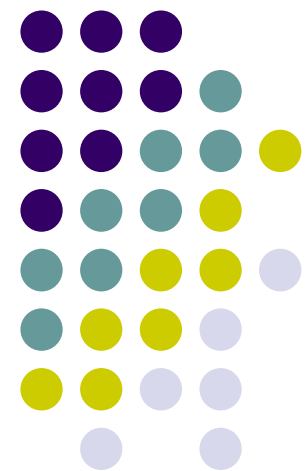# Ubiquitous and Mobile Computing
CS 403x: *Visage*

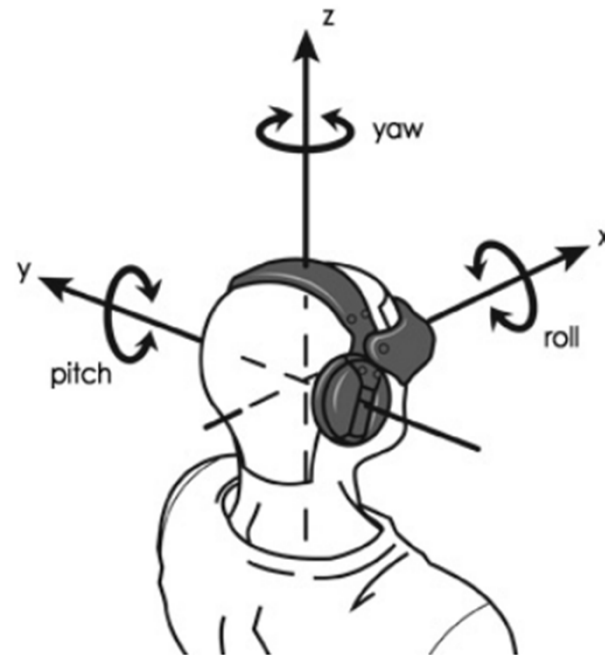## Ross Foley, Chris Hanna, Dan True

Computer Science Dept.

Worcester Polytechnic Institute (WPI)

What is Visage ?

- Real-time Face Interpretation Engine

- Input to Apps
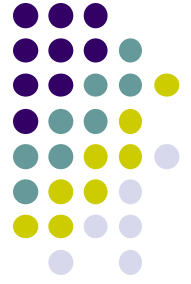 - 3D Head Poses
  - Mood Interpretation

Motivation

- Front-Facing Camera Enables New Possibilities

- Search for New Solution for Onboard Facial Recognition
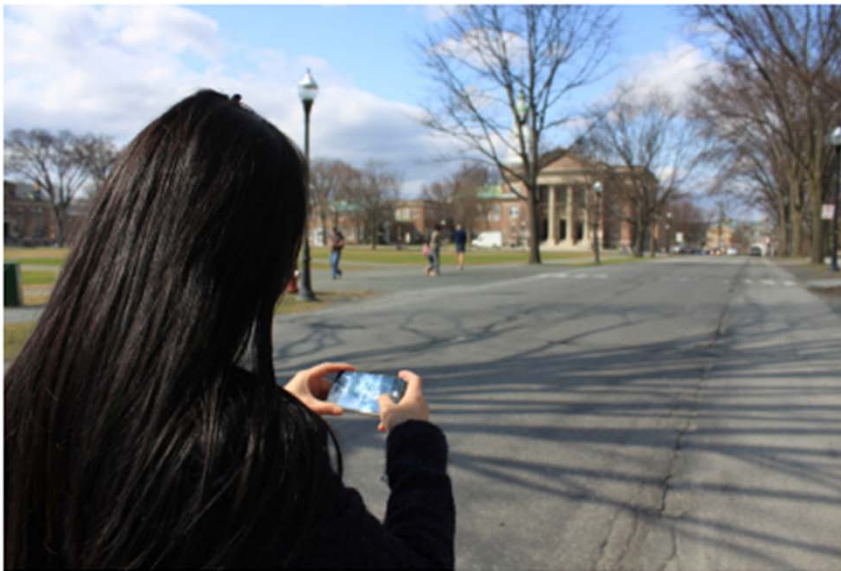 - Resource Aware
  - Mobile Camera

Vision

- Onboard System
  - Without need for backend server
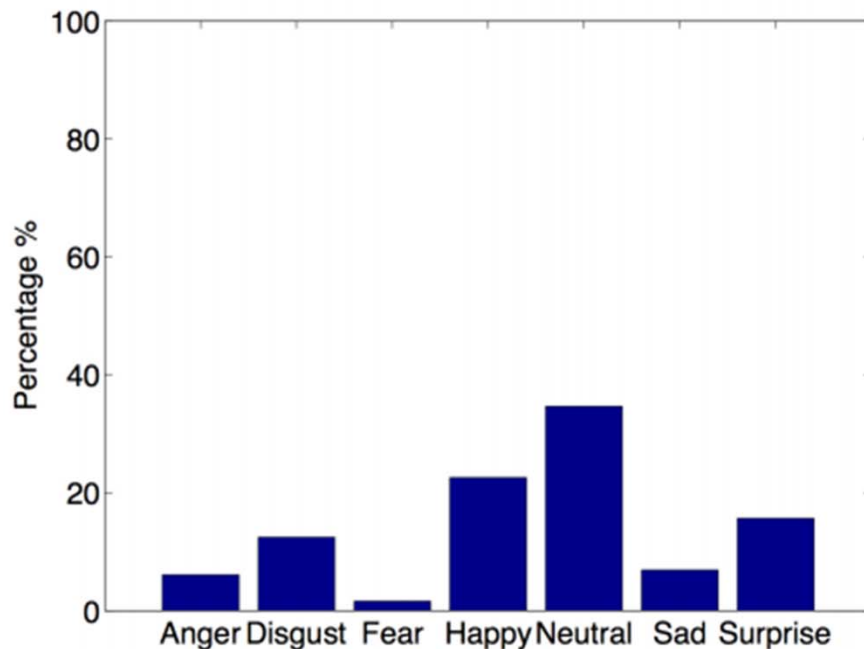
- Resource-limited Mobile Devices

Street View +

- Makes use of head pose inference
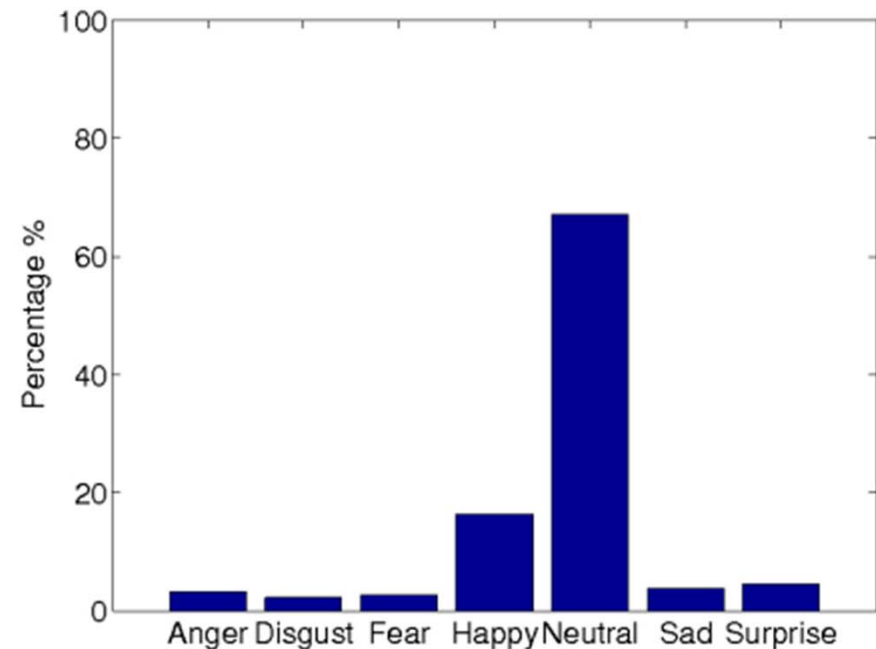- Provide user with navigation on-the-go

Mood Profiler

- Senses users' expressions
- Visualized summaries while users are interacting with specific applications
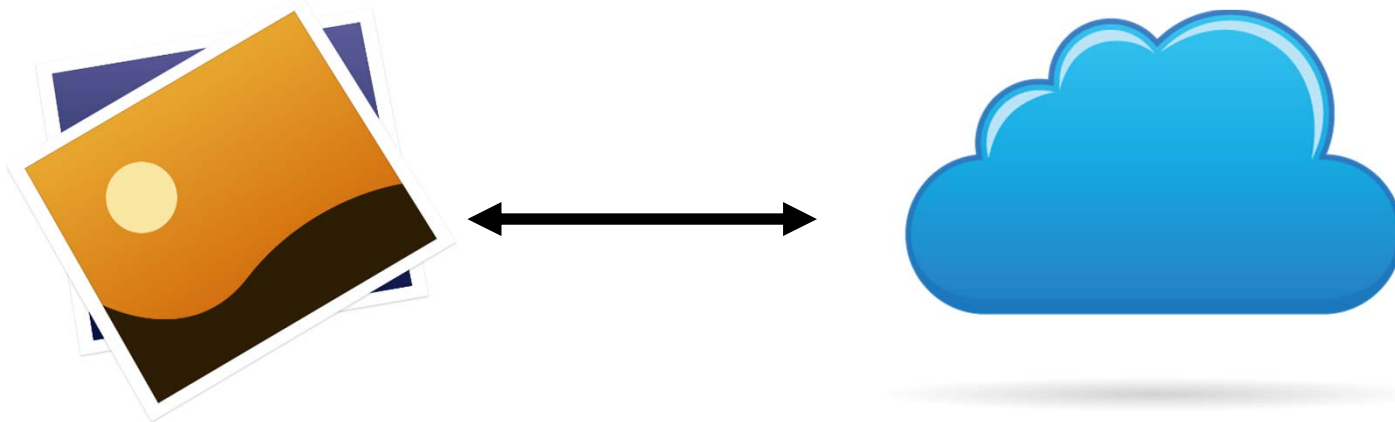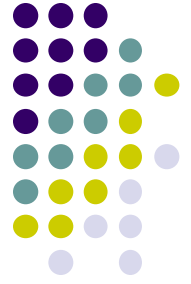

(a) YouTube

(b) Email

Related Work

- Sense Cam
- MoVi
- Recognizer
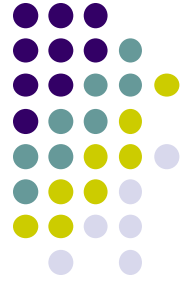- PEYE

Methodology

- Preprocessing Stage

- Tracking Stage
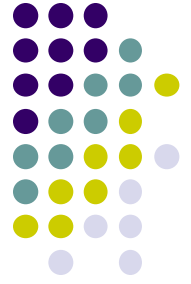
- Inference Stage

Methodology

- Preprocessing Stage

- Tracking Stage

- Inference Stage

Preprocessing Stage
Phone Posture Component
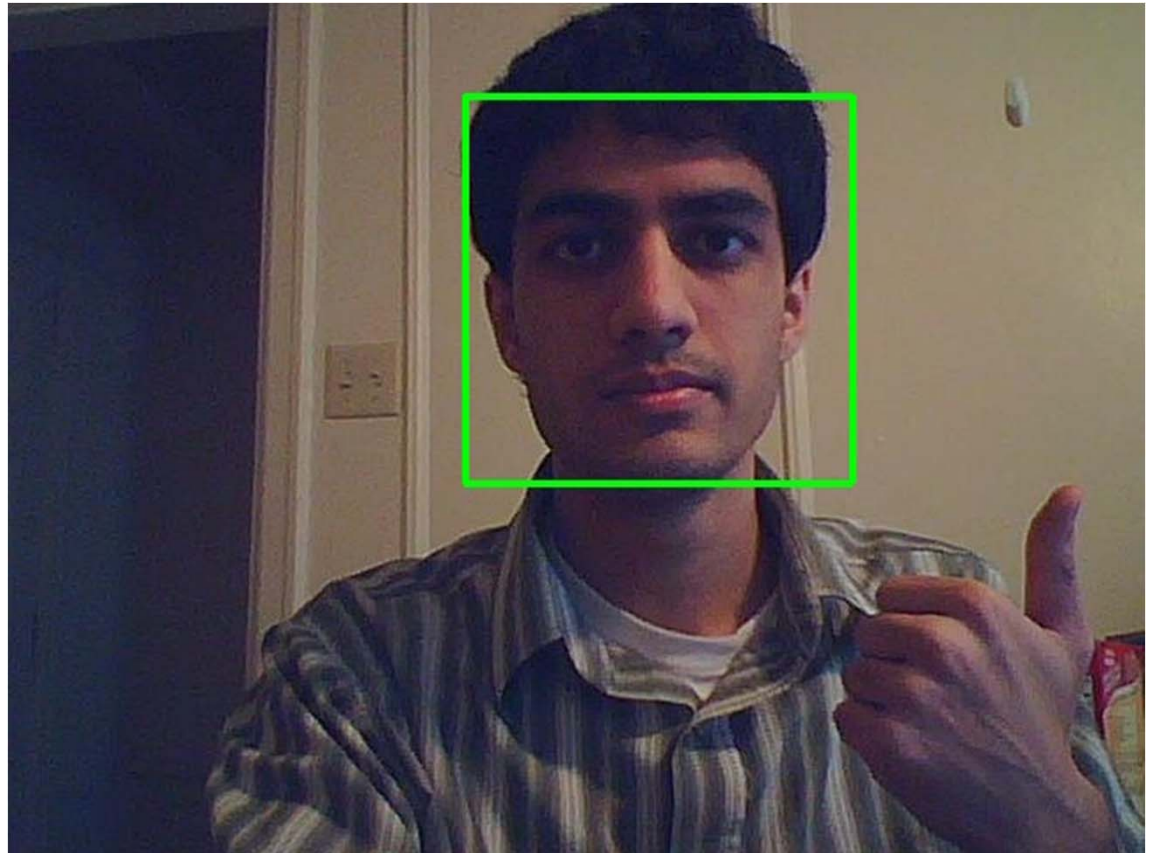
- Raw data from sensors

- Estimates direction of gravity

http://archive.gogadgetnews.com/wp-content/uploads/2010/07/iphone4-now-available-t-mobile-0.jpg

Preprocessing Stage
Face Detection with Tilt Compensation
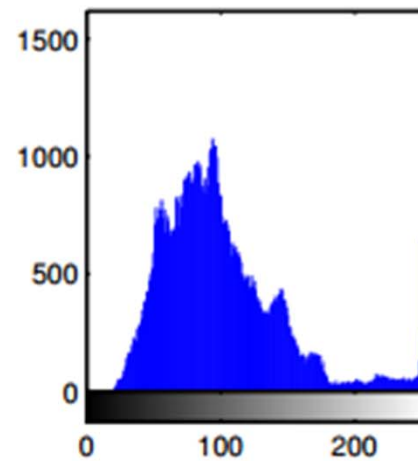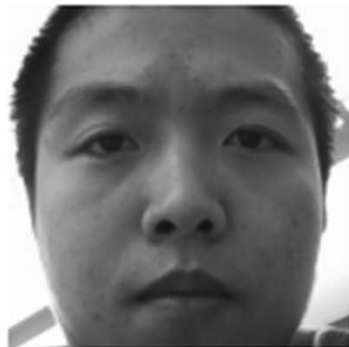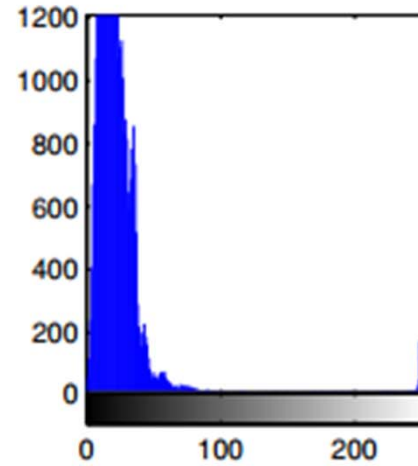
- Locates face

- Normalizes the face angle

http://eclecti.cc/files/2008/03/face.jpg

Preprocessing Stage
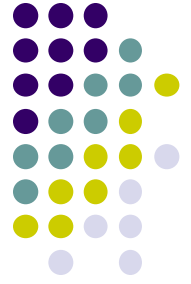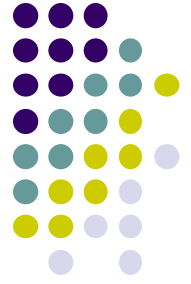## *Adaptive Exposure Component*

Methodology

- Preprocessing Stage

- Tracking Stage

- Inference Stage

Tracking Stage
Feature Point Tracking

- Searches for Facial Feature Points
  - Looks for lips and eyes
  - Multiple frames of video required
  - Uses spatial relationships for further calculation

http://www.mymakeupshow.com/wp-content/uploads/2013/10/perfect365-adjust-key-points.jpg
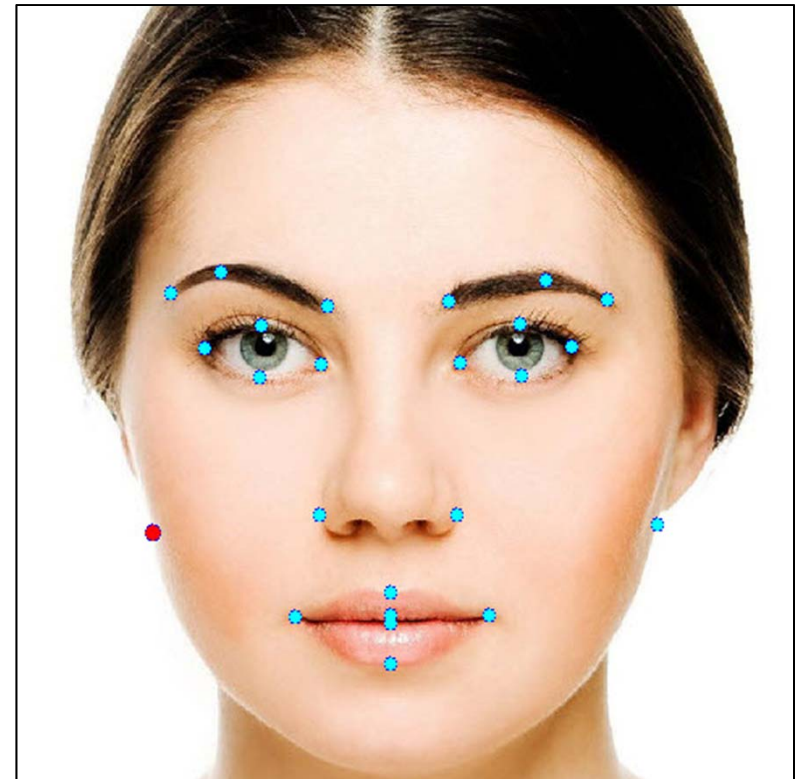
Tracking Stage
Pose Estimation

- Estimates 3D pose of head

- Models head as cylinder

- Compensates for error

http://www.nlreg.com/cylinder.jpg
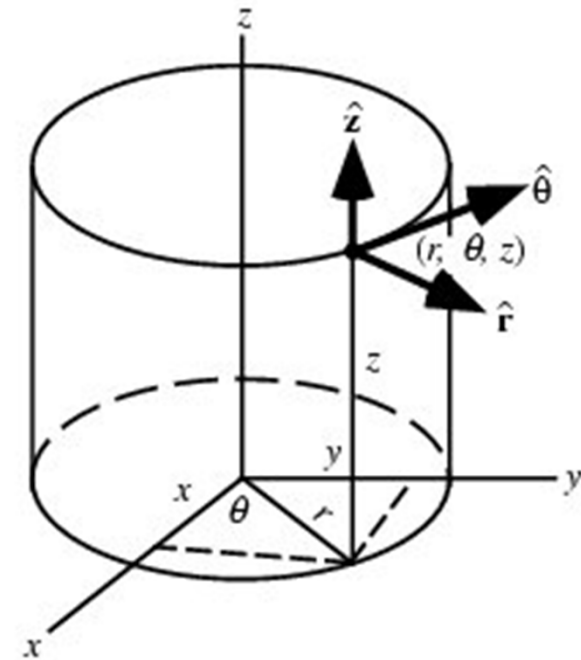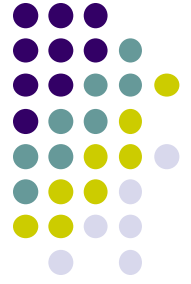
Tracking Stage
Pose Estimation
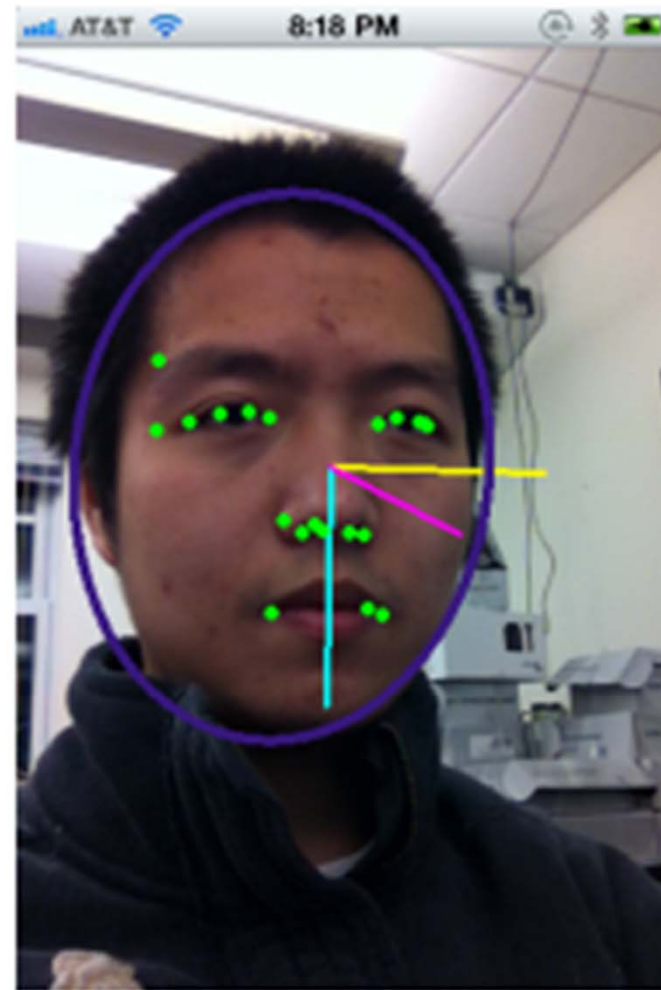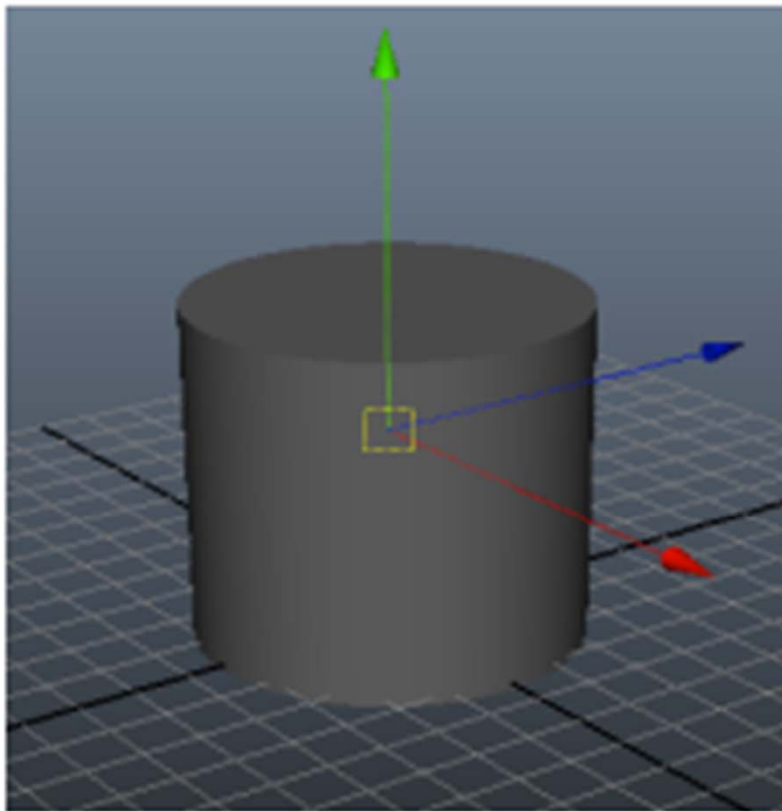
Methodology

- Preprocessing Stage

- Tracking Stage

- Inference Stage

Inference Stage
Active Appearance Model

- Machine Learning Algorithm

- Generates Triangular Mesh over Image
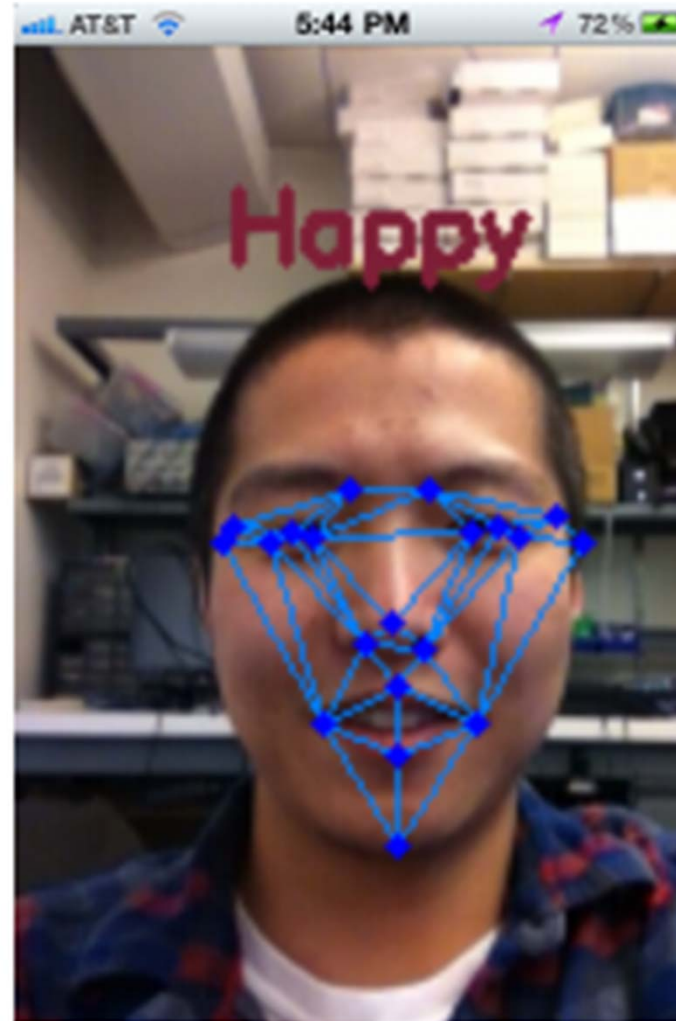
Inference Stage
Expression Classification

- Support Vector Machine Classifier
  - Angry, Disgust, Fear Happy, Neutral, Sad Suprise

Results

- Pose Estimation

- Expression Estimation

- Computation Expenses
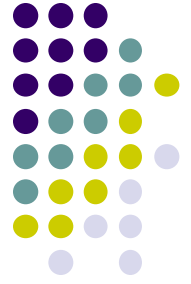
Results
Pose Estimation

- Head in constant position
- Phone rotated
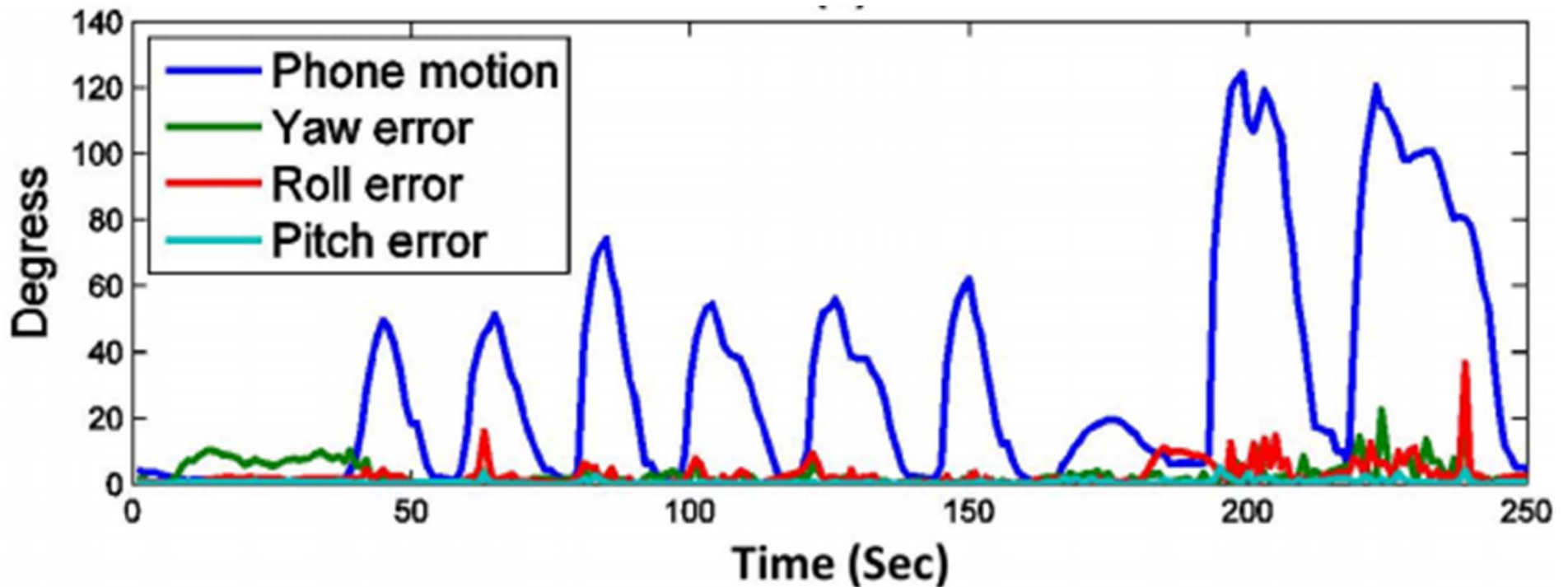
(b)

Results
Pose Estimation

- Head rotated
- Phone constant

Results
Expression Estimation

- 5 Volunteers make facial expressions
- Visage categorized resulting expressions

Expressions	Anger	Disgust	Fear	Happy	Neutral	Sadness	Surprise
Accuracy(%)	82.16	79.68	83.57	90.30	89.93	73.24	87.52

- Overall accuracy = 83.78%

Results
Expression Estimation

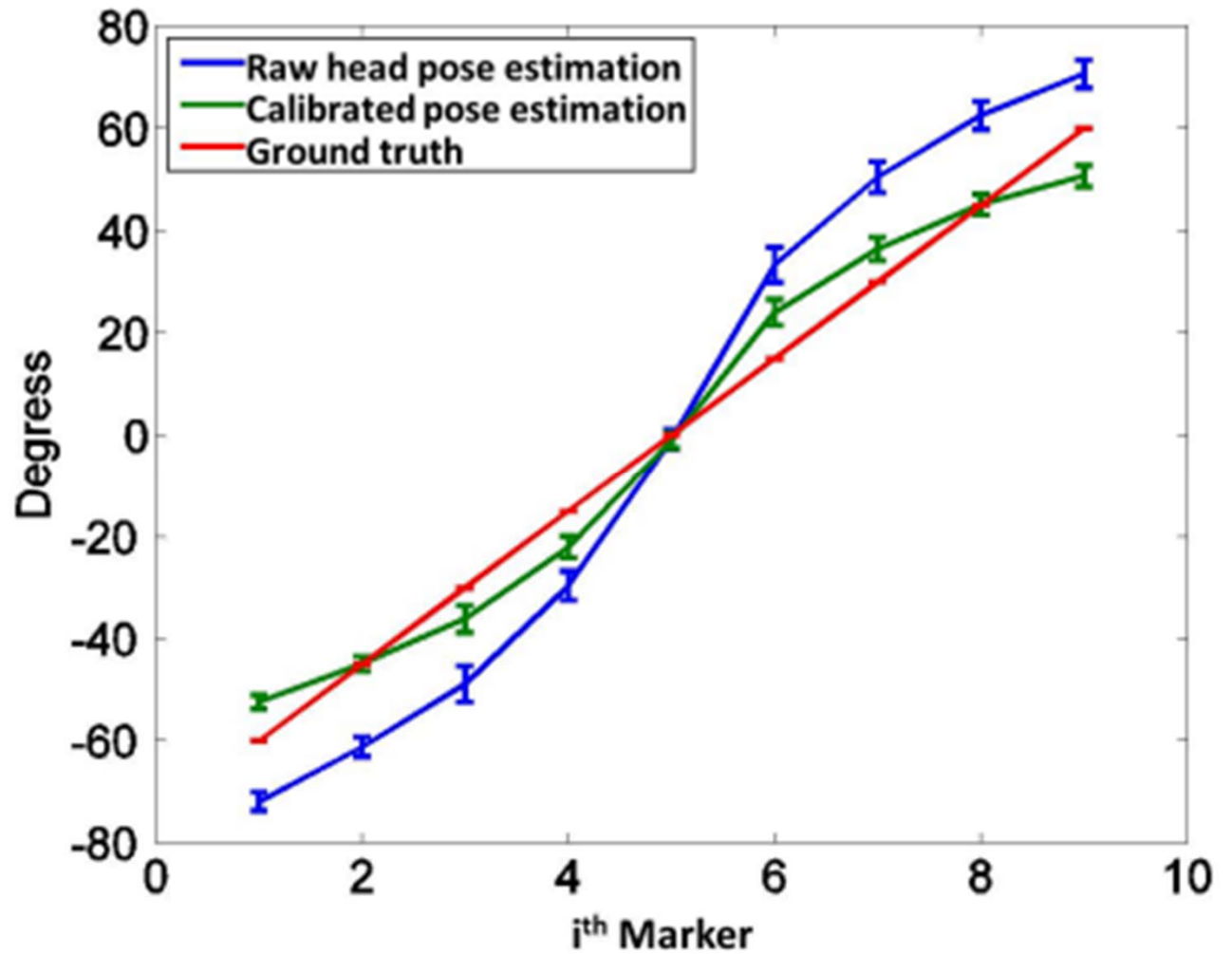| Expressions	Anger	Disgust	Fear	Happy	Neutral	Sadness	Surprise
Anger	93.33	6.67	0	0	0	0	0
Disgust	6.90	75.86	17.24	0	0	0	0
Fear	0	7.41	92.54	0	0	0	3.23
Happy	0	0	0	87.10	6.45	3.23	0
Neutral	0	0	0	0	90.00	10.00	0
Sadness	0	6.45	9.68	3.23	9.68	70.97	0
Surprise	0	0	3.33	3.33	0	0	93.33

Results
Computation Estimation

Tasks	Avg. CPU usage	Avg. memory usage
GUI only	$< 1\%$	3.18MB
Pose estimation	58%	6.07MB
Expression inference	29%	4.57MB
Pose estimation & expression inference	68%	6.28MB

Conclusions

- Succeeded in creating an onboard facial recognition platform
  - Comparable to traditional cloud-based image analysis systems

- Could be Useful ?

Questions ?

References

- *The Visage Face Interpretation Engine for Mobile Phone Applications Xiaochao Yang, Chuang-Wen You, Andrew Campbell, in Proc MobiCase 2012*

Insert your Title here

- Insert your stuff here