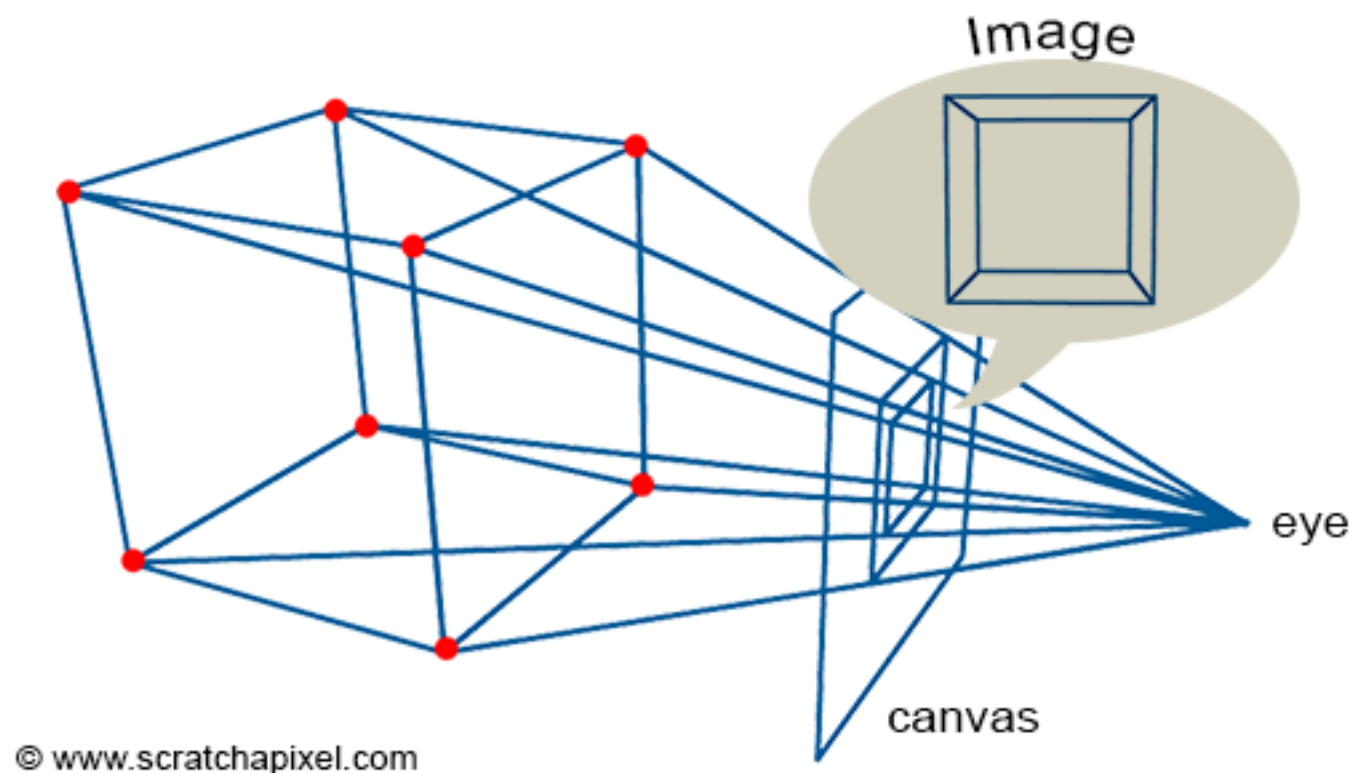


image processing ABC

Fall 2015

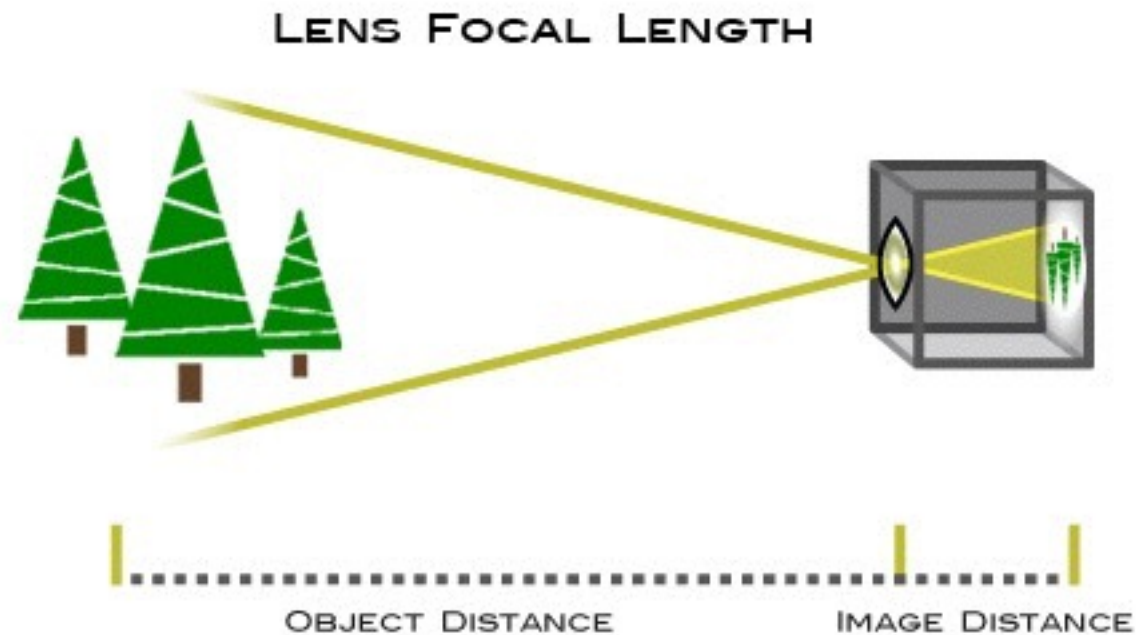
dr. federica bianco fb55@nyu.edu
[@fedhere](#)

projection of 3D world in 2D



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projection of 3D world in 2D



tele photo (800mm)



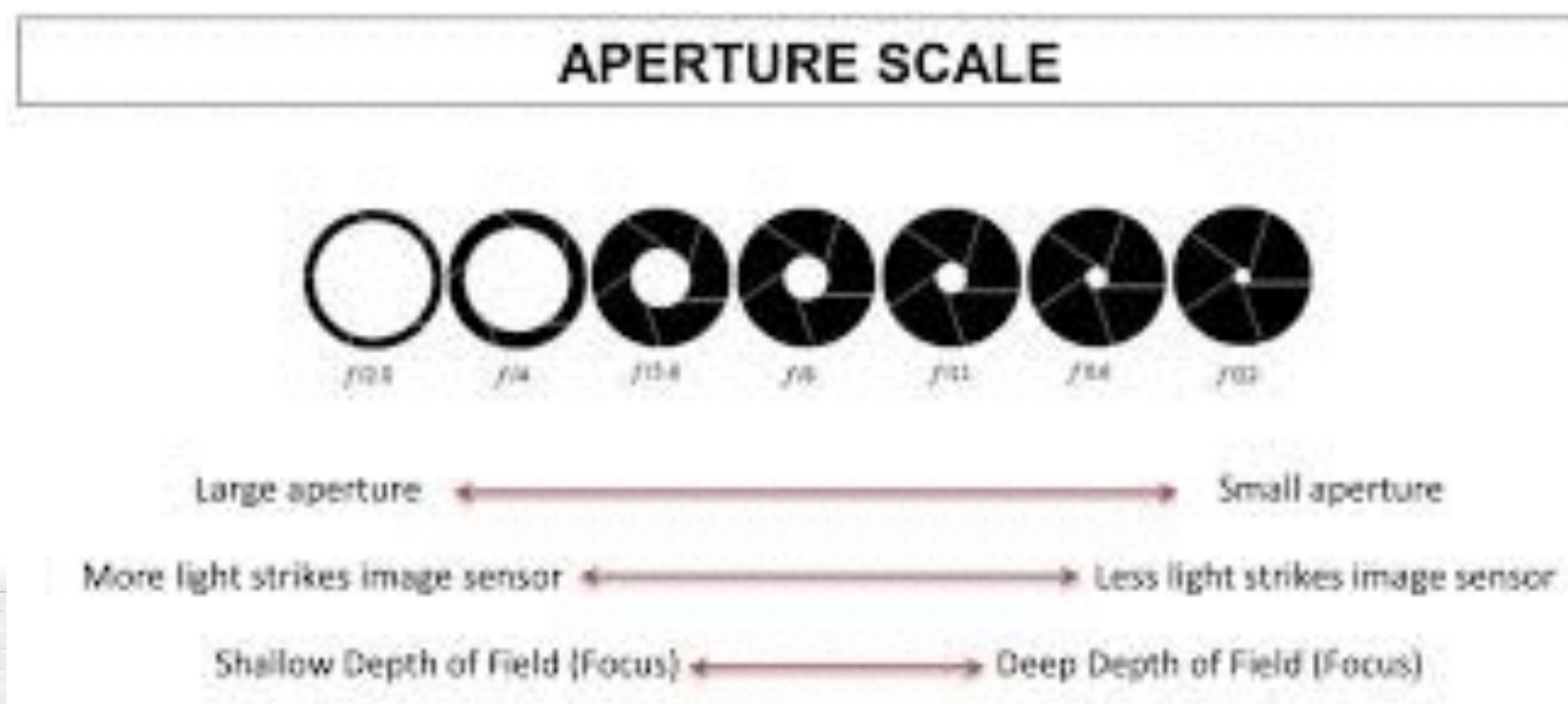
wide angle (15mm)



deformation demo
(google street view)

Focal Length (nikon)

projection of 3D world in 2D



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projection of 3D world in 2D

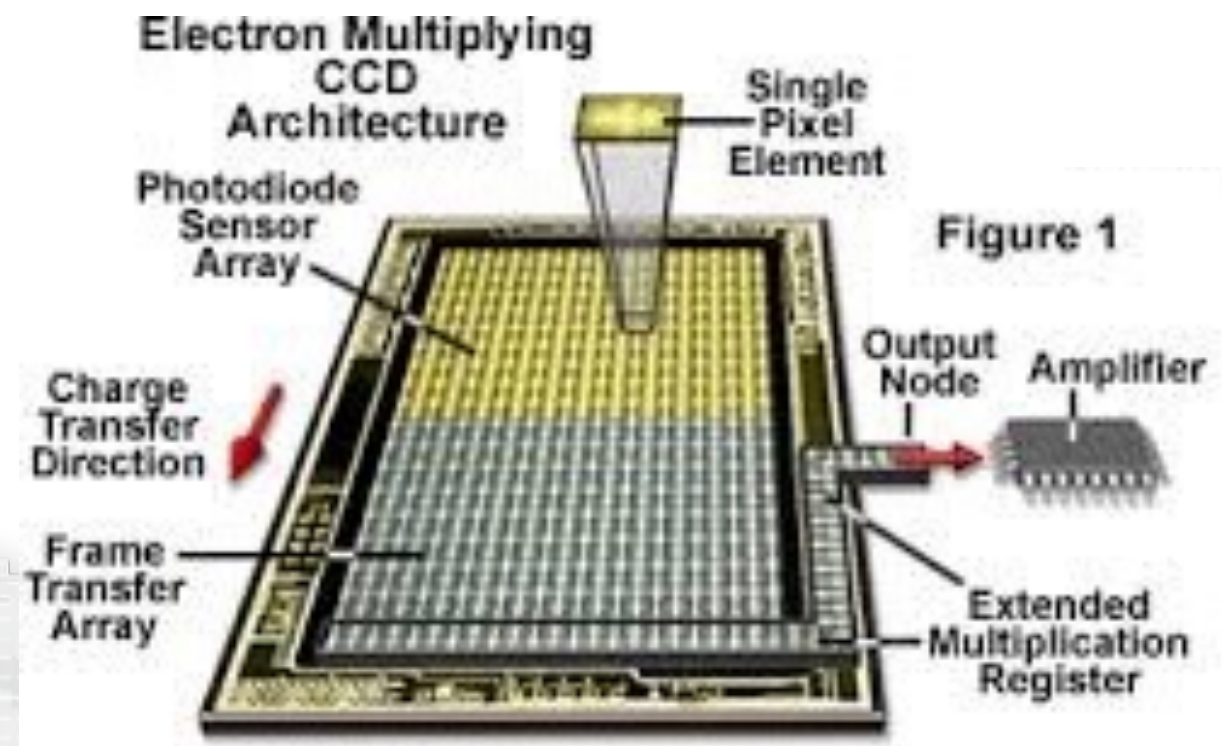


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how digital cameras work

- 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



resolution



6

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

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Color perception

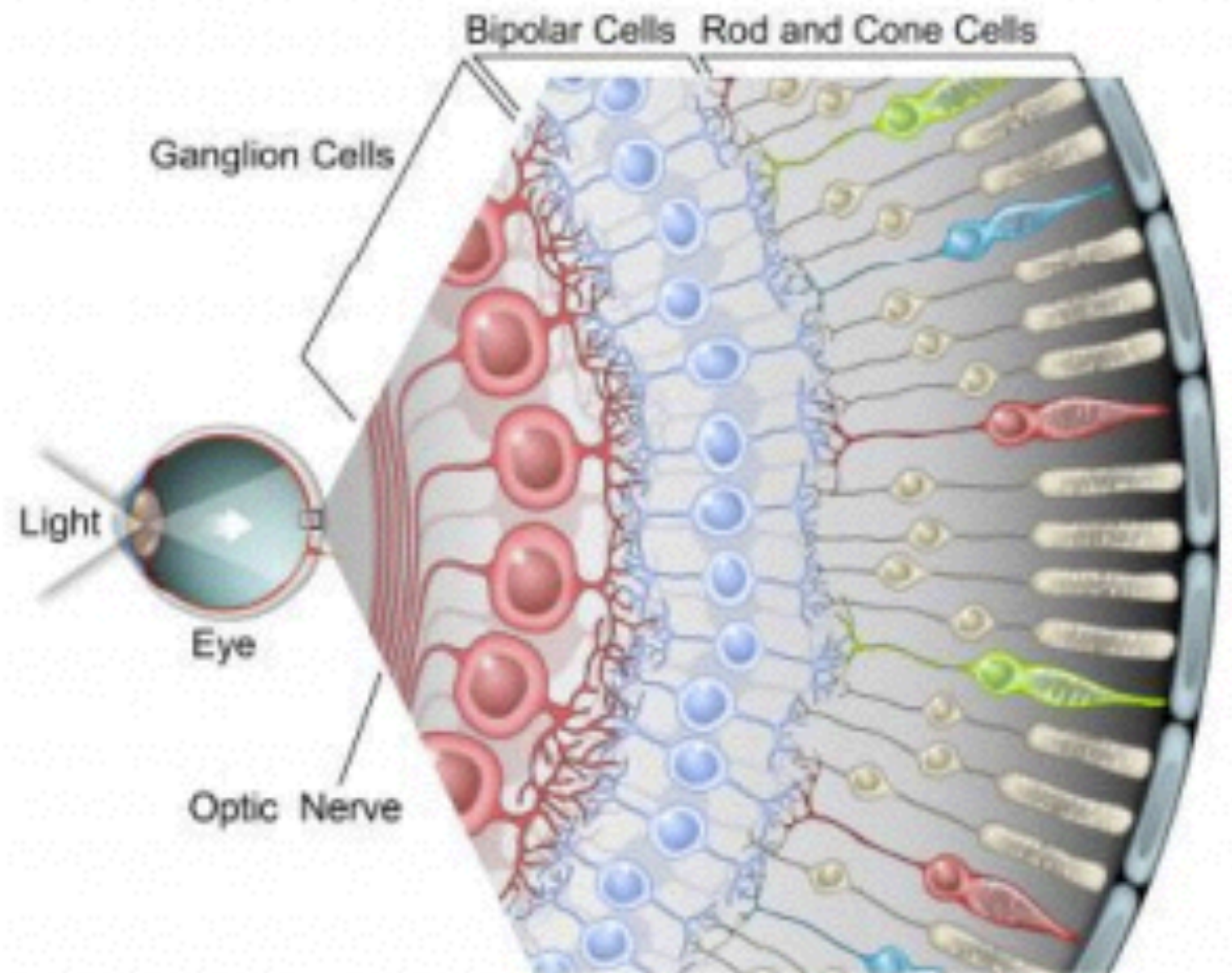
80M

5M

Rods & Cones

Brightness & Color

3 types of cones
perceiving
R G B



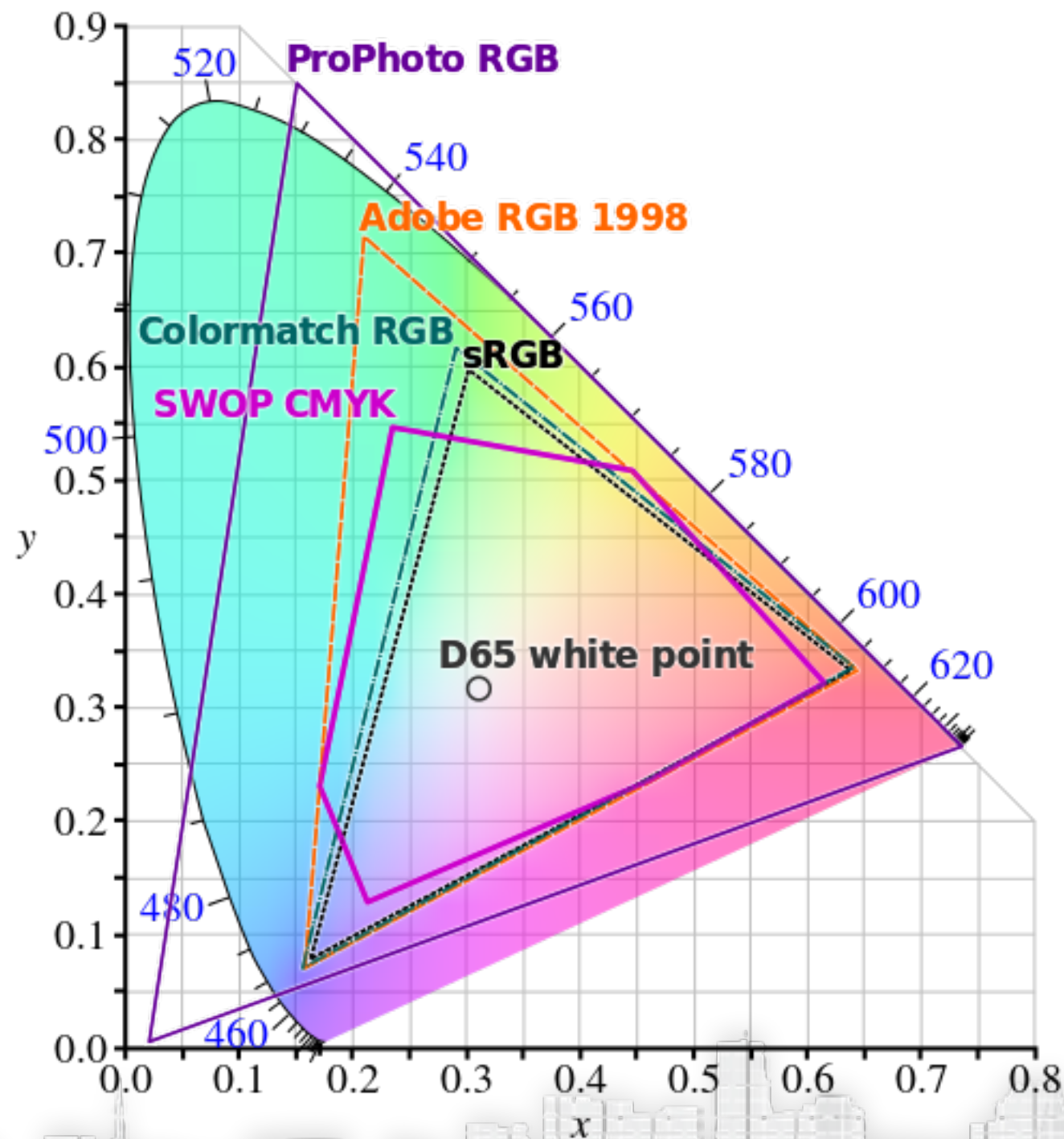
Federica Bianco, CSCI 100, NYU

Color perception



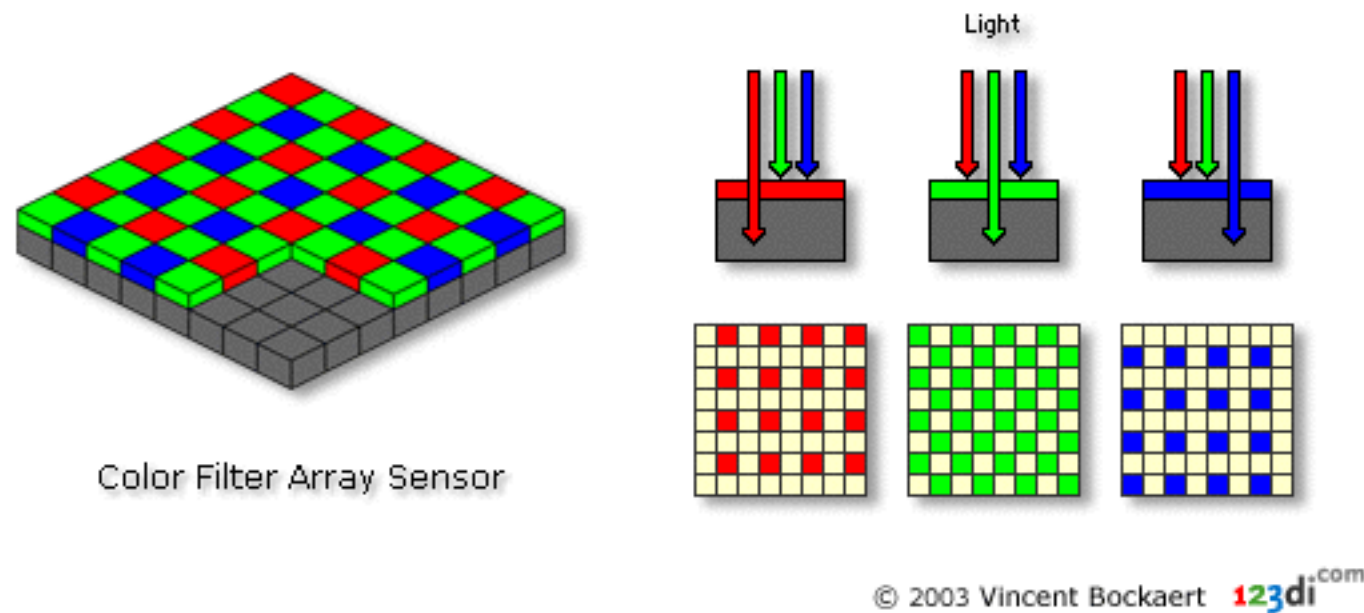
Within each large, roving eye, mantis shrimp have twelve types of color-sensitive cells called photoreceptors. That's four times as many as we humans have, despite our self-assurance that we have the best vision in the animal kingdom. (Lewin, 1999, 2014)

Color representation



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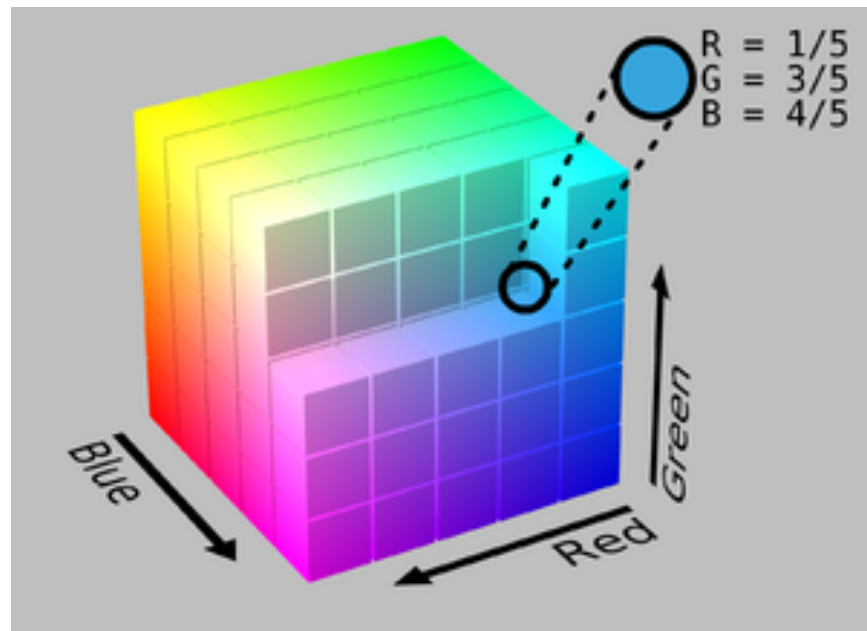
Color representation



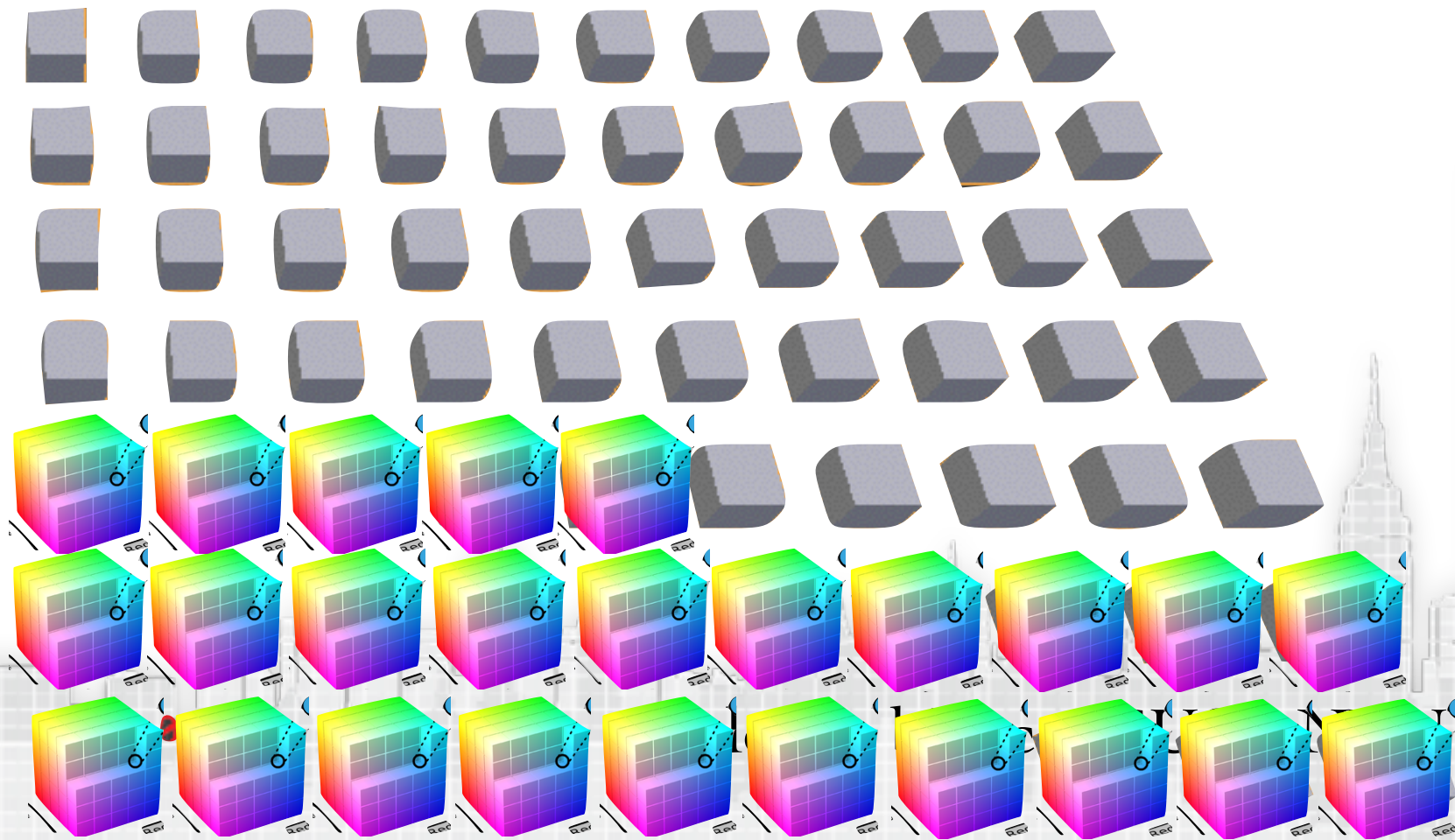
each pixel must read 3 colors

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Color representation



single pixel representation



pixel array

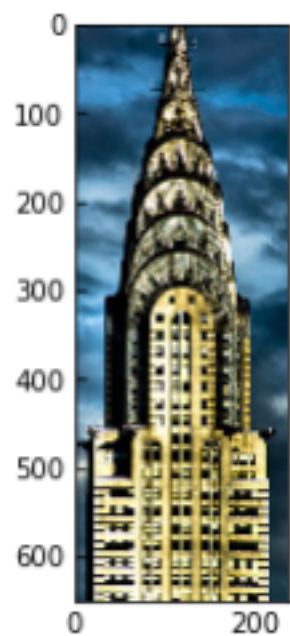
image from a computer point of view

```
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>



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)

limitations and possible systematics

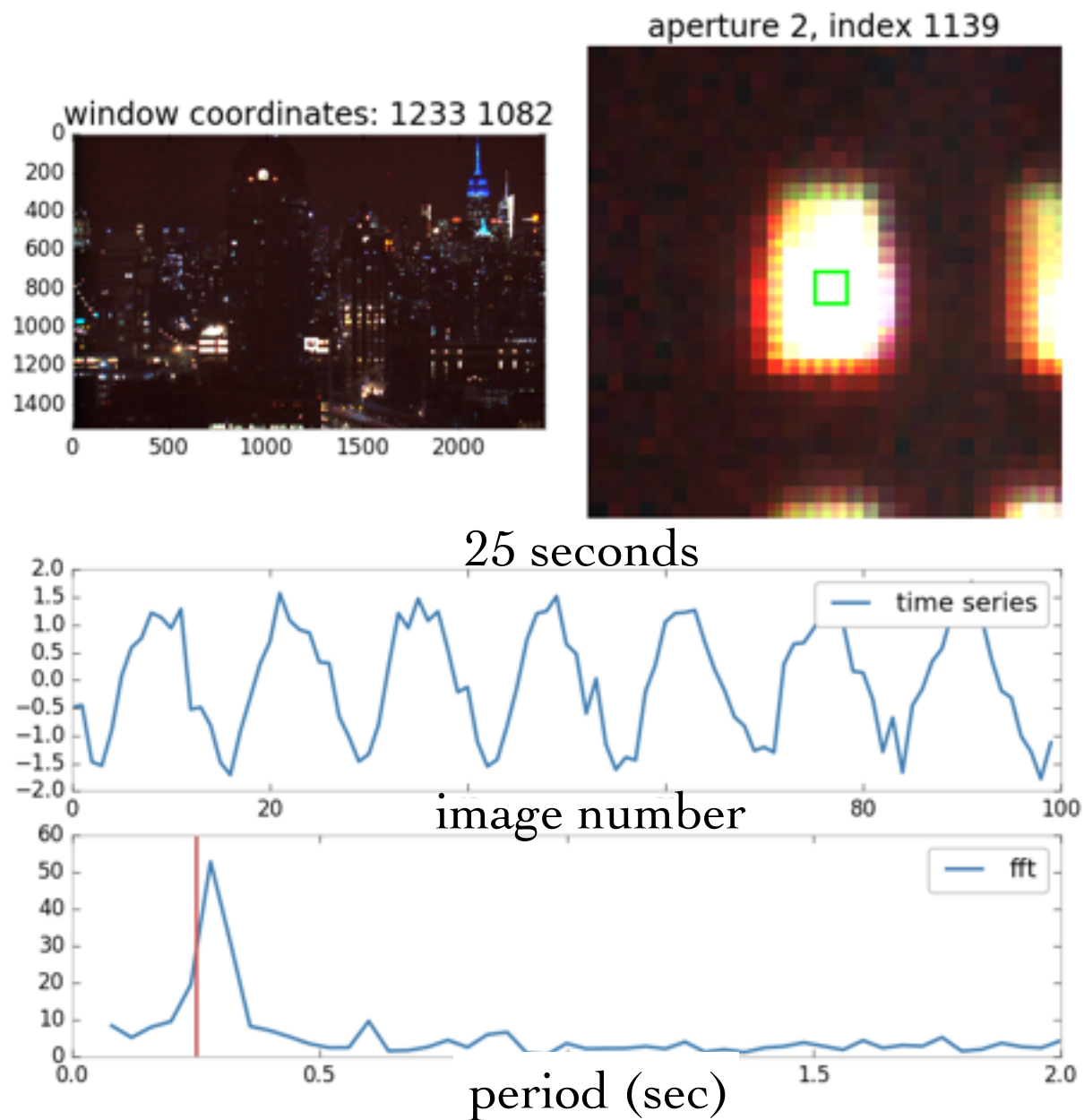




[https://github.com/fedhere/Ulnotebooks/tree/master/
imgPorcessingABC](https://github.com/fedhere/Ulnotebooks/tree/master/imgPorcessingABC)

6

extracting time series from series of image files

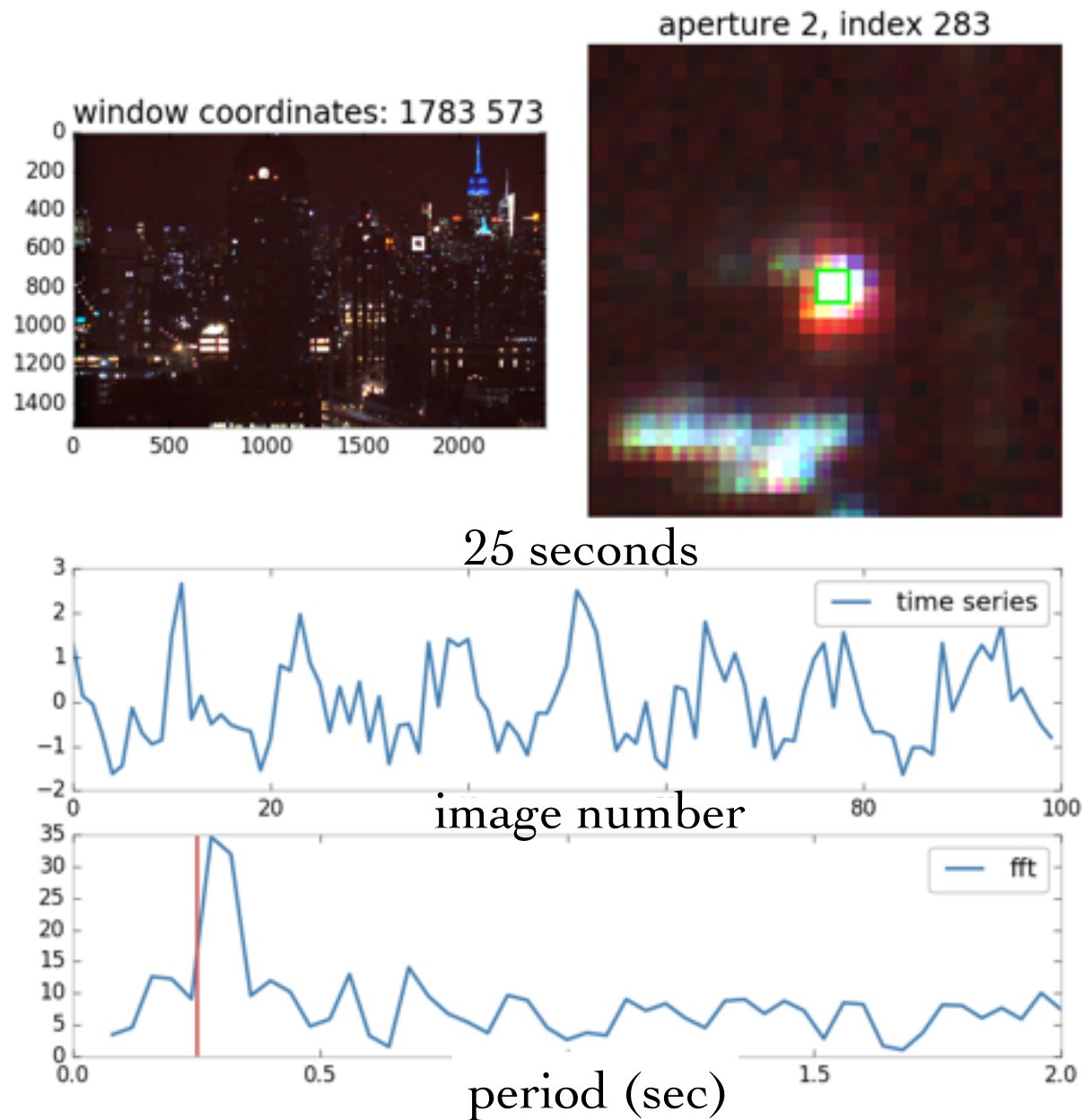


ynamics



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extracting time series from series of image files

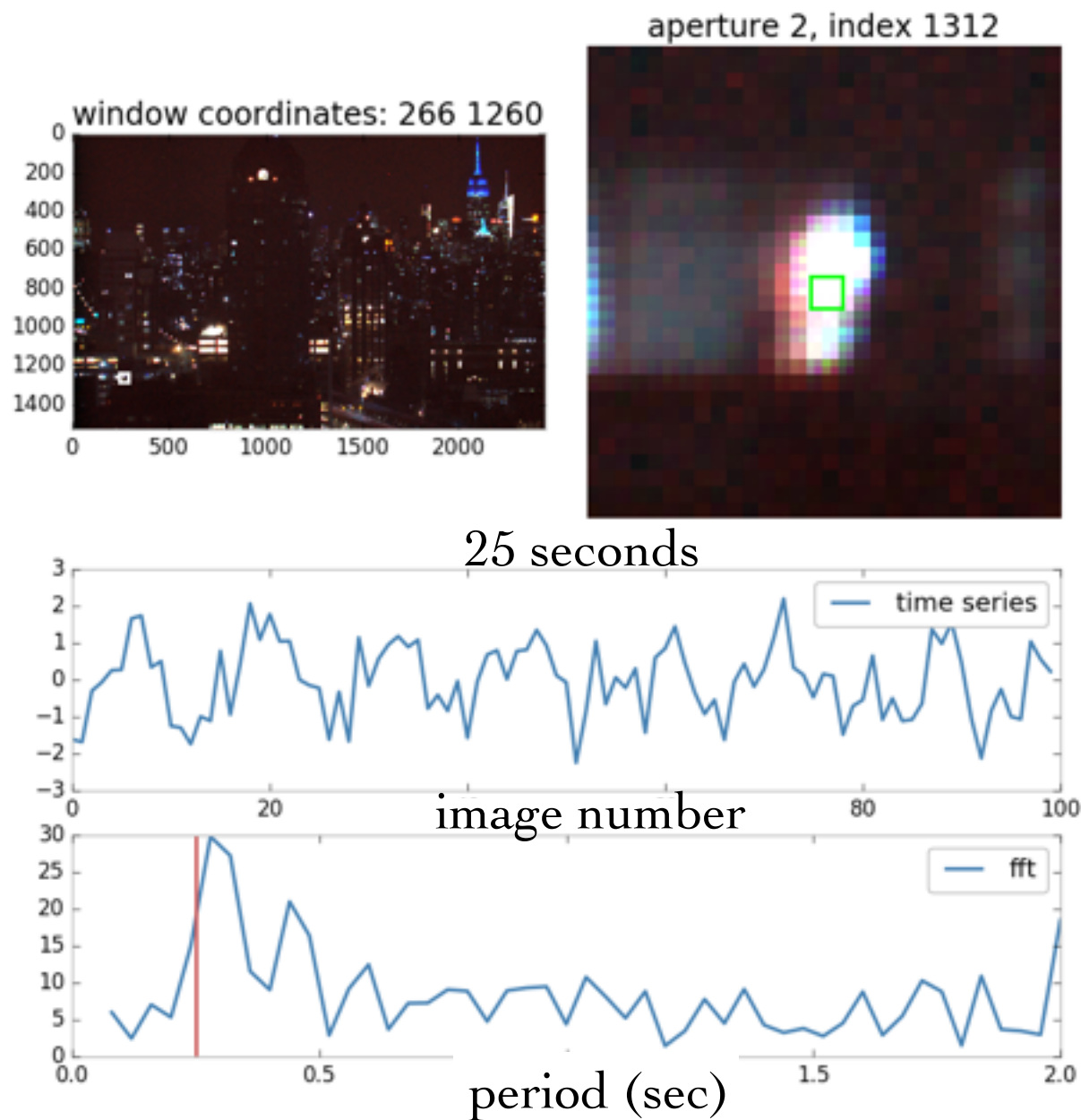


ynamics



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extracting time series from series of image files

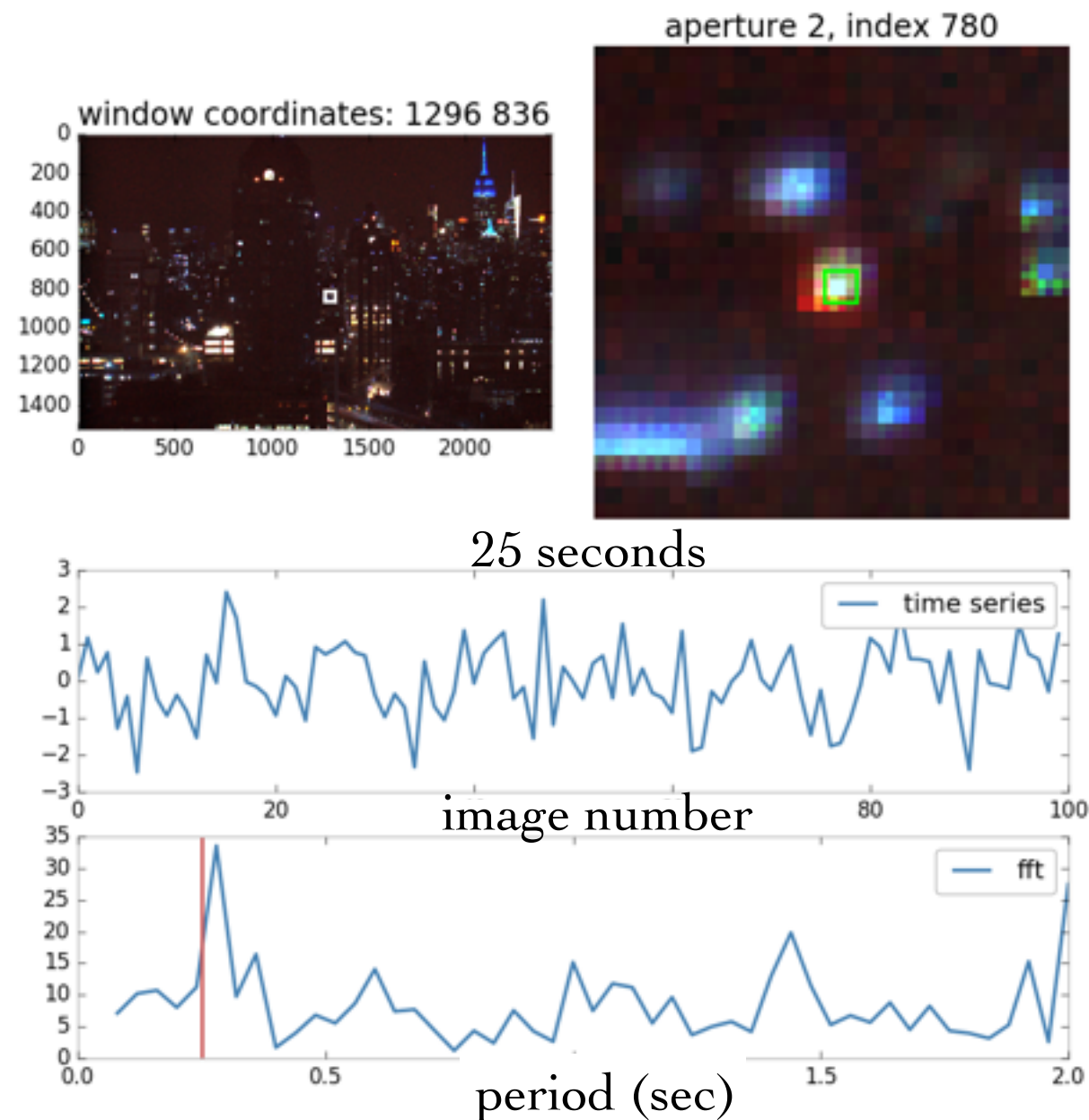


ynamics



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extracting time series from series of image files

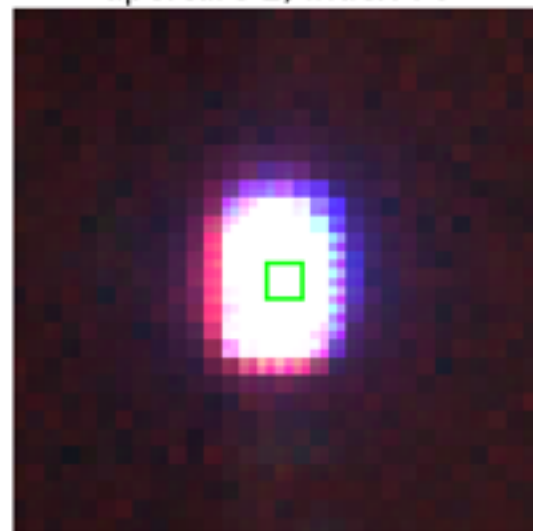
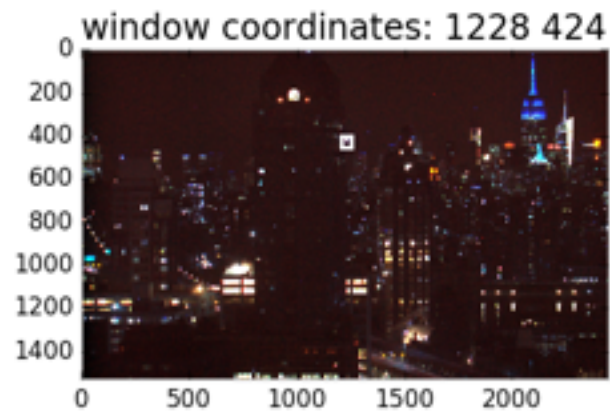


ynamics



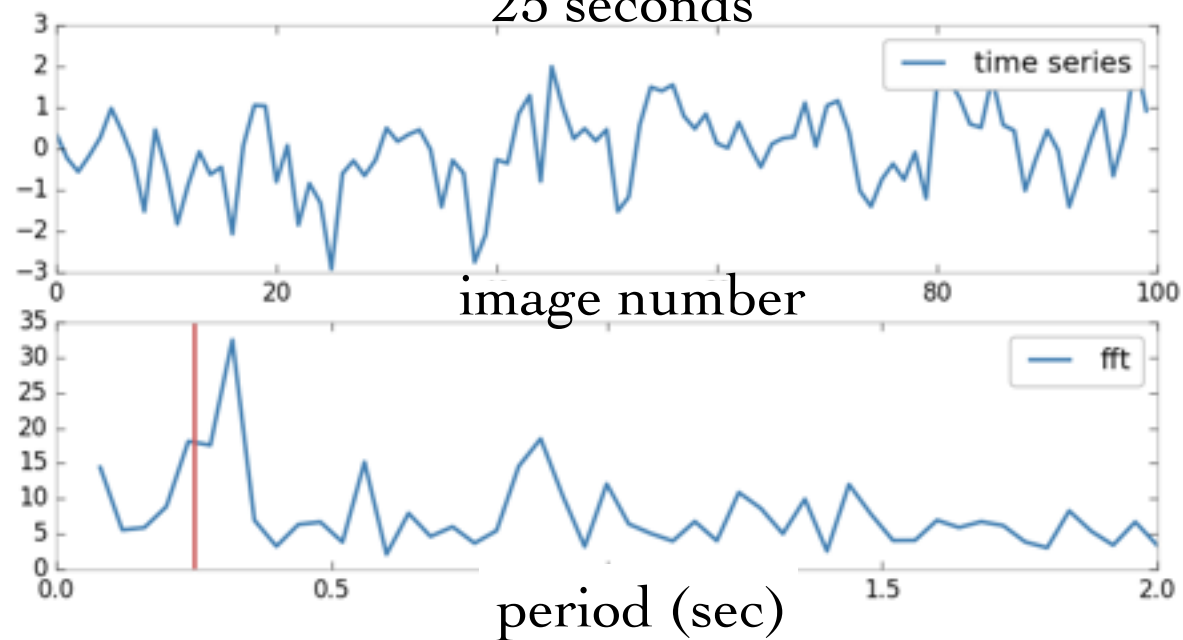
extracting time series from series of image files

aperture 2, index 70



ynamics

25 seconds



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