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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Point Processes: Pixel Blending Modes

* A Real Life example of point arithmetic
* Variety of Blending modes built on concept of Point Processes

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Point Processes: "What is with the weird artifacts in the lecture videos?

* A Real Life example of point arithmetic
* Variety of Blending modes built on concept of Point Processes

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Pixel/Point Arithmetic: An Example

Image 1

Image 2

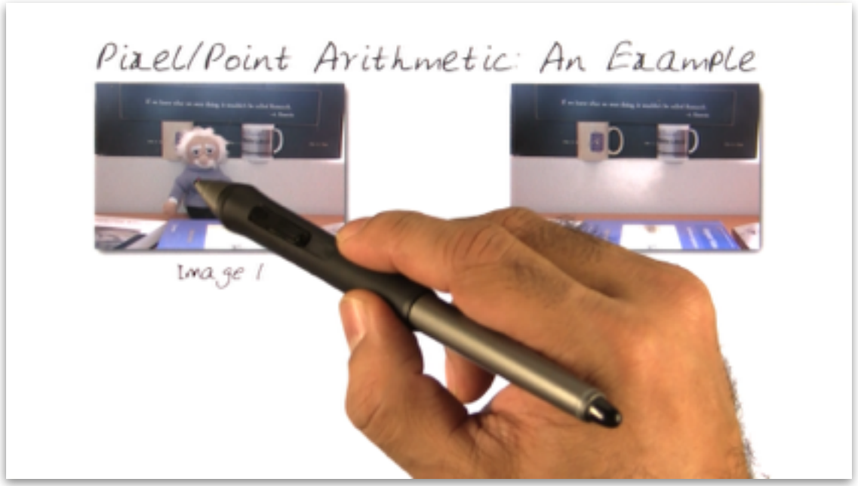
1. Explain what is happening on the videos you are seeing

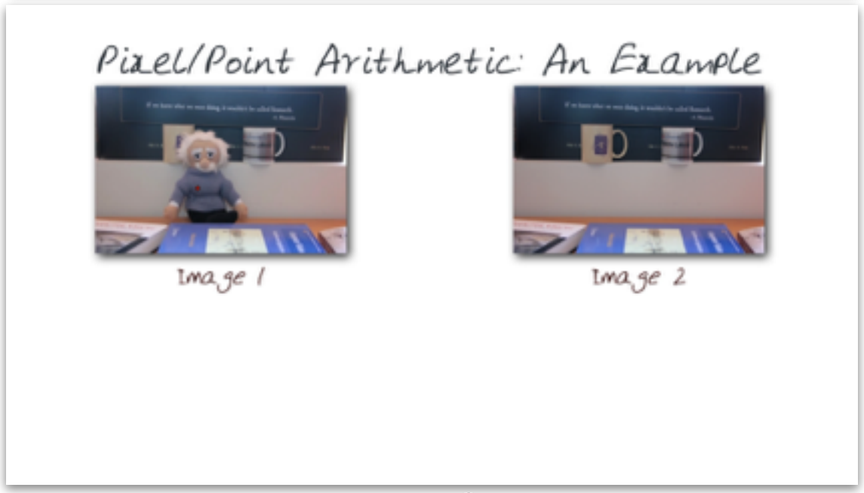
2. Introduce the variety of blending modes in wide use

A bit about the setup

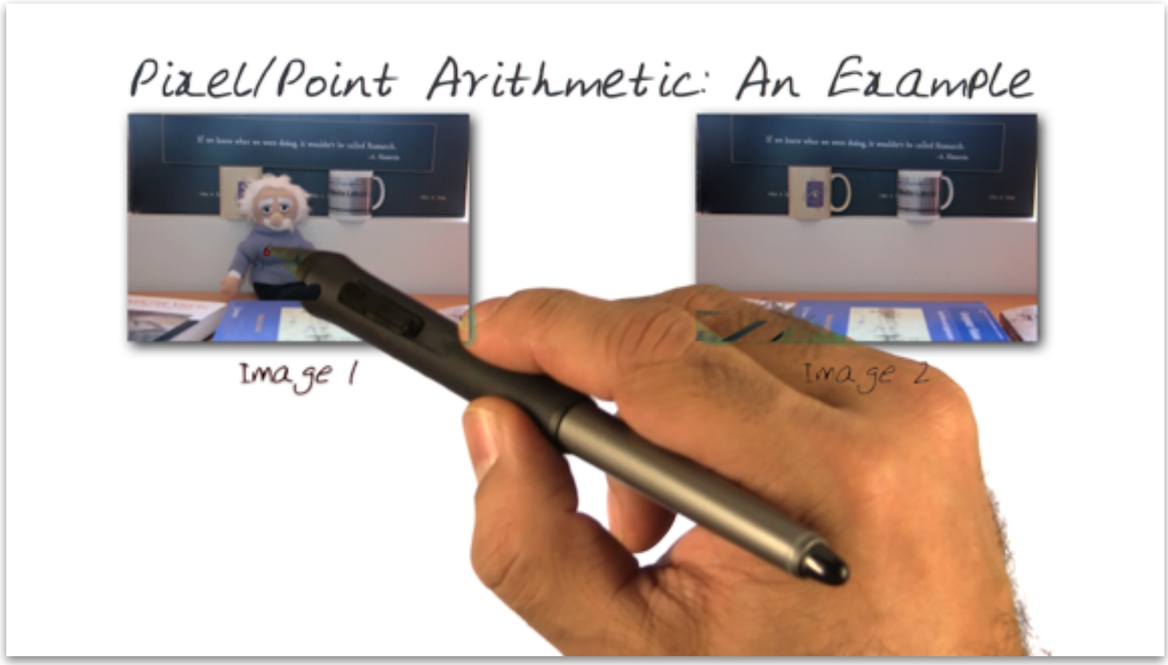
The final output is a pixel blend

Camera





Screen Capture



Screen Capture

+

Camera

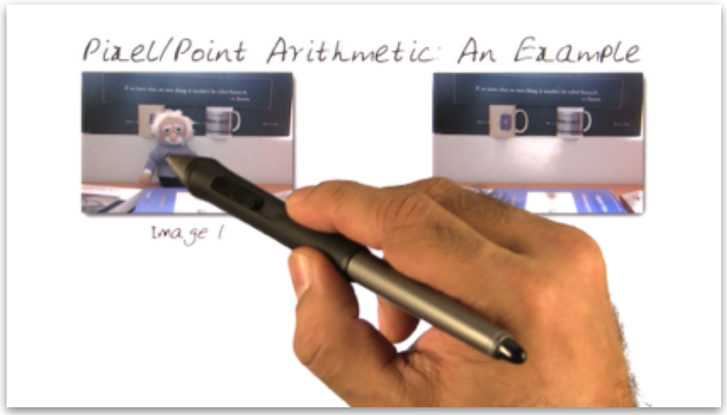
Blending Pixels

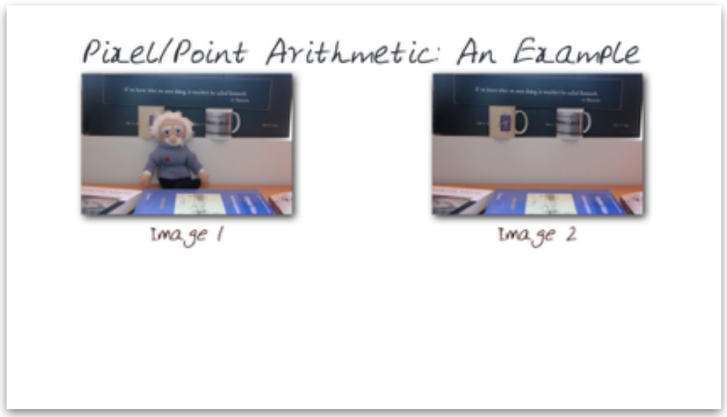
* Blend two pixels from two images: $f_{blend}(a, b)$
* For example
  * average:

$$f_{blend}(a, b) = (a + b)/2$$

  * normal:

$$f_{blend}(a, b) = b$$





Arithmetic Blend Modes

* Divide (brightens photos)
* Addition (too many whites)
* Subtract (too many blacks)
* Difference (subtract with scaling)
* Darken: $f_{blend}(a, b) = min(a, b)$ for RGB
* Lighten: $f_{blend}(a, b) = max(a, b)$ for RGB

Advanced Modes

* multiply $f_{blend}(a,b) = ab$
  * darker
* screen $f_{blend}(a,b) = 1 - (1-a)(1-b)$
  * brighter
* Overlay $f_{blend}(a,b) = \begin{cases} 2ab, & \text{if } a < 0.5 \\ 1 - 2(1-a)(1-b), & \text{otherwise} \end{cases}$
  * The parts of the top layer where base layer is light become lighter, the parts where the base layer is dark become darker

Dodge and Burn

* Dodge and burn change the lightness of the pictures
* Dodging lightens an image, while burning darkens it.
* Dodge builds on Screen mode
* Burn builds on Multiply mode
* There are numerous variations of each!

Darken

Pixel/Point Arithmetic: An Example

Summary

* Introduced Pixel/Layer Blending
* Explained variety of Blending approaches
* Showed why some of the videos look ODD!

Credits

* For more information, see:
  * http://en.wikipedia.org/wiki/Blend_modes
  * http://blog.udacity.com/2014/09/udacity-videos-transparent-hand.html

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