

EE402: Digital Image Processing

- Instructor:
 - M Usman Sadiq (sadiq@purdue.edu; usman.sadiq@nu.edu.pk)
PhD, Purdue University 2016,
Image Processing, Inverse Problems,
Neuroimaging
- Office hours: Mon, Wed 2:00-3:30 pm
- TA:
 - Yet to be assigned
- Course info: Slate, Piazza

EE402: Digital Image Processing

- Pre-requisites:
 - Undergraduate signals and systems
 - Undergraduate probability and random variables
- Course objectives:
 - Understand the physics of imaging systems
 - Understand and apply mathematics of imaging algorithms
 - Understand visual perception

EE402: Digital Image Processing

- Course Texts:
 - R. C. Gonzalez and Woods, *Digital Image Processing*, Prentice Hall, 2nd Ed
 - Anil K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall, 1989
 - Pratt, *Digital Image Processing*, 4th Edition
- Reference Texts:
 - Al Bovik, *Handbook of Image & Video Processing*, Academic Press, San Diego
 - A. Rosenfield and A.Kak, *Digital Picture Processing*
 - Z. H. Cho, J. P. Jones, and M. Singh, *Foundations of Medical Imaging*, Wiley, 1993
- Background Texts:
 - Papoulis, *Probability, Random Variables and Stochastic Processes*, 4th edition
 - Strang, *Linear Algebra with Applications*
- Supplementary resources:
 - Purdue **EE637** <https://engineering.purdue.edu/~bouman/ece637/>
 - **EE620** and **EE641**
 - Stanford **CS232**

EE402: Grading Policy

- 2 Mid-term exams: 15% each
- Final exam: 40%
- 2 Projects/Home works: 30%

Academic Honesty Policy

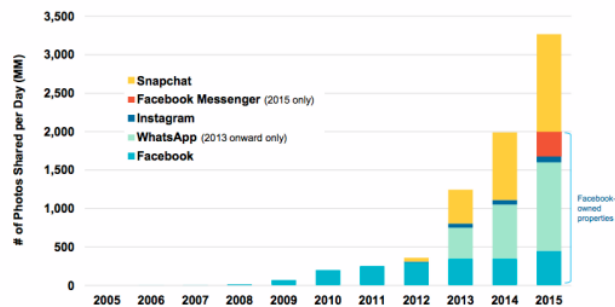
- No cheating, copying on home works
- Will result in F
- No exam from any book

Why study image processing?

- 93 million selfies taken each day!
- Each millennial takes about 25000 selfies in his lifetime!

Image Growth Remains Strong

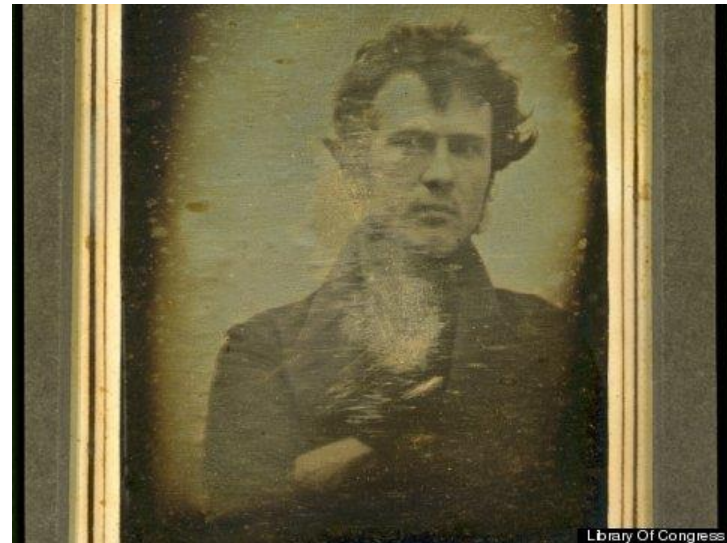
Daily Number of Photos Shared on Select Platforms, Global, 2005 – 2015



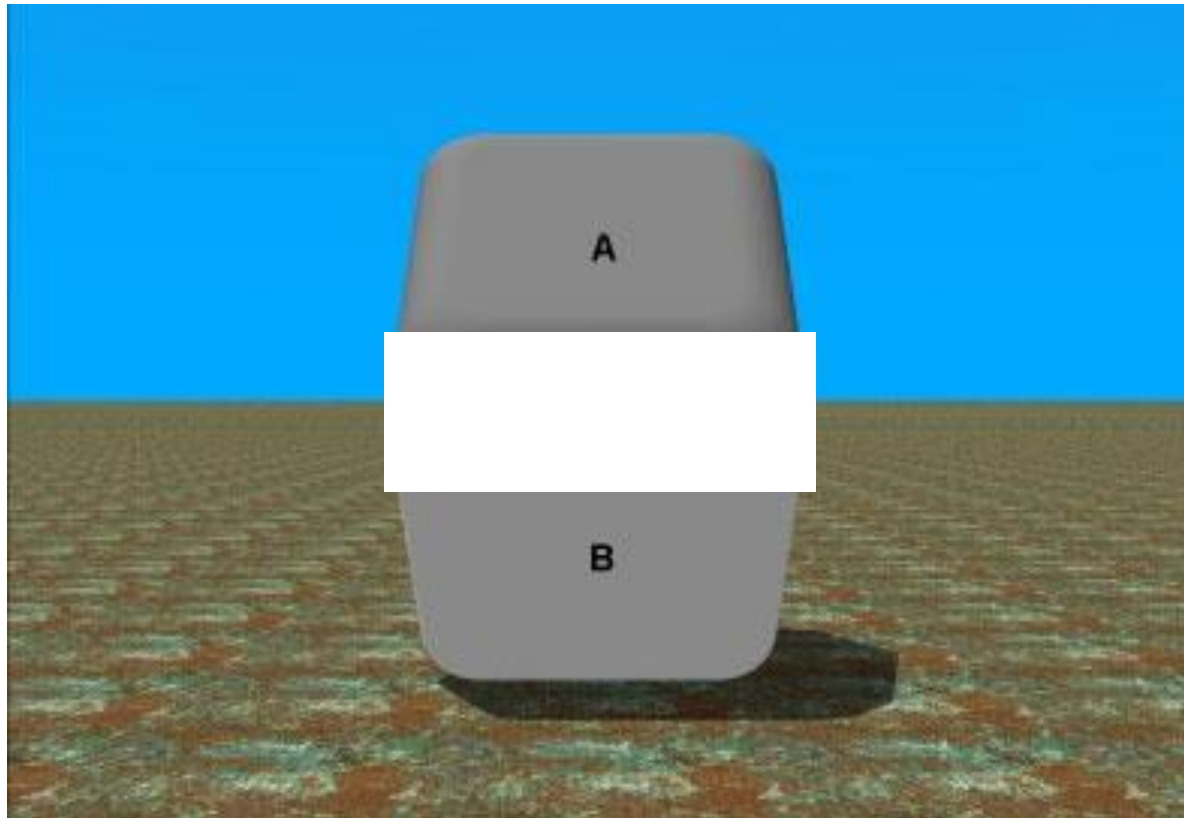
@KPCB

Source: Snapchat, Company download information, KPCB estimates.
Note: Snapchat also includes images and videos. Download data is a compilation of images and videos. WhatsApp data is based on average of photos shared (downloaded) in 2015 (24-18).
Instagram data is based on average of photos shared (downloaded) in 2015 (24-18). Facebook data is based on average of photos shared (downloaded) in 2015 (24-18).

KPCB INTERNET TRENDS 2016 | PAGE 90



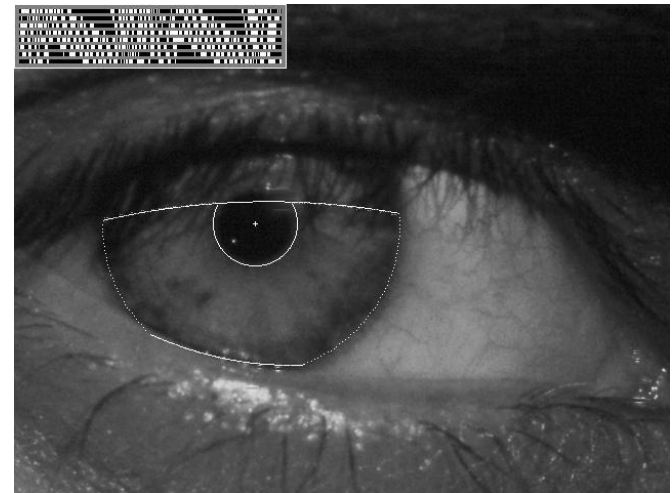
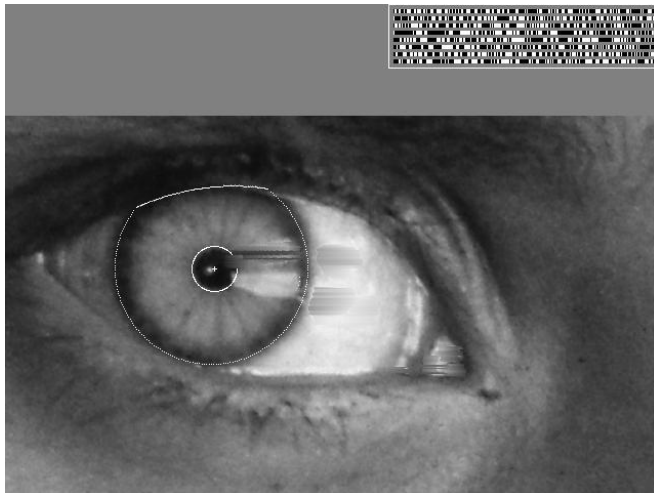
Color and perception



Vision-based biometrics



“How the Afghan Girl was Identified by Her Iris Patterns” Read the [story](#)
[wikipedia](#)



Cervical Cancer: Why Should We Care



2nd most common cancer in women worldwide



Pakistan: ranked 7/50 in cervical cancer deaths

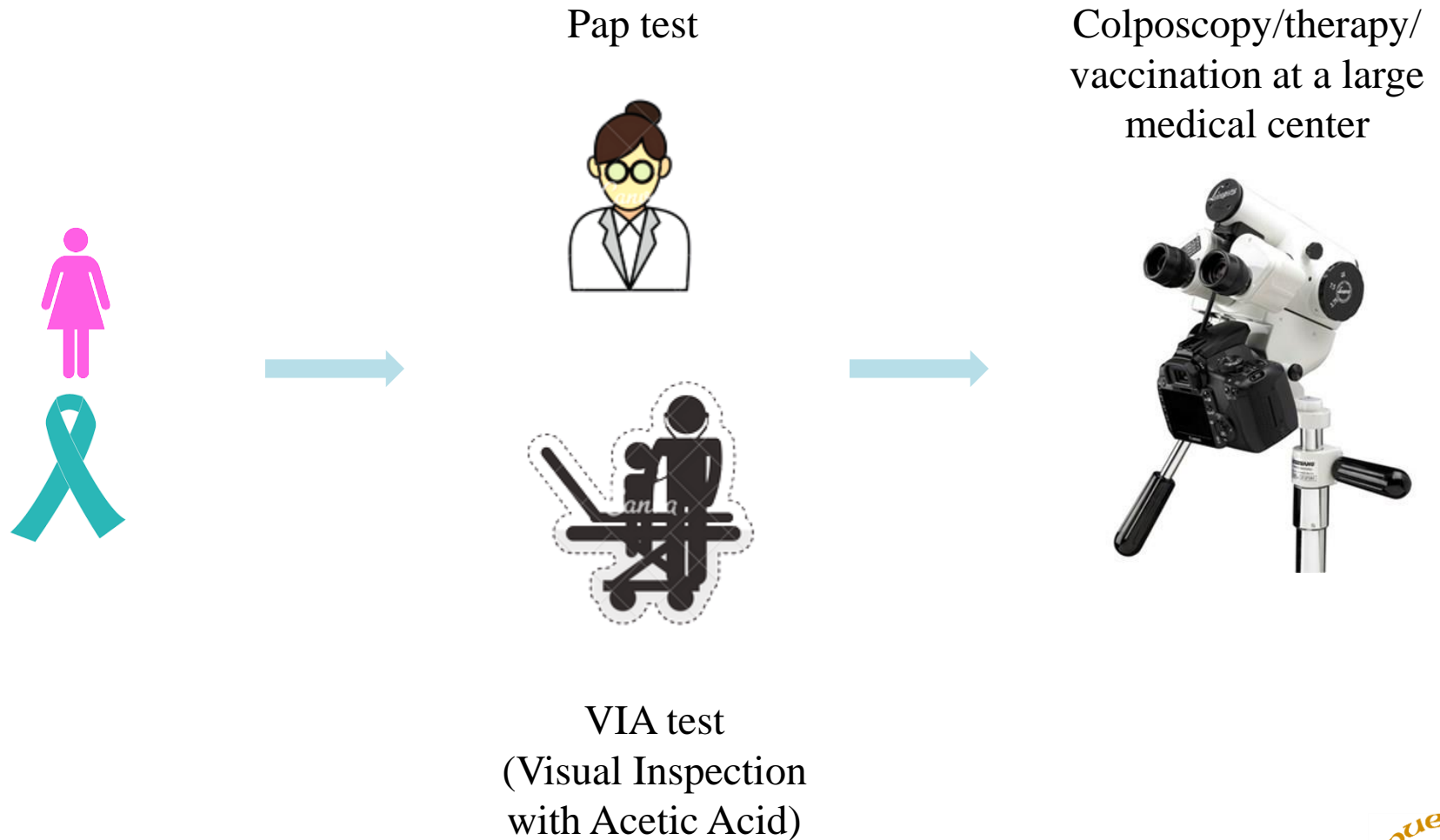


85% of women worldwide without access to screening



Tragedy: takes 20 years to develop, can be cured in 40 minutes if diagnosed in first 5 years

Cervical Cancer: Diagnosis Pipeline



About 3.1% women are screened in India

Mobile Colposcope



- Diagnosis comparison with VIA: treatment rate increased to ~50% vs 12%
- Use in third-world:
 - Pink Ribbon Red Ribbon – about 80% successfully treated in Ethiopia
 - More than 15 countries including Apollo Hospital India, Afghanistan
- Pricing:
 - Conventional colposcope ~ \$10,000-20,000
 - Mobile EVS ~ \$2000 phone, hardware and software included

Why do we care?



Augmented-collaboration (Cisco)



Controller-free motion gaming (Microsoft)

Original Thinking



Digital Image Processing

- Values that matter even before the technical stuff:
 - Understand ‘things’ over know things
 - Honest skepticism and asking questions:
 - “Do I actually understand this topic, or just for the exam?”
 - Fascination over forceful study
 - Be ready for challenge

EE 402- Course outline

- Welcome to EE402
- Background: Continuous Parameter Signals
- Discrete transforms and image filters
- 2D random processes and eigen-signal analysis
- Image neighborhood and segmentation
- Edge detection and connected components
- Imaging systems

EE 402- Course outline

- Tomographic reconstruction and MRI
- Visual perception concepts
- The tri-stimulus model
- Other image models and fidelity metrics
- Image enhancement and estimation
- Source coding
- Advanced topics in imaging