

DIGITAL IMAGE FILTERING

Digital Image Processing

- * Application of various algorithms/filters on image data
- * *Example:* Image smoothing
 - * Reducing **noise** from the image.
 - * **Noise:** random changes in brightness and color levels within the image data



"SALT AND PEPPER" IMAGE NOISE

Image smoothing (cont.)

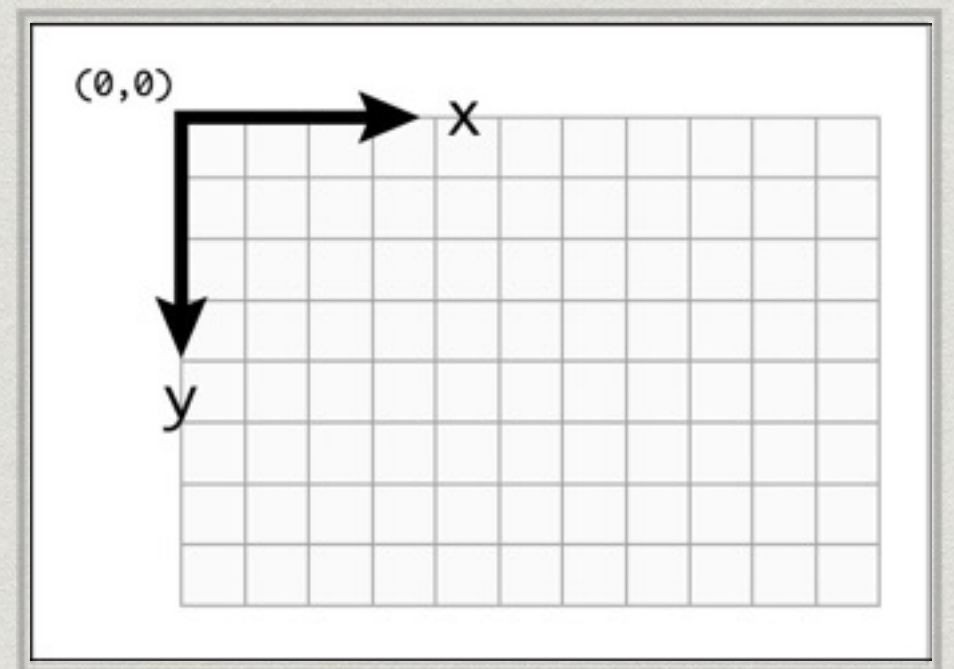
- * Good filtering/enhancement method should
 - * remove image noise
 - * maintain the edge information

Fundamentals of Color Imaging

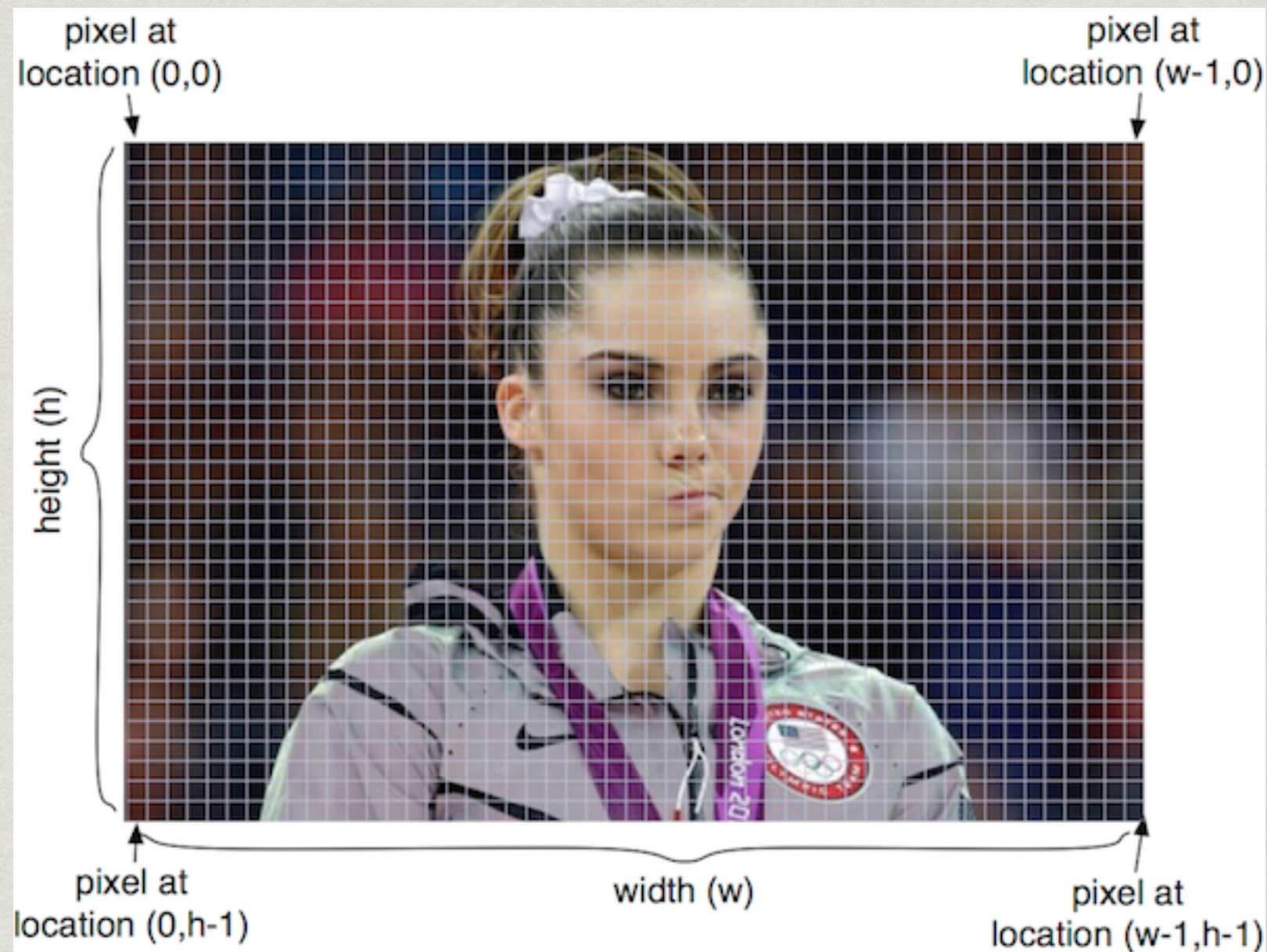
- * **Tristimulus theory** of color representation
 - * Human retina has three kinds of color sensors called **cones**
 - * Red, green, and blue are in the peak response range of each of the cones.
- * Each pixel in a Red-Green-Blue image can be viewed as a three-tuple consisting of the red, green and blue values
 - * non-negative integers, e.g., green as (0,255,0)

Pixel coordinates

- * With JES, we saw how to add an oval to an image.
- * To add lines, shapes, text, we provide coordinates on the image
- * The pixel coordinate system starts in the upper-left corner.



Two-dimensional matrix of pixel values



Goal of Project One

Combine pictures of the same location at different times and remove *undesirable* parts.



How can we remove that
guy from those images?



Combine →



Bad pixels?

- * Think pixel by pixel
- * We don't want bad pixels to bleed over into our final image



Image filtering

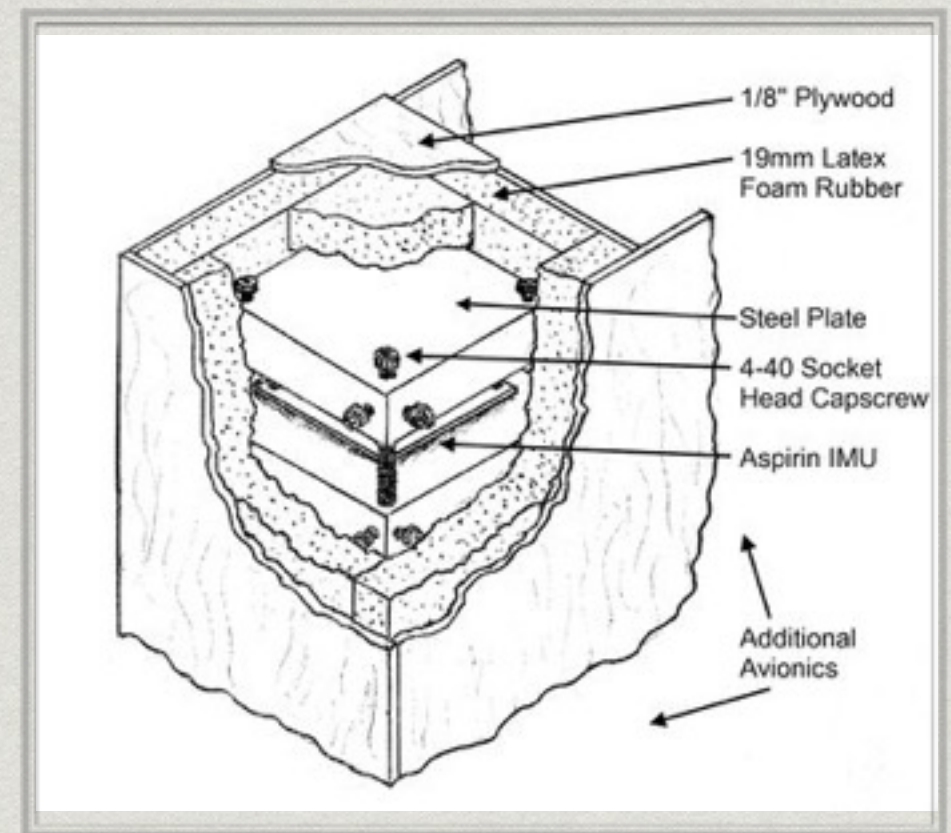
- * Two major noise reduction techniques

- * Linear

- * linear combinations of the input

- * Nonlinear

- * discretely choose at each step what value we want



Completely unrelated picture

Advantages of non-linear filtering

- * Outliers (extreme values) are eliminated
- * Given a list of values, e.g.,
1, 1, 1, 1, 1, 1, 1, 9000, 1
- * the average (linear filter) results in the value 1001
- * the median (non-linear filter) results in the value 1

Spatial vs. Temporal filtering

- * **Spatial**

- * Analyzing **one** image.
- * Forces a pixel to be like its neighbors

- * **Temporal**

- * Analyze a **series of images** taken at different times.
- * Potentially have full image information.

Project 1 Details

- * Download 9 images
- * Write a median filter program using JES to create a new image from the 9 images without the pesky tourist.
- * Due February 12

