(d) is obtained.

Figure 3(a) shows a simulation result in case of extracting red. Main different from Fig. 2 is an edge resolution. Basically, green which is one of primary colors is applied 50 percent in all pixels. Red and Blue are applied 25 percent each. Thus, the edge resolution of red is worse than green.

Figure 3(b) and (c) show simulation results in case of extracting yellow and purple, respectively. The system can extract even non-primary colors.

## IV. CONCLUSIONS

In this study, a modified cellular neural network using Bayer arrangement have been proposed. This system can process by one layer and the structure is almost same as a conventional cellular neural network.

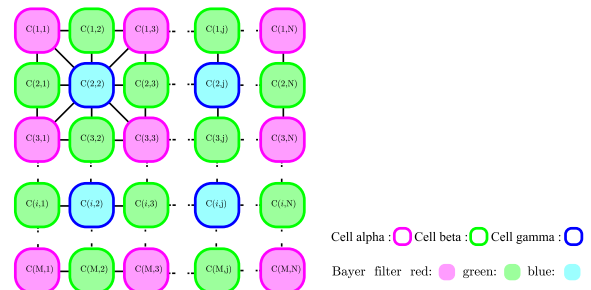


Fig. 1. System model.

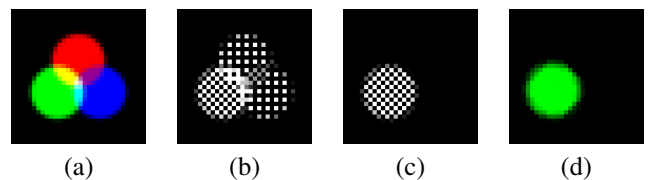


Fig. 2. Computer simulation result. An image size is  $32 \times 32$ . (a) Input image. (b) Bayer image. (c) Output image. (d) Demosaic image.

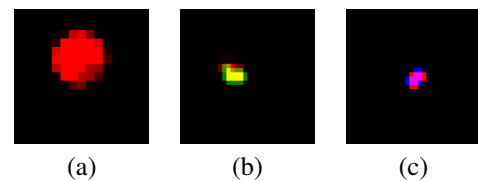


Fig. 3. Computer simulation results. An image size is  $32 \times 32$ . (a) Extracting red. (b) Extracting yellow. (c) Extracting purple.

## REFERENCES

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- [3] Bryce E. Bayer, "Color Imaging Array," U.S. Patent 3971065, Mar. 5, 1975.