Case Study:
the Bayer Colour Imaging Array

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Hochschule der Künste Bern
Digital Files
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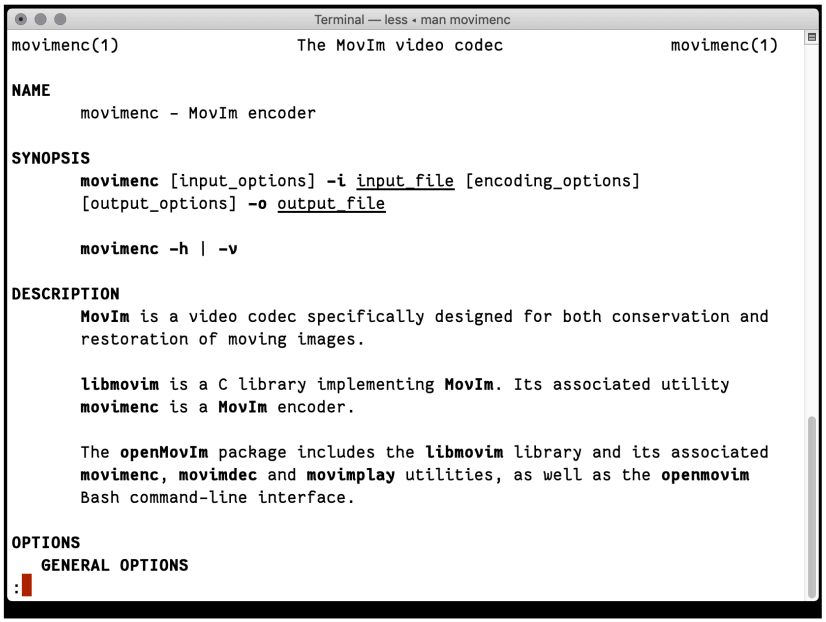
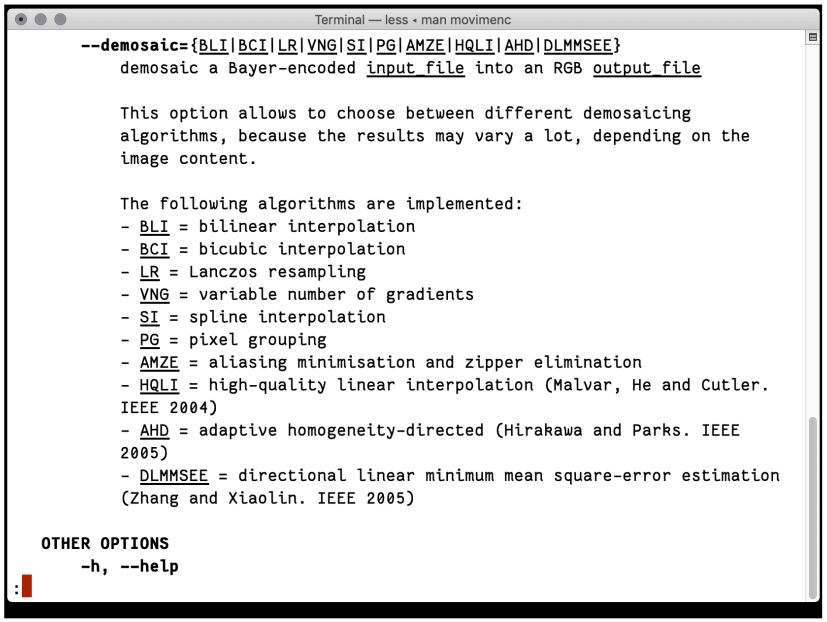
Uncomfortable Truths

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

Let's experiment!




Terminal — less • man movimenc
--demosaic={BLI|BCI|LR|VNG|SI|PG|AMZE|HQLI|AHD|DLMMSEE}
demosaic a Bayer-encoded input_file into an RGB output_file
This option allows to choose between different demosaicing algorithms, because the results may vary a lot, depending on the image content.
The following algorithms are implemented:
- BLI = bilinear interpolation
- BCI = bicubic interpolation
- LR = Lanczos resampling
- VNG = variable number of gradients
- SI = spline interpolation
- PG = pixel grouping
- AMZE = aliasing minimisation and zipper elimination
- HQLI = high-quality linear interpolation (Malvar, He and Cutler. IEEE 2004)
- AHD = adaptive homogeneity-directed (Hirakawa and Parks. IEEE 2005)
- DLMMSEE = directional linear minimum mean square-error estimation (Zhang and Xiaolin. IEEE 2005)
OTHER OPTIONS
-h, --help
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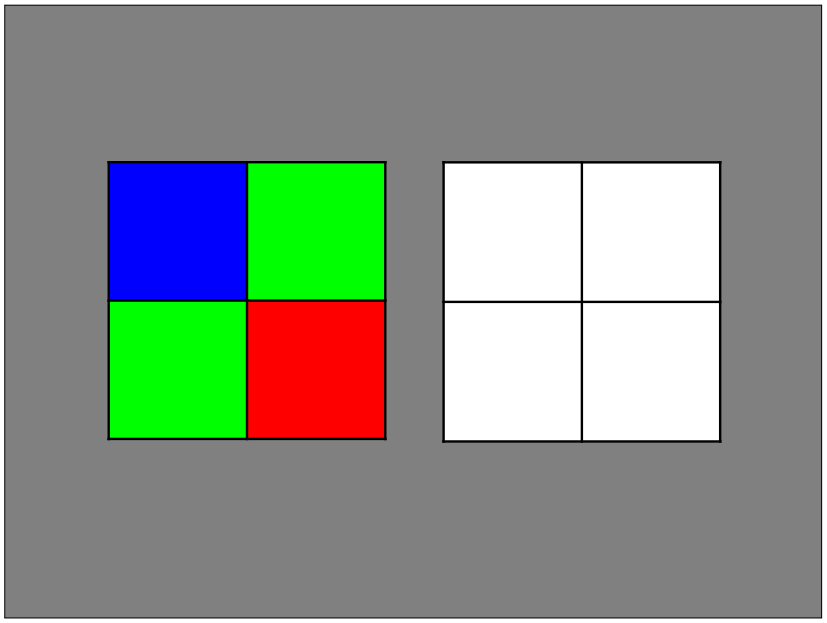

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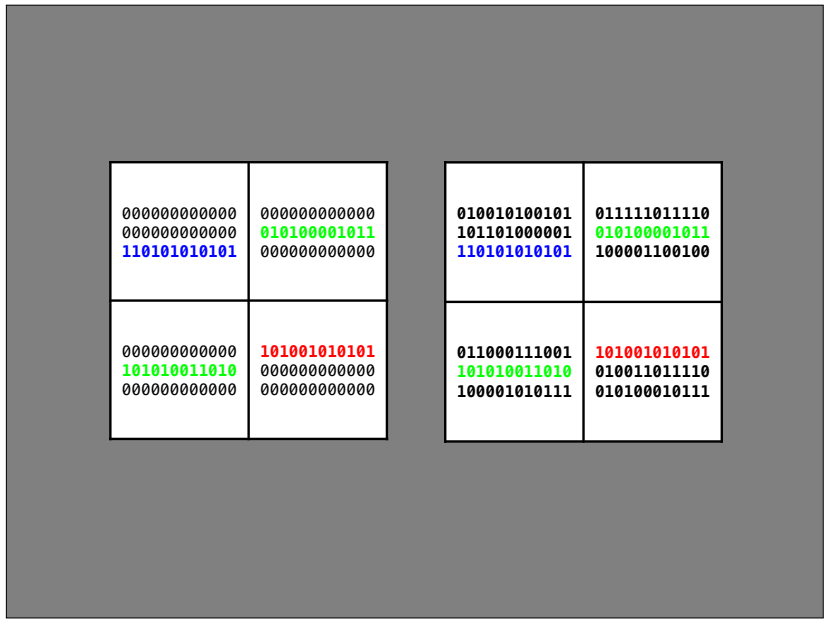

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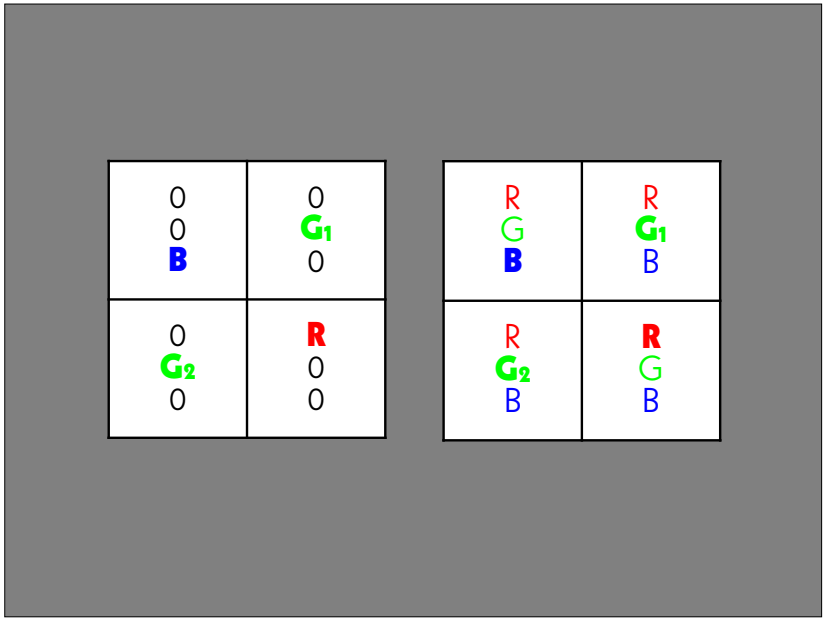
0 0 B
0 G1 0
R G B
R G1 B
0 G2 0
R 0 0
R G2 B
R G B

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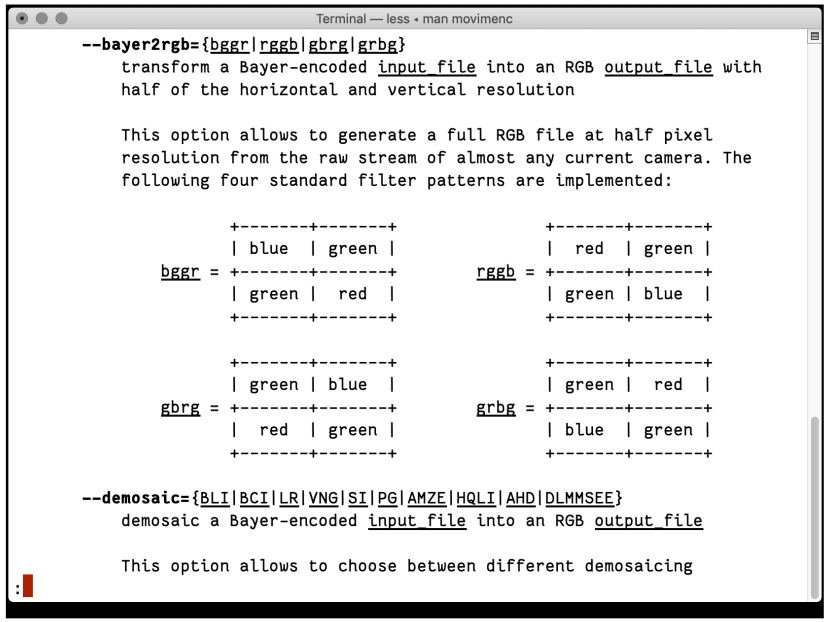
Terminal — less ◂ man movimenc
--bayer2rgb={bggr|rggb|gbrg|grbg}
transform a Bayer-encoded input_file into an RGB output_file with half of the horizontal and vertical resolution
This option allows to generate a full RGB file at half pixel resolution from the raw stream of almost any current camera. The following four standard filter patterns are implemented:
bggr = | blue | green | / | green | red |
rggb = | red | green | / | green | blue |
gbrg = | green | blue | / | red | green |
grbg = | green | red | / | blue | green |
--demosaic={BLI|BCI|LR|VNG|SI|PG|AMZE|HQLI|AHD|DLMMSEE}
demosaic a Bayer-encoded input_file into an RGB output_file
This option allows to choose between different demosaicing
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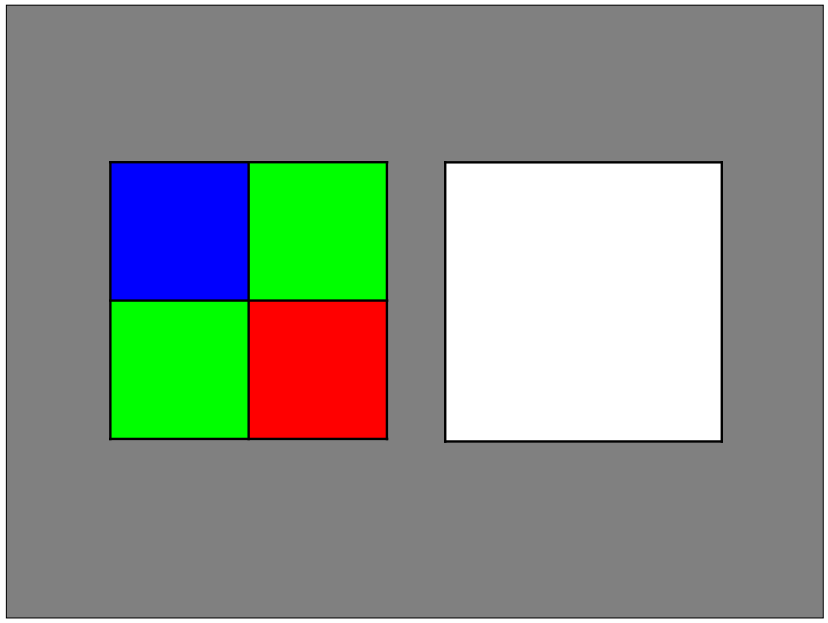

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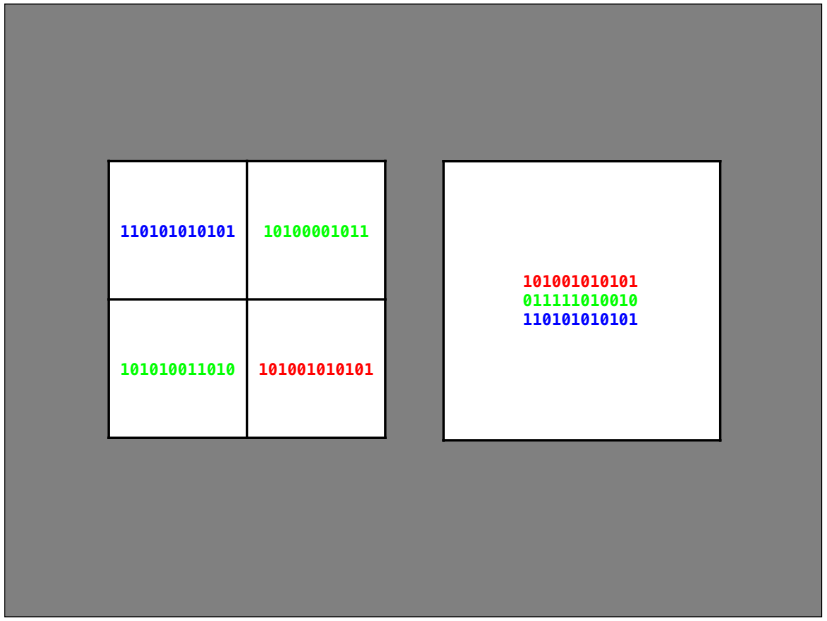

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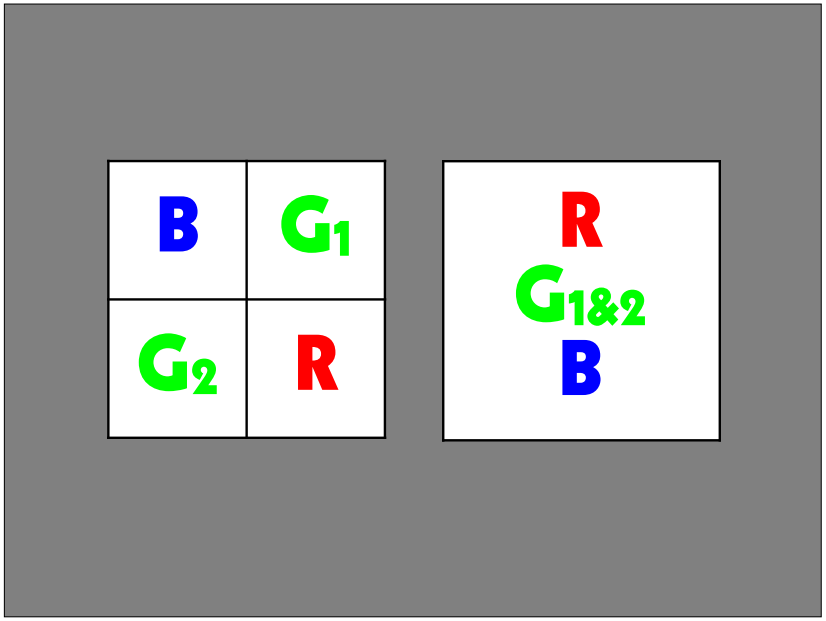

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Terminal — less ◂ man openmovim

```
openmovim(1)                The MovIm video codec                openmovim(1)

NAME
       openmovim - Command-line interface to encode, decode, play and analyse
       moving images using 'libmovim'

SYNOPSIS
       openmovim (-e | -d | -p | -a | -m | -s) -i input_file [-o output_file]

       openmovim (-c | -u) -i input_file [-o output_file]

       openmovim -h | -v

DESCRIPTION
       MovIm is a video codec specifically designed for both conservation and
       restoration of moving images.

       libmovim is a C library implementing MovIm and movimenc, movimdec and
       movimplay are its associated utilities.

       openmovim is a Bash command-line interface to libmovim allowing to
       encode, decode, play and analyse virtually any moving images.

       The openMovIm package includes the libmovim library and its associated
:
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Terminal — less ◂ man openmovim

```
OPTIONS
   GENERAL OPTIONS
       Select a mode:

       -e, --encode
           encoding mode: use movimenc to encode an input_file to an
           output_file

       -d, --decode
           decoding mode: use movimdec to decode an input_file to an
           output_file

       -p, --play
           playing mode: use movimplay to play an input_file

       -a, --analyse, --analyze
           analysing mode: use movimdec to analyse the validity of an
           input_file and write a report to an output_file if specified or to
           the Terminal otherwise

       -m, --metadata
           metadata mode: use movimdec to extract the technical metadata of an
           input_file (without analysing its validity) and write a report to
           an output_file if specified or to the Terminal otherwise
:
```

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Terminal — less • man openmovim

```
-e, --encode
    encoding mode: use movimenc to encode an input_file to an
    output_file

-d, --decode
    decoding mode: use movimdec to decode an input_file to an
    output_file

-p, --play
    playing mode: use movimplay to play an input_file

-a, --analyse, --analyze
    analysing mode: use movimdec to analyse the validity of an
    input_file and write a report to an output_file if specified or to
    the Terminal otherwise

-m, --metadata
    metadata mode: use movimdec to extract the technical metadata of an
    input_file (without analysing its validity) and write a report to
    an output_file if specified or to the Terminal otherwise

-s, --scan
    scan mode: use movimenc to encode the input_file (i.e. the stream
    coming from a sensor) into an output_file
:
```


Two ways to use Bayer 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

Acknowledgements

- Tommy Aschenbach
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