Everything you wanted to know about cameras but were afraid to ask

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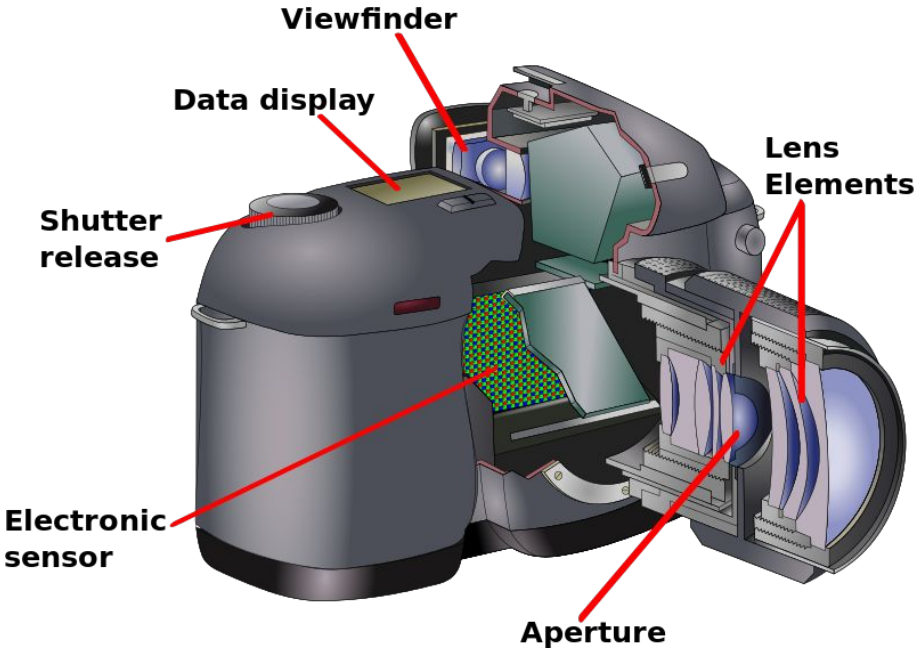
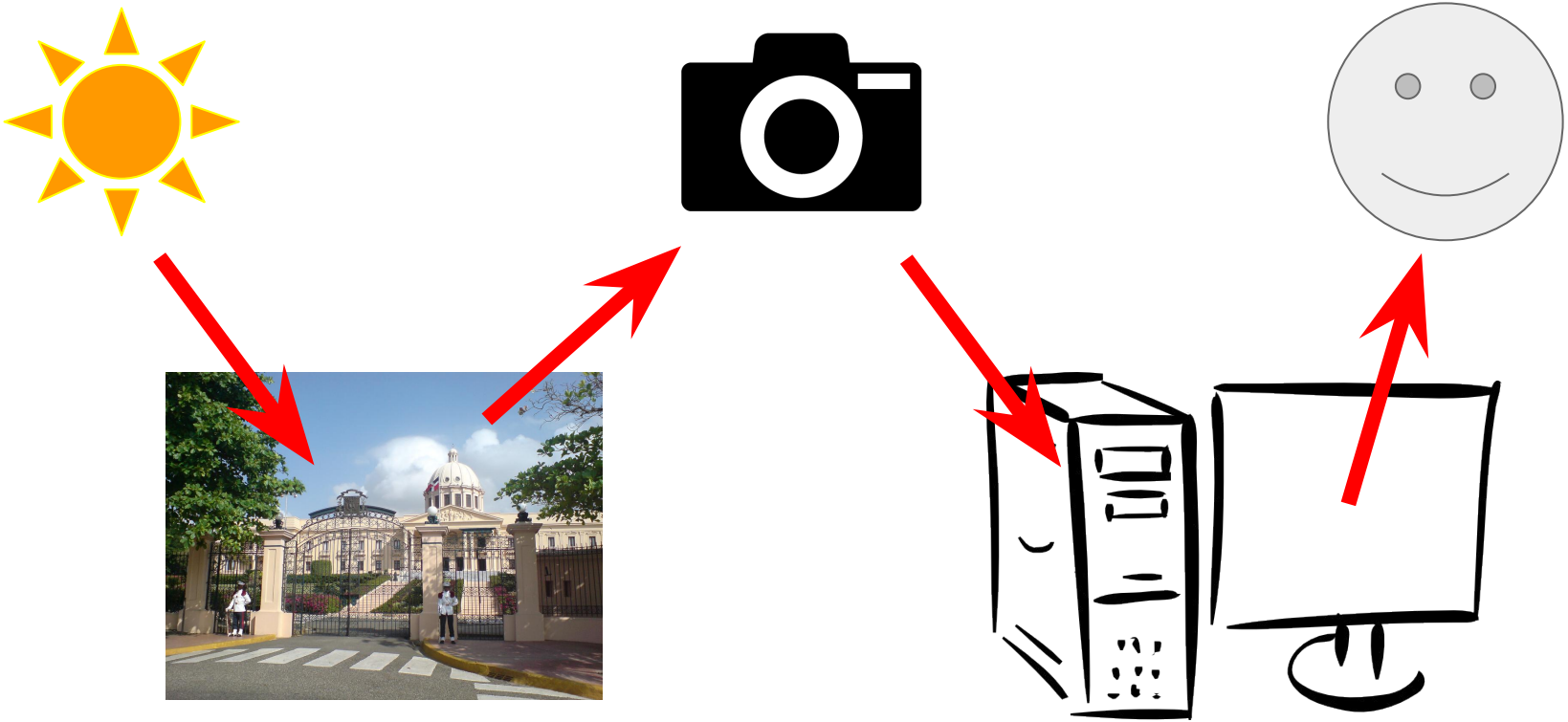
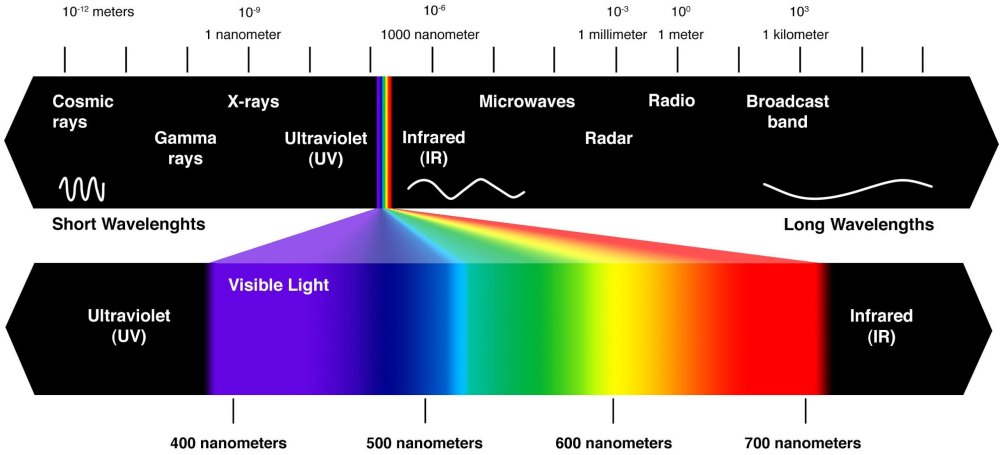
Lesson One: A camera is more than the sum of its parts



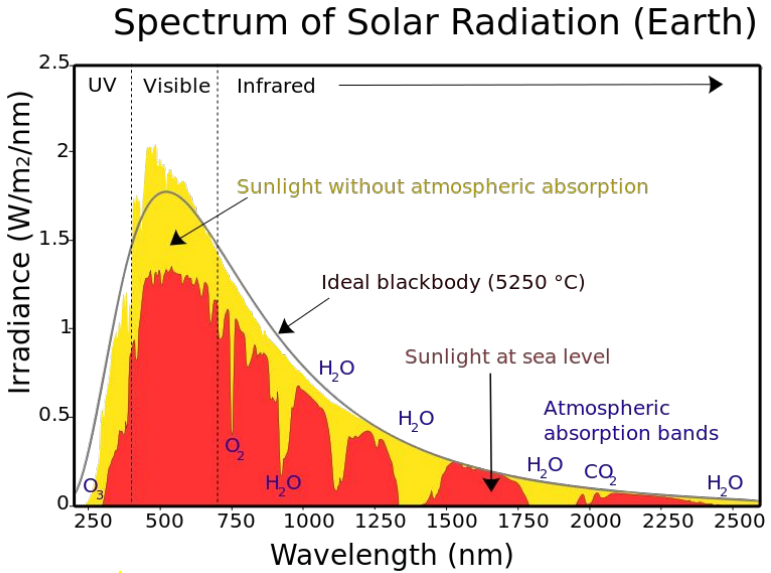
Cameras are part of a system for reproducing light

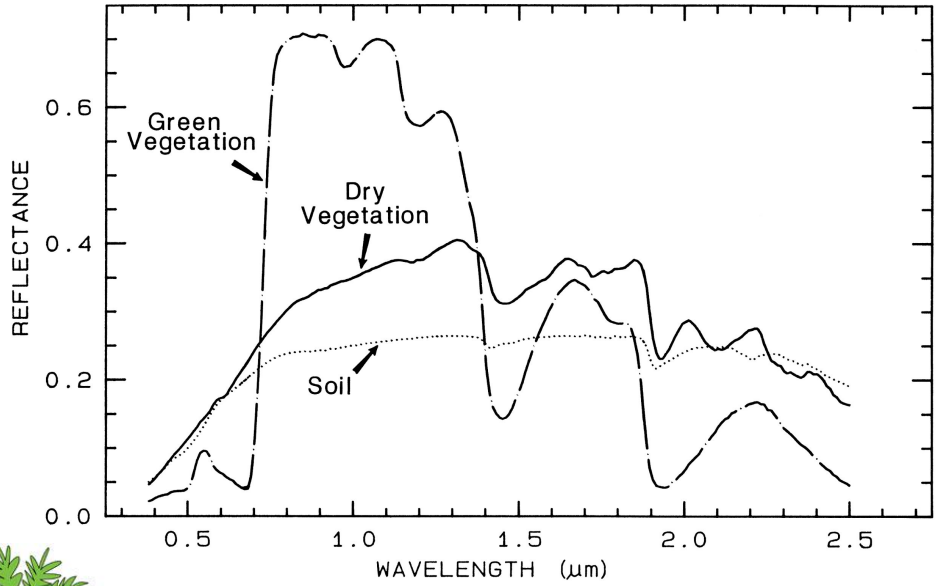


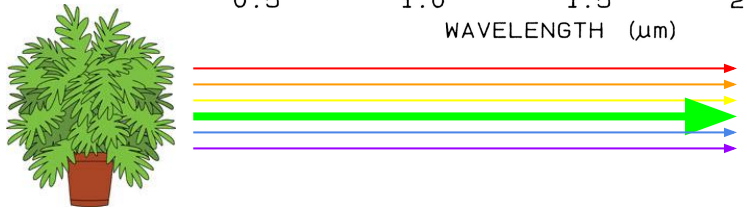
Simplicity hides complexity



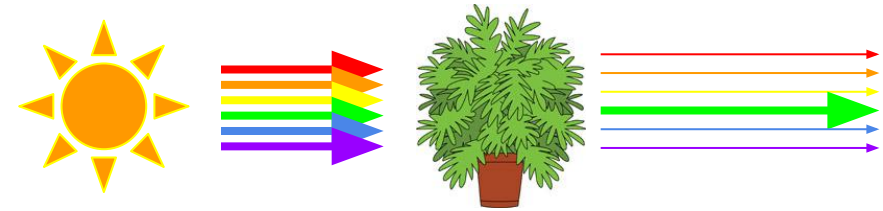
Sunshine and Rainbows







We then shove that light through some glass and a hole

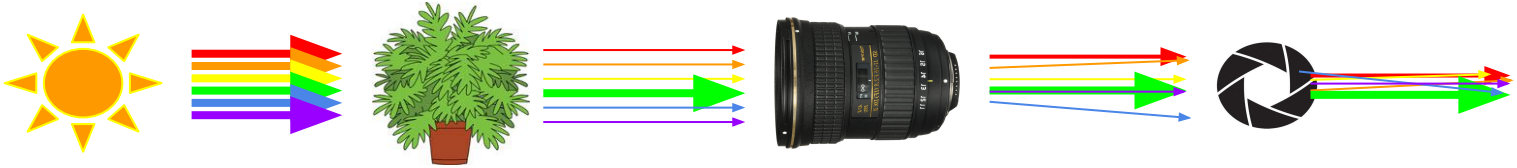


LENS

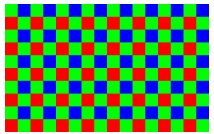
APERTURE

???

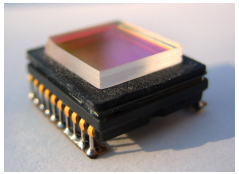
Now to get the light into the computer

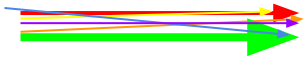


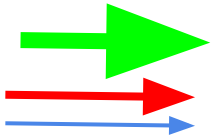
Bayer Filter



IR Filter





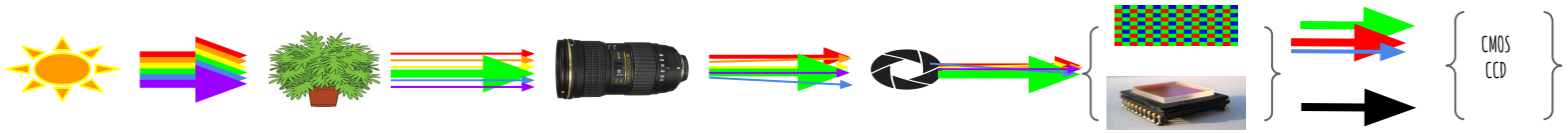


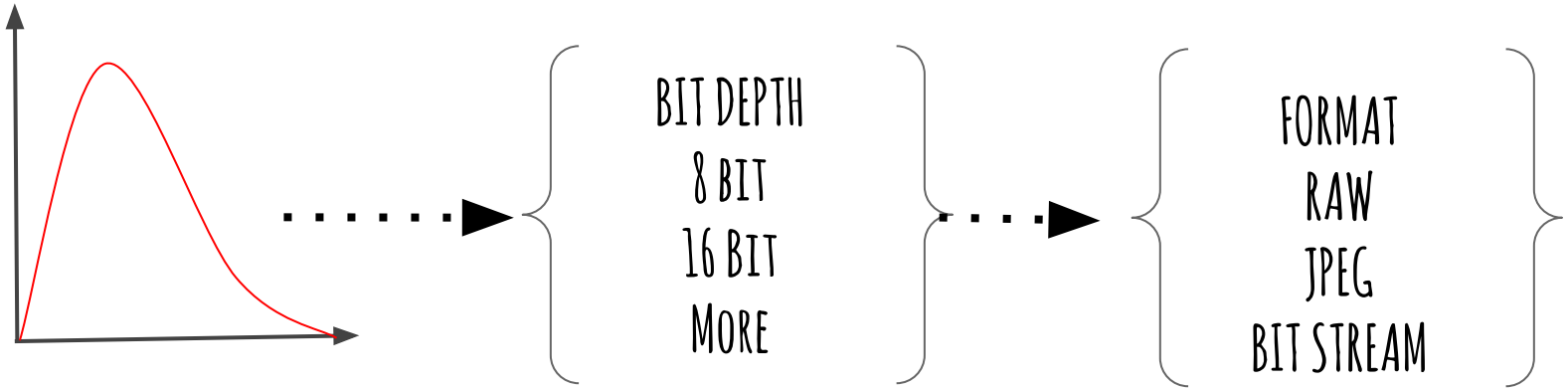
CMOS SENSOR

-OR-

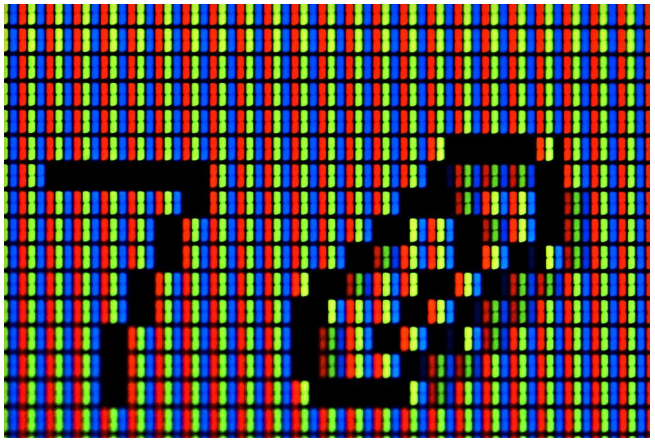
CCD SENSOR

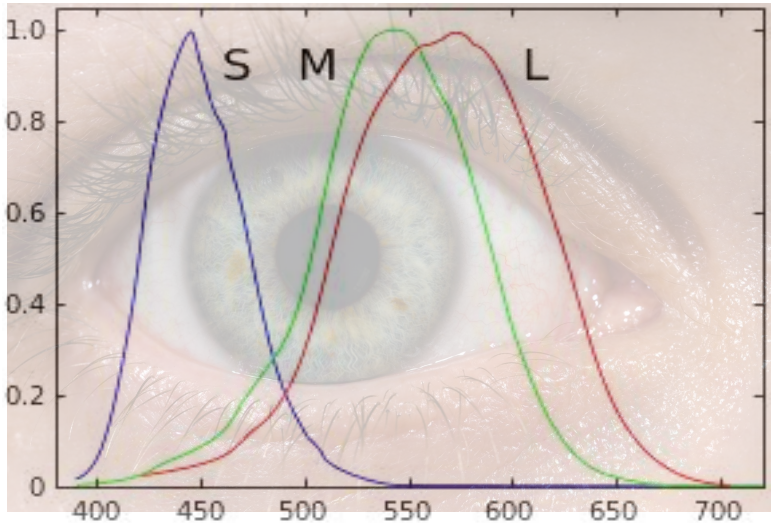
Photons -> Electrons -> Bits



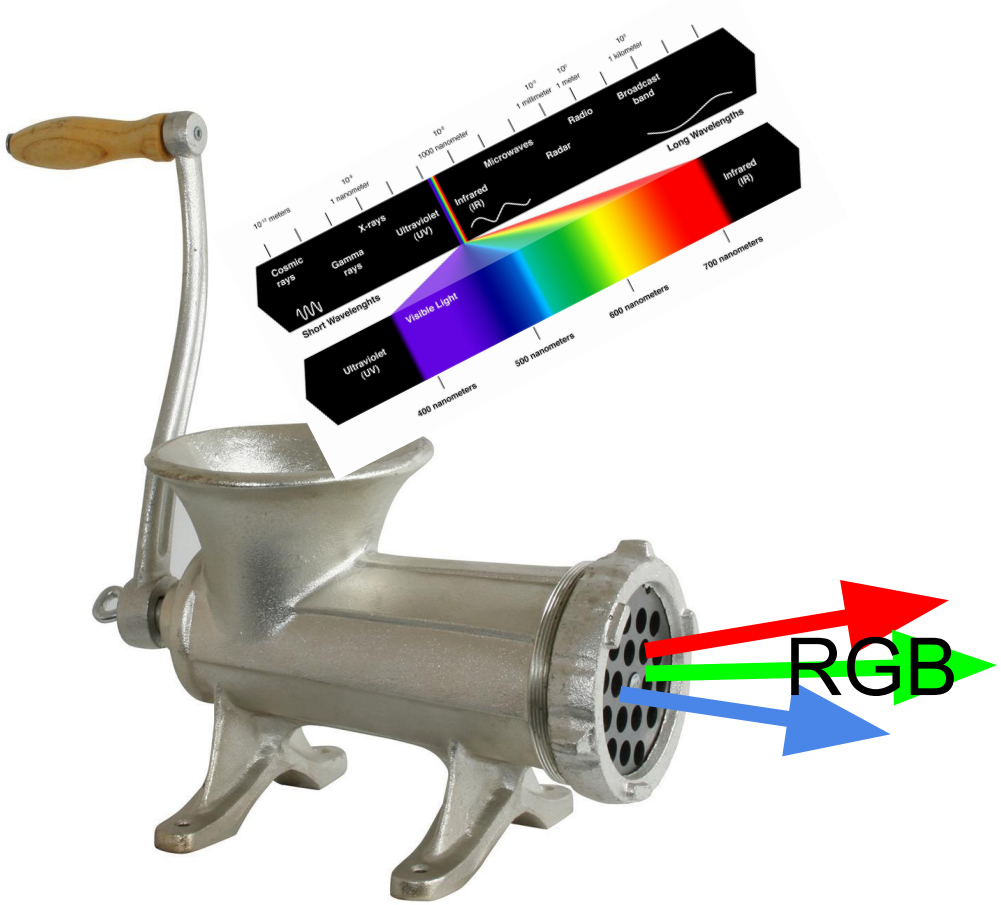


From bits to your brain





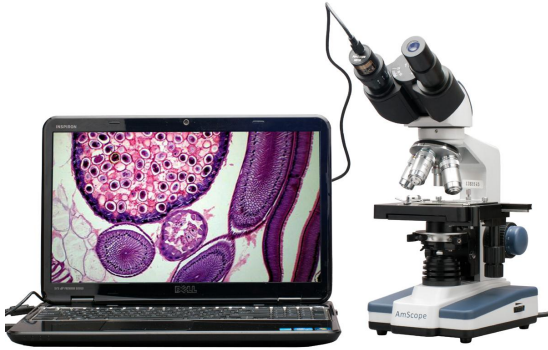
What you see is a massive fake.

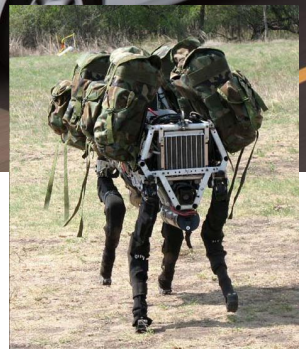


What does this have to do with programming?

- Garbage in, garbage out.
- Pick the right tool (sensor/library) for the job
- do it right the first time
- Know what problems can be solved

So where are cameras used?





What to do with images once we get them...

- OpenCV Python
- Scikit-Image
- Numpy/Scipy
- Mahotas
- SimpleCV
- PIL/Pillow
- ilastik
- Matlab (blech)
- Roll your own library

Let's start simple, web cameras aka UVC

OpenCV	Well supported. Generally well documented
GStreamer	Finicky
Robot Operating System	Installation is complex but tractable. Lot of support.
Command Line Treachery	Good for a single image, may not be good for video.