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AN AREA-EFFICIENT COLOR DEMOSAICKING SCHEME FOR VLSI ARCHITECTURE

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Abstract. *In this paper, we propose an efficient demosaicking design, which achieves good image quality with very low computational complexity and less line-buffer memory. Our demosaicking scheme exploits both edge information and inter-channel correlations to improve the quality of the interpolated image. Furthermore, we develop a tight and low-cost VLSI architecture for the scheme by using the resource sharing and pipeline scheduling approaches. Compared with previous demosaicking designs, our circuit requires the least hardware cost and performs well in terms of PSNR and visual quality.*
Keywords: VLSI architecture, Color filter array, Demosaicking

1. **Introduction.** In recent years, digital still cameras (DSCs) have become one of the most popular consumer electronic devices. More and more people take pictures with DSCs rather than film cameras. When a digital image is captured, it needs processing to obtain a viewable image, including correction for sensor nonlinearities and nonuniformities, white balance adjustment, compression and more [1-19].

Based on RGB color image, a single sensor, charge-coupled device (CCD) or complementary metal oxide semiconductor (CMOS), is able to capture a single color component, so, three sensors are required to sample the red, green and blue values for a complete color image. To minimize cost and size, most DSCs use a single sensor instead of three with the help of color filter array (CFA) technique. CFA consists of a set of selective filters that are arranged in an interleaving pattern so that each sensor pixel samples one of three primary color values. As there is only one color value available at each pixel, the two missing color values must be estimated to construct a full-color image. This image reconstruction process is called CFA interpolation or CFA demosaicking.

The most frequently used CFA pattern is the Bayer CFA pattern [1], shown in Figure 1. Half of the pixels are allocated to the green color; the other half is shared by the red and blue one. The rationale behind having a more green samples in the Bayer pattern is that green colors contribute most to luminance signals of a color image for the human eye's perception. In this paper, we focus on the development of demosaicking method for the Bayer CFA pattern. In order to reconstruct a full-color image from the original CFA samples, many efficient demosaicking methods have been proposed in the past few years [2-16]. They can be classified into two categories: lower-complexity techniques [2-9] and higher-complexity techniques [10-16]. The former techniques require lower-complexity