The Photon Path: from Sensel Values to Pixel Values

Reto Kromer • AV Preservation by reto.ch

Transparency, Teaching & Trust
(= No Time to Wait 6)
The Hague, Netherlands, 26–28 October 2022

RAW data are cooked.

Summary

- past
- present
- future

United States Patent [19]
Bayer

[11] 3,971,065
[45] July 20, 1976

[54] COLOR IMAGING ARRAY

[75] Inventor: Bryce E. Bayer, Rochester, N.Y.
[73] Assignee: Eastman Kodak Company, Rochester, N.Y.

[22] Filed: Mar. 5, 1975
[21] Appl. No.: 555,477

[52] U.S. Cl. ..... 358/41; 350/162 SF; 350/317; 358/44
[51] Int. Cl.[2] H04N 9/24
[58] Field of Search ..... 358/44, 45, 46, 47, 358/48; 350/317, 162 SF; 315/169 TV

Past

[56] References Cited
UNITED STATES PATENTS

2,446,791	8/1948	Schroeder	358/44
2,508,267	5/1950	Kasperowicz	358/44
2,884,483	4/1959	Ehrenhaft et al.	358/44
3,725,572	4/1973	Kurokawa et al.	358/46

Primary Examiner—George H. Libman
Attorney, Agent, or Firm—George E. Grosser

[57] ABSTRACT

A sensing array for color imaging includes individual luminance- and chrominance-sensitive elements that are so intermixed that each type of element (i.e., according to sensitivity characteristics) occurs in a repeated pattern with luminance elements dominating the array. Preferably, luminance elements occur at every other element position to provide a relatively high frequency sampling pattern which is uniform in two perpendicular directions (e.g., horizontal and vertical). The chrominance patterns are interlaid therewith and fill the remaining element positions to provide relatively lower frequencies of sampling.

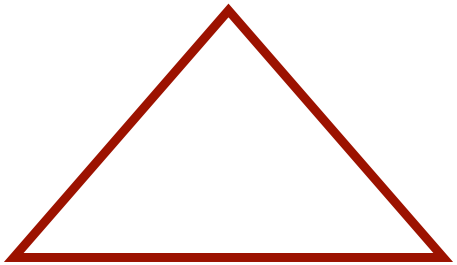
In a presently preferred implementation, a mosaic of selectively transmissive filters is superposed in registration with a solid state imaging array having a broad range of light sensitivity, the distribution of filter types in the mosaic being in accordance with the above-described patterns.

11 Claims, 10 Drawing Figures

Digital Video

- resolution
- bit depth
- linear, power, logarithmic encoding
- colour model
- chroma subsampling and compression
- illuminant

image quality



encoding time file size

Uncomfortable Truths

- sensors are colour blind
- Bayer sensors do not generate full RGB

Bryce E. Bayer (1929–2012)

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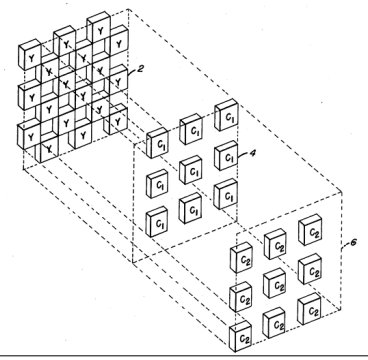

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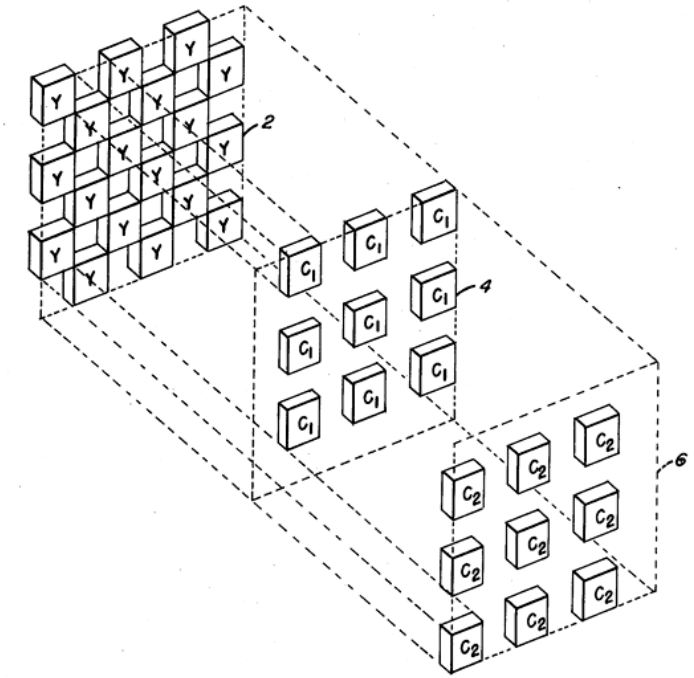

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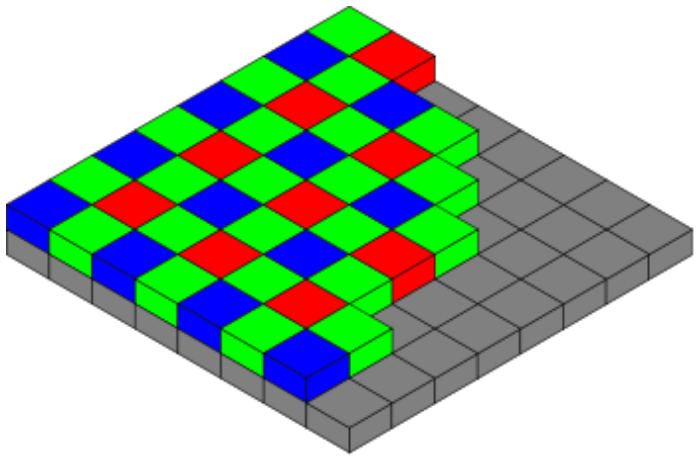

source: wikipedia.org

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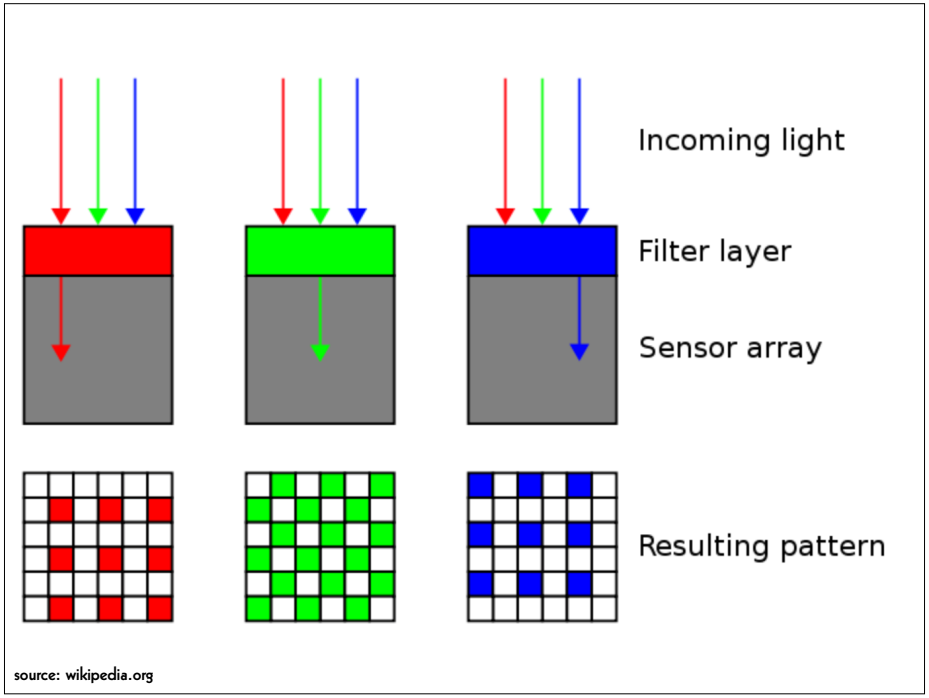
Incoming light
Filter layer
Sensor array
Resulting pattern
source: wikipedia.org

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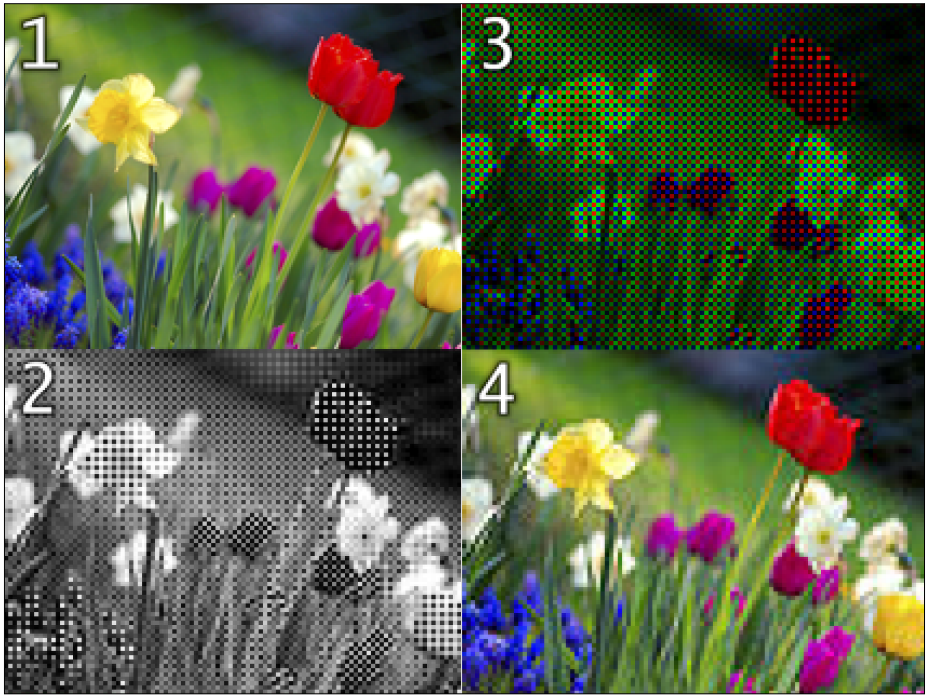
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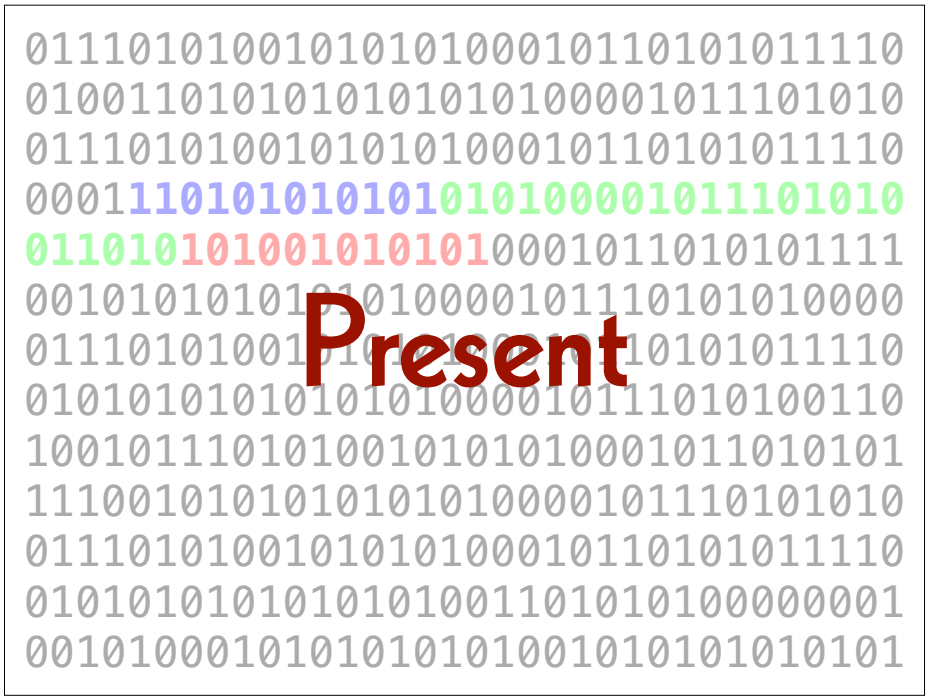
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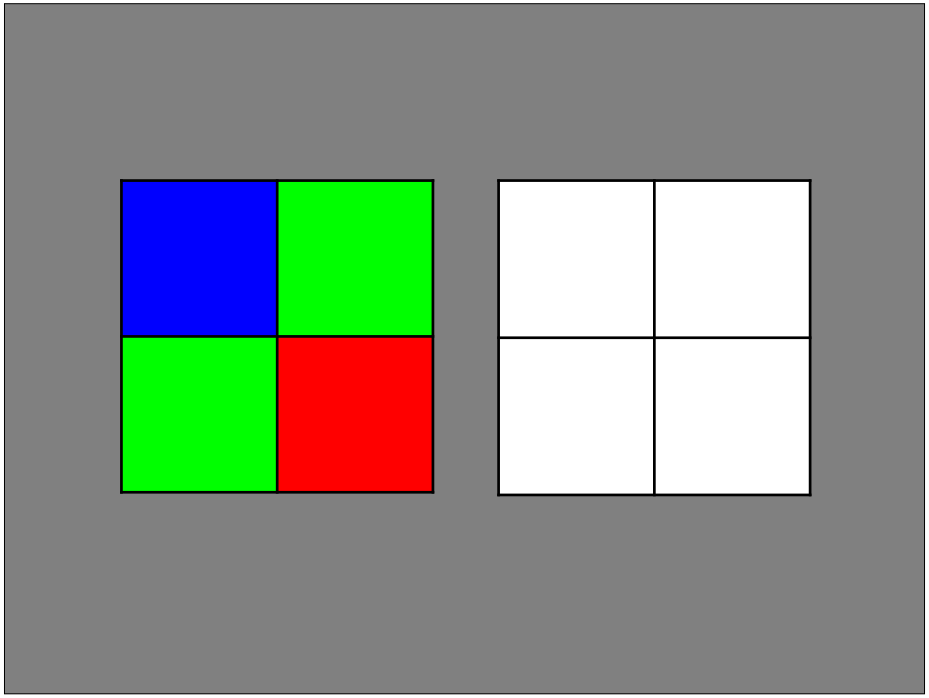

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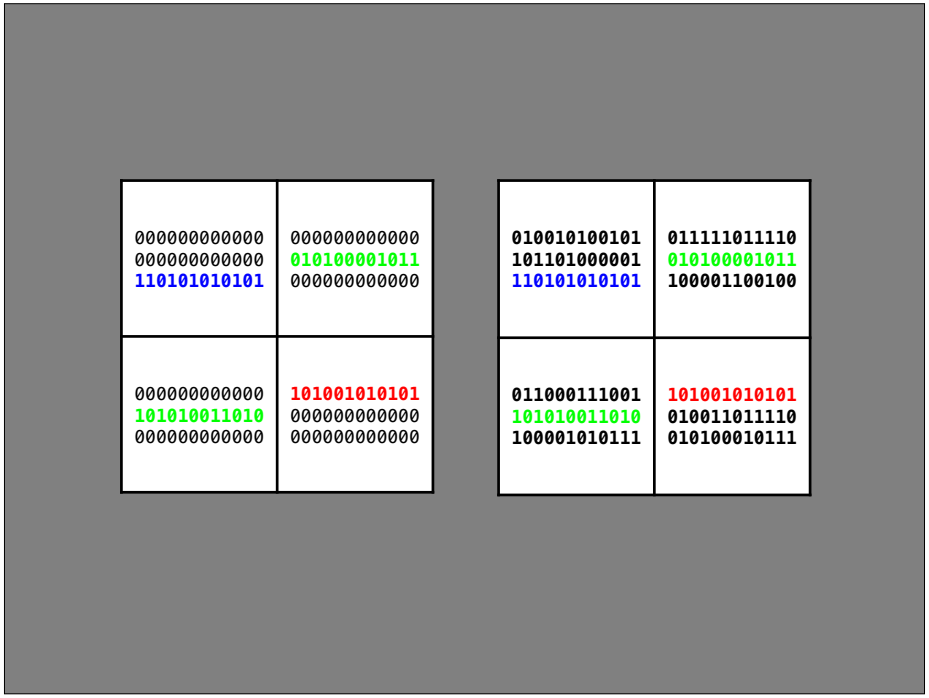
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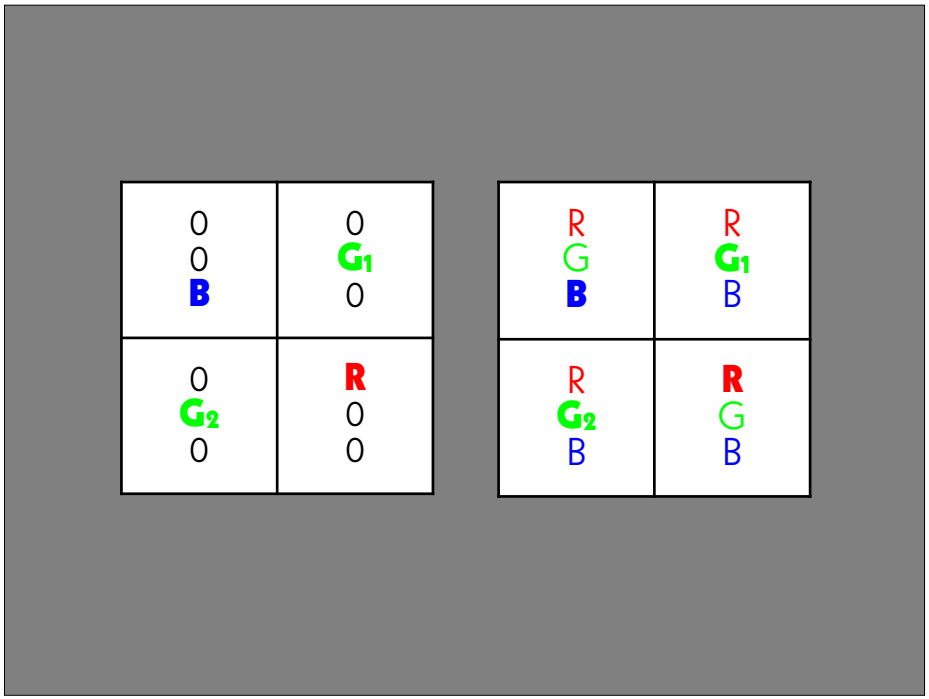
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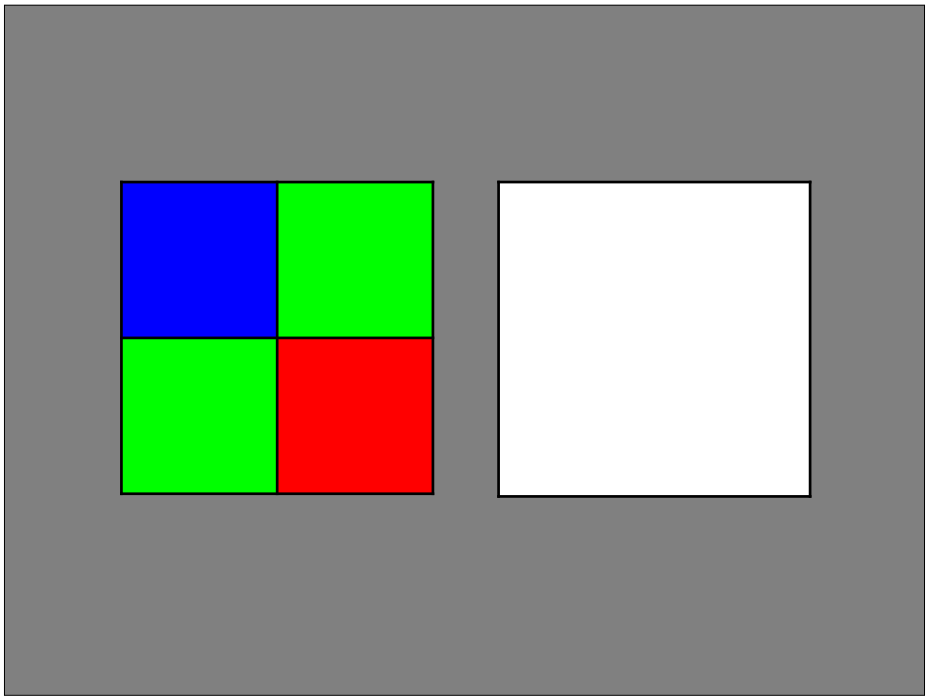

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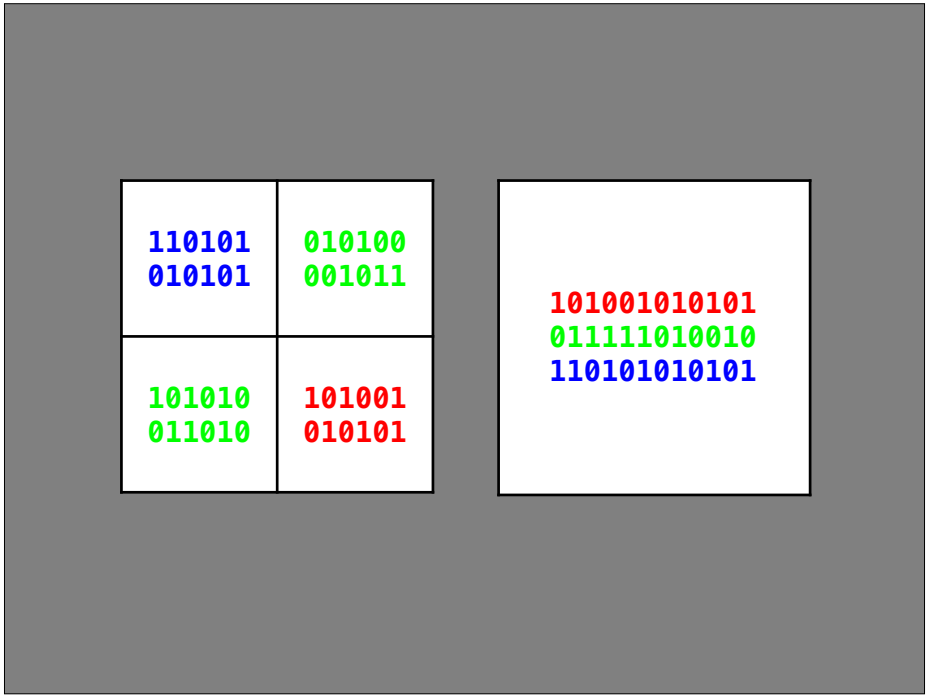

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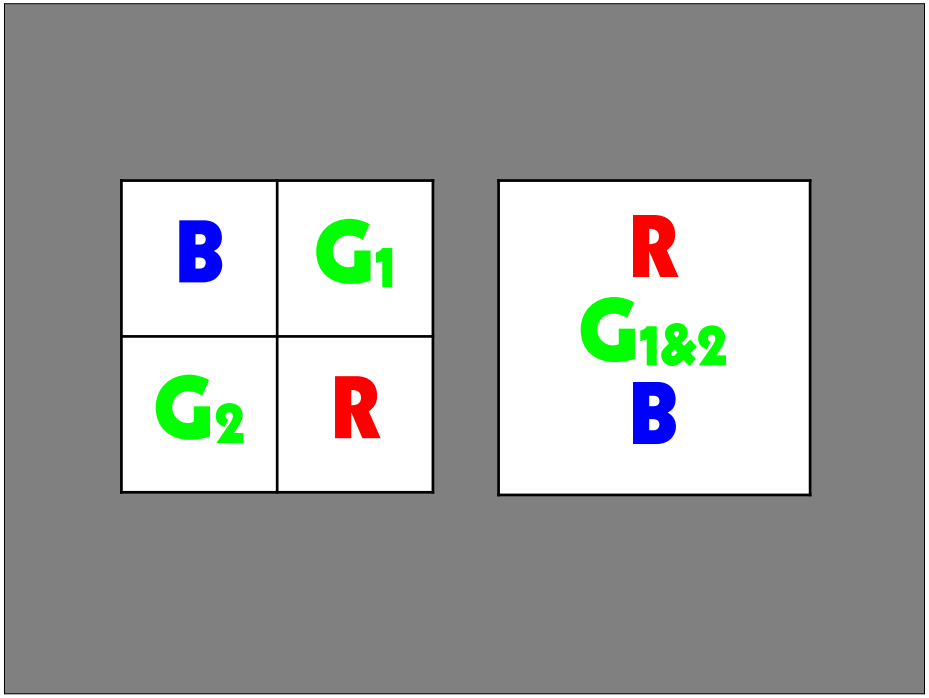

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Ways to use Bayer-type data

digital blow-up to RGB

- 3 times the amount of the generated data
- the file has the full sensor resolution
- only ⅓ of the data are real

digital reduction to RGB

- ¾ the amount of the generated data
- the file has ½ of the sensor resolution
- all data are real

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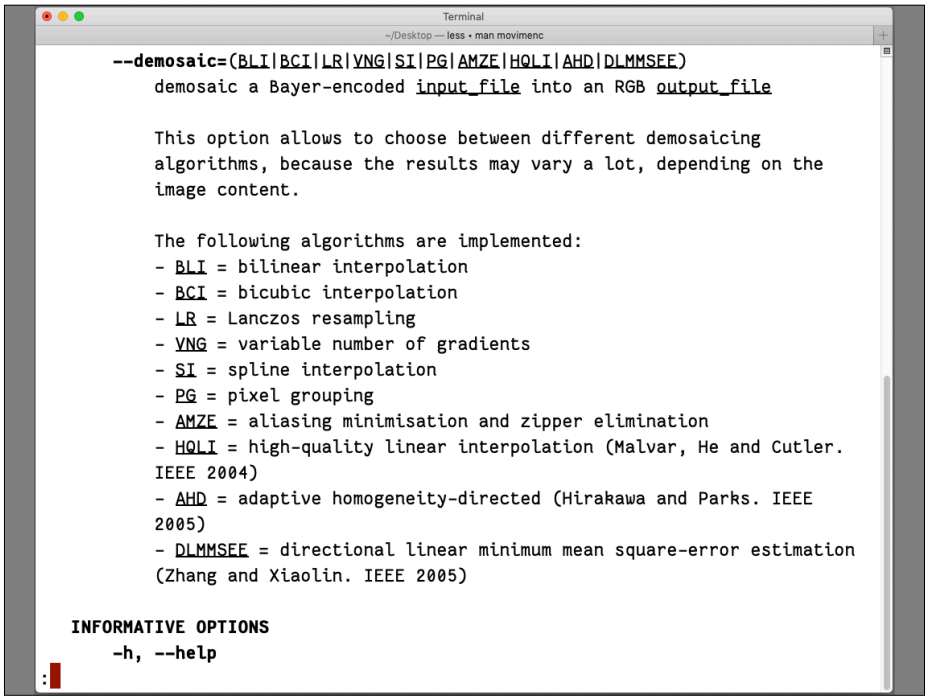

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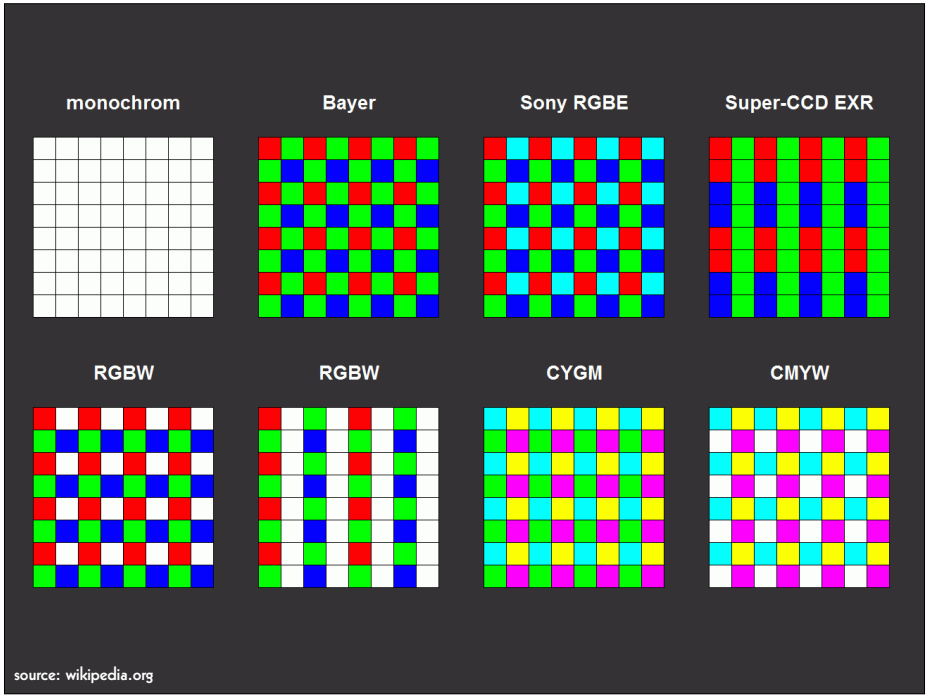

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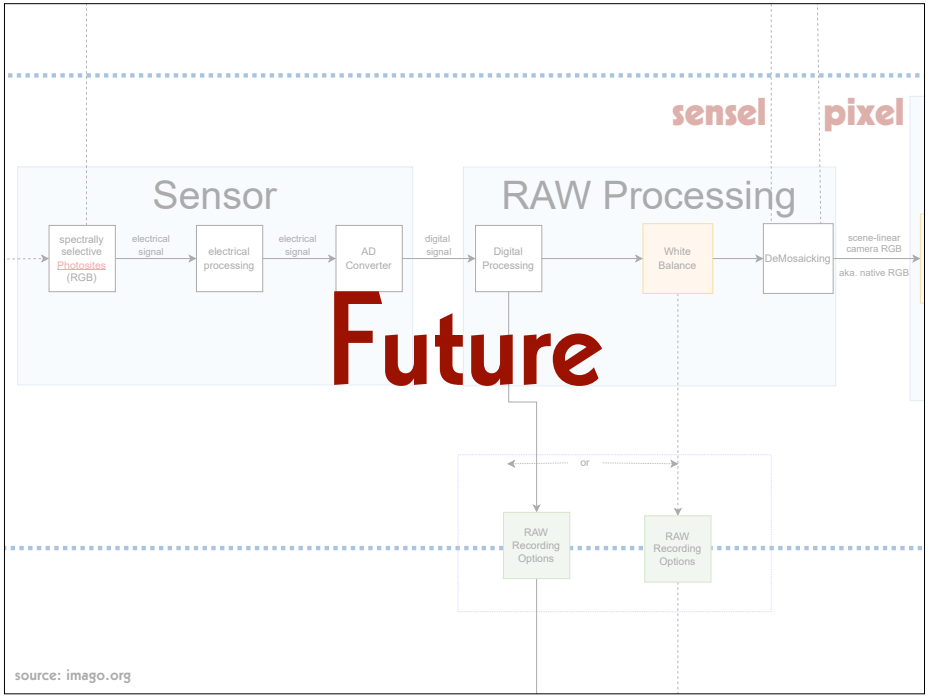

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Proposed Terminology

pixel

= picture element

sensel

= sensor element

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imago.org

The photon path workflow diagram

- will be published in the next weeks (or months) by the IMAGO Technical Committee
- has already been approved by many manufacturers

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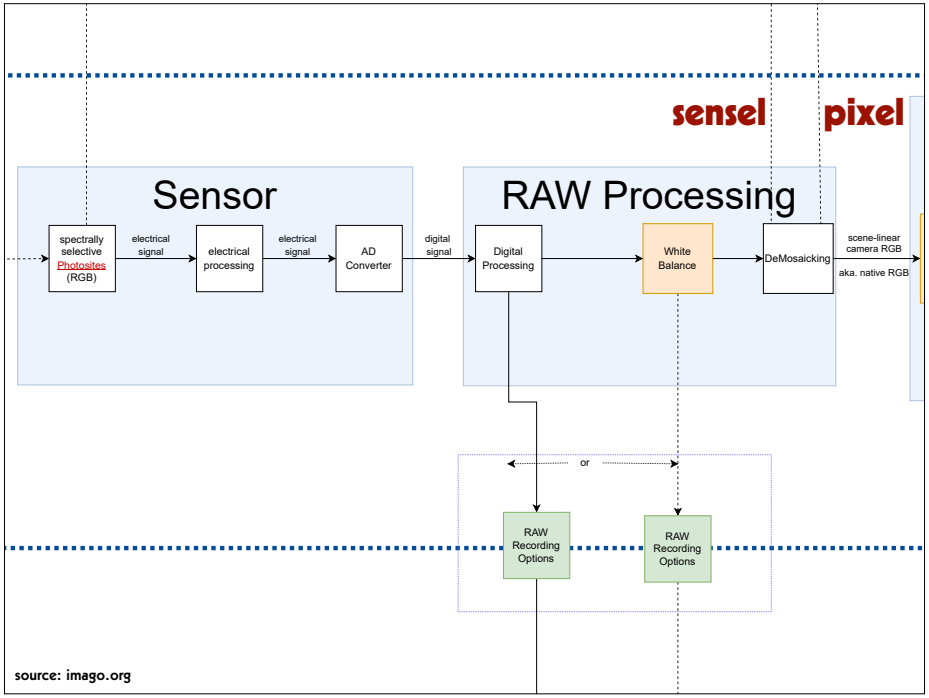

Stream:	Internet Engineering Task Force (IETF)
RFC:	9043
Category:	Informational
Published:	August 2021
ISSN:	2070-1721
Authors:	M. Niedermayer D. Rice J. Martinez

RFC 9043
FFV1 Video Coding Format Versions 0, 1, and 3

Abstract

This document defines FFV1, a lossless, intra-frame video encoding format. FFV1 is designed to efficiently compress video data in a variety of pixel formats. Compared to uncompressed video, FFV1 offers storage compression, frame fixity, and self-description, which makes FFV1 useful as a preservation or intermediate video format.

Status of This Memo

This document is not an Internet Standards Track specification; it is published for informational purposes.

FFV1: Directions (1)

- support of the Y′CoCg colour model
- support of Bayer-type data
- support of any channel
- support of 1D and 3D LUTs
- support of HDR

FFV1: Directions (2)

- revision of the bit stream
- tuning of the compression algorithm (speed and rate)

Ways to store Bayer-type data

- pixel values generated by one de-mosaicking algorithm (digital blow-up)
- pixel values generated by mixing two green sensel values into one (digital reduction)
- raw sensel values

The sensel values
are the raw ingredients
to cook the pixel values.