

# 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.

# Introduction to the Course

- \* Instructor Introductions
- \* Overview of the Course Structure
- \* What to Expect?

# *Instructor Introductions*



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# Overview of the Course Structure

- \* CS 6475: Computational Photography
- \* Video lectures, quizzes, weekly homework assignments (coding / peer feedback), exam, final project
- \* Learn about imaging and computing concepts as applied to Computational Photography with hands-on experimentation



# Requirements

- \* mathematics (Linear Algebra, Calculus, Probability)
- \* Computing
  - \* OpenCV / Python / C++ OR
  - \* matlab / Octave
- \* Camera
  - \* Could be useful (nothing advanced)
  - \* Images will be provided





# Module 1: Introduction

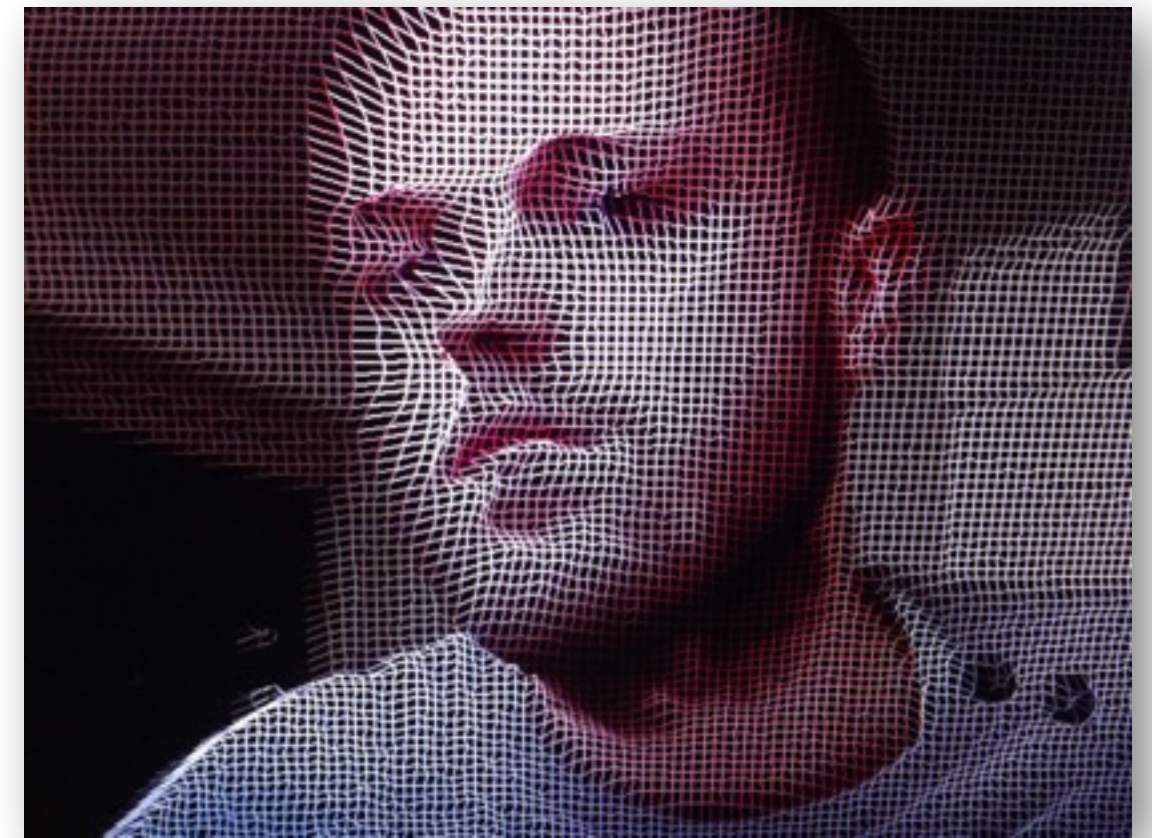
- \* What is Computational Photography?
- \* Examples of Computational Photography to provide context
- \* Overview of the scope of Computational, with respect to other disciplines, and its potential impact
- \* Assignment: Getting set up and sharing some pictures!



Camera 2.0, Marc Levoy

# Module 2: Image Processing and Analysis

- \* Digital Image Representation
- \* Pixel/Point Processes for Images
- \* Smoothing and Filtering methods for Images
- \* Extracting Features from Images
- \* Assignments: Experiments with Image Filtering, Features Detection



# Module 3: Cameras, Optics and Sensors

- \* Pin-Hole Camera
- \* Importance of Optics
- \* How does a Camera work?
- \* Sensors
- \* Assignments: Epsilon  
Photography & make your  
own Camera Obscura!



[wikimedia.org/wiki/File:Cameras.jpg](https://commons.wikimedia.org/wiki/File:Cameras.jpg)



[wikimedia.org/wiki/File:Byelorussky\\_Station\\_-\\_a\\_pinhole\\_photograph.jpg](https://commons.wikimedia.org/wiki/File:Byelorussky_Station_-_a_pinhole_photograph.jpg)



# Module 4: Image Blending/Merging

- \* Sampling and Frequencies
- \* Image Blending
- \* Image Features
- \* Homework: Exercise on Image Blending



Irfan Essa, gatech.edu



Irfan Essa, gatech.edu



# Module 5: Doing Computational Photography

- \* Panoramas
- \* HDR
- \* Image Editing
- \* Assignment: Experiments with HDR/Panoramas



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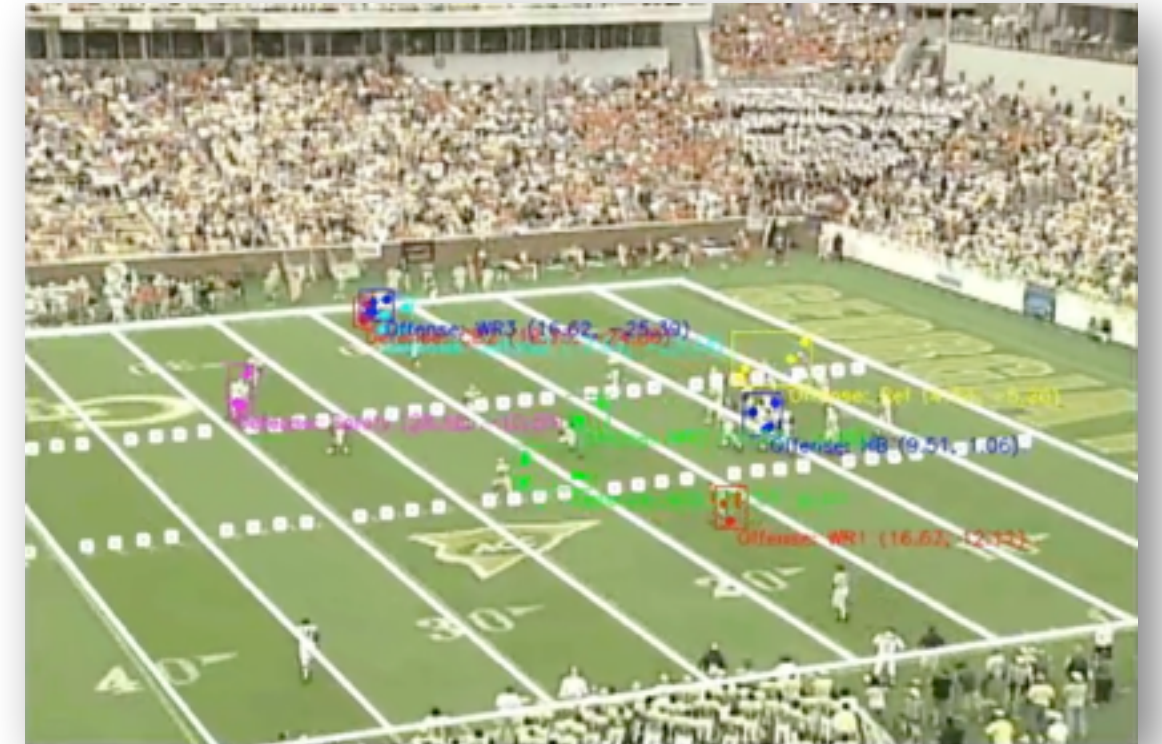


Irfan Essa



# Module 6: Extending to Video

- \* Video
- \* Video Textures
- \* Video Stabilization
- \* Homework Assignment:  
Experiments with Video  
Textures



Irfan Essa, gatech.edu



[wikipedia.org/wiki/Quadcopter](http://wikipedia.org/wiki/Quadcopter)

# Module 7: Computational Cameras

- \* Computational Cameras
- \* Light field Cameras
- \* Multi-view
- \* Projector Camera Systems



[pelicanimaging.com](http://pelicanimaging.com)



[lytro.com](http://lytro.com)



Programmable Automotive Headlights,  
Srinivasa Narasimhan, CMU



# Module 8: Advanced Topics. Special Cases

- \* Newer camera technologies
- \* Blur/Deblur
- \* Social/Crowd Photography
- \* Final Project
  - \* Select a topic of your choosing and make it work for real



Paul Debevec, USC and whitehouse.gov



# What to Expect?

- \* Not a photography class
- \* Technology-related content
- \* A hands-on activities class
- \* You will learn by doing, by yourself and with the class



# 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.

# Next

- \* Deeper dive into what Computational Photography is, and
- \* What aspects (and frameworks) of Computational Photography we need to study

