Computational Photography

* Study the basics of computation and its impact on the entire workflow of photography, from capturing, manipulating and collaborating on, and sharing photographs.

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Image Processing and Filtering

- Point-process Computations on an Image
- How to combine intensities from 2 images?

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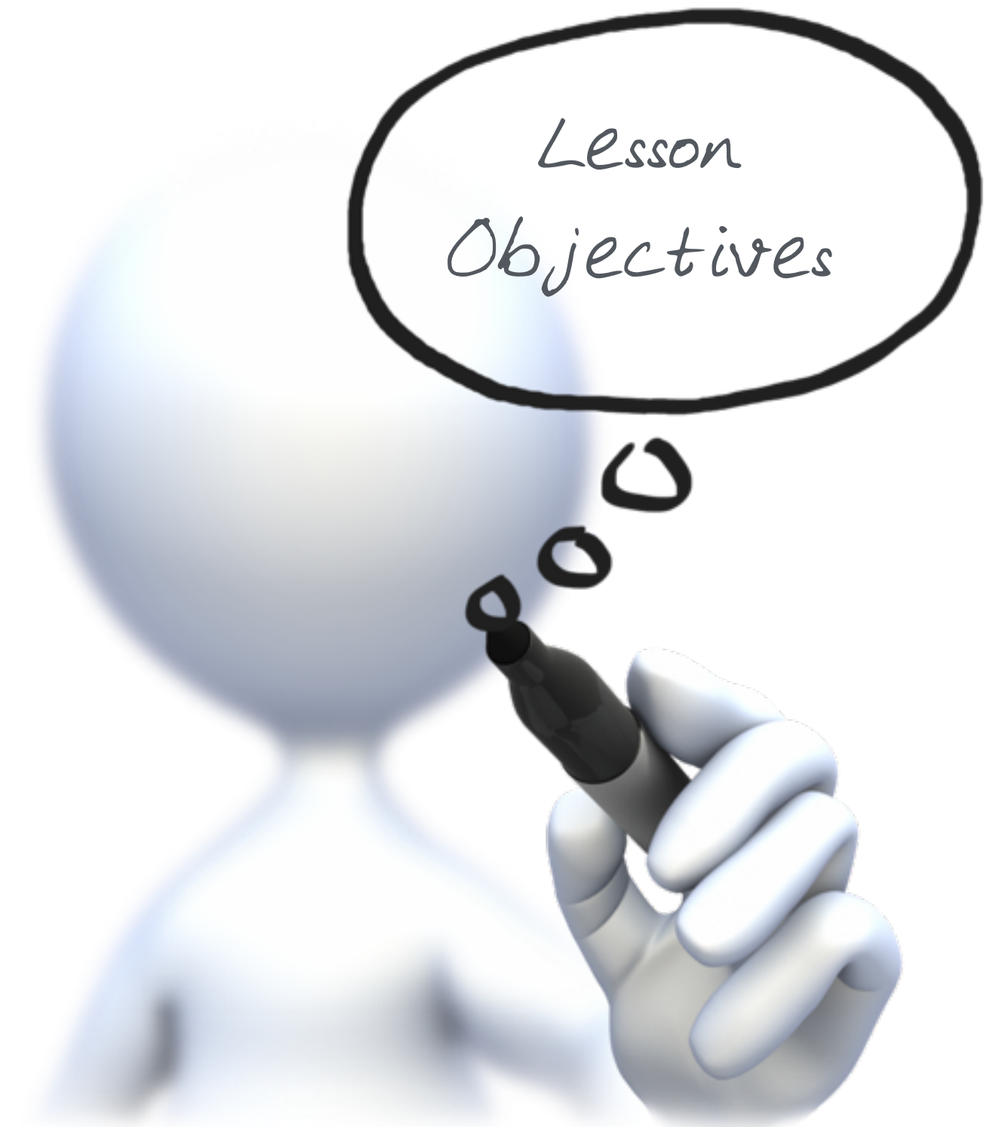
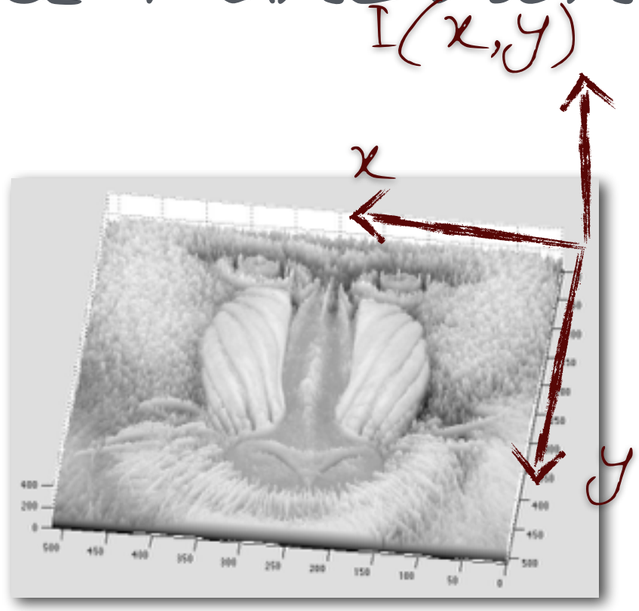


* Point-process Computations.
* Add/Subtract Images
* α-blending & its applications
* Image Histograms

Recall: Digital Image is a Function

100	120	121	122	30	40
120	120	121	122	70	40
60	50	40	41	7	8
100	120	121	122	1	0
200	120	200	122	12	14
200	220	225	250	30	40



* How to obtain discrete values?
  * Sample the two-dimensional (2D) space on a regular grid
  * Quantize each sample (round to "nearest integer")
* Result: matrix of integer values (range, e.g.: 0-255)

Slide adapted from Steve Seitz and Aaron Bobick

Point-Process: Pixel/Point Arithmetic

120	122	140	142	143
121	120	141	144	147
122	121	144	146	11
125	121	144	145	10
126	121	145	147	13

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120	122	140	142	143
121	80	40	144	10
122	81	40	0	151
125	80	40	0	152
126	70	40	0	153

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240	244	280	284	286
121	200	181	288	157
122	202	184	146	162
125	201	184	145	164
126	191	185	147	166

120	122	140	142	143
121	120	141	144	147
122	121	144	146	11
125	121	144	145	10
126	121	145	147	13

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120	122	140	142	143
121	80	40	144	10
122	81	40	0	151
125	80	40	0	152
126	70	40	0	153

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0	0	0	0	0
0	40	101	0	137
0	40	104	146	-140
0	40	104	145	-142
0	191	185	147	-140

Pixel/Point Arithmetic: An Example

Image 1

Image 2

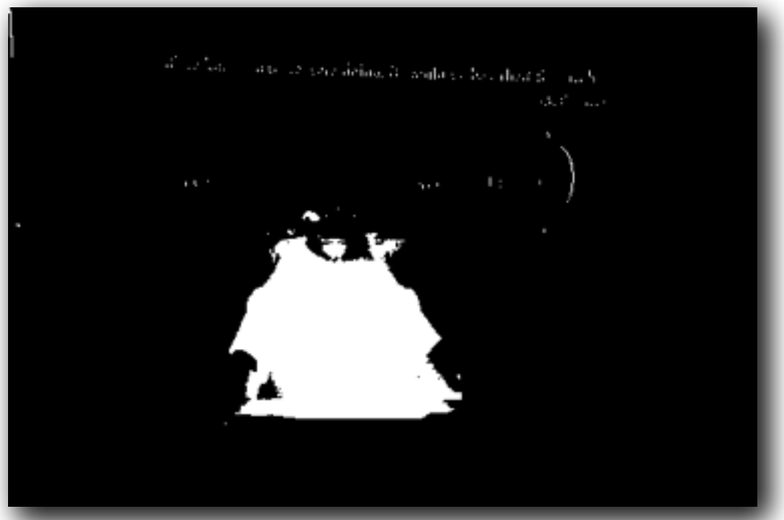
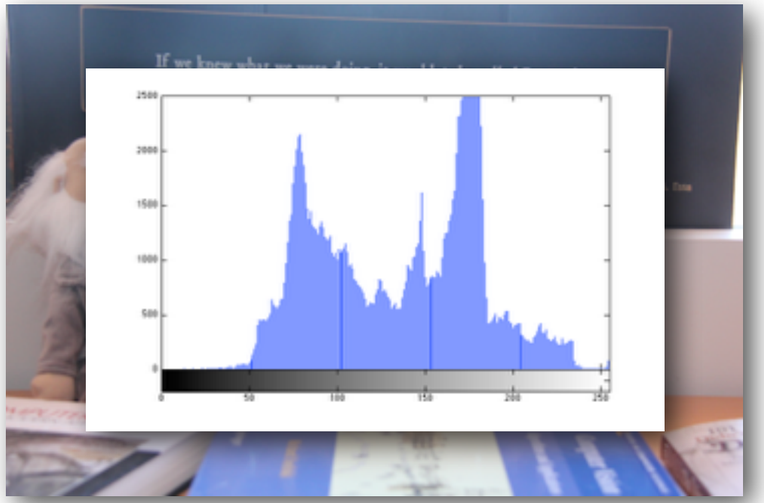


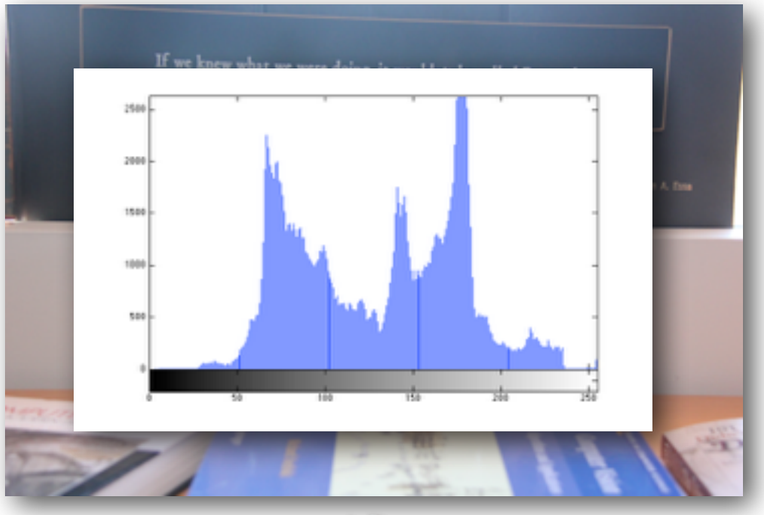
Image 1 - Image 2

Binary(Image 1 - Image 2)

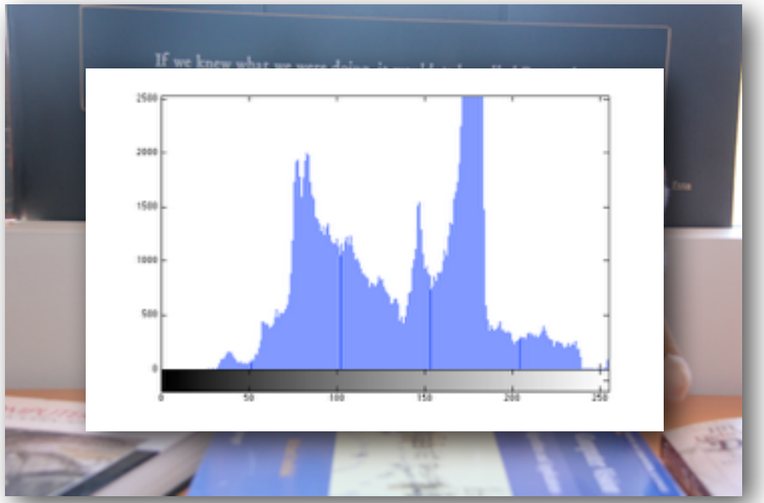
Pixel Operations: Another Example



CD

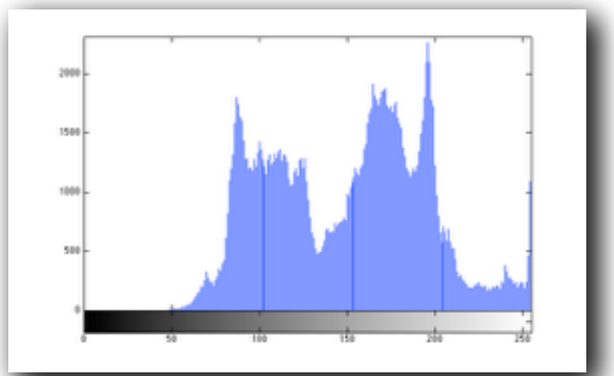


AE



LD

CD+AE+LD=



.34 X CD+ .34 X AE+ .34 X LD=

Alpha-blending (α-blending)

.34 x CD + .34 x AE + .34 x LD =

* Transparency (Conversely, Opacity!)
* Usually represented as: **α**
* **α** varies from 0 to 1.0 (0=invisible, 1.0=fully visible)
* RGB → **α**RGB

Summary

* Point-process Computations on Images to Add and Subtract images.
* Showed an example of **α**-blending commonly used in Image Processing.
* Use of Image Histogram in Image Processing.

Next Class

Image Processing and Filtering, via Convolution and Correlation

Credits

* Matlab software by Mathworks Inc.
* Some content adapted from Steve Seitz and Aaron Bobick
* Images
  * by Irfan Essa

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