Introduction to Digital Image Processing

Ming-Sui Lee

Department of Computer Science and Information Engineering

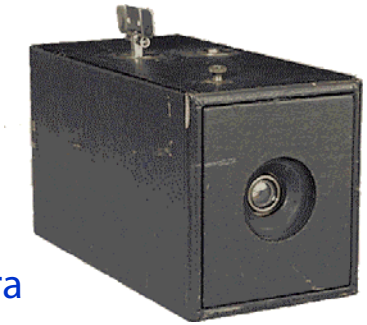
Lecture 1
Introduction

Invention of Photography

- **1816** -- first world negative on the idea "making permanent on a support through a compound the images seen at the back of camera obscura ."
  - Joseph Nicephore Niepce (France)

Camera Obscura

- **1839** -- "Daguerreotypes "
  - French painter Louis J M Daguerre
- **1839** "Photography", "Negative", "Snapshot"
  - England astronomer Sir Johe Herschel



The first Kodak handheld camera

- **1870** "paper-backed film "
  - instead of "glutted dry plate"
  - USA George Eastman

- **1884** -- "Kodak Camera"
  - Eastman Kodak
- **1889** -- "Pocket Kodak Camera"
  - Eastman

Pocket Kodak Camera

Film Camera

Once Time Use Camera

Polaroid Camera

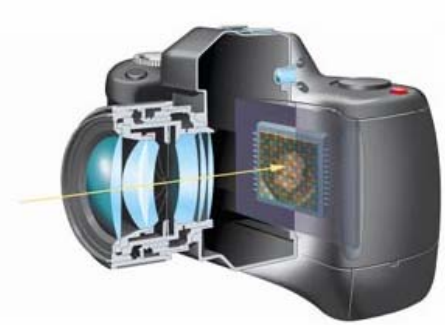
Portable Camera

Professional SLR

Medium Format Camera

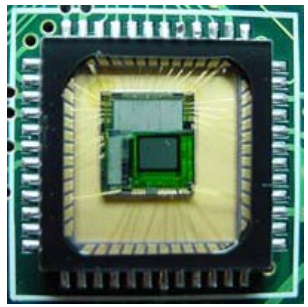
Digital Still Camera (DSC)

- **Main difference**
  - no film needed
  - has a sensor that converts light into electrical charges



- **Image sensor**
  - most DSC: charge coupled device (CCD)
  - some low-end camera: complementary metal oxide semiconductor (CMOS) technology

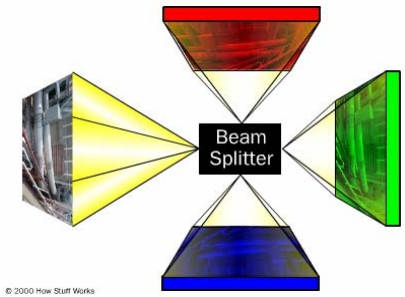
- **Resolution**
  - measured in pixels
    - 256x256 pixels: cheap cameras
    - 640x480 pixels: low-end cameras. Great for e-mail exchange
    - 1216x912 pixels: (1.1 megapixel) good for print images
    - 1600x1200 pixels: (2 million pixels) good for 8x10 inches image



CMOS

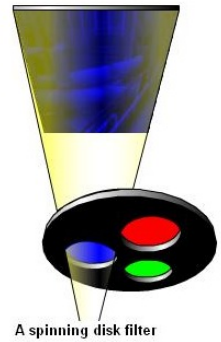
Digital Still Camera (DSC)

- **several ways of recording RGB color**
  - **Beam Splitter**
    - separates the light into different sensors
    - each sensor responds to one of the primary colors
    - Advantage: records each of the three colors at each pixel location



Beam Splitter

  - **Spinning Disk**
    - rotating a series of red, blue and green filters in front of a single sensor
    - camera and the target of the photo remain stationary for all three readings.
    - not practical for candid photography or handheld cameras



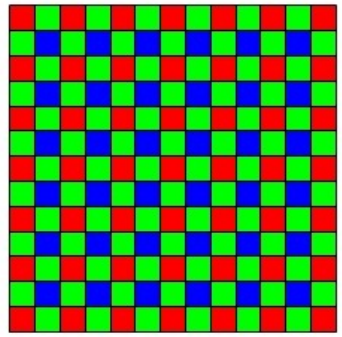
Spinning Disk

Digital Still Camera (DSC)

several ways of recording RGB color

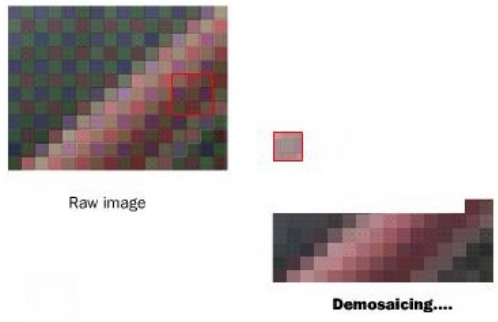
Bayer Filter

- alternates a row of R and G filter with a row of B and G filters
- not evenly divided
- Advantage: only one is required and all the color information is recorded at the same moment. Smaller, cheaper in camera design



De-mosaicking Algorithms

- convert the mosaic of separate colors into an equally sized mosaic of true colors
- each colored pixel can be used more than once
- true color can be determined by averaging the values from the closest surrounding pixels



Storage and Image Capacity

- **A number of storage systems (reusable digital film)**
  - Build-in memory
  - Smart Media cards
  - Compact Flash
  - Floppy Disk and Hard Disk
  - Writeable CD and DVD

- **Two main file formats**
  - TIFF: uncompressed format
  - JPEG: compressed format and also providing quality setting

Image Size	TIFF (uncompressed)	JPEG (high quality)	JPEG (medium quality)
640x480	1.0 MB	300 KB	90 KB
800x600	1.5 MB	500 KB	130 KB
1024x768	2.5 MB	800 KB	200 KB
1600x1200	6.0 MB	1.7 MB	420 KB