# Introduction to Computer Vision

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## Project Ideas

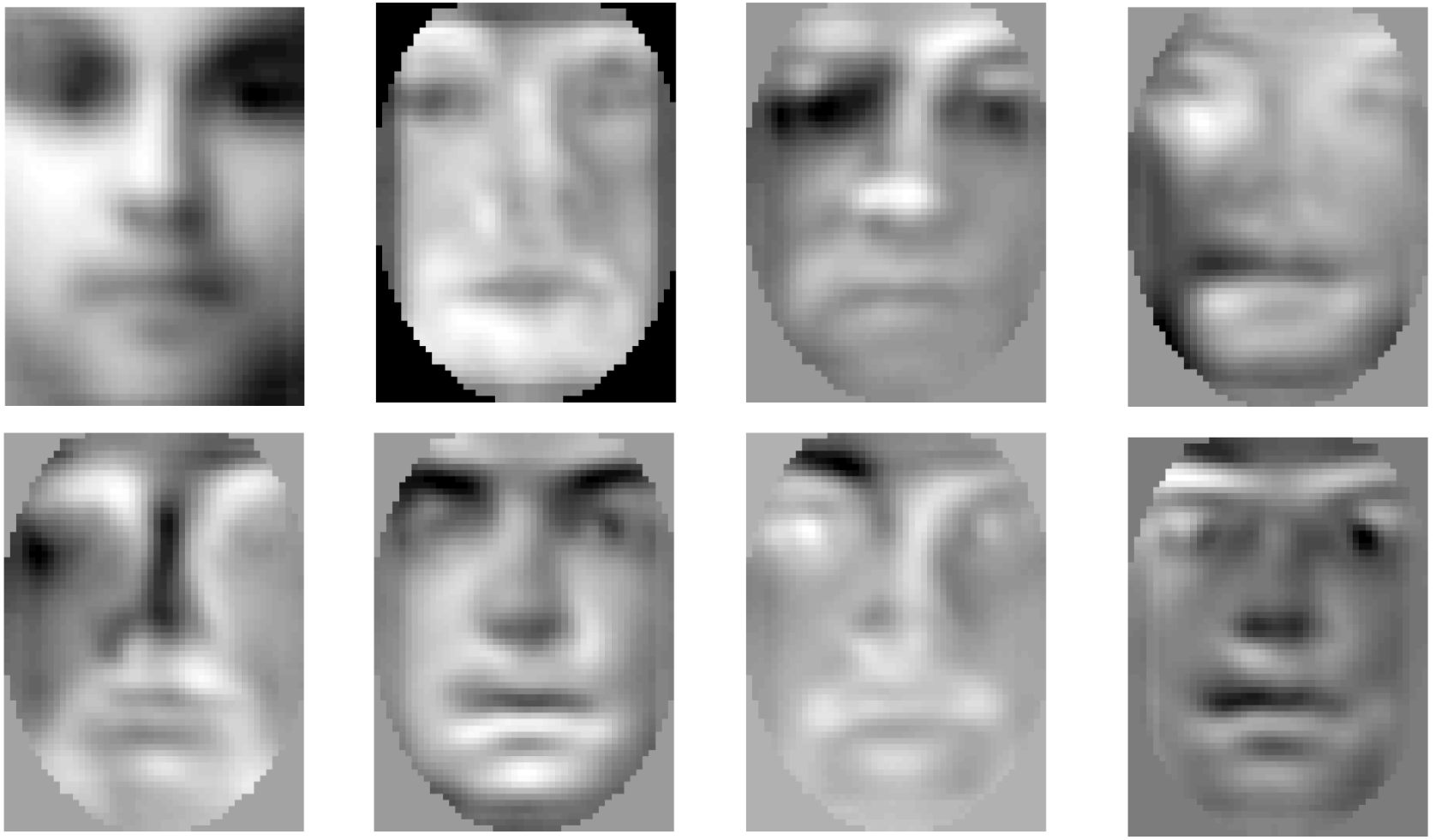
# Dates

**11/13 Proposals due**

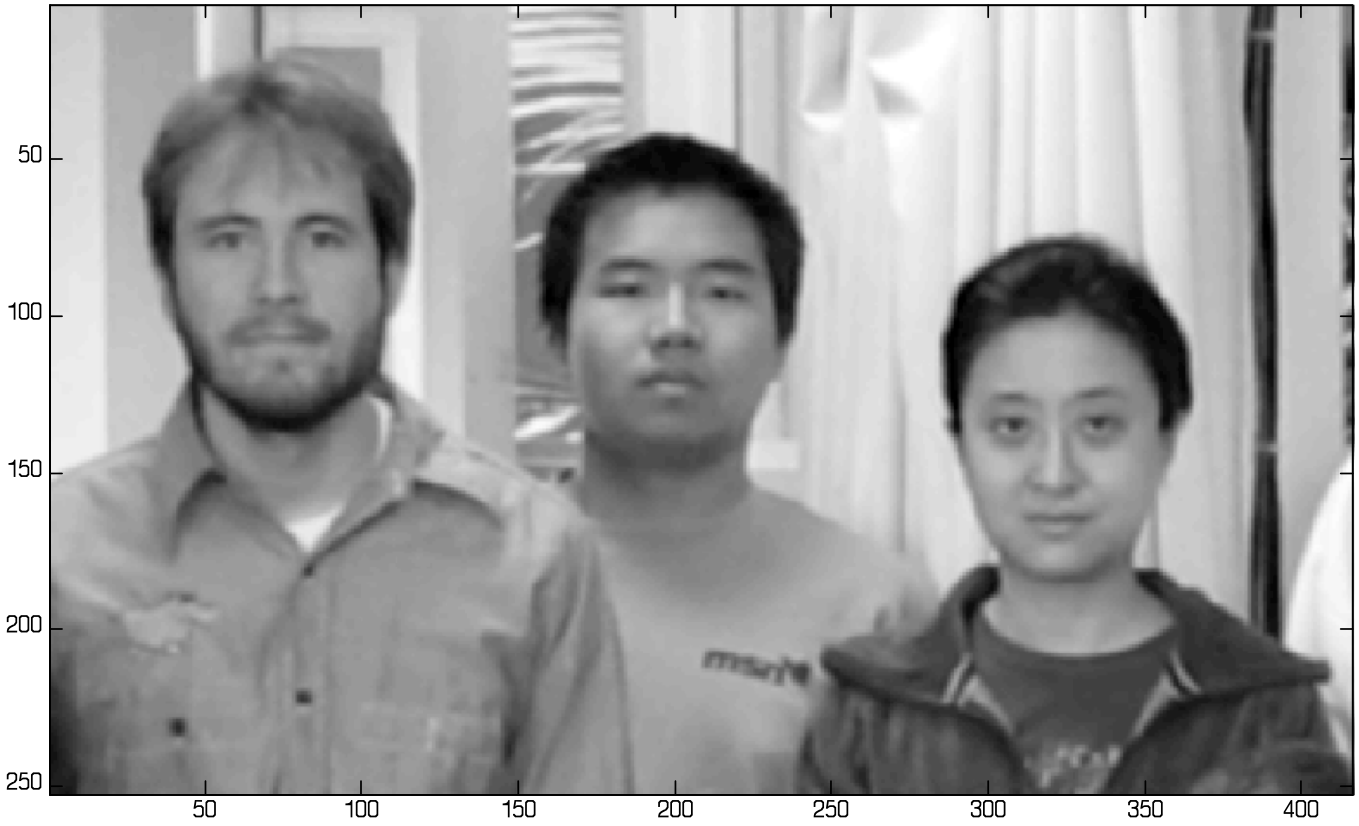
- 1 page write-up
- summary and goals (problem/approach)
- what are the key references
- where will you get data and how will you evaluate your method?

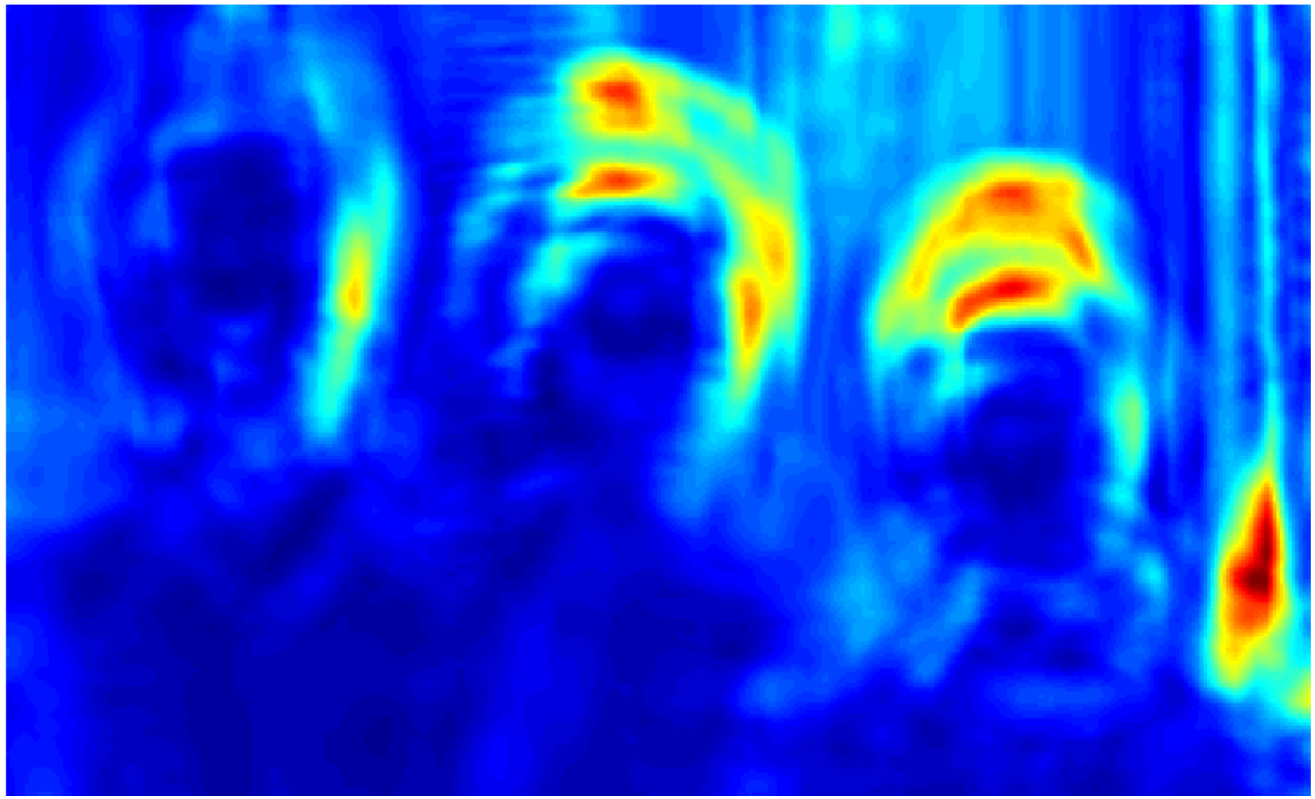
**12/14 Projects due**

# Eigen faces

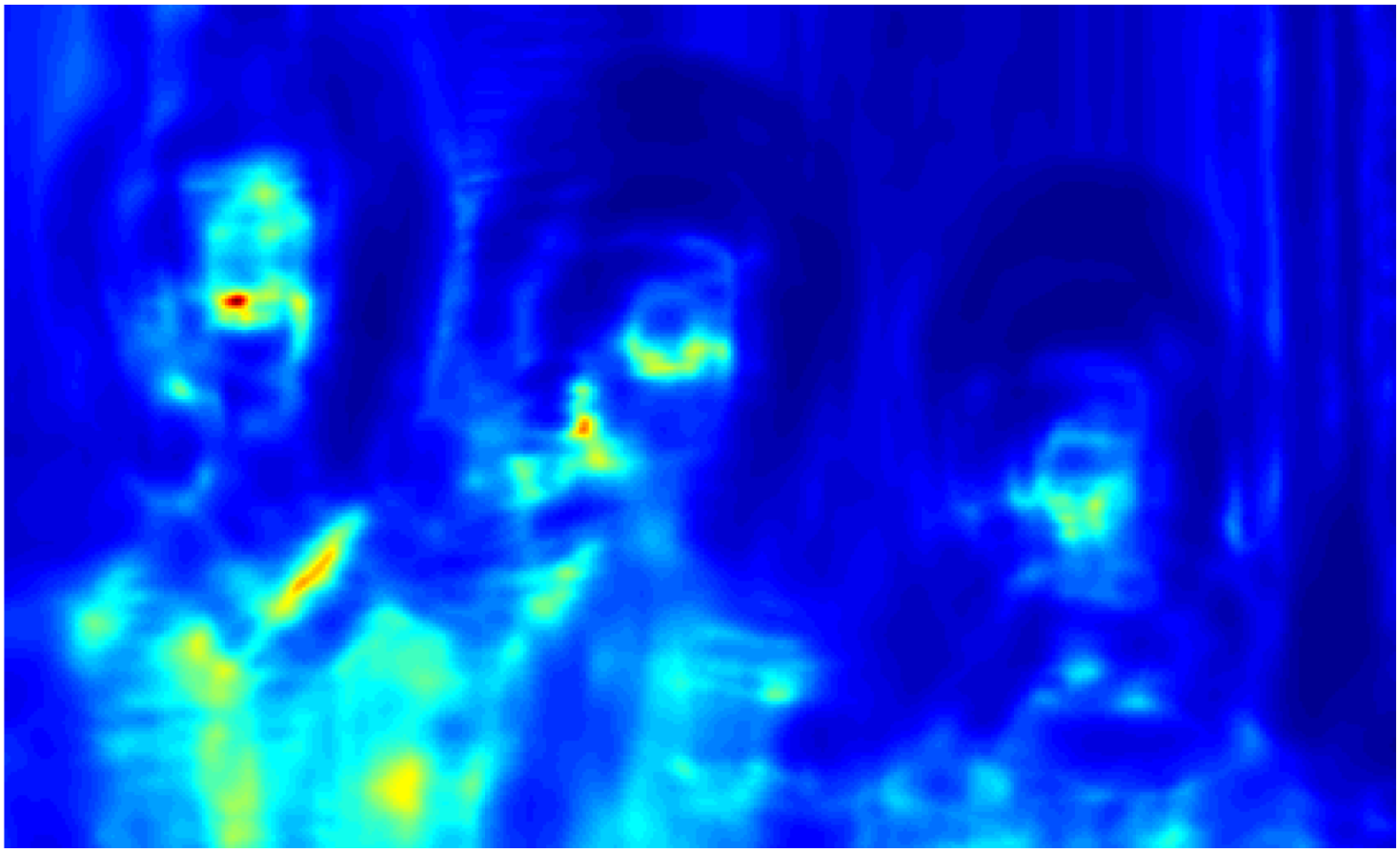


# Detect faces

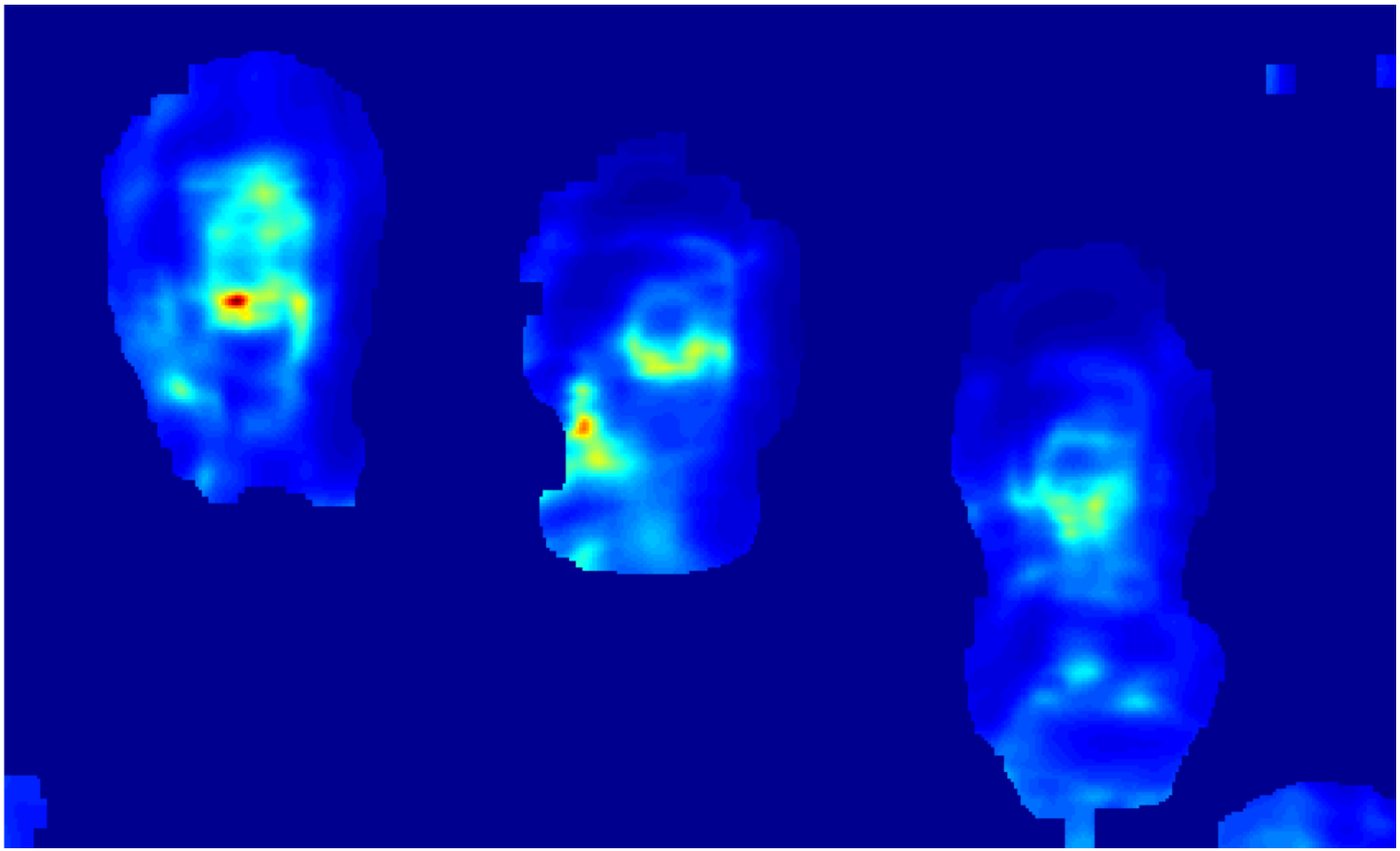




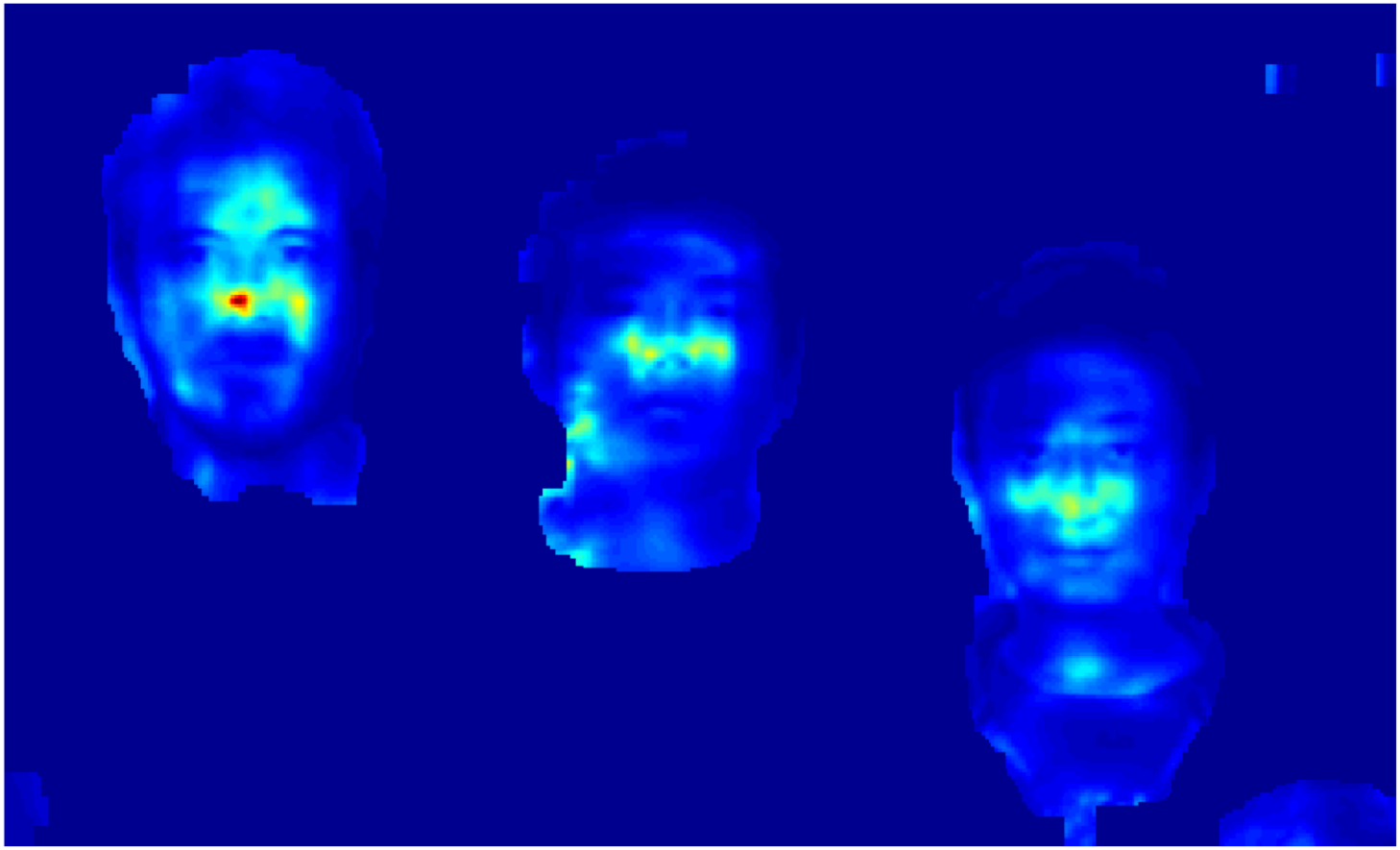
*Mahalanobis distance*



*1./d*



*Masked by skin detections*



*Times the image*

# If you work on face detection

- You must use color in some way (e.g. color eigenspace)
- You must search across a range of scales.
- You must try it on some image data that was not collected in class.
- Use the Moghaddam and Pentland paper.
- Extra: try gender recognition.

# Space Carving

a) original photo b) silhouette c) reconstruction

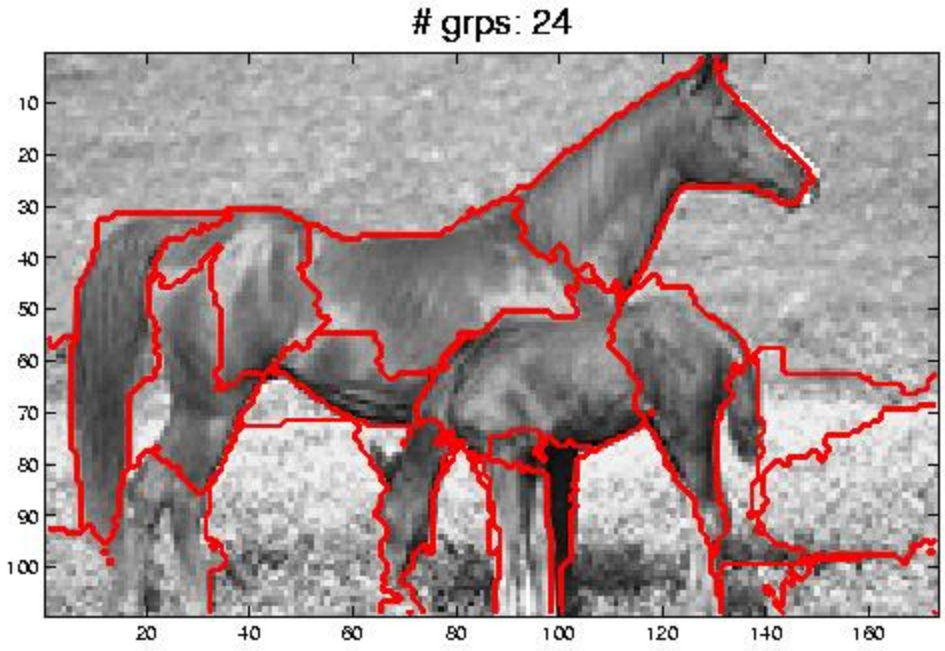
- Kutulakos, K. and Seitz, S. 2000. Theory of Shape by Space Carving. *International Journal of Computer Vision*,
- 38(3):199-218.

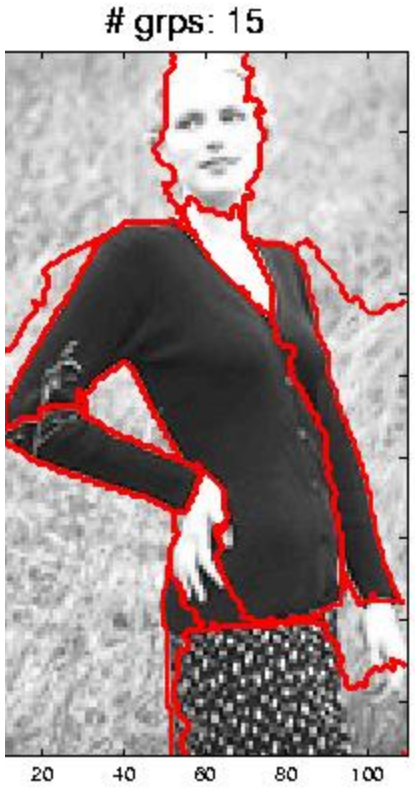
- Images from ETH-80 database.

# Sources of data

http://www.vision.ethz.ch/projects/categorization/eth80-db.html

# Image segmentation




Normalized cuts:

http://www-2.cs.cmu.edu/~jshi/Grouping/

# Face gender classification?

http://vis-www.cs.umass.edu/lfw/

13233 labeled faces of 5749 people found with Viola-Jones detector (Adaboost).

Use names to get gender: (http://www.gpeters.com/names/baby-names.php?)

# More face images

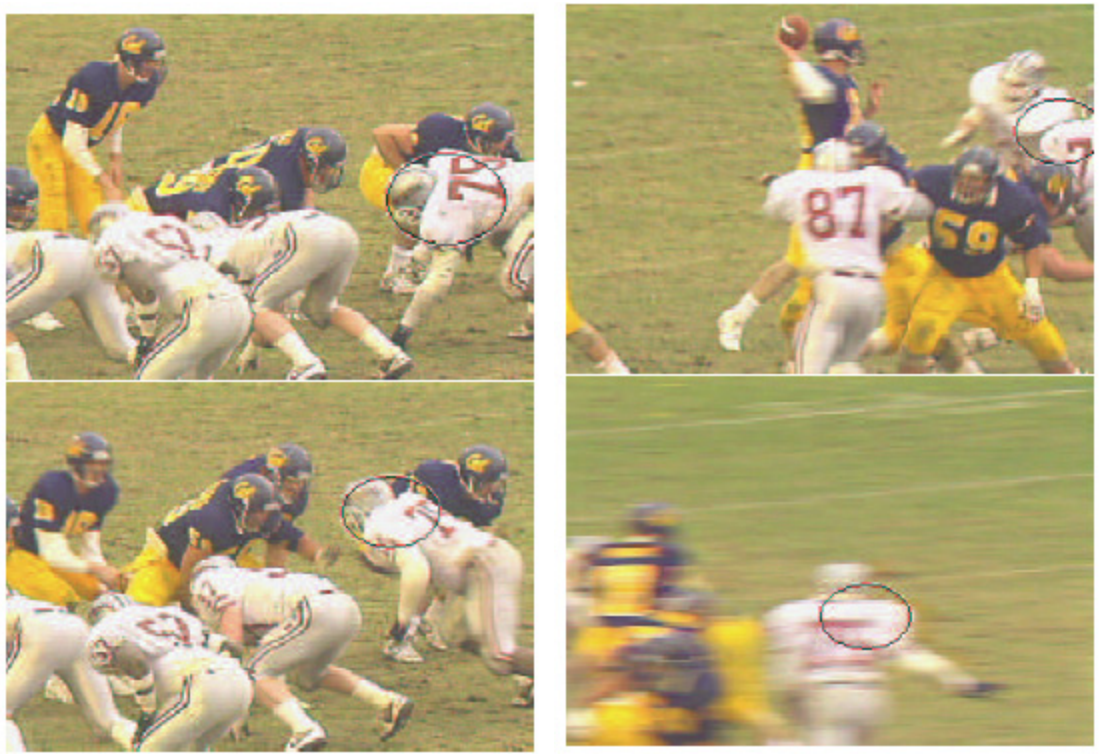
There are many other face databases on the web. Eg:

http://titan.cog.brown.edu:8080/TarrLab/face-place

# Kalman Filter Tracker

- Real-time tracker using a PC camera.

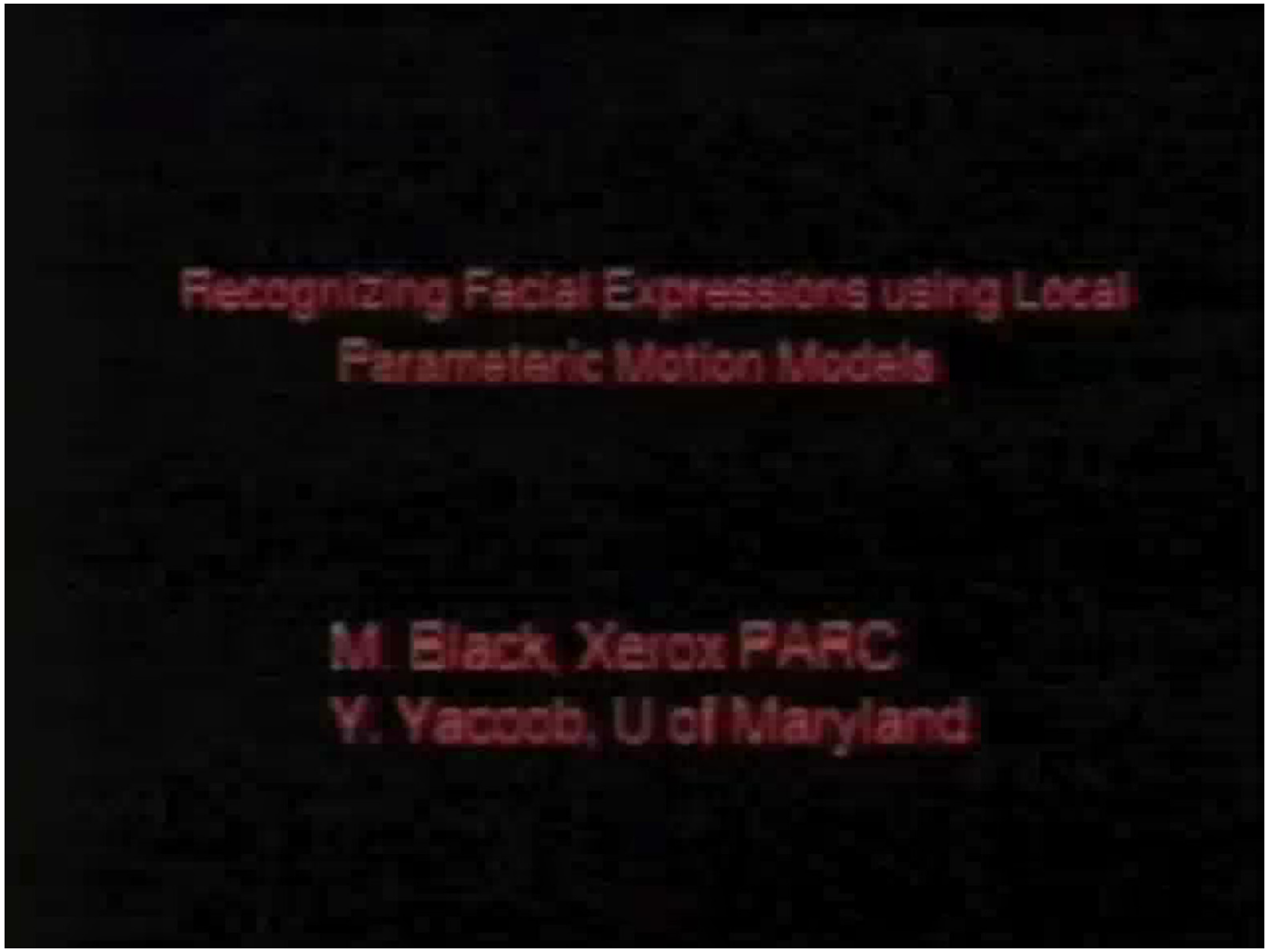
# Mean-shift tracking



http://www.caip.rutgers.edu/~comanici/Papers/KernelTracking.pdf

# Facial expressions

- Affine head tracking
- analysis of motions of facial features


Recognizing Facial Expressions using Local
Parameteric Motion Models
M. Black, Xerox PARC
Y. Yacoob, U of Maryland

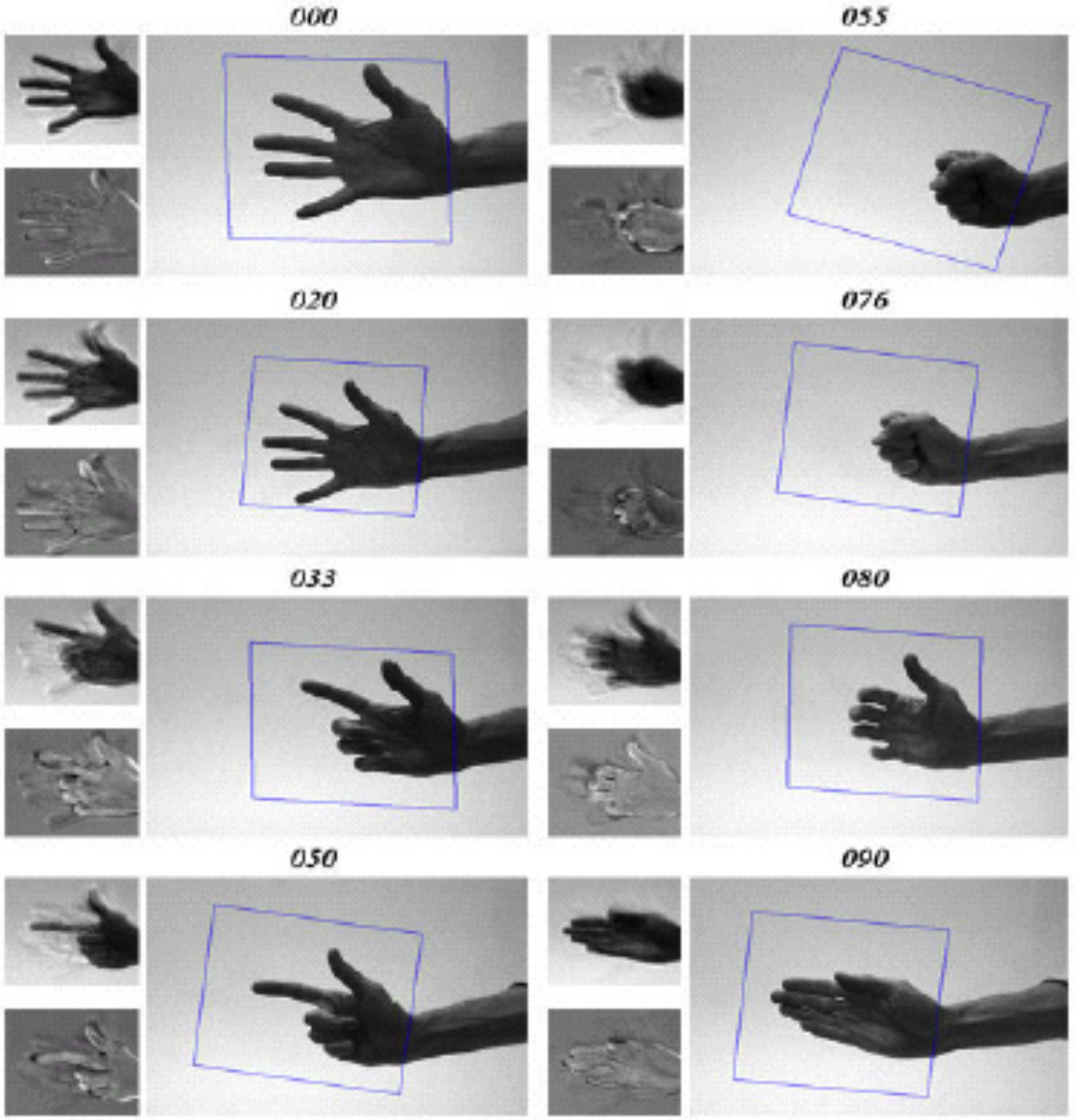
# EigenTracking

(Black and Jepson)

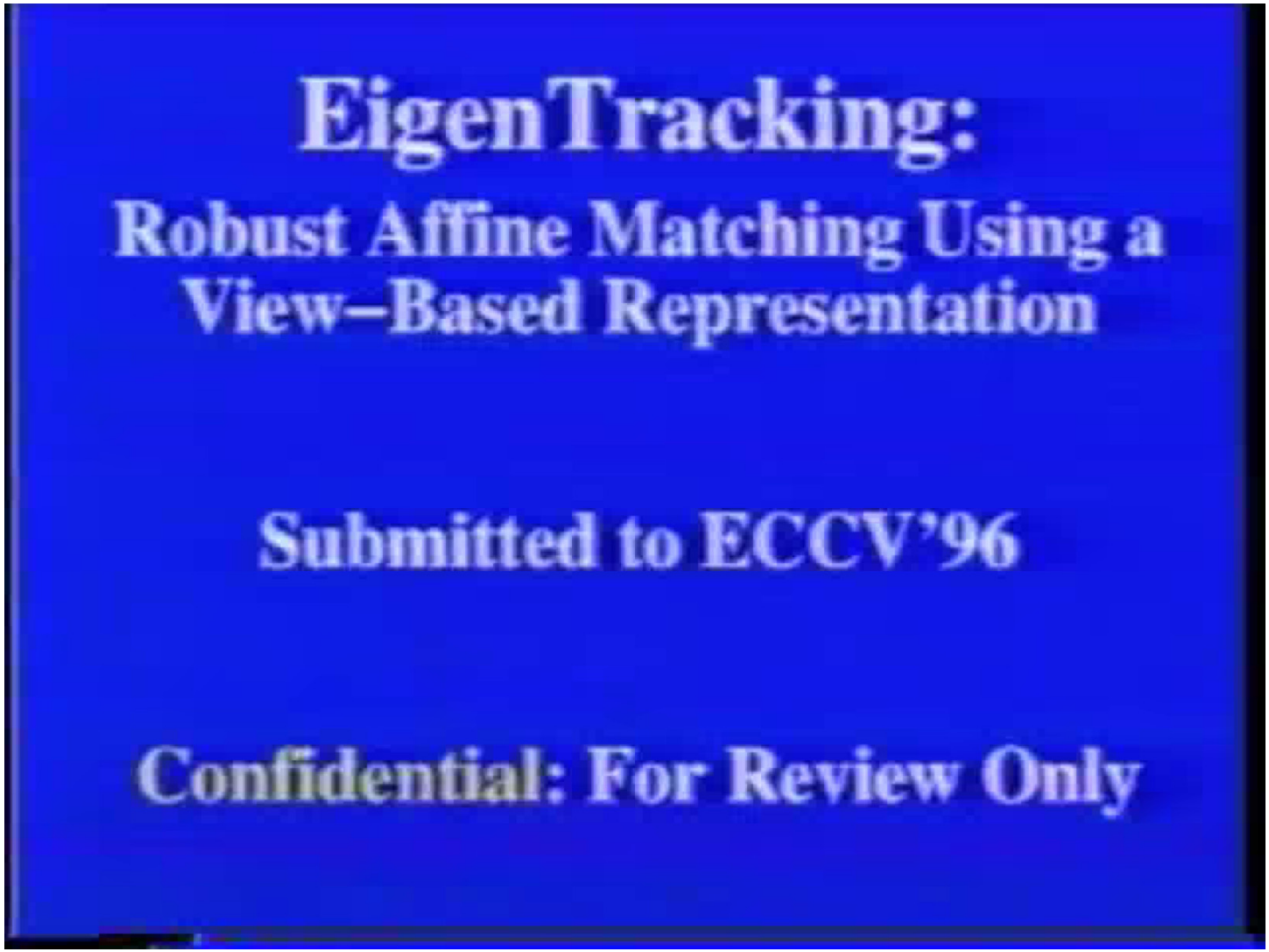
*Combines affine motion estimation with PCA representation to allow tracking of deforming objects.*

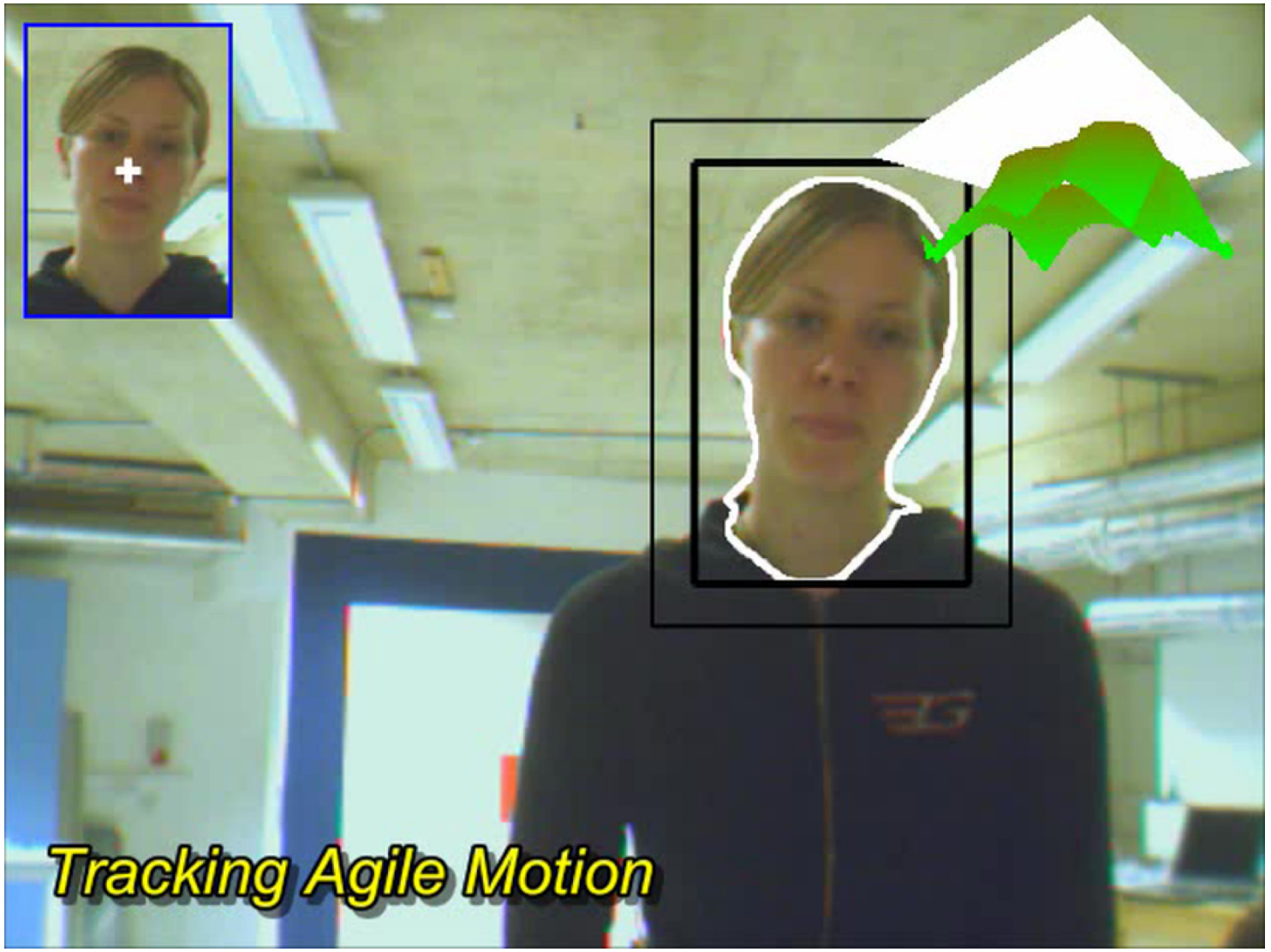
*Data:*

http://www.cs.brown.edu/~black/images.html



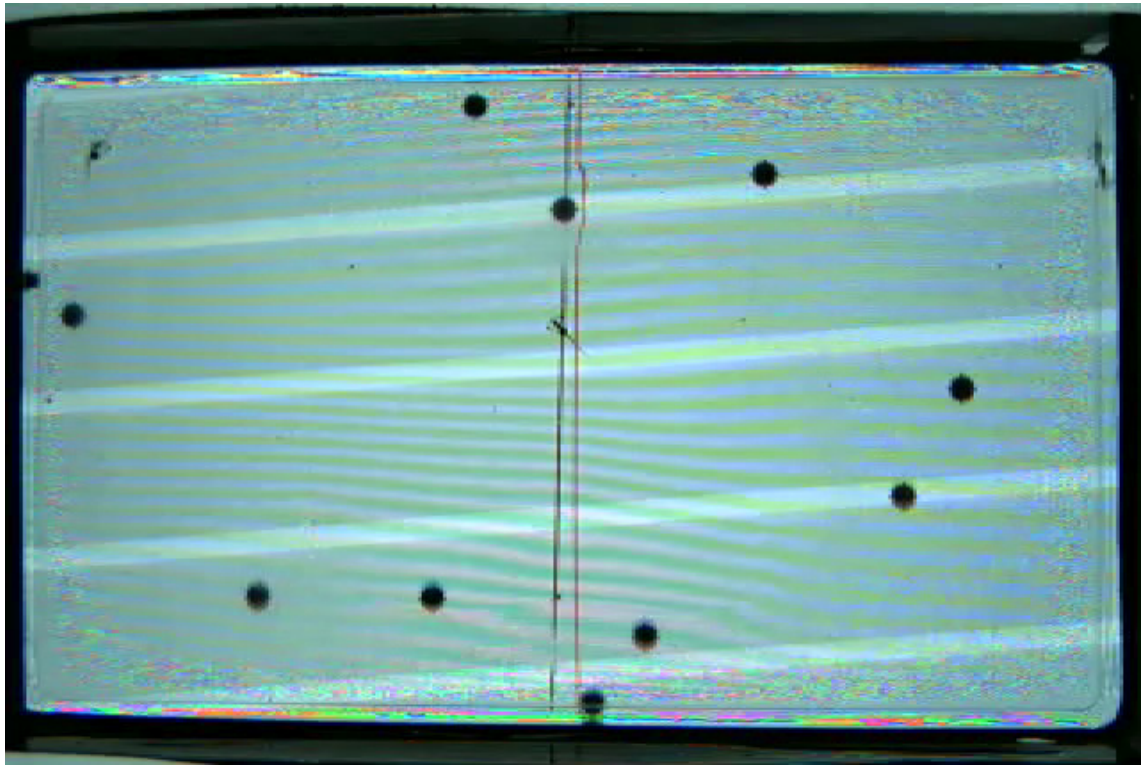

http://www.cs.brown.edu/~black/eigenTrack.html


EigenTracking:
Robust Affine Matching Using a
View–Based Representation
Submitted to ECCV'96
Confidential: For Review Only

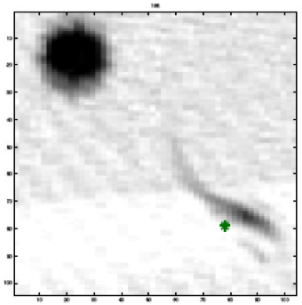



http://www.robots.ox.ac.uk/~cbibby/research_pwp.shtml

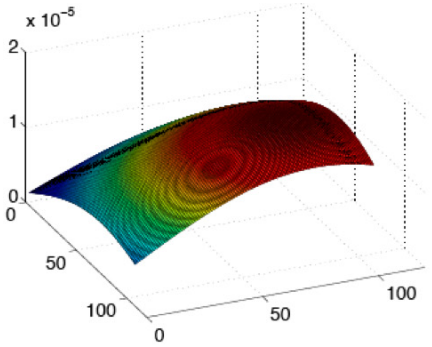
# Tadpole tracker



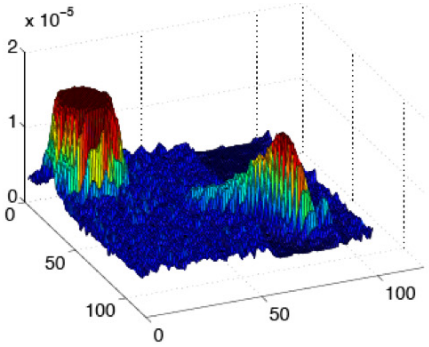
- Contact black or moldovan for data.



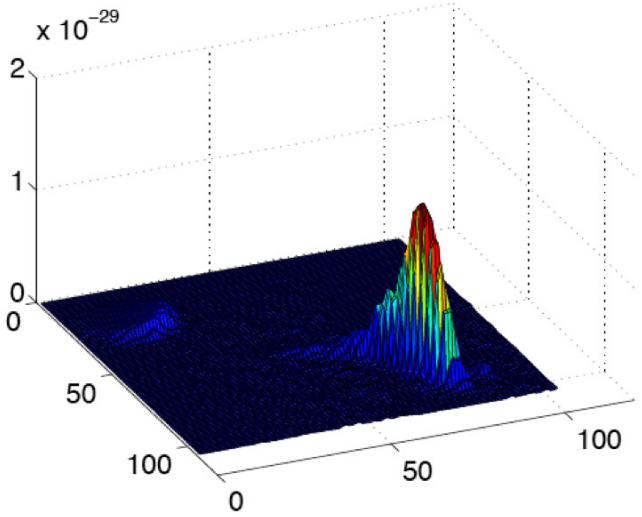
(a) Example image with predicted position plotted



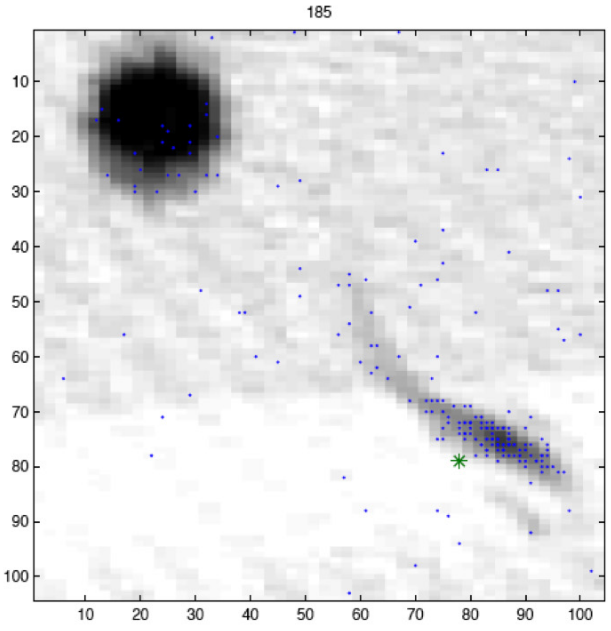

(b) Motion model-based distribution




(c) Pixel intensity distribution



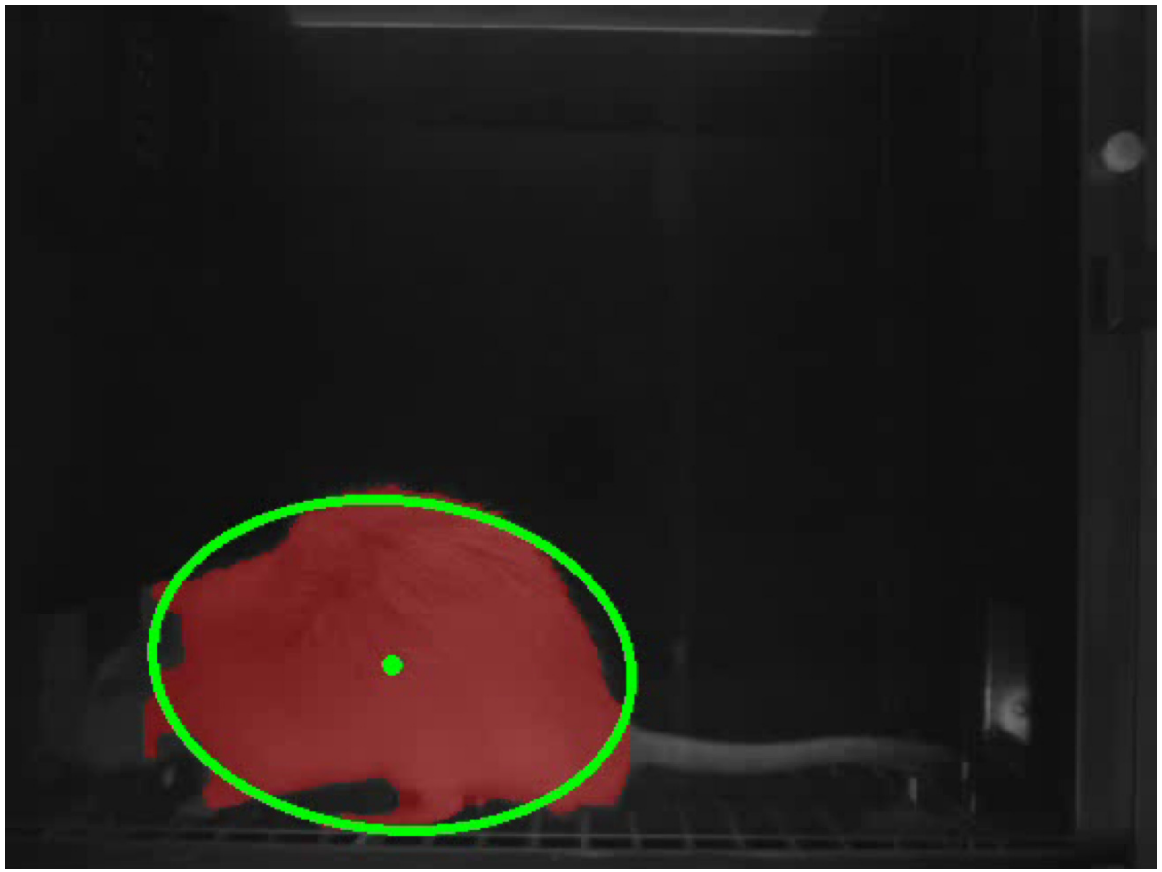

(d) Combined distribution




(e) Example image with 200 particles

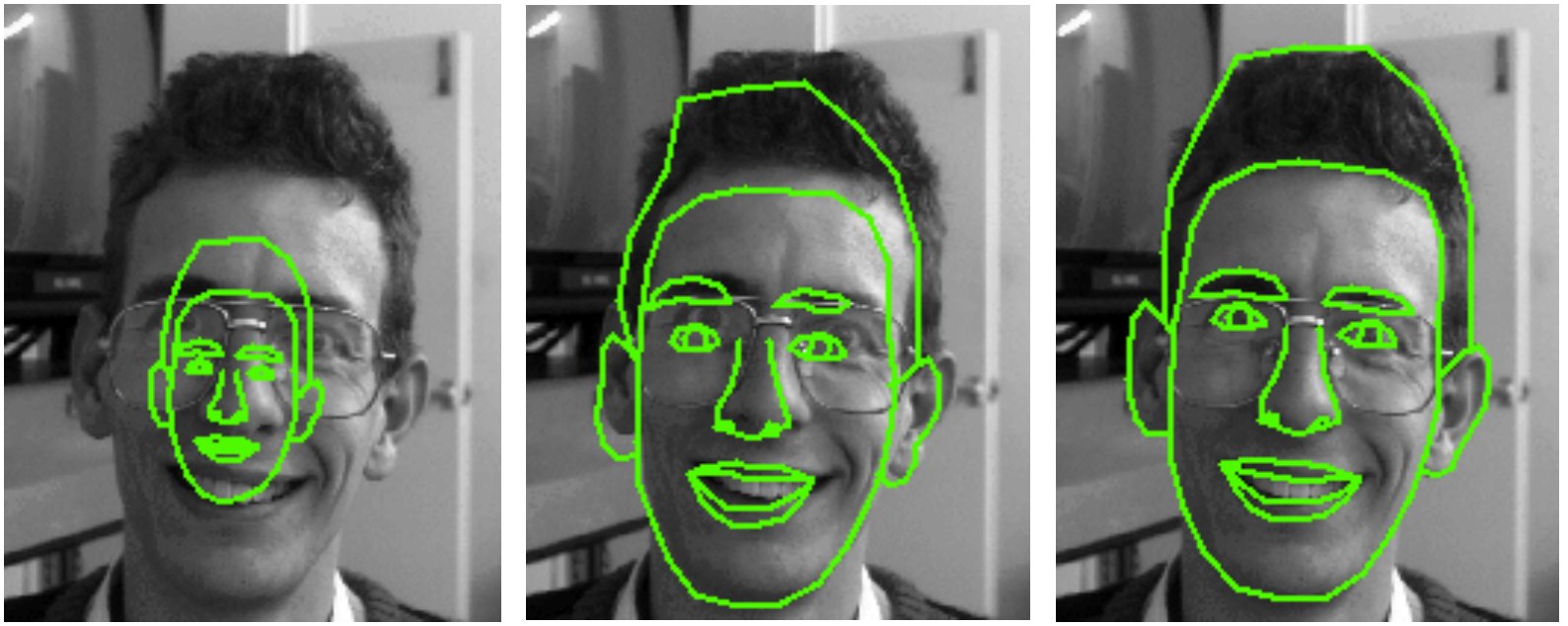
*Greg Nicholas '07*

# Rodent tracker



*Contact: Prof. Russ Church (Russell_Church@brown.edu)*

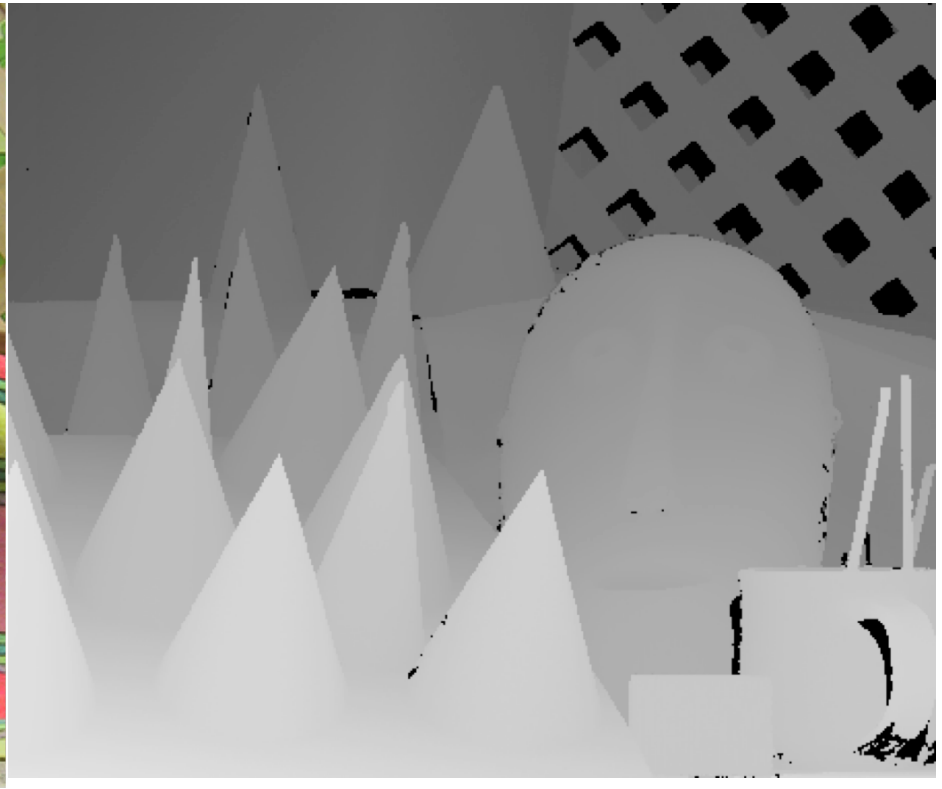
# Active Shape/Appearance Models



*http://www.isbe.man.ac.uk/~bim/*

Lot's of support code and data on web.

# Stereo

- http://vision.middlebury.edu/stereo/

# Panoramic Mosaics

http://www.cs.washington.edu/education/courses/455/03wi/projects/project2/project2.htm

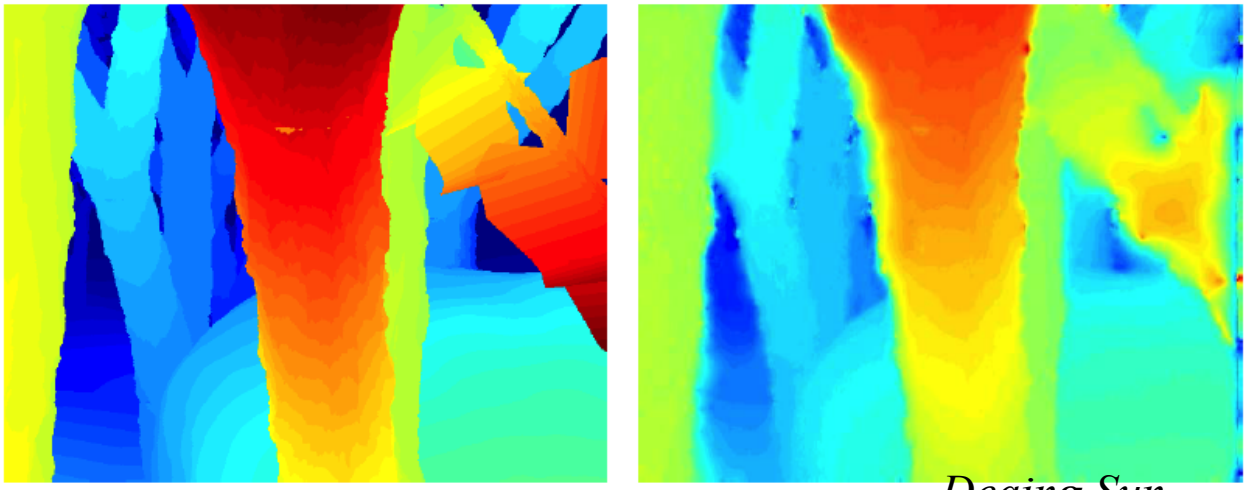
# Dense Optical Flow or Stereo

Data and ground truth flow:

http://vision.middlebury.edu/flow/

Same for stereo

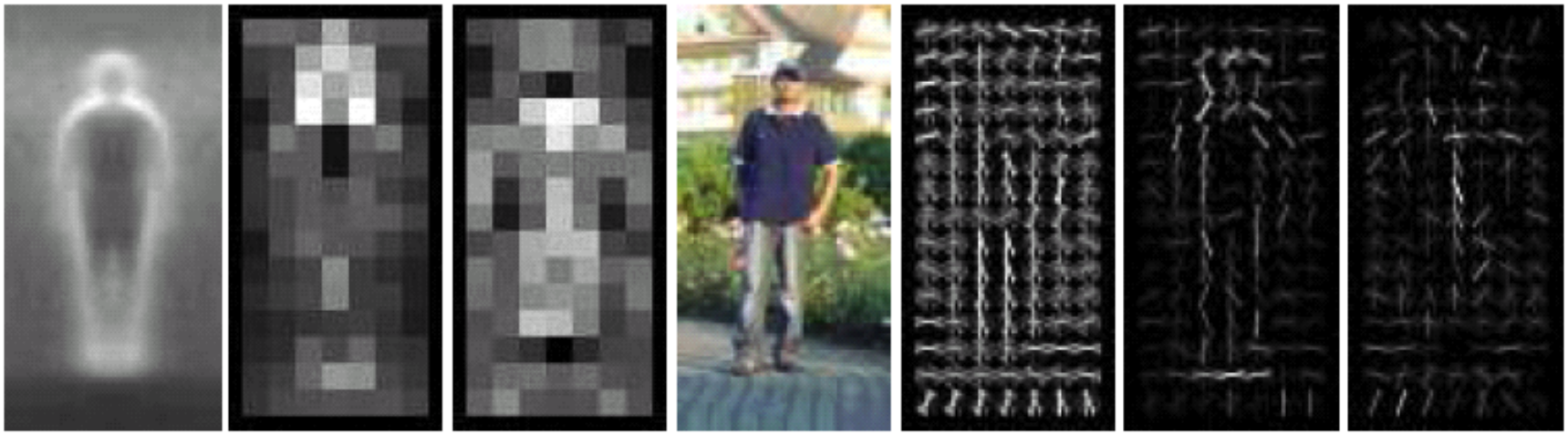
http://vision.middlebury.edu/stereo/



*Deqing Sun*

# Pedestrian Detectors

http://lear.inrialpes.fr/people/triggs/pubs/Dalal-cvpr05.pdf



(a) (b) (c) (d) (e) (f) (g)

Figure 6. Our HOG detectors cue mainly on silhouette contours (especially the head, shoulders and feet). The most active blocks are centred on the image background just *outside* the contour. (a) The average gradient image over the training examples. (b) Each "pixel" shows the maximum positive SVM weight in the block centred on the pixel. (c) Likewise for the negative SVM weights. (d) A test image. (e) It's computed R-HOG descriptor. (f,g) The R-HOG descriptor weighted by respectively the positive and the negative SVM weights.

# Non-linear diffusion

Image denoising.

Original Image

Edge Enhancing Diffusion

http://www-mount.ee.umn.edu/~guille/inpainting.htm

-this turns out to be too hard and the best thing to do is a non-linear diffusion method.

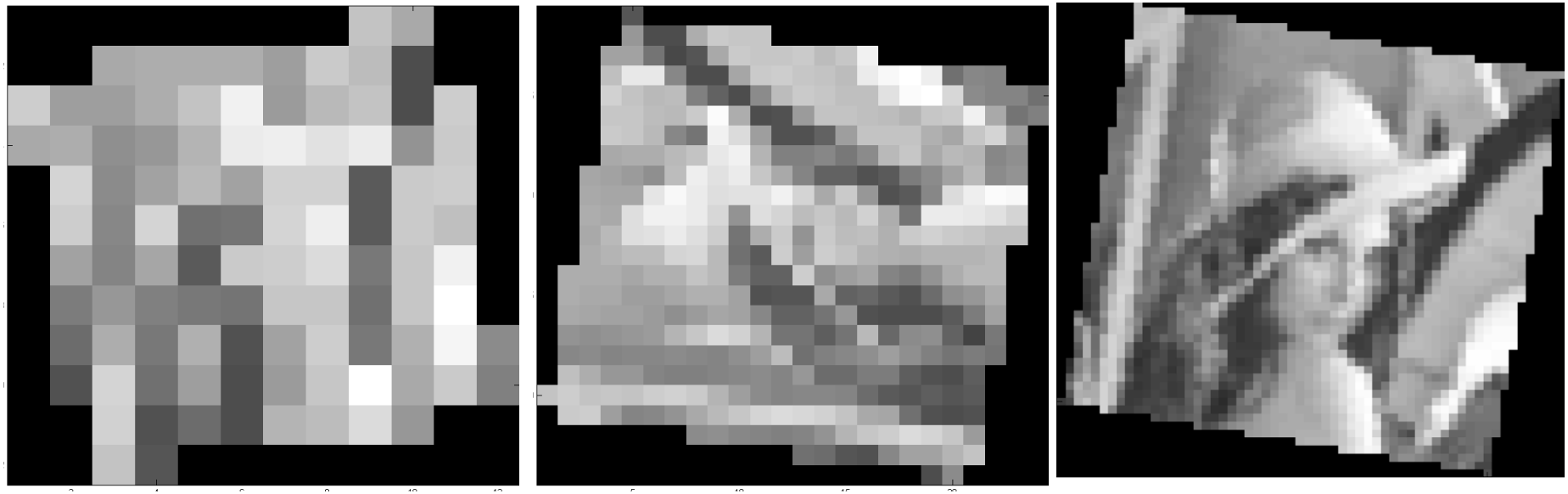
# Image Inpainting


# Colorization



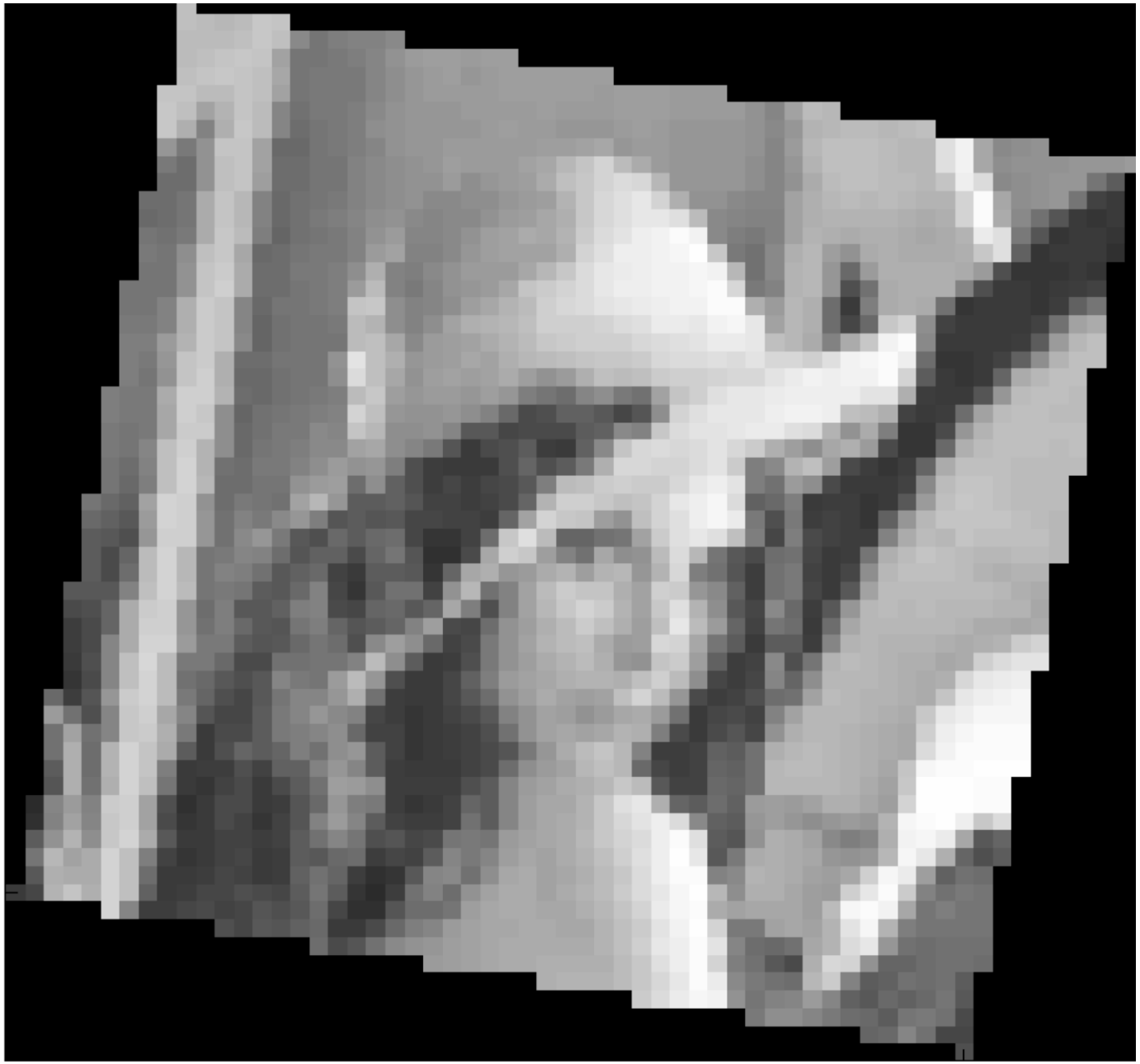
http://www.cs.huji.ac.il/~yweiss/Colorization/

# Super-resolution



See Michal Irani and Shmuel Peleg.

Super Resolution From Image Sequences. IEEE, 1990.



# Super-resolution

# More Project "Ideas"

Temporal model of mouth motions (HMM) for recognition.

More advanced machine learning method for mouth or person detection

- AdaBoost
- support vector machines

Bayesian image denoising

Stereo

Space carving from silhouettes

Grab-cut

*Moghaddam mixture model for face/mouth recognition.*