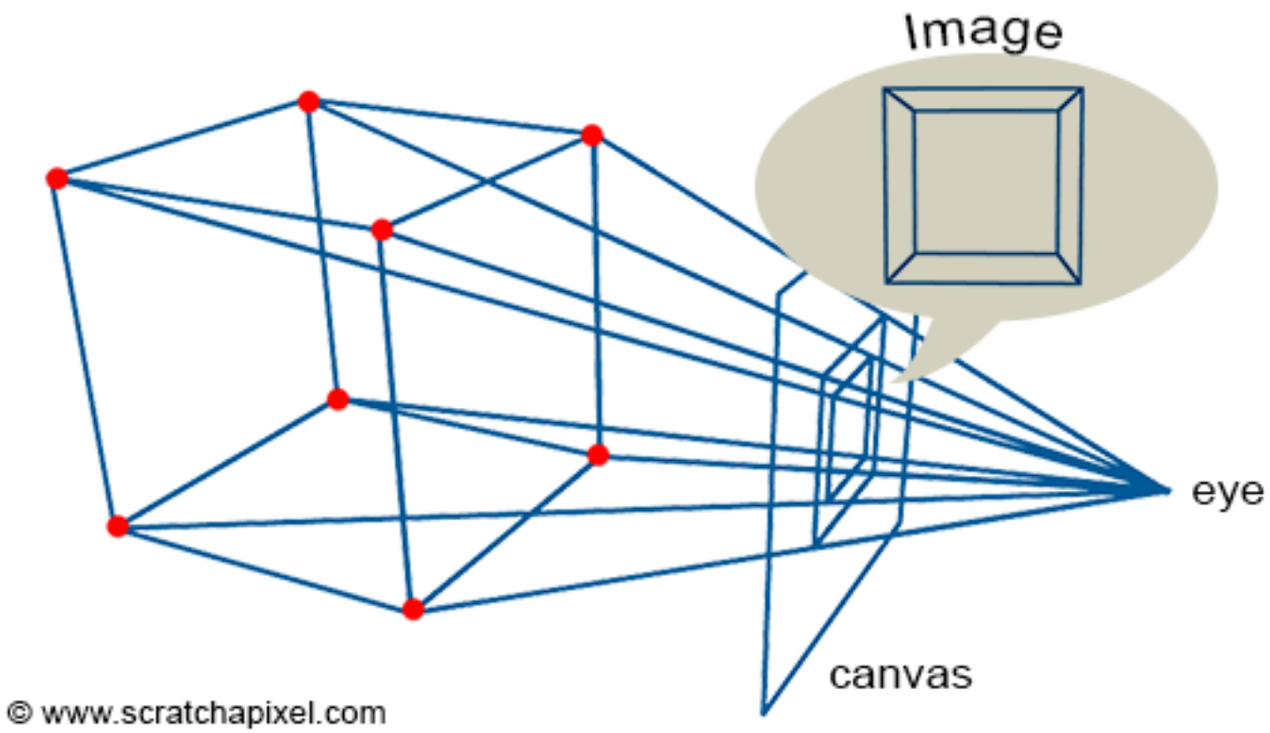
image processing ABC

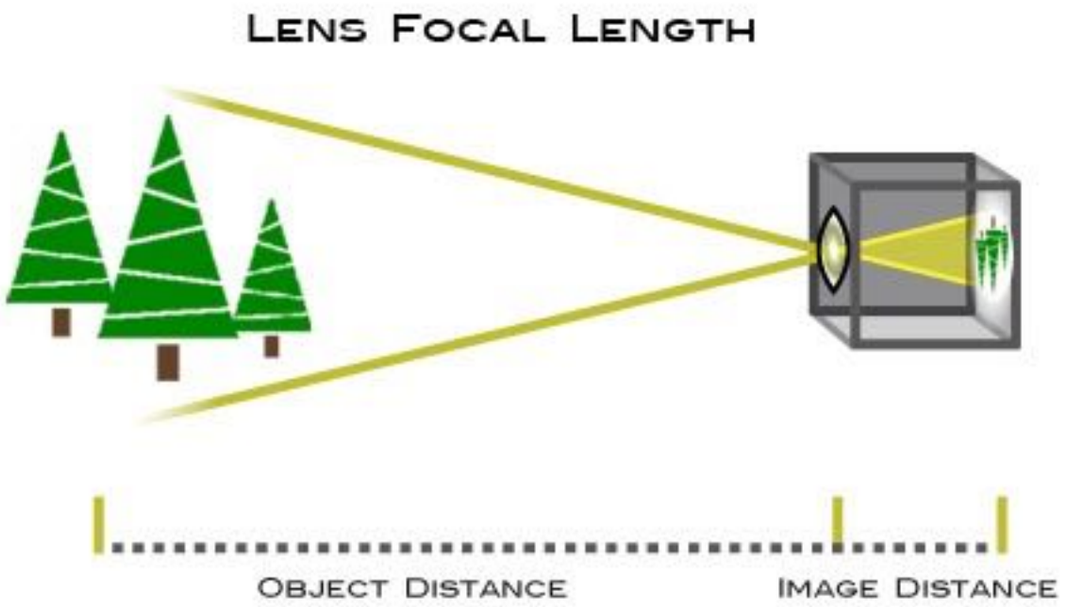
dr. federica bianco fbianco@nyu.edu
@fedhere

projection of 3D world in 2D

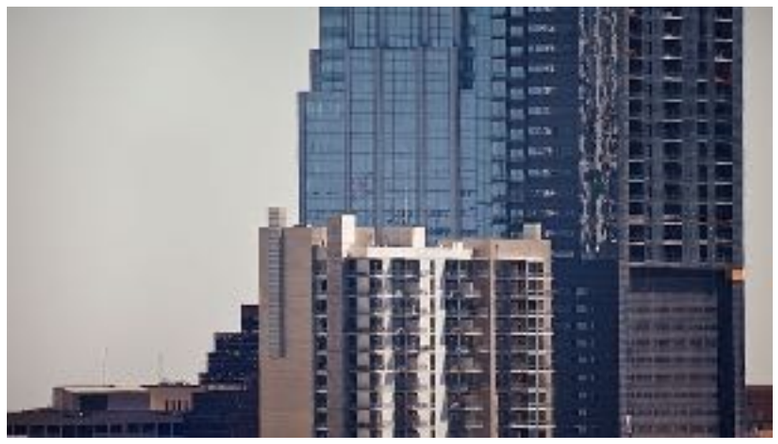


Source: Intel.com

projection of 3D world in 2D



tele photo (800mm)



wide angle (15mm)

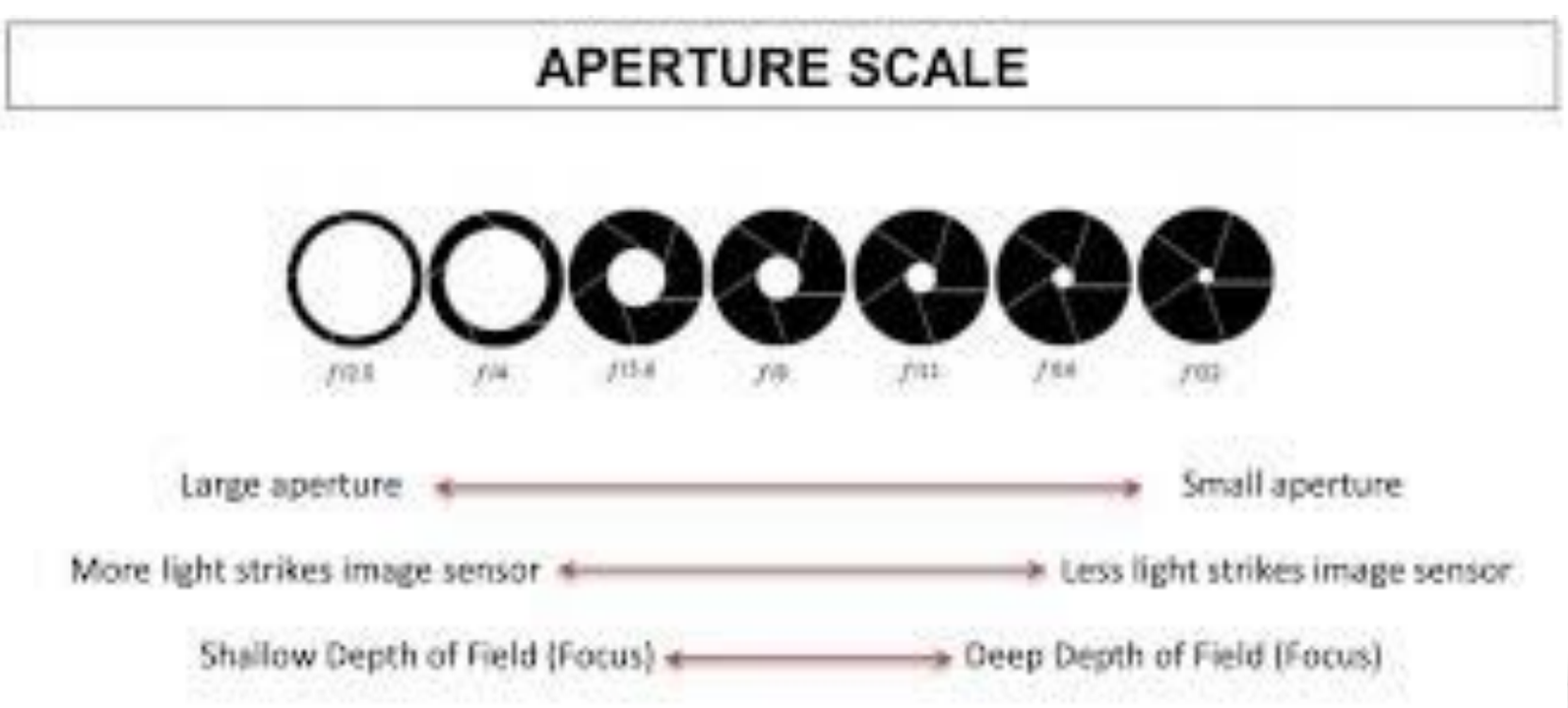
<u>deformation</u> demo
(google street view)

<u>Focal Length</u> (nikon)

Source: Intel.com

federica bianco, CUSP NYU

projection of 3D world in 2D



Source: intel.com

projection of 3D world in 2D

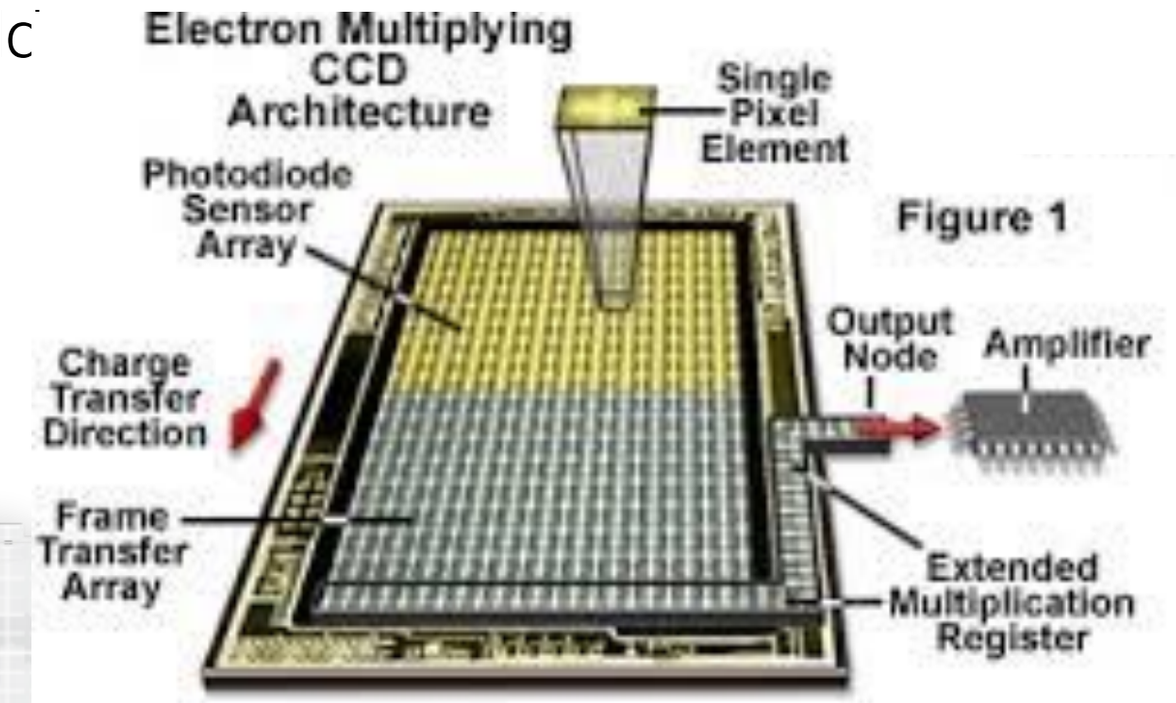
Source: Intel.com

how digital cameras work

- a 2D array of light-sensitive photodiodes absorbs photons and releases electrons through the photoelectric effect.

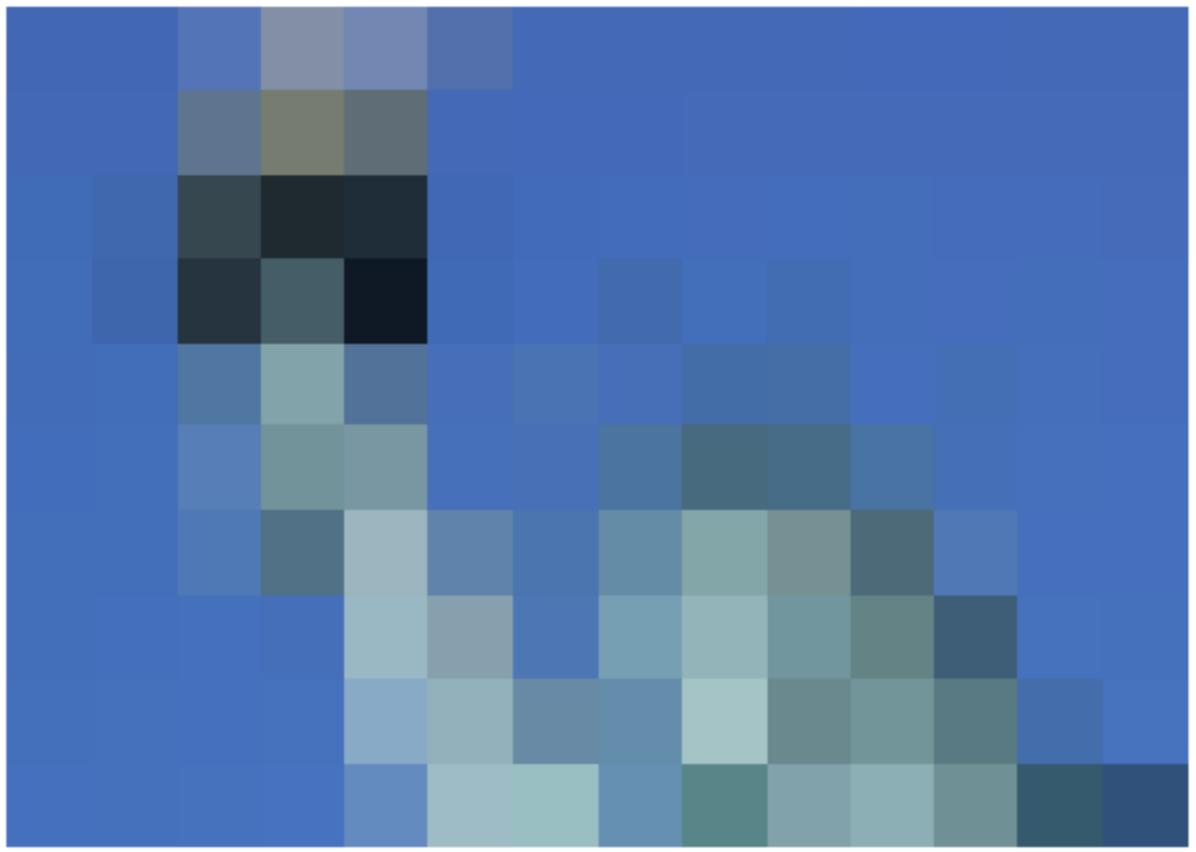
- electrons are stored in a well as an electrical charge that is accumulated over the length of the exposure. The charge that is generated is proportional to the number of photons that hit the sensor.

systematics: saturation, minimum threshold



Source: intel.com

resolution



Source: Intel.com

Color representation

Different choices for color spaces

- **RGB**
- **Normalized RGB**
- HIS, HSV, HSL
- Fleck HSV
- TSL
- YcrCb
- Perceptually uniform colors
- CIELAB, CIELUV
- Others
- YES, YUV, YIQ, CIE-xyz

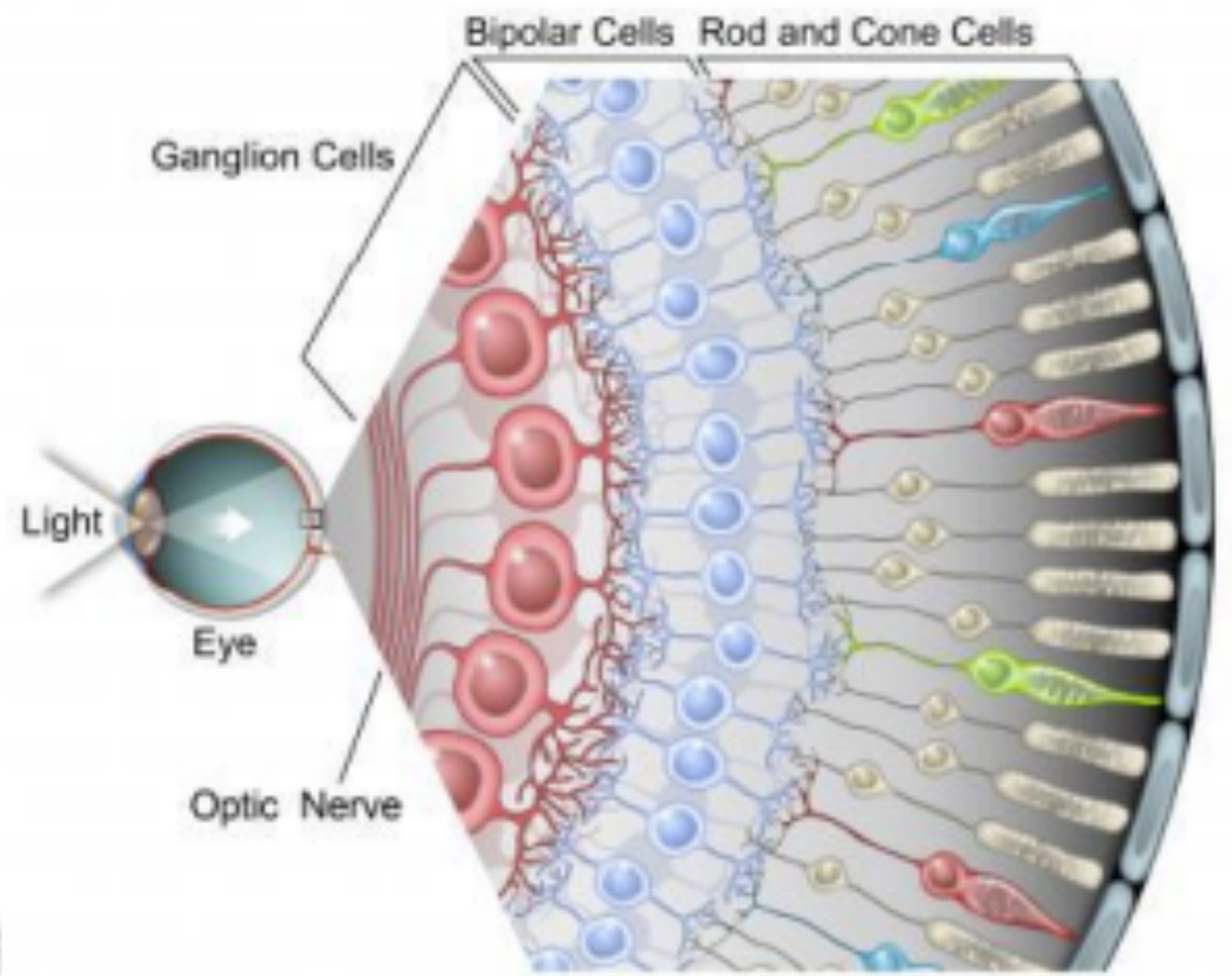
Source: intel.com

Color perception

80M 5M

Rods & Cones

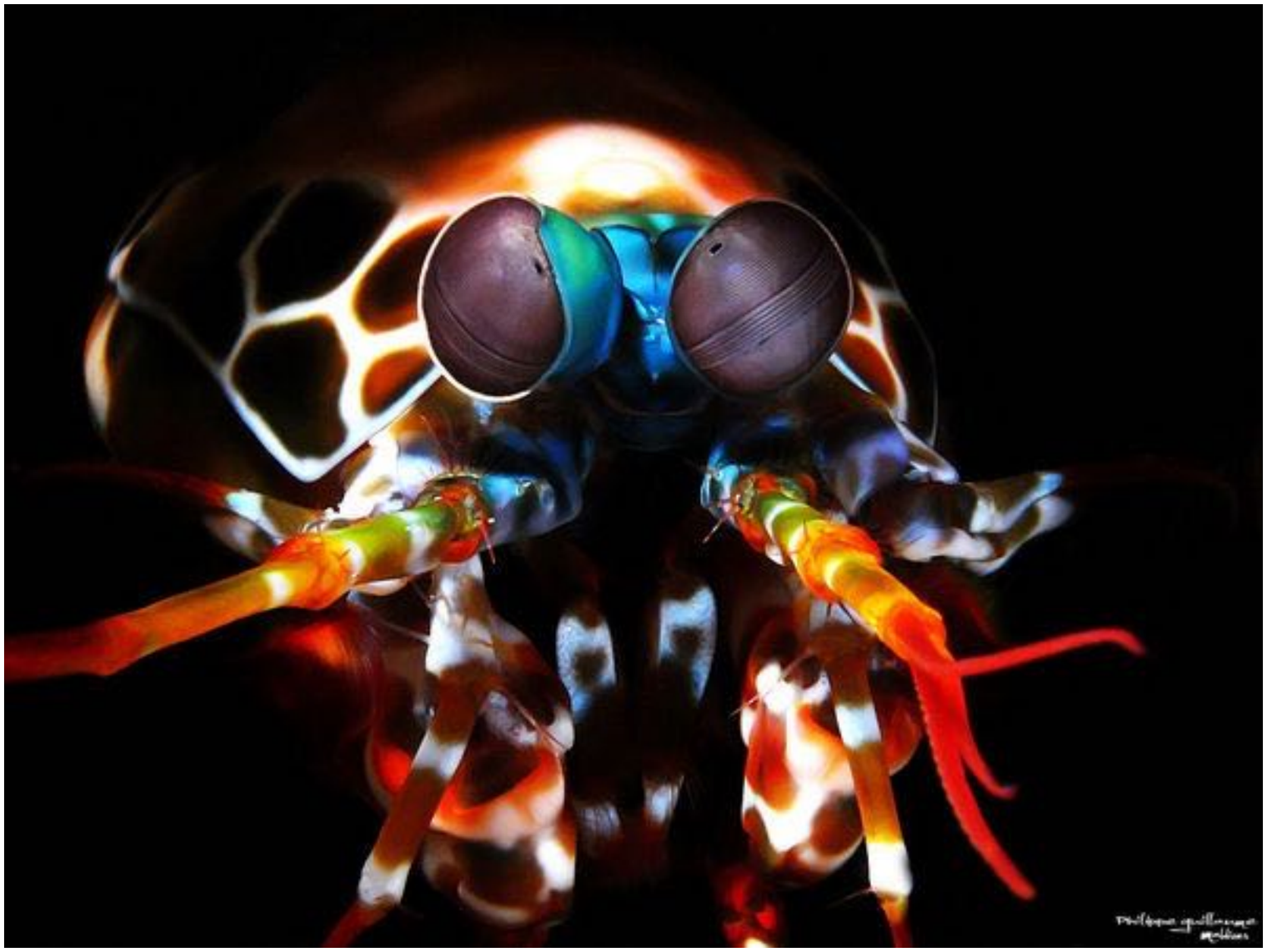
Brightness & Color



3 types of cones perceiving R G B

Source: intel.com

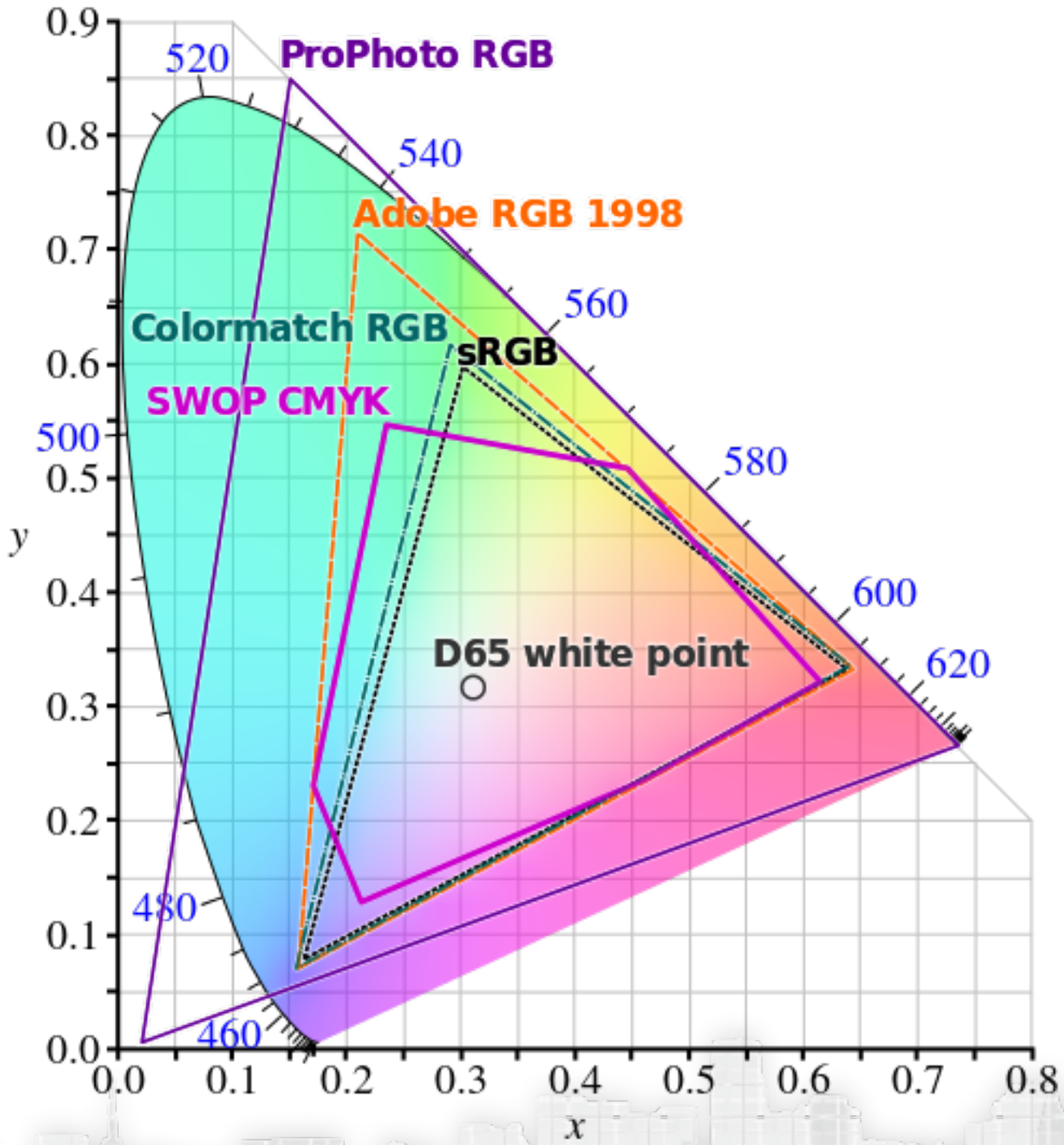
Color perception



Within each large, roving eye, mantis shrimp have twelve types of color-sensitive cells called photoreceptors. That's four times as many as we humans have, despite our self-assurance that we have the best vision in the animal kingdom.

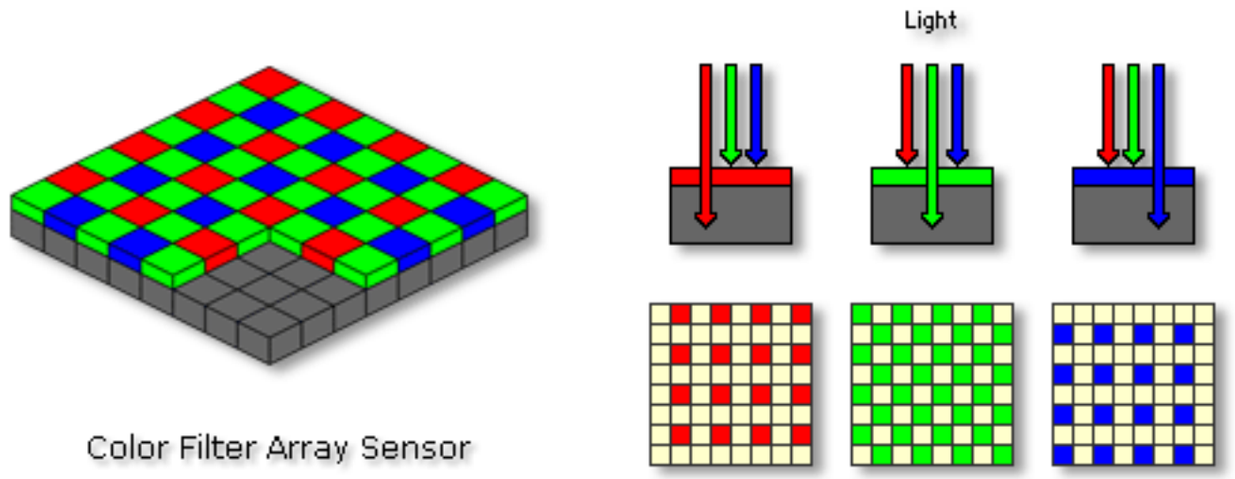
Source: Intel.com

Color representation



Source: intel.com

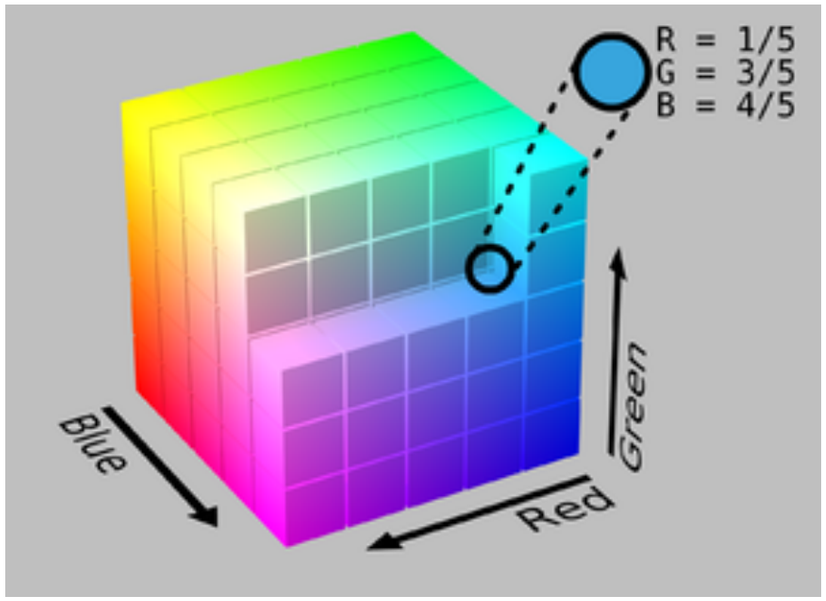
Color representation



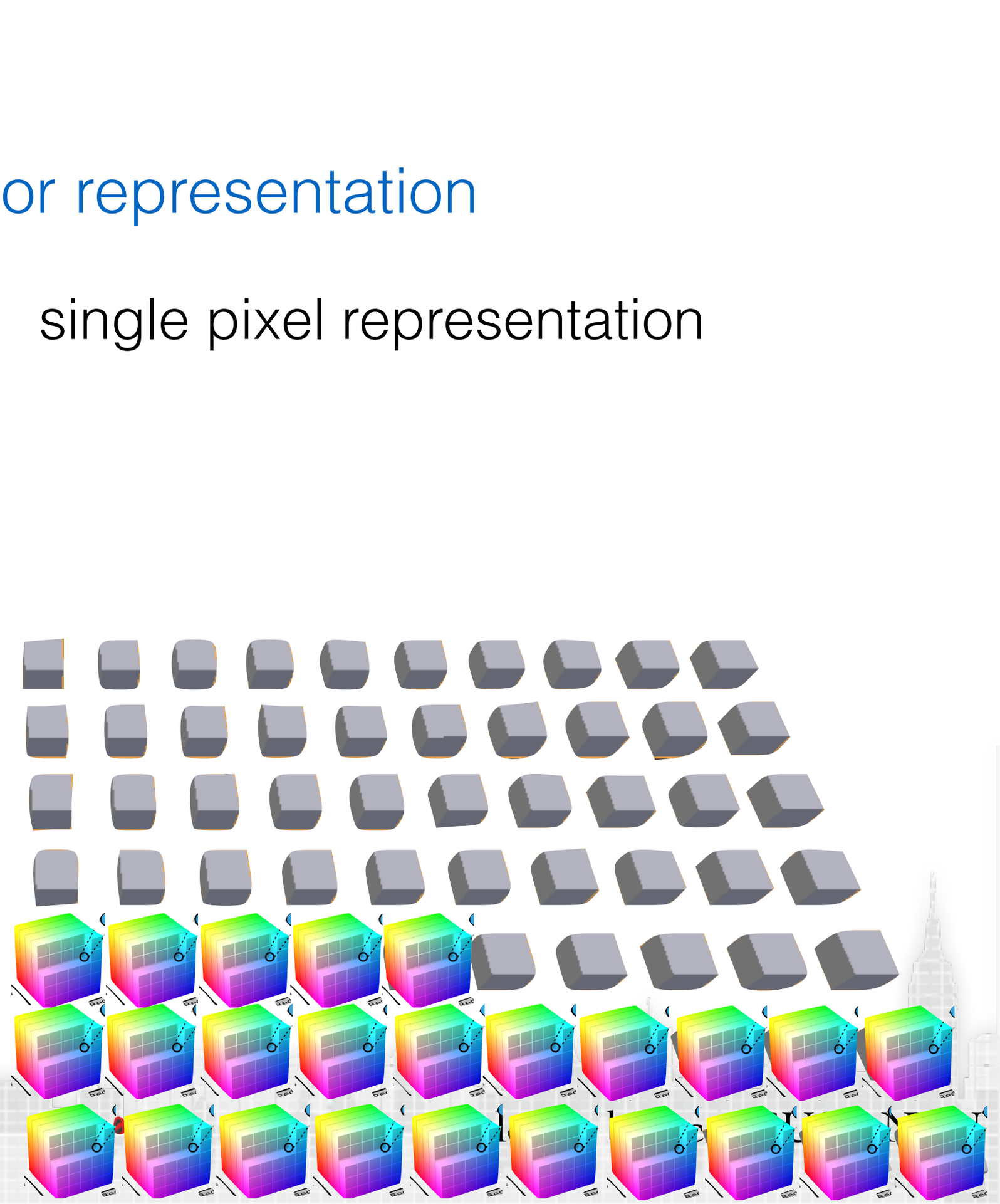
each pixel must read 3 colors

Source: intel.com

Color representation



single pixel representation



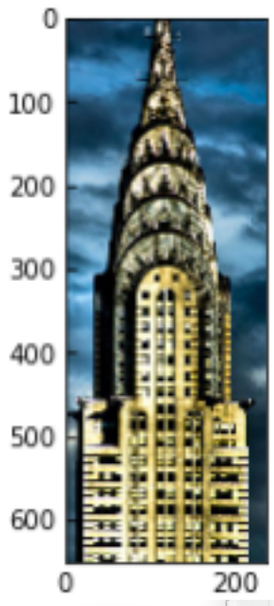
pixel array

image from a computer point of view

```
print (nd.imread("esb.jpg").shape)
imshow(nd.imread("esb.jpg"))
```

Last executed 2017-01-30 07:04:35 in 827ms

```
(652, 236, 3)
<matplotlib.image.AxesImage at 0x106631610>
```



Source: intel.com

limitations and possible systematics

- location dependent deformation
- low light cutoff (complete loss of info)
- saturation (complete loss of info)
- pixelization (loss of details)
- color bias (calibration)

Source: Intel.com

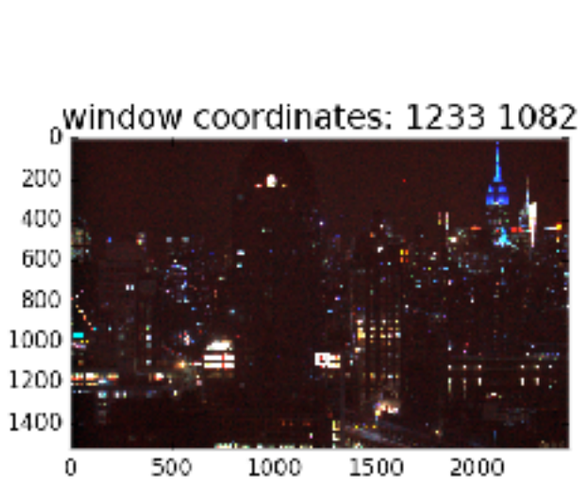
limitations and possible systematics

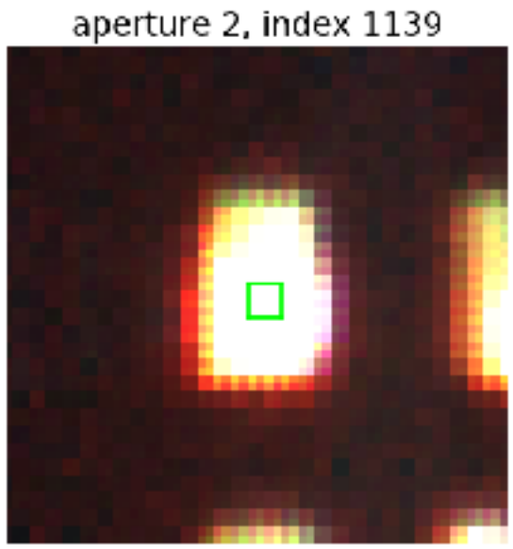
Source: intel.com

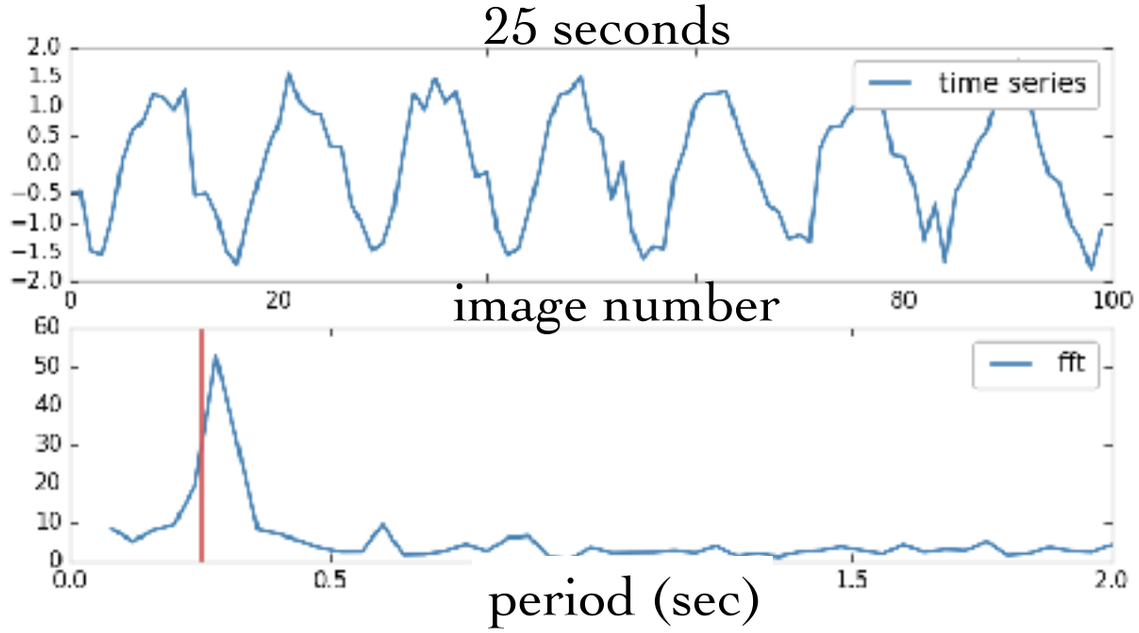
https://github.com/fedhere/UInotebooks/tree/master/imgPorcessingABC

Source: Intel.com

extracting time series from series of image files



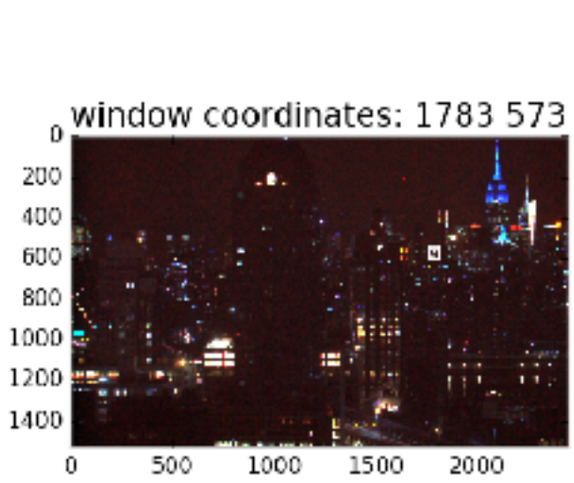


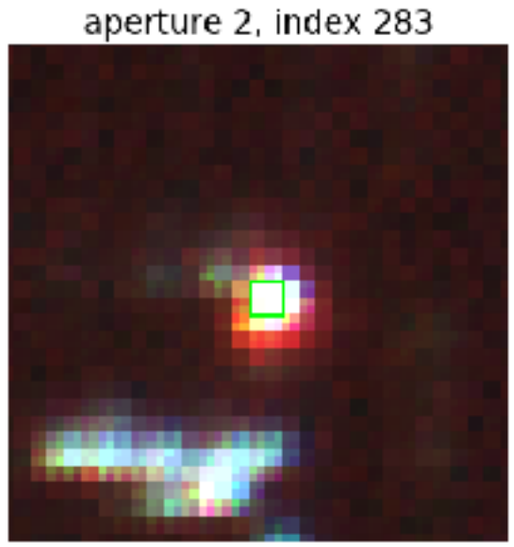


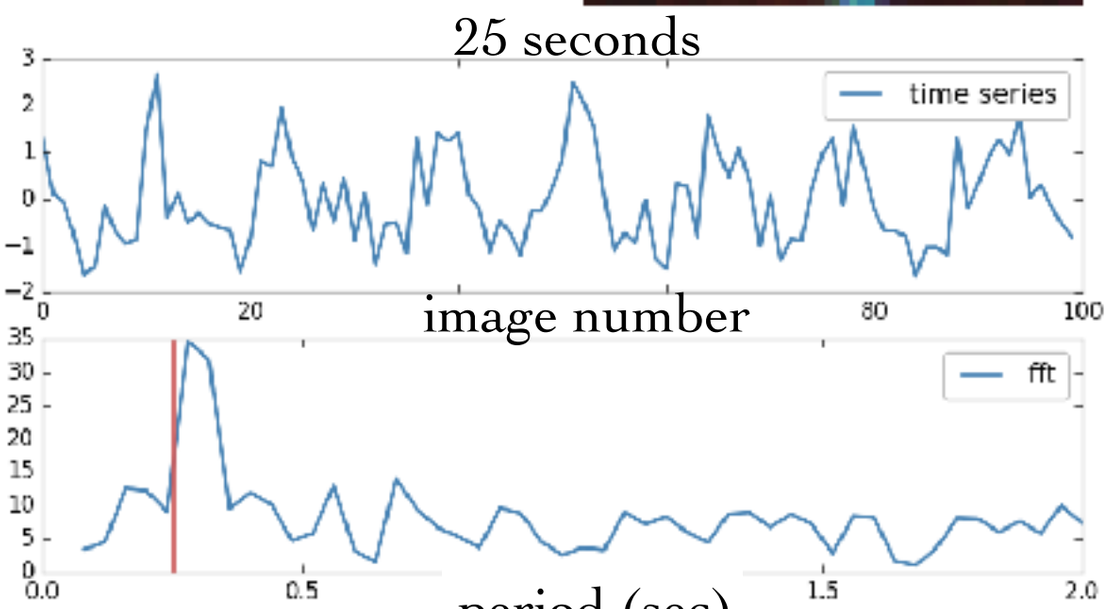
High speed observations & grid dynamics

Source: Intel.com

extracting time series from series of image files



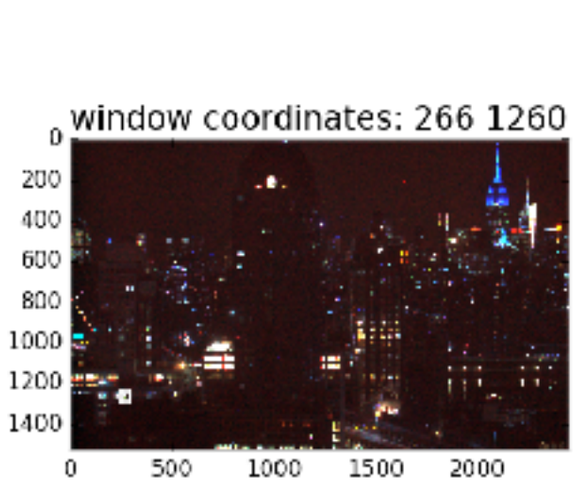


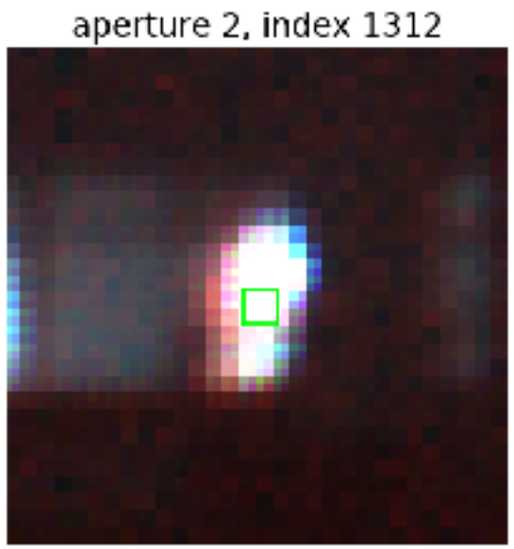


High speed observations & grid dynamics

Source: Intel.com

extracting time series from series of image files





25 seconds

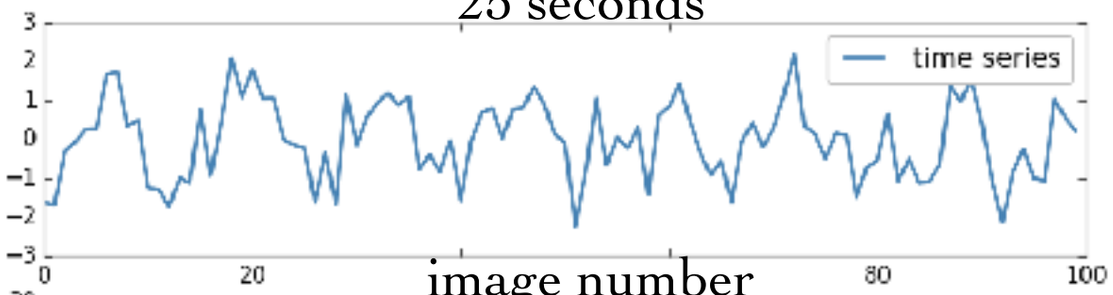
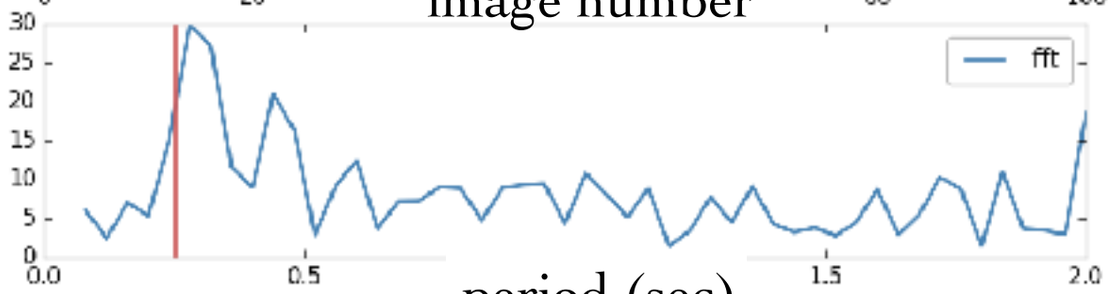


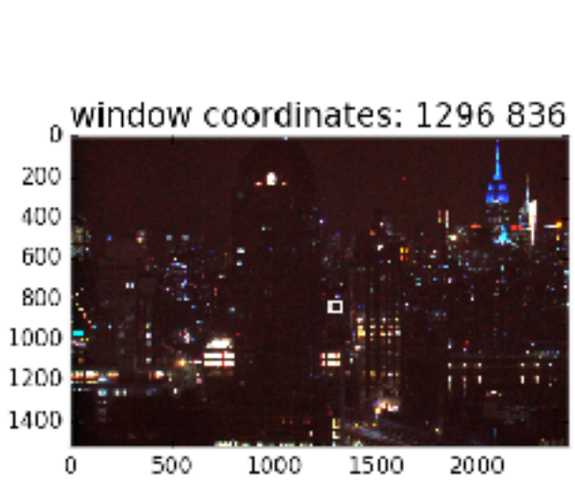
image number

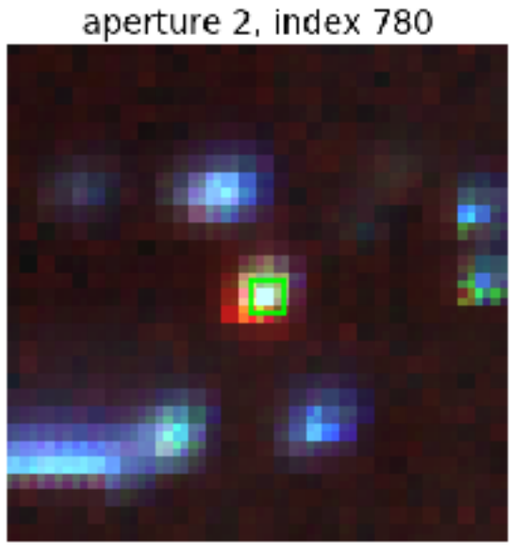


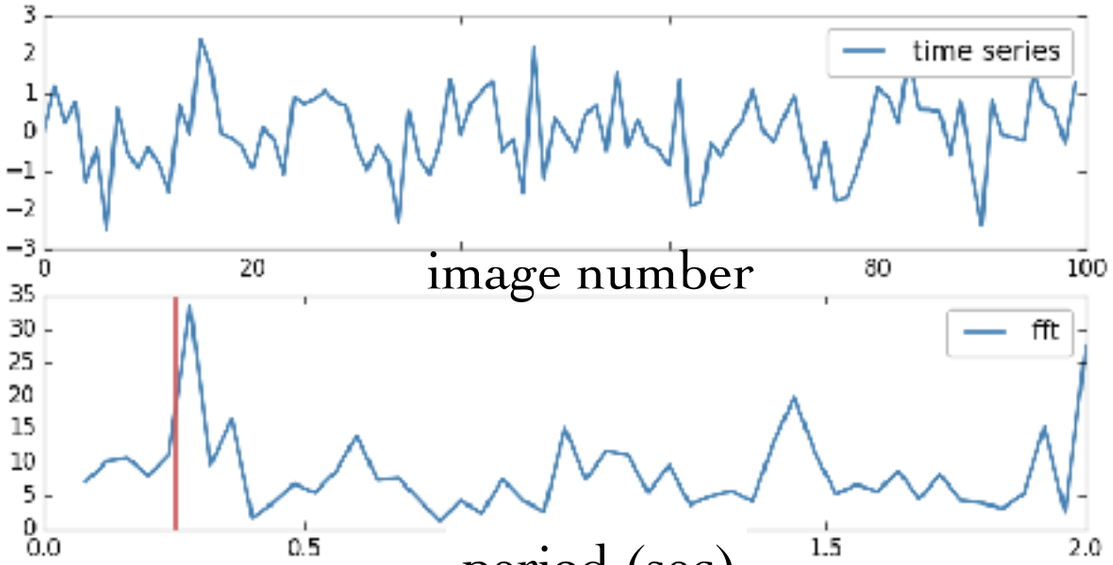
period (sec)

Source: intel.com

extracting time series from series of image files

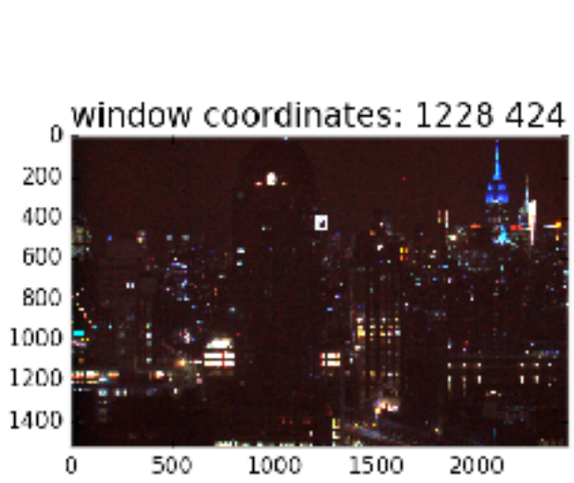


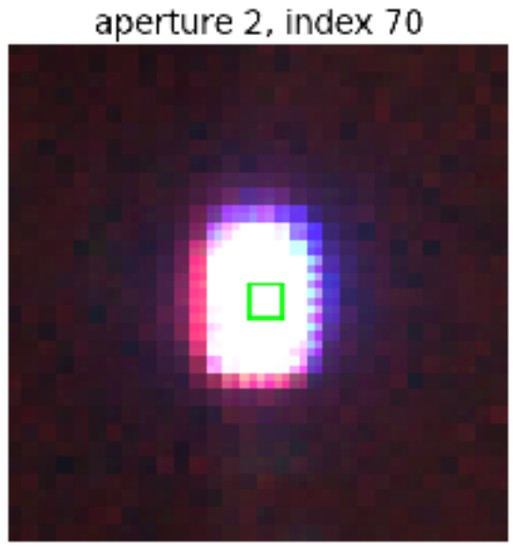


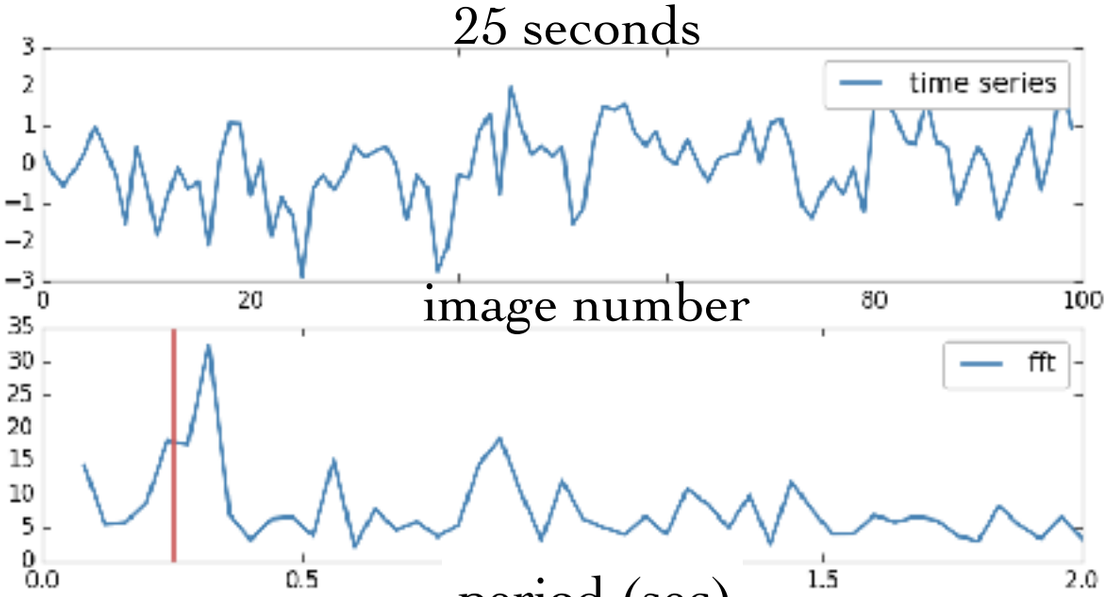


Source: Intel.com

extracting time series from series of image files







Source: Intel.com