

Image Data Emulation and Analysis (IDEA) Lab

- Directed by: Prof. Xiaolei Huang, Lehigh CSE

▶ People Projects Publications Events Internal

IMAGE DATA EMULATION & ANALYSIS LABORATORY



Spotlight

Salient Region Feature based Registration

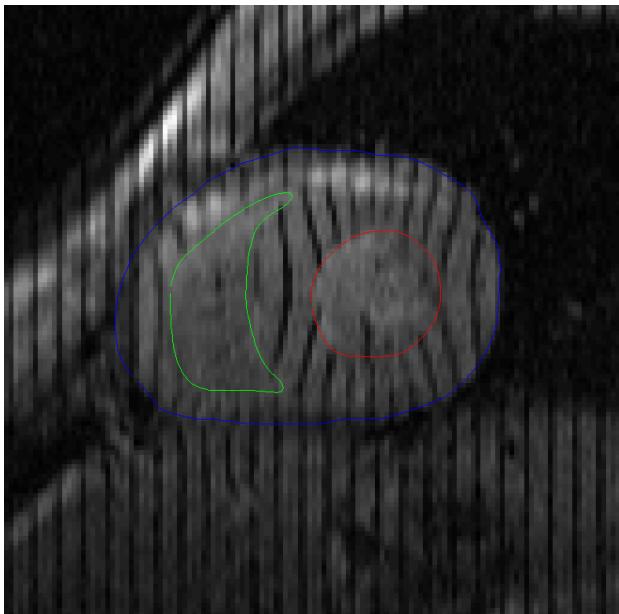
In this project, we develop a novel method for aligning images under arbitrary poses, based on finding correspondences between image region features. The method uses a small number of automatically extracted scale-invariant salient region features, whose interior intensities can be matched using robust multi-modal similarity measures.

Please move your mouse to the images on the left to find out more about our ongoing projects.

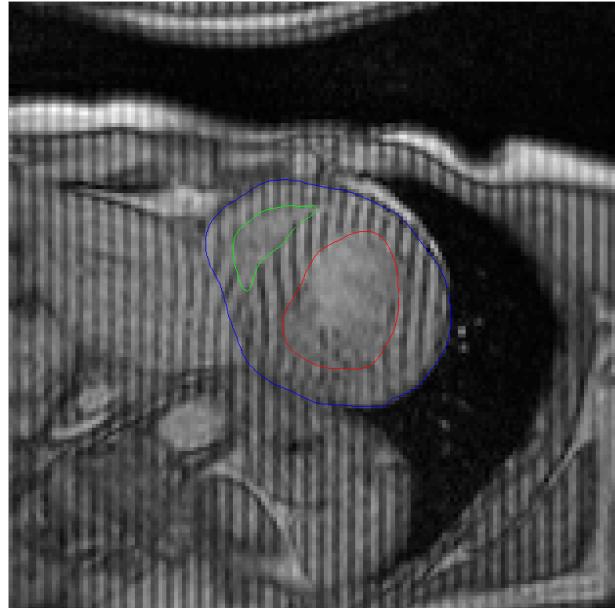
Computational Approaches to Biomedical Image Analysis

- Biomedical imaging and robust image analysis for image-guided diagnosis or therapy, information extraction, modeling
 - Aid doctors in accurate and reproducible diagnosis
 - Help understand the anatomical and physiological relationships in normal and diseased states
 - Help biologists and biophysicists in understanding and modeling complex biological pathways and systems.
 - Create intelligent vision systems that are capable of learning effectively and reasoning about multiple sources of information in order to achieve functions typical of human vision.

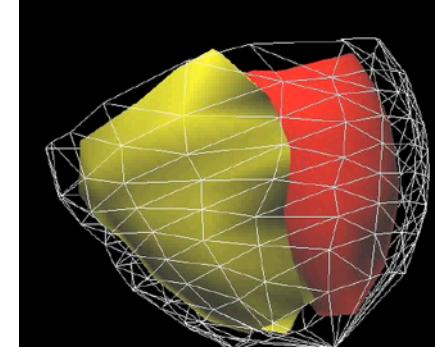
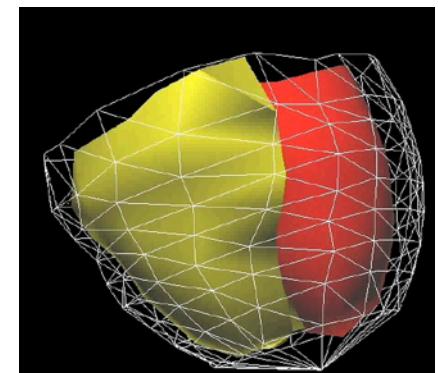
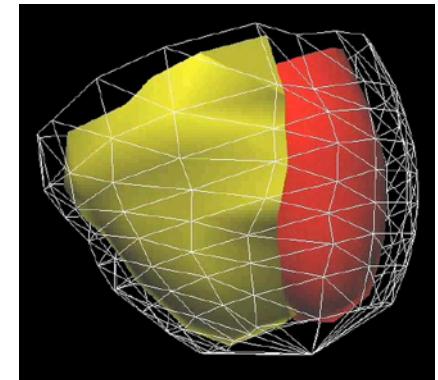
Heart Modeling and Wall Motion Analysis



Normal heart

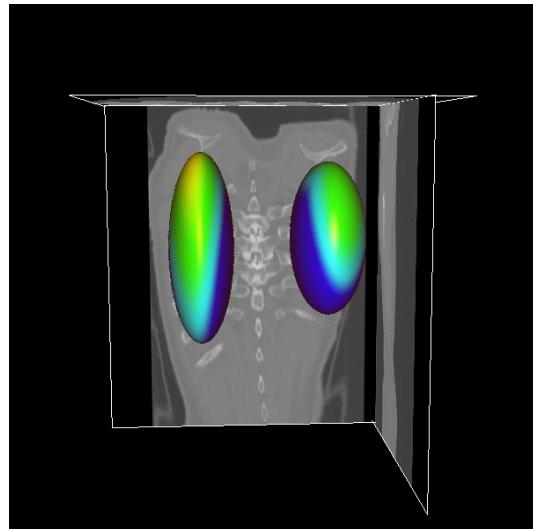


Diseased heart
after heart attack

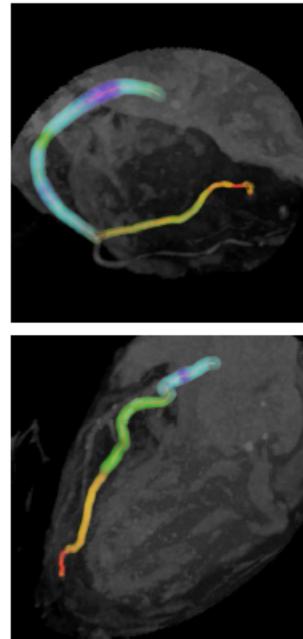


Finding Organ Boundary in 3D Volumetric Medical Images

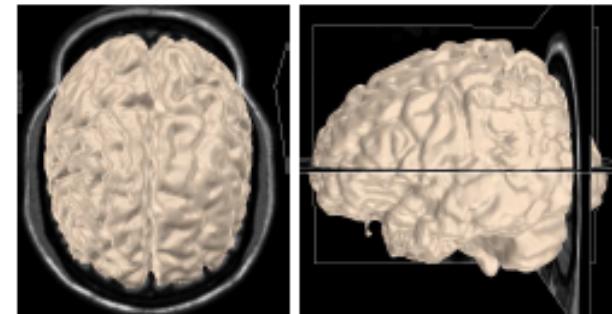
- Quantitative analysis of organ properties
- Detecting abnormalities
- Building statistical atlas for normal vs. abnormal anatomy.



Lung



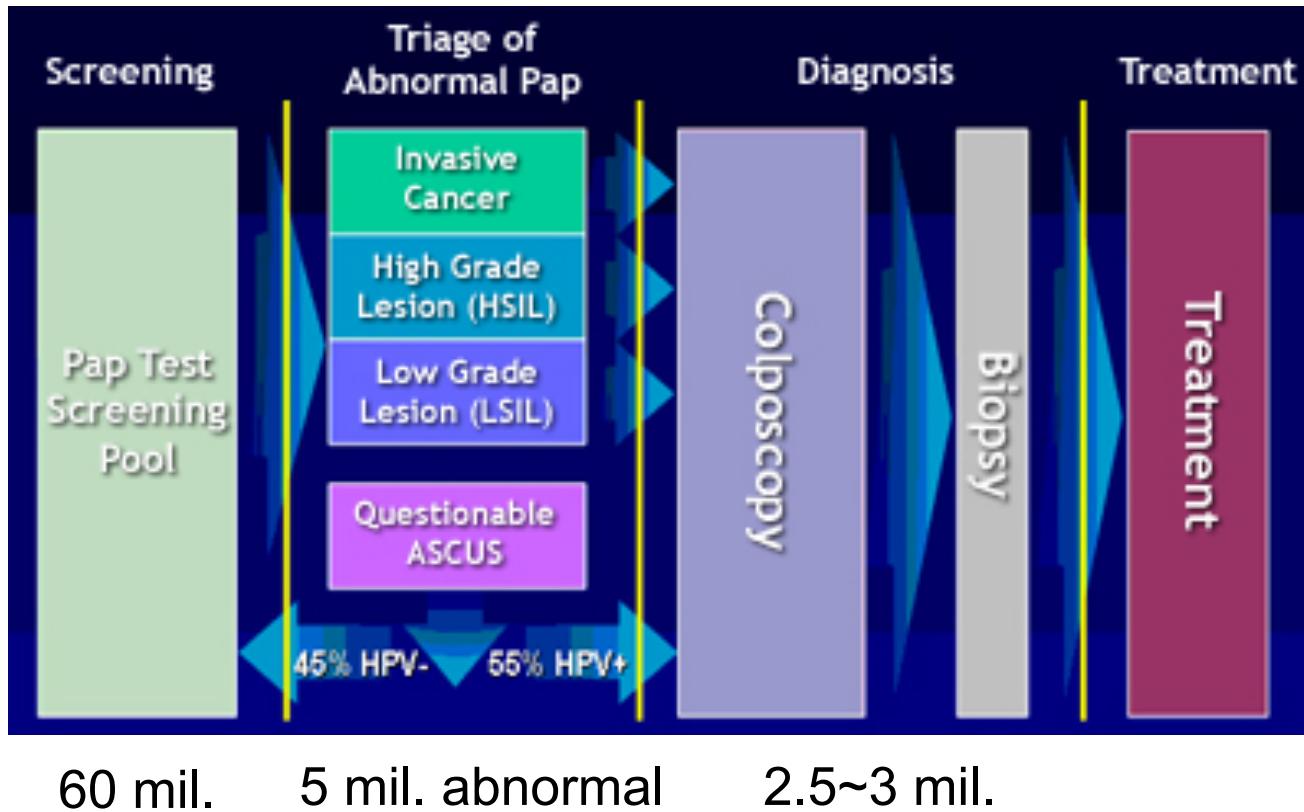
Coronary Arteries



Brain

Segmentation of organs in CT/MRI images and 3D visualization

Early Detection of Cervical Cancer

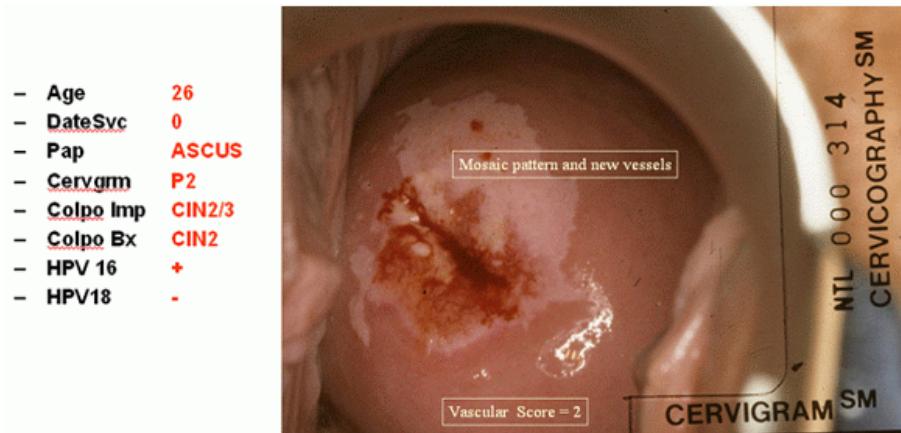


Picture Courtesy
of Medispectra

- Pap smear: 15-35% false negative rate
- HPV Test: 20-30% false positive rate
- Administering both is costly
- In developing countries, access to screening and lab facilities is scarce.

Computer-assisted Visual Interactive Recognition of Cervical Lesions

- Toward a more cost-effective way for early detection of cervical cancer by computer-assisted recognition of cervical lesions in cervigrams -- photographs of the cervix.
- Specific aims
 - Computer learning, from annotated cervigrams, of the correlation between image features and the severity of lesions.
 - Enable the search of medical records based on image content, e.g.
 - Web browser-based retrieval of similar cervigrams, along with diagnostic comments, from a large NCI/NLM archive
 - Online educational tool to help medical personnel learn how to grade cervical lesions.



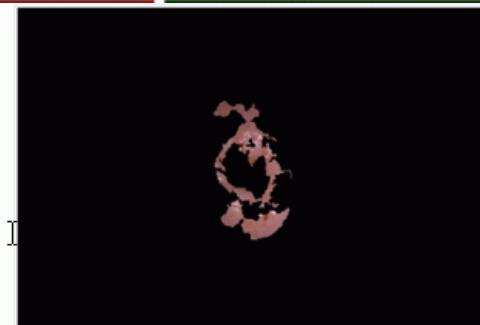
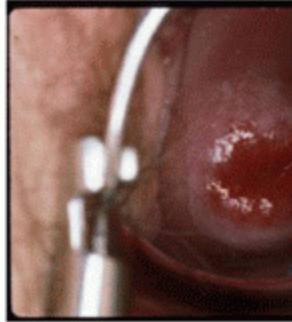
REID'S CLASSIFICATION SYSTEM (MODIFIED)

Colpo Sign	0 Points	1 point	2 Points
Margin	<input type="checkbox"/> condylomatous <input type="checkbox"/> Indistinct borders <input type="checkbox"/> Flocculated/feathered margins <input type="checkbox"/> jagged, angular, lesion Satellite lesion (outside TMZ)	<input checked="" type="checkbox"/> Regular, smooth, straight edges <input type="checkbox"/> Sharp, peripheral, margins	<input type="checkbox"/> Rolled, pealed, edges <input type="checkbox"/> Internal borders between areas differing appearance
Color	<input type="checkbox"/> Shiny, snow-white <input type="checkbox"/> Indistinct acetowhite	<input checked="" type="checkbox"/> Shiny, gray-white <input type="checkbox"/> Intermediate white (semitransparent)	<input type="checkbox"/> Dull, Oyster-gray
Vessels	<input type="checkbox"/> Uniform, fine caliber <input type="checkbox"/> Random Pattern <input type="checkbox"/> Nondilated capillary loops <input type="checkbox"/> Ill defines fine punctuation or mosaicism	<input type="checkbox"/> Absent surface vessels <input type="checkbox"/> Intermediate white	<input checked="" type="checkbox"/> Punctuation or mosaicism <input type="checkbox"/> Individual dilated vessels with sharp demarcation and well-defined pattern

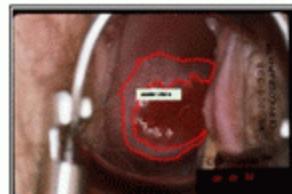
Score = 4

Preliminary Results

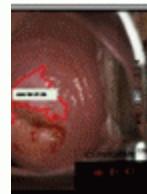
(1)



(2)



Ranking: 1
Distance: 0.05841098217372
Filename: o_seg.svg



Ranking: 5
Distance: 1489055651573
Filename: 11_seg.svg



Ranking: 6
Distance: 3.1503808108242
Filename: 5_seg.svg



Ranking: 10
Distance: 2852540812799
Filename: 24_seg.svg

(1) V
A

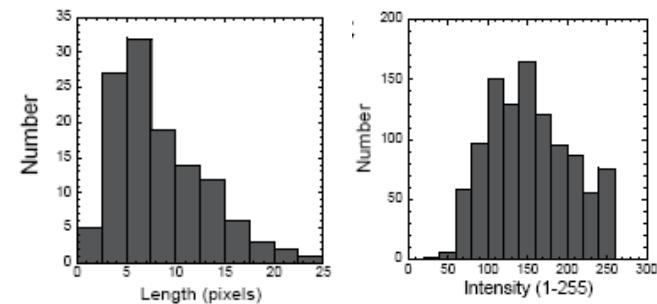
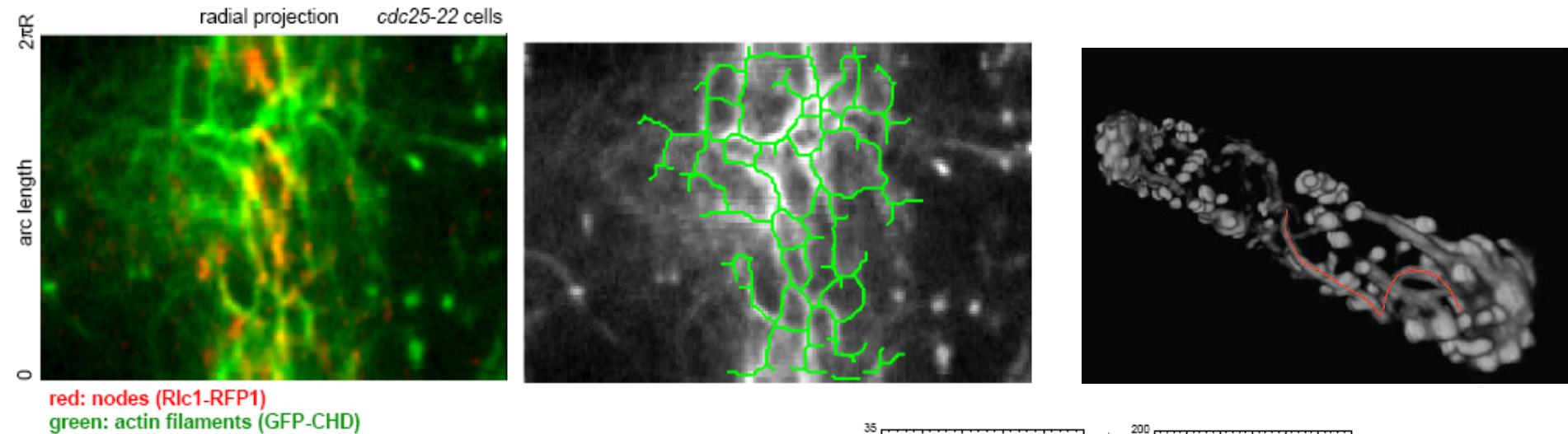
er.

- (2) Retrieval of similar cervigrams from the database based on Acetowhite region Properties (e.g. similar color, area, location)

Computer Recognized Acetowhite Regions

Quantitative Computer Analysis of Biological Images

- Skeletonization of actin meshwork during cell division

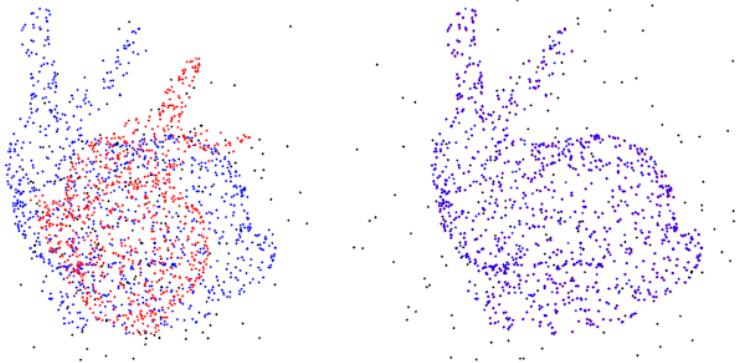


NIH project co-PIs: Dimitrios Vavylonis
(Physics), Xiaolei Huang (CSE);
In collaboration with Jian-Qiu Wu (Ohio State U.)
and Tom Pollard (Yale)

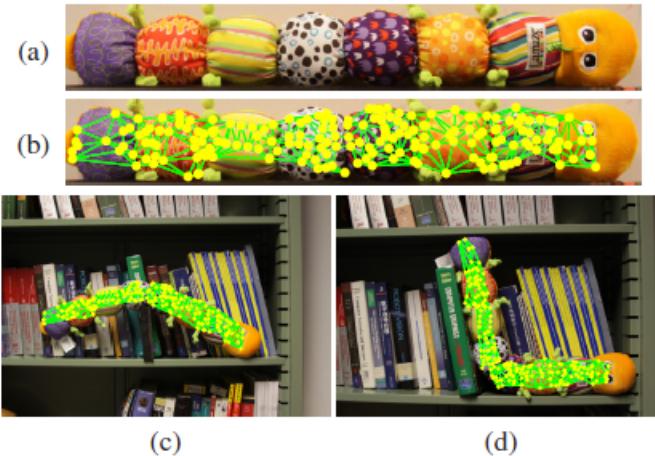
Filament length (left) and intensity (right)
statistics, based on extraction result above

IDEA Lab (Cont'd)

– Computer Vision



Alignment of Shapes
regardless of noise



Detecting and matching objects that undergo
Affine or articulated deformation

– Computer Graphics



User editing transfer: interactions on
one cake is transferred to all others



Model-based Face Matching and
3D Facial Expression Retargeting