



## ALY A. FARAG



### I. PERSONAL INFORMATION

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### 1. Degree Information

<b>Degree</b>	<b>Date</b>	<b>School</b>	<b>Area</b>
Ph. D.	1990	Purdue University	Electrical Engineering
M. S.	1984	University of Michigan	Bioengineering
M. S.	1981	Ohio State University	Biomedical Engineering
B. S.	1976	Cairo University	Electrical Engineering

#### **Theses:**

- “A Stochastic Modeling Approach to Region- and Edge-based Image Segmentation.” Ph. D. Dissertation, Purdue University. Advisor: Edward J. Delp.
- “Dynamic Spectral Analysis of the Myoelectric Signal During Downhill Walking with Reference to Muscle Soreness,” M. S. Thesis, The Ohio State University. Advisors: Richard M. Campbell.

### 2. Employment

Current	Professor of Electrical and Computer Engineering, University of Louisville
2007-Pesent	Adjunct Professor, College of Computing, Cairo University, Egypt
2004-Present	Adjunct Professor, College of Engineering, Mansoura University, Egypt
1996-1999	Associate Professor of Electrical & Computer Eng, Univ. of Louisville
1990-1995	Assistant Professor of Electrical & Computer Eng, Univ. of Louisville
1999-Present	Adjunct Professor, Dept of Neurological Surgery, Univ. of Louisville
1993-Present	Adjunct Professor, School of Dentistry, University of Louisville
1989-1990	Visiting Professor, University of Minnesota
1986-1989	TA/RA, Purdue University, School of Electrical Engineering
1984-1985	Engineer, Biomedical Engineering Center, West Lafayette, Indiana
1983-1984	Engineer, University of Michigan Hospital
1976-1979	Demonstrator (TA), Cairo University College of Engineering, Egypt

### 3. Scientific and Honor Societies

- Institute of Electrical and Electronics Engineers – IEEE (Senior Member)
- Society of Manufacturing Engineers – SME (Senior Member)
- Optical Society of America - OSA (Member)
- Sigma-XI (Member) and Phi-Kappa-Phi (Member)

#### 4. Awards and Recognition

- Dr. Farag was appointed a University Scholar in 2002 for his basic contribution in Computer Vision and Medical Imaging.
- Dr. Farag received the University of Louisville President's Award for Outstanding Scholarship, Research, and Creative Activity (March 1999).
- Dr. Farag had been associate editor of the journal IEEE Transactions on Image Processing for the term 2000-2004.
- Dr. Farag's work at the CVIP Lab was used in a Congressional discussion on the NSF's agenda in February 98 (Ref: Larry Goldberg and George Lea of NSF).
- Dr. Farag is a regular reviewer to the NSF and the NIH. He has participated in various ECS, CISE panels at the NSF including CAREER, SEIII, SBIR and center proposals for science and technology.
- Dr. Farag's research has been profiled over 30 times at local and national news media outlets, including the Speed Engineer, Inside UofL, Louisville Courier and Journal, Et Ultra (Research and Scholarship at UofL), WAVE-3 TV, Fox TV, KET TV, and the Learning Channel.
- Dr. Farag has been on the organizing committee of several international conferences, and is reviewer to all major conferences in the fields of image processing, computer vision, pattern recognition and medical imaging, including ICCV, CVPR, ICPR, ICIP, MICCAI, and CARS. Dr. Farag is a regular reviewer to IEEE Transactions on Image Processing (TIP), IEEE Transactions on Medical Imaging (TMI), and IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI), Journal of Machine Vision, Optical Society of America (OSA), IEEE Transactions on Biomedical Engineering (T-BME), and the Journal of Pattern Recognition (PR). He was general chair of the 2005 Graphics, Vision and Image Processing (GVIP 05) International Conference. He is co-chair of the upcoming IEEE International Conference on Image Processing (ICIP09).
- Dr. Farag has been invited to deliver seminars at over 30 universities in the U.S. and abroad, and has been a consultant to Auckland University, New Zealand, Swiss Federal Academy, Cairo University, Egypt, the University of Technology, and Malaysia. He holds honorary professorship position at Mansoura University, Egypt.
- Dr. Farag has evaluated research proposals for national and international organizations, including the NIH and NSF in the US, Science Foundation of Ireland, Research Council of Canada, and the Austrian Science Funds.
- Dr. Farag has evaluated faculty promotions for Cairo and Ain Shams Universities in Egypt, Sultan Qaboos University in Oman, and has been referenced for faculty at Glasgow University, UK, and York University, Canada.
- Locally, Dr. Farag's research on medical imaging won the first place in the annual **Research!Louisville** meeting three times, and has been chief judge for the annual Louisville Science and Engineering meeting since 2003. Dr. Farag's research has also been featured on the Louisville Science Museum, January 20, 2007 and February 1, 2008.

## II. RESEARCH

### 1. Summary of Significant Research Accomplishments

Dr. Farag research focus is model-based computer vision and image understanding with practical applications. His contributions have been in active computer vision, image modeling, segmentation, registration, and object reconstruction. Below is a sample.

#### a) Contributions to Object Reconstruction:

Farag and students developed a unified framework for shape-from-shading (SFS) under various imaging conditions (e.g., Lambertian/Specular/Diffuse surfaces, orthographic/perspective cameras, and general lighting). The irradiance equation of each setting is an explicit Partial Differential Equation amenable to convergent numerical methods. The concave/convex ambiguity resulting from the existence of singular points in the image is solved by taking into account the attenuation of illumination due to distance; a unique solution is obtained without information about the height of the image at the singular points of its surface (PAMI-00, CVPR-06 and CVPR-07). They applied SFS to important practical problems, including tile design (1995), reconstruction of the human jaw (2000) and 3D face recognition (2007). Farag holds patent on his SFS work (Farag, et al. "System and Method for 3-D Digital Reconstruction of An Oral Cavity from Sequence of 2-D Images," US Patent No. 09/842,587.

Farag and students designed one of the early active vision systems (registered under CardEye) with five degrees of freedom: pan, tilt, roll, vergence and variable baseline in addition to automated zoom and focus of the lenses. They developed novel approaches for active camera calibration with sub-pixel accuracy, and for correcting lens distortion (CVPR-97, ICCV-99, TIP-05). CardEye is employed in research and teaching of geometric computer vision since 1997; it improved reconstructions of smooth objects, and enables sensor planning of vision-guided systems.

Horn introduced SFS in the 1970's. Since then the focus has been on object modeling and numerical solutions. Farag has taken the progress in the past 40 years and generalized various aspects of image formation (camera, lighting and surface characteristics), and developed cohesive solutions that lend benefits to various real world problems. Likewise, computational stereo is over half a century old. Real world objects are three-dimensional; hence, vision is 3D. It is not easy to envision/grasp building a 3D world from 2D images. Farag's contribution has been in the engineering aspect and in generalization of still camera calibration to include zoom and focus. Very few institutions have actual vision systems. The CardEye system brings computer/machine vision into reality and enables study of computer vs. human vision.

#### b) Contributions to Analysis of Multimodality Imaging:

Farag and students developed variational models for image segmentation and characterization of shape. Their surface signatures (IEEE-PAMI-02), vector level sets (ICCV-05, IEEE-PAMI-07) and skeletonization (CVPR-05 and ICCV-07) provide robust shape models. These analytic models are efficient in segmentation and registration of multimodality imaging, especially with occluded and degraded objects, and are the basis of a new visualization system for virtual colonoscopy, known as *Fly-Over* (IPMI-05, MICCAI-06). The *Fly-Over* approach provides up to 10% improvement in visualization over the

state of the art, enabling accurate detection of colon polyps. Farag holds two provisional patents on this work (US 60/842,850 and US 11/823,738).

Farag and colleagues have major focus on early detection and follow-up of lung cancer using chest low dose CT (LDCT) scans (e.g., MICCAI-04, MICCAI-05, ICPR-06). Their approach combines shape and appearance information to distinguish nodules from lung tissue in LDCT scans, and outperforms the state-of-the-art in terms of sensitivity and specificity on nodules less than 1 mm diameter. This work, under provisional patent, is basis for automated CAD system for screening of lung cancer from LDCT scans.

c) Theoretical Contributions on Image Modeling

Dr. Farag has long standing contributions to statistical image modeling. In his 1992 work with Delp (*Journal of Optical Engineering*, Vol. 12, pp. 2594-2607, December 1992), a composite model was used to describe the image information in a dual random field description of the appearance (texture) and regions that involved simultaneous autoregressive models plus Gibbs-Markov. These models were also used in their work for sequential edge linking ("Edge Linking by Sequential Search," *Pattern Recognition*, Vol. 24, No. 5, pp. 611-633, 1995) where edges were modeled as a topological graph in which nodes representing edge information were sequentially extracted by a path metric based on second order Gibbs-Markov model.

Farag and colleagues introduced a novel probability density model that generalized the linear combinations of Gaussian representation (ICIP-04, IEEE-TIP-06). They introduced a novel modification to the classical E-M algorithm to estimate the weights and kernel parameters. The estimate is consistent, converges to the MLE solution, and outperforms the plethora of histogram modeling approaches in the literature. In the context of Bayesian classification from limited data, Farag's density model provides a robust estimate for the number of classes and the marginal densities; it is currently the most accurate empirical approach to density estimation based on histogram modeling.

Farag and students work on identification of the Gibbs-Markov model from limited data. They developed an analytic expression for the Gibbs energy from pair-wise pixel repetitions with generalized distance. The domain of energy concentration is used to estimate the topology of the neighborhoods. A second step evaluates the clique potentials on this topology. Even though these models existed in the literature for decades, the problem has been with accurate model identification. Dr. Farag's approach is novel and automatic, and has shown to be robust for segmentation of various imaging modalities (ICIP-06, MICCAI-06 and ICPR-06). An Energy optimization approach is under investigation for generating the clique potentials under any topology.

Farag and students introduced a new identification approach for the kernels in the support vector machine (SVM) classifier using the mean field theory which lend itself to faster and more optimal estimation (IEEE-GSRS-05).

d) Impact on the University of Louisville

Dr. Farag joined the University of Louisville in 1990, created the computer vision and image processing laboratory (CVIP Lab) from scratch, graduated 25 MS and 13 PhD students who hold prestigious positions in academia and industry, published over 200 articles, edited two books on level set methods, authored an upcoming textbook on signal processing, and holds a number of patents. He received his institution's top research award in 1999, Awarded University Scholar designation in 2002 in recognition of his achievements, and his research

has been featured on local and national media and by the NSF. Among the impacts of the CVIP Lab are the following:

- ❖ The CVIP Lab is the vehicle that brought supercomputing, immersive visualization, autonomous robotics, high bandwidth networking, and multidisciplinary bioimaging research to the University of Louisville. Facilities at the CVIP Lab are used by university wide audience; researchers from engineering, medicine, psychology, physics and mathematics collaborate with Dr. Farag and use the facilities of the CVIP Lab.
- ❖ The CVIP Lab is a popular visiting site for local high schools, which impacts positively on student recruiting to the University and in making younger students develop interests in science and engineering.
- ❖ In addition, the research at the CVIP Lab was cited in an official media release by NSF [http://www.eng.nsf.gov/engnews/1998\\_News/computer\\_vision\\_for\\_better\\_med.htm](http://www.eng.nsf.gov/engnews/1998_News/computer_vision_for_better_med.htm), Silicon Graphics, Inc. <http://www.sgi.com/features/2003/jan/louisville/> , and the Louisville Science Museum. <http://www.louisvillescience.org>

## 2. Publications

The full list of publications can be downloaded from the CVIP Lab web site: [www.cvip.uofl.edu](http://www.cvip.uofl.edu). Also, some of these articles can be downloaded from our web site ([www.cvip.uofl.edu](http://www.cvip.uofl.edu)), unless they are under a copyright agreement.

### (a) **Refereed Journal Articles**

1. M. Sabry Hassouna, Alaa Abdel-Hakim and **Aly A. Farag** "PDE-Based Robust Robotic Navigation," *Image, Vision and Computing – In Press --* On line can be uploaded from <http://authors.elsevier.com/redirect/http://dx.doi.org/10.1016/j.imavis.2007.03.005>
2. H. Shi, **Aly A. Farag**, R. Fahmi and D. Chen "Validation of Finite Element Models of Liver Tissue using Micro-CT and CBCT," *IEEE Transactions on Biomedical Engineering – Vol. 55, No. 3, pp. 978-984, March 2008.*
3. M. Sabry Hassouna and **Aly A. Farag**, "Multi-Stencils Fast Marching Methods: A Highly Accurate Solution to the Eikonal Equation on Cartesian Domain," *IEEE Transactions on Pattern Analysis and Machine Intelligence – Vol. 29, No. 9, pp. 1563-1574, September 2007.*
4. Hossam Abd EL Munim and **Aly A. Farag**, "Curve/Surface Representation and Evolution using Vector Level Sets with Application to the Shape-based Segmentation Problem," *IEEE Transactions on Pattern Analysis and Machine Intelligence – Vol. 29, No. 6, pp. 945-958, June 2007.*
5. Manuel F. Casanova, **Aly Farag**, Ayman EL-BAZ, Meghan Mott, Hossam Hassan, Rachid Fahmi, Andrew E. Switala, "Abnormalities of the Gyral Window in Autism: A Macroscopic Correlate to a Putative Minicolumnopathy ," *Journal of Special Education and Rehabilitation*, pp. 1:85-101, 2007.
6. Seniha E. Yuksel, Ayman El-Baz, **Aly A. Farag**, Mohamed El-Ghar, Tarek Eldiasty and Mohamed A. Ghoneim, "A Kidney Segmentation Framework for Dynamic Contrast Enhanced Magnetic Resonance Imaging, *Journal of Vibration and Control*, **13(9-10): 1505-1516, 2007.**

7. **A.A. Farag**, A. El-Baz, and Georgy Gimel'farb, "Precise Image Segmentation of Multimodal Images," *IEEE Transactions on Image Processing*, Vol. 15, No. 4, pp. 952-968, April 2006.
8. M. Sabry. Hassouna, **A.A. Farag**, S. Hushek, and T. Moriarty, "Cerebrovascular Segmentation from TOF Using Stochastic Models," *Medical Image Analysis*, Vol 10, pp. 2-18, February 2006.
9. A. El-Baz, **Aly A. Farag** and Georgy Gimel'farb, "Iterative Approximation of Empirical Grey Level Distributions for Precise Segmentation of Multi-modal Images," *European Journal of Applied Signal Processing (EURASIP)*, Vol. 13, pp. 1969-1983, 2005.
10. A. Eid and **Aly A. Farag**, "On the Performance Evaluation of 3-D Reconstruction Techniques from a Sequence of Images," *European Journal of Applied Signal Processing (EURASIP)*, Vol. 13, pp. 1948-1955, 2005.
11. M.T. Ahmed El-Melegy and **A. A. Farag**, "Nonmetric Calibration of Camera Lens Distortion: Differential Methods and Robust Estimation," *IEEE Transactions on Image Processing*, vol. 43, no. 7, pp. 1215-1230, August 2005.
12. **Aly A. Farag**, Refaat M. Mohamed and A. El-Baz, "A Unified Framework for MAP Estimation in Remote Sensing Image Segmentation," *IEEE Transactions on Geosciences and Remote Sensing*, vol. 14, no. 8, pp. 1617-1634, July 2005.
13. Refaat M. Mohamed, A. El-Baz, and **Aly A. Farag**, "Probability Density Estimation Using Advanced Support Vector Machines and the Expectation Maximization Algorithm", *International Journal of Signal Processing*, vol. 1, pp. 185-188, March, 2005.
14. A. El-Baz, Refaat M. Mohamed, and **Aly A. Farag**, "Advanced Support Vector Machines for Image Modeling Using Gibbs-Markov Random Field", *International Journal of Computational Intelligence*, vol. 1, pp. 306-309, March, 2005.
15. **Aly A. Farag**, A. El-Baz, and Refaat M. Mohamed, "Density estimation using generalized linear model and a linear combination of Gaussians, " *International Journal of Signal Processing*, 2005, vol. 1, pp. 76-79, March, 2005.
16. G. Gimel'farb and **A. A. Farag**, "Texture Analysis by Accurate Identification of Simple Markov Models," *Ukrainian Journal of Cybernetics and Systems Analysis*, vol. 41, no. 1, pp. 37-49 January 2005.
17. Refaat M. Mohamed, A. El-Baz and **Aly A. Farag**, "Image Modeling using Gibbs-Markov Random Field and Support Vector Machines Algorithm," *International Journal of Computational Intelligence*, IJCI, December 2004.
18. **A. A. Farag**, H. Hassan, R. Falk and S. Hushek, "3D Volume Segmentation of MRA Data Sets Using Level Sets," *Academic Radiology*, Vol. 11, pp. 419-435, April 2004.
19. Matthew P. Eklund, **Aly A. Farag**, and Moumen El-Melegy "Robust Correspondence Methods For Stereo Vision," *International Journal of Pattern Recognition and Artificial Intelligence*, vol. 17, no. 7, pp. 1059-1079, 2003.

20. **Aly A. Farag** and Ahmed Eid, "Video reconstructions in dentistry," *Orthod Craniofacial Res* 6 (Suppl. 1), pp. 108–116, 2003.
21. G. H. Mostafa, **A. A. Farag**, and E. A. Essock, "Multimodality image registration and using neural network," *Journal of Harbin Institute of Technology*, No.3, 235-240, 2003.
22. S. M. Yamany and **A. A. Farag**, "Surface Signatures: An Orientation Independent Free-Form Surface Representation Scheme for the Purpose of Objects Registration and Matching" *IEEE Transactions on Pattern Analysis and Machine Intelligence* – Vol. 24, No 8, pp. 1105-1120, August 2002.
23. M. T. Ahmed and **A. A. Farag**, "A neural network approach for solving the problem of camera calibration," *Imaging, Vision and Computing* – Vol. 20, No. 9-10, pp. 619-630, August 2002.
24. M. N. Ahmed, S. Yamany, N. Mohamed, **A. A. Farag**, and T. Moriarty "A Modified Fuzzy C-Means Algorithms for Bias Field Estimation and Segmentation of MR Data", *IEEE Transactions on Medical Imaging*, Vol. 21, No. 3, pp. 193-199, March 2002.
25. S. M. Yamany, **A. A. Farag**, D. Tasman and A. G. Farman, "Robust 3-D Modeling of the Human Jaw Using Sequence of Intra-Oral Images," *IEEE Transactions on Medical Imaging*, Vol. 19 (5), pp. 538-547, May 2000.
26. M. G. Mostafa, E. Hemayed, and **A. A. Farag**, "Target recognition via 3D Object Reconstruction From Image Sequence and Contour Matching," *Pattern Recognition Letters*, Vol. 20 (11-13), pp. 1381-1387, November 1999.
27. S. M. Yamany, **A. A. Farag**, and S. Hsu, "Fuzzy Hyperspectral Classifier for Automatic Target Recognition (ATR) Systems," *Pattern Recognition Letters*, Vol. 20 (11-13), pp. 1431-1438, November 1999.
28. W. D. Ehringer, S.M. Yamany, K. Steier, **A. A. Farag**, F. J. Roisen, A. Dozier and F. N. Miller, "Quantitative Image Analysis Of F-Actin in Endothelial Cells," *Microcirculation*, Vol. 6, pp. 291-303, 1999.
29. S. M. Yamany, M. N. Ahmed and **A. A. Farag**, "A new genetic-based technique for matching 3D curves and surfaces," *Pattern Recognition*, Vol. 32 (10), pp. 1817-1820, October 1999.
30. M. N. Ahmed and **A. A. Farag**, "Two-stage Neural Network for Volume Segmentation of Medical Images," *Pattern Recognition Letters*, Vol. 18, No 11-13, pp. 1143-1151, November 1997.
31. S. M. Yamany, K. Khiani, **A. A. Farag**, "Application of Neural Networks and Genetic Algorithms in the Classification of Endothelial Cells," *Pattern Recognition Letters*, Vol. 18, no 11-13, pp. 1205-1210, November 1997.
32. Y. M. Kadah, **A. A. Farag**, J. M. Zurada, A. Badawi and A. Youssef, "Efficient Algorithms for Computer-Assisted Diagnosis of Diffused Liver Diseases from Ultrasound Images," *IEEE Transactions on Medical Imaging* Vol. 15, No. 4, pp. 466-478, August 1996.
33. **A. A. Farag** and E. J. Delp, "Edge Linking by Sequential Search," *Pattern Recognition*. Vol. 24, No. 5, pp. 611-633, 1995.

34. **A. A. Farag**, W. A. Tacker, K. S. Foster, J. D. Bourland, and L. A. Geddes, "Detection of Pulse and Respiration Signals from the Wrist Using Dry Electrodes," *Biomedical Instrumentation & Technology*, pp. 311-314, 1994.
35. **A. A. Farag** and E. J. Delp, "Image Segmentation Based on Composite Random Field Models," *Journal of Optical Engineering*, Vol. 12, pp. 2594-2607, December 1992.
36. **A. A. Farag**, "Edge-based Image Segmentation," *Remote Sensing Reviews*, Vol. 6(1), pp. 95-120, 1992.
37. A. G. Farman, **A. A. Farag**, and Yuen-Pin Yeap, "Communication in Dental Radiology," *Dento Maxillo Facial Radiology*, Vol. 21(3), pp. 213-215, November 1992.

**(b) Journal Articles Submitted and Under Reviews**

1. M. Sabry Hassouna and **A. A. Farag**, TPAMI-0845-1206 - Variational Curve Skeletons Using Gradient Vector Flow," *IEEE Transactions on Pattern Analysis and Machine Intelligence* – revision submitted 2-08.

**(c) Edited books**

1. Jasjit S. Suri and **Aly A. Farag**, Ed., *Deformable Models I: Biomedical and Clinical Applications (Topics in Biomedical Engineering. International Book Series)*, Springer, New York, July 2007 (Approx. 575 pp.). ISBN: 978-0-387-31201-9.
2. Jasjit S. Suri and **Aly A. Farag**, *Deformable Models II: Theory & Biomaterial Applications (Topics in Biomedical Engineering. International Book Series)* Springer, New York, July 2007 (Approx. 600 pp.). ISBN: 978-0-387-31204-0.

**(d) Tutorials at International Meetings**

1. **Aly A. Farag** "A Tutorial on 2-D and 3-D Level Set for Medical Imagery " with J. Suri, K. Mikula, C. Lamberti, 28th IEEE-EMBS Meeting, August 30 – September 3, 2006, New York, NY.
2. **Aly A. Farag** "A Survey and Recent Advances in Image Registration and Fusion (Full Day)" with H. Abdelmunim, G. Carneiro, A. Goshtasby, R. D. Eastman, J. Flusser, A. Leow, F. Sroubek, B. Vemuri, I. Yanovsky, and B. Zitova," International Conference on Computer Vision and Pattern Recognition, CVPR 2008, Egan Convnection Center, Anchorage, Alaska, June 24-26, 2008.

**(e) Published Chapters of books**

1. M. Sabry Hassouna and **Aly A. Farag**, "Accurate Tracking of Monotonically Advanced Fronts," J. Suri and A. Farag, Editors, *Deformable Models I: Biomedical and Clinical Applications*, Chapter 8, pp. 235-258, Springer, New York, July 2007.
2. Ayman El-Baz, **Aly A. Farag**, Seniha E. Yuksel, Mohamed E. Aboel Ghar, Tarek A. Eldiasty, and Mohamed A. Ghoneim, "Application of Deformable Models for the Detection of Acute Renal Rejection," J. Suri and A. Farag, Editors, *Deformable Models I: Biomedical and Clinical Applications*, Chapter 10, pp. 293-333, Springer, New York, July 2007.

3. M. Sabry Hassouna, **Aly A. Farag**, and Robert Falk "PDE-Based Three Dimensional Path Planning for Virtual Endoscopy" J. Suri and A. Farag, Editors, *Deformable Models I: Biomedical and Clinical Applications*, Chapter 13, pp. 445-475, Springer, New York, July 2007.
  4. H. Abd El Munim, R. Fahmi, N. Youssry El-Zehiry, **Aly A. Farag**, and M. Casanova, "Volumetric MRI Analysis of Dyslexic Subjects Using Level Set Framework," J. Suri and A. Farag, Editors, *Deformable Models II: Theory & Biomaterial Applications*, Chapter 14, pp. 461-492, Springer, New York, July 2007.
  5. Rachid Fahmi, Ayman El-Baz, Hossam Abd El-Munim, Alaa E. Abdel-Hakim, and **Aly A. Farag**, "Robust Neuroimaging-Based Classification Techniques for Autistic vs. Typically Developing Brain," J. Suri and A. Farag, Editors, *Deformable Models II: Theory & Biomaterial Applications*, Chapter 16, pp. 535-566, Springer, New York, July 2007.
  6. A. E. Abdel-Hakim and **A. A. Farag**. Colored local invariant features for distinct object description in vision-based intelligent systems. In X. F. Zha, editor, *Artificial Intelligence and Integrated Intelligent Information Systems: Emerging Technologies and Applications*, chapter 10, pages 178–205. Idea Group Publishing, Hershey, PA, USA, October 2006.
  7. **A. A. Farag**, Hongjian Shi, Fahmi Rachid, and Michael J. Voor, "Basic Experiments on Finite Element Analysis of Soft Tissues," Y. Payan, Ed. A book chapter in *Biomechanics Applied to Computer Assisted Surgery*, ed. Research Signpost Publisher, 2006.
  8. **A. A. Farag**, H. Shi, R. Fahmi and M. Voor, "Basic Experiments and Finite Element Analysis of Soft Tissues," *Biomechanics Applied to Computer Assisted Surgery*, (Yohan Payan, Ed.), Research Signpost, Kerala, India, Chapter 12, pp. 193-208, ISBN 81-308-0031-4, 2005.
  9. **A. A. Farag**, S. M. Yamany, J. Nett, T. Moriarty, A. El-Baz, S. Hushek, and R. Falk, "Medical Image Registration: Theory, Algorithm, and Case Studies in Surgical Simulation, Chest Cancer, and Multiple Sclerosis," *In Handbook of Biomedical Image Analysis*, (J. S. Suri, D. L. Wilson, and S. Laxminarayan, Eds.), Kluwer Academic/Plenum Publishers, London, vol. III: Registration Models, pp. 1-42, 2005.
  10. **A. A. Farag**, M. N. Ahmed, A. El-Baz, and H. Hassan, "Advanced Segmentation Techniques," *Handbook of Biomedical Image Analysis*, (J. S. Suri, D. L. Wilson, and S. Laxminarayan, Eds.), Kluwer Academic/Plenum Publishers, London, Vol I: Segmentation Models, pp. 479-534, 2005. ISBN: 0306485508.
  11. E. E. Hemayed, M.T. Ahmed and **A. A. Farag**, "CardEye Active Vision System," Lecture Notes in Computer Science, Bernt Schiele, Ed., Springer, Berlin, pp. 155-173, 2001.
  12. M. N. Ahmed, S. M. Yamany, and **A. A. Farag**, "Function Approximation using Neural Networks." Wiley Encyclopedia of Electrical and Electronic Engineering, Vol. 8, pp37-45, John G. Webster Ed., John WILEY & Sons Inc., NY, 1999.
- (f) Books and Monographs in Preparation**
1. **A. A. Farag**, A Course on Digital Signal Processing; 300 pages (estimate) Manuscript in Progress. Official Contract with Springer -- due 2008.

2. **A. A. Farag**, A Course on Stochastic Processes, 300 pages (estimate) Manuscript in Progress.
3. **A. A. Farag**, Three-Dimensional Model Building in Computer Vision; 400 pages (estimate). Manuscript in Progress.
4. **A. A. Farag**, Surface and Volume Registration in Engineering and Medicine; 350 pages (estimate). Manuscript in Progress.

**(g) Patents**

1. **Aly A. Farag**, Sameh Yamany and David Tasman, "System and Method for 3-D Digital Reconstruction of An Oral Cavity from Sequence of 2-D Images," US Patent Application Patent Application No. 09/842,587.
2. **Aly A. Farag** and Mohamed Sabry, "VIRTUAL FLYOVER OF COMPLEX TUBULAR ANATOMICAL STRUCTURES," (Provisional Patent – 9/7/06; US Patent Application in file 60/842,850; 9/6/07).
3. **Aly A. Farag** and Mohamed Sabry, METHOD AND SOFTWARE FOR SHAPE REPRESENTATION WITH CURVE SKELTONS," (Provisional Patent – 6/30/06; US Patent Application in file 11/823,738; 10/5/07 ).
4. **Aly A. Farag** and Sergey Chekmenev, "NON CONTACT AND PASSIVE MEASUREMENTS OF ARTERIAL PULSE THROUGH THERMAL IR IMAGING, AND ARTERIAL IR IMAGING," (Provisional Patent – 6/30/06).
5. **Aly A. Farag** and Ayman El-Baz, "AUTOMATIC DETECTION AND MONITORING OF NODULES AND SHAPED TARGETS IN IMAGE DATA" (Provisional Patent – 6/30/06).

**(h) Peer-Reviewed Conference Proceedings** (full manuscript peer reviews: CVPR, ICCV, ICPR, IPMI, MICCAI are based on double-blind reviews – acceptance rate is less than 30%)

1. Sabry Hassouna and **Aly A. Farag**, "On the Extraction of Curve Skeletons using Gradient Vector Flow," *Proc. of IEEE International Conference on Computer Vision (ICCV'07)*, Rio de Janeiro, Brazil, October 14-20, 2007.
2. Asem Ali, **Aly Farag**, Ayman El-Baz, "Graph Cuts Framework for Kidney Segmentation with Prior Shape Constraints," *Proc. of International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI'07)*, Sydney, Australia, October 29 – November 2, 2007.
3. Abdelrehim Ahmed, Aly **Farag** and Thomas Starr, "A New Statistical Model Combining Shape and Spherical Harmonics Illumination for Face Reconstruction," *3<sup>rd</sup> International Symposium on Visual Computing (ISVC-07)*, Lake Tahoe, Nevada/California, November 27-29, 2007, pp. 531-541.
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**(k) Selected Presentations and Abstracts**

1. **A. A. Farag**, "On shape representation," Invited talk, Microsoft Research-Cairo, Egypt January 11, 2007.
2. **A. A. Farag**, "Recent Advances in statistical and variational image modeling," Invited talk, Cairo University 3<sup>rd</sup> Biomedical Engineering Conference, Cairo, Egypt December 21-24, 2006.
3. **A.A. Farag**, Robert Falk and Renato LaRoca, "A three-year progress on image analysis for lung nodule detection from low dose CT scans" The Brown Cancer Meeting, November 29, 2006.
4. **A. A. Farag**, "Medical Imaging for Better Healthcare," Invited Talk, Mansoura University, Egypt, September 13, 2006.
5. A. A. Farag, "Latest Progress in PDE Approaches for Medical Image Analysis," Keynote talk, the Graphics, Vision and Image Processing Conference (GVIP05), Cairo, Egypt, December 21, 2005.
6. A.H. Eid, **A.A. Farag**, D. Tasman, A. Farman, "3D Modeling of the Human Jaw," Research!Louisville, October 2001.
7. A. El-Baz, **A.A. Farag**, and R. Falk, "Image Analysis for Automatic Screening of Lung Cancer," Research!Louisville, October 2001.
8. Jeremy Nett, **A.A. Farag**, R. Falk, and S. Ildstad "Medical Image Processing and Visualization Applied to the Study of Multiple Sclerosis," Research!Louisville, October 2001.
9. **A.A. Farag**, T. Moriarty, C.B. Sites, S. Hushek, "Virtual Endoscopy: Modeling the Navigation in 3D Brain Volumes," Research!Louisville, October 2001.
10. Larson, P., Mohamed, A., Eldeib, A., Mohamed, A., Yamany, S., Sites, C., Vitaz, T., **Farag, A.**, Shields, C., and Moriarty, T, "Image-guided Navigation for Neuroendoscope," the 49<sup>th</sup> Annual Meeting of the Congress of Neurological Surgeons – CNS'99, Oct. 30 – Nov. 4, Boston, MA, 1999.
11. Larson, P., Eldeib, A., Mohamed, A., Sites, C., **Farag, A.**, Shields, C., and Moriarty, T, "Image Processing Paradigms for Image-Guided Neurosurgical Navigation," the 49<sup>th</sup> Annual Meeting of the Congress of Neurological Surgeons – CNS'99, Oct. 30 – Nov. 4, Boston, MA, USA, 1999.
12. Mohamed, A., Larson, P., Eldeib, A., Sites, C., **Farag, A.**, and Moriarty, T, "Rapid Registration for Image Guided Neurosurgery," the 5<sup>th</sup> International Workshop – Computer

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13. Sites, C., Larson, P., Mohamed, A., Eldeib, A., **Farag, A.**, and Moriarty, T, “3-D Modeling of the cerebral Vasculature,” the 5<sup>th</sup> International Workshop – Computer Assisted Surgery – CAS'99 and Rapid Prototyping in Medicine, Oct. 14 – 16, Erlangen, Germany 1999.

### 3. Grants and Contracts

External funding totaling over \$8 million has been received for the following projects.

#### (a) **Proposals funded by external source**

1. **A. A. Farag (PI)**, “Novel Approaches in Perception for Autonomous Mobility” NASA-entry grant; \$41K, 8/1/07 – 5/31/08.
2. T. Starr (PI) and **Aly Farag (Co-PI)**, “3D Face Recognition,” EAW, Inc. and DoD Special Operation, 8/1/06 – 7/1/08; \$752,862. Extension to this project approved to 8/2010 at additional \$750K.
3. **A. A. Farag (PI)**, “Perception-Based Robotic Navigation in Unknown Environments,” NASA-entry grant; \$42K, 8/1/06 – 5/31/07.
4. **A. A. Farag (PI)**, “3D Modeling of the Human Jaw,” National Science Foundations, 7/1/05 – 6/31/08; \$652K.
5. **A. A. Farag (PI)**, “Image Analysis for Early Detection of Lung Cancer,” Kentucky Lung Cancer Program, 3/1/04 – 2/28/07; \$300K.
6. **A. A. Farag (PI)**, “PDE-based Path Planning for Autonomous Robotics,” NASA-entry grant; \$25K, 8/1/05 – 7/31/06.
7. **A. A. Farag (PI)**, “Perception for Autonomous Mobility – Phase II,” US Army, 10/30/03 - 4/21/05; \$1,200,000.
8. **A. A. Farag (PI)**, “Perception for Autonomous Mobility - Addendum,” US Army, 10/30/03 - 9/21/04; \$214,179.
9. **A. A. Farag (PI)**, “Perception for Autonomous Mobility,” US Army, 2/15/02 - 6/30/03; \$642,537.
10. **A. A. Farag (PI)**, “Multimodality Image Fusion for 3-D Model Building with Applications” Air Force Office of Scientific Research, 5/15/01 – 4/31/04; \$356,070.
11. **A. A. Farag (PI)** “Active Stereo Vision with Applications,” US Army, 1/15/01 - 4/1/02; \$348,415.
- A. A. Farag (PI)** “Image Analysis for Chest Cancer Screening,” The Jewish Hospital Foundation, 9/1/01 – 8/31/02; \$50,000.
12. **A. A. Farag (PI)**, “Immersive Visualization Laboratory,” Silicon Graphics, Inc 7/1/99 - 6/31/01; \$150,000.

13. **A. A. Farag** (PI) "Multimodality Image Fusion Study," Eastman Kodak Company, Rochester, New York, 7/30/99 - 8/31/99; \$20,000.
14. **A. A. Farag** (Co-PI) with M. Dyer, Chuck Sites "Creating a Kentucky vBNS GigaPOP," NSF, 2/15/99-1/31/01; \$350,000 – University matching of \$700K.
15. **A. A. Farag** (PI), "Motion Artifact Suppression in MRI," National Institute of Health, 7/1/98 - 6/30/00; \$213,000.
16. **A. A. Farag** (PI), T. Moriarty (Co-PI), C. Shields (Co-PI), C. Sites (Co-PI) and M. Dyre (Co-PI) "CVIP Lab ATM Medical Imaging Net," Alliant Community Trust Fund, 7/1/98 - 7/1/00; \$200,000.
17. **A. A. Farag** (PI), "Upper-Limb Myoelectric Prosthesis," NSF, 9/1/98 - 8/31/99; \$20,000.
18. **A. A. Farag** (Co-PI) with T. Moriarty, "3-D Navigation Through the Human Brain: A Computer Vision-Based System for Endoscopic Surgery," The Whitaker Foundation, 8/1/98 – 7/31/01; \$197,283.
19. **A. A. Farag** (PI), T. Moriarty (Co-PI), Y. M. Kadah, and M. N. Ahmed, "High Performance Computer Aided Guidance System for Minimally Invasive Surgery," Alliant Community Trust Fund, 1/1/98 - 12/31/99; \$184,000.
20. **A. A. Farag** (PI), J. M. Zurada, E. A. Essock, and J. He, "Integration of Multiple Cues for Robust 3D Object Description: A Computational and Psychophysical Study with Applications," Department of Defense, DEPSCoR Program, 9/14/1997 - 9/13/2000; \$396,000.
21. **A. A. Farag** (PI), C. M. Maxfield, K. K. Bloom, and W. A. Kraft, "A Supercomputer-based System to Evaluate Pediatric TBI Recovery," Alliant Community Trust Fund, 1/1/97 - 12/31/98; \$145,500.
22. A. A. Farag (PI), D. Chenoweth, and B. Seales, "3-D Model Building in Computer Vision: New Approaches and Applications," NSF, 8/1/1996 - 8/1/1999; \$616,000.
23. **A. A. Farag** (PI), D. Tasman, A. Farman, and S. Braun, "3D Model Building in Computer Vision with Orthodontics Applications," The Whitaker Foundation, 4/1/95 - 4/1/98; \$180,000.
24. **A. A. Farag** (PI), D. L. Chenoweth, and R. W. Cohn, "Laboratory for Computer Vision and Image Processing," National Science Foundation, 4/20/95 - 4/20/96; \$75,000. .
25. **A. A. Farag** (PI), "A Computer Vision System for Tile Inspection," AV Concepts, Inc., 9/1/94 - 12/31/95; \$61,000.
26. D. Tasman (PI) and **A. A. Farag** (Co-PI) "A Computer Vision System for Orthodontics," American Association of Orthodontics, 4/1/93 - 1/31/94; \$14,500.
27. **A. A. Farag** (PI), "Coding and Transmission of Images Reconstructed from Incomplete Projections," BellSouth Foundation, 10/1/92 - 12/31/93; \$17,000.
28. **A. A. Farag** (PI), "Reliable Network Access of Image Databases," Software Management, Inc., 10/1/92 - 8/1/93; \$19,000.

**(b) Proposals submitted and pending with external sources**

1. **Aly A. Farag**, PI; Co-PIs, Edward Essock, Michael Cunningham, Aruni Bhatnagar and William M. Penrod "Integrated Biometrics for Care of the Elderly and People with Disabilities: A Modern Computer Vision Approach," NSF, 7/1/08 – 6/31/11, \$1.2M.
2. **Aly A. Farag**, PI "Novel Visualization for Virtual Colonoscopy," NSF, 7/1/08 – 6/31/11, \$450K.
3. **Aly A. Farag**, PI; Co-PIs, Adel Denewer and Sabry El-Mogy, "Visualization of Complex 3D Topology and Applications in Virtual Colonoscopy," NSF-Egypt, 7/1/08 – 6/1/30/10, \$180K.
4. **Aly A. Farag**, PI; Co-PI's Manuel Casanova, Ayman Elbaz, and Hossam Hassan, "Structural Neuroimaging for Study of Pediatric Autism," Norton Healthcare, \$300,000.00; 8/1/07 – 6/30/10.
5. **Aly A. Farag**, PI; Co-PI, Olfa Nasraoui, "Scale-Space and Level Set-Based Approaches for Registration of Multispectral Data: Novel Approaches and Applications," NASA-EPSCoR, \$487,494K, 8/1/08- 7/31/11.
6. **Aly A. Farag**, PI, "Remote Sensing for Surveillance of Critical Infrastructure- Phase 1," NASA-EPSCoR, \$45K, 8/1/08 – 5/31/09.

Resubmission planned for mid-2008

7. **A. A. Farag** (PI), Gerald Dryden, Robert Falk, Susan Galandiuk, and Albert Seow "A Novel Visualization Approach for Virtual Colonoscopy with Clinical Validation," NIH – R01; \$ 1,451,768; 07/09 – 07/12 (Resubmission due June 08).
8. **Aly A. Farag**, PI; Co-PI's, Waldemar Karwowski, Edward Essock, and Michael Cunningham, "Fusion of Biometric Technologies for Threat Identification," Department of Justice, \$953,720.00, 8/1/07 – 7/31/2010 (Resubmission Due June 08).

**(c) Proposals funded by University of Louisville**

1. **A. A. Farag** (PI), H. Parsaei, and T. J. Gornet, "3D Model Model-Based Vision," University of Louisville, Graduate School, 5/1/93 - 12/31/93; \$4,000.
2. **A. A. Farag** (PI), "Gibbs-Markov Random Fields and Stochastic Geometry: Theory and Applications in Region Segmentation," University of Louisville, President Research Initiative Program, 1/1/92 - 10/1/93; \$10,000.

**4. Dissertations and Theses Directed**

Dr. Farag has graduated 40 students (25 Masters and 15 PhD) as of Spring 08, and currently advises six graduate students and two undergraduate students.

**(a) Dissertations and theses completed**

1. Abdelrehim Ahmed, "Shape from Shading under Various Imaging Conditions," Ph.D. Spring 2008.

2. Sergey Chekmenev, "Non-Contact and Passive Computer Vision Methodology for Measurement of Arterial Pulse Using Thermal IR Imaging," Ph.D. Spring 2008.
3. Asem Ali "Optimization Methods using Graph Cuts," Ph.D., Spring 2008.
4. Rachid Fahmi, "Shape Registration," Ph.D., Spring 2008.
5. Hong Shi, "Partial Differential Equation Methods for Analysis of Tissue Deformations in Surgical Simulation," Ph.D. Fall 2007.
6. Hossam Abd El Munim "Variational Approaches in Image Segmentation using Level Sets," Ph.D., Spring 07.
7. Alaa El-din Aly, "Local Features Invariance Beyond 2D Gray Spaces," Ph.D., Spring 07.
8. Ayman Elbaz, "Novel Statistical Models for Medical Image Analysis," Ph.D., August 2006.
9. Ravi K. Mulpuri, "Implementation of Categorization for Faceted Search Using Naïve Bayesian Classifier," Master of Science, Fall 2006.
10. Mohamed Sabry, "Visualization of 3D Volumes in Surgical Simulations," Ph.D. , May 2006
11. Jeffrey M. Colyer, "Initial In Vitro Characterization of a Pediatric Cardodopulmonary Assit System," Master of Engineering, Spring 2006.
12. Ham Rara, "2D Algorithms for Face Recognition," Master of Science, Summer 06.
13. Refaat Mohamed, "Multimodality Image Fusion for 3D Terrain Mapping," Ph.D., December 2005.
14. Sneiha Esen Yuksel, "Analysis of Renal Rejection," Master of Science, December 2005.
15. Ahmed H. Eid, "Performance Evaluation of 3D Reconstruction Approaches," Ph.D., December 2004.
16. Robert Welch "Experiments in object tracking," Master of Engineering, January 2002.
17. Moumen M. Ahmed, "Zoom-lens Camera Calibration for an Active Vision System," Ph.D., December 2001.
18. Jeremy Nett, "Image Analysis for Quantification of Multiple Sclerosis," Master of Engineering, December 2001.
19. Erin Rickard, Master of Engineering, "Neural Networks Methods for Image Segmentation," Master of Engineering, December 2001.
20. Matthew Eklund, "Robust Correlation Methods in Object Reconstruction," Master of Engineering, August 2001.
21. Yurong Li, "Motion Tracking for Active Vision," Master of Engineering, May 2001.
22. Timothy Perkins, "Data Fusion in Aerial Imaging Applications," Master of Engineering, December 2000.

23. Abdoulah Sangare, "Space Carving for 3-D Object Modeling," Master of Engineering, December 2000.
24. Sameh M. Yamany, "Surface Registration by Surface Point Signature," Ph.D., December 1999.
25. Elsayed E. Hemayed, "A 3-D Trinocular Active Vision System for Surface Reconstruction," Ph.D. August 1999.
26. Mohamed. N. Ahmed, "Novel Image Segmentation and Registration Algorithms for the Study of Brain Structure and Function," Ph.D., December 1997.
27. Diana L. Guidry, "Active Contours: With Application to Motion Artifact Cancellation and Segmentation in MRI," Master of Engineering, August 1999.
28. Nevin M. Mohamed, "A Modified Fuzzy C-Mean for Medical Image Segmentation and Partial Volume Estimation," Master of Science, May 1999.
29. Peter Lehel, "Sensor Planning for a Trinocular Active Vision System," Master of Engineering, May 1999.
30. John D. Bethge, "A Fast Algorithm of Object Tracking in MPEG Sequences," Master of Engineering, December 1997.
31. Adam E. Sandbek, "Evaluation of Stereo based 3D Object Reconstruction," Master of Engineering, December 1996.
32. Steve W. Roberts, "Surface Registration," Master of Engineering, December 1996.
33. Sherif N. Ahmed, "3D Texture Building with Applications in Tile Design," Master of Science, May 1996.
34. Kamal J. Khiani, "Quantification of Endothelial Cells," Master of Engineering, May 1996.
35. Stuart A. Wilson, "Image Compression Using Neural Networks," Master of Engineering, December 1995.
36. Andrew C. Arbaugh, "Surface Registration with Applications in Intelligent Manufacturing," Master of Engineering, December 1995.
37. Bin Wang, "3-D Surface Reconstruction from Images with Application in Orthodontics," Master of Science, August 1994.
38. Ravi Kolli, "Wavelet-Based Compression," Master of Science, June 1994.
39. Yuen Pin Yeap, "Algorithms for Texture Simulation and Segmentation Based on Stochastic Models," Master of Science, April 1993.
40. Grace Shuang Liang, "An Integration of Edge Linking and Corner Detection," Master of Science, May 1993.

**(b) Dissertations and theses in progress**

41. Donqing Chen, "A Geometric Approach for Polyp Detection in Virtual Colonoscopy," (Expected Graduation Summer/Fall 08)
42. Ham Rara, MS, "3D Face Recognition," ( Started PhD Program, Fall 06, Expected to graduate Spring 09)
43. Travis Gault, Ph.D. (joined the CVIP lab Summer/Fall 07, Expected Graduation Fall 09)
44. Melih Aslan, Ph.D. (to join the group Fall 07)
45. Shireen Y. Elhabian, Ph.D. (joined the group Fall 07)
46. Wael Mamdouh, Ph.D., (joined the group Spring 08)

**(c) Dissertations and theses committee participation**

Dr. Farag has been in the reading committee of over 20 graduate students in the School of Engineering, in addition to one Ph.D. student in Psychology (Dr. Zijiang He, Advisor) and one M.S. student in Dentistry (Dr. David Tasman, Advisor).

**(d) Research Scientists Hosted**

1. Dr. Georgy Gimel'farb, University of Auckland, New Zealand – work on statistical modeling, (02/03 – 12/03 and 04/05 – 11/05).
2. Dr. Hani Mahdi, Ain-Shams University, Egypt – work on data fusion, August 01 – July 02.
3. Dr. Naoufel Werghi, University of Glasgow, UK, "Computer vision models," February – April 2001.
4. Dr. Ahmed Elbially, Cairo University, February 2000- September 2000.

In addition to several other scholars who have been hosted on short tem (e.g., one to two weeks) including Professor Edward Delp (Purdue University), Professor Jon Benediktson (University of Iceland), Professor Ahmed Hisham (Cairo University).

**(e) Postdoctoral fellows supervised**

1. Dr. Abdelrehim Ahmed, Assiut University, Egypt, "Reconstruction from Sequence of Images" February 2008 – Present.
2. Dr. Hossam Abelmunim, Ein Shams University, "Varitional Image Modeling," April 2007- December 2007.
3. Dr. Alaa Aly, Assiut Egypt, "Scale Space Methods for Object Representation" April 07 – August 07.
4. Dr. Mostafa G. Mostafa, Ain-Shams University, Egypt, "Data Fusion for 3-D Object Description," February 98 – June 2000.

5. Dr. Ayman Eldeib, Cairo University, Egypt, "Minimally-Invasive Neurosurgery," May 98 – April 2000.
6. Dr. Elsayed E. Hemayed, Cairo University, Egypt, "Active Vision and Robotics," August 99 – December 99.
7. Dr. Mohamed N. Ahmed, Cairo University, Egypt April 99., "3D segmentation and visualization," January 98 -
8. Dr. Yasser M. Kadah, Cairo University, Egypt, "Motion Estimation in MRI," July 97-Feb. 98.

### **III. TEACHING**

Dr. Farag takes pride in teaching at the undergraduate and graduate levels. Several manuscripts are in various stages of preparation and are planned for publications in the near future. These manuscripts are an outgrowth of the lecture notes on ECE520 (Digital Image Processing), ECE 530 (Stochastic Processes), ECE618 (Digital Image Processing), ECE619 (Computer Vision), ECE 620 (Pattern Recognition), and ECE 641 (Medical Imaging). Dr. Farag has introduced a total of 11 new courses into the ECE curriculum in the past 13 years.

#### **1. Courses Taught during the past four years at the ECE Department**

1. ECE 520: Digital Signal Processing
2. ECE 521: Digital Signal Processing Laboratory
3. ECE 530: Stochastic Processes and Estimation Theory
4. ECE 618: Digital Image Processing
5. ECE 635: Digital Image Processing Laboratory
6. ECE 619: Computer Vision
7. ECE 645: Computer Vision Laboratory
8. ECE 620: Pattern Analysis and Machine Intelligence
9. ECE 655: Pattern Recognition Laboratory
10. ECE 640: Introduction to Biomedical Engineering
11. ECE 641: Medical Imaging
12. ECE 643: Introduction to Biomedical Computing
13. ECE 523: Introduction to Biometrics (first taught during Fall 05 under ECE 500-78)

#### **2. New subject matter introduced into the curriculum (in order of approval)**

1. ECE 521: (Laboratory Course for EE 520, Digital Signal Processing)

2. ECE 620: Pattern Recognition and Machine Intelligence
3. ECE 640: Introduction to Biomedical Engineering
4. ECE 530: Introduction to Random Processes and Estimation Theory
5. ECE 635: (Laboratory Course for ECE 618, Digital Image Processing)
6. ECE 645: (Laboratory Course for ECE 619, Computer Vision)
7. ECE 655: (Laboratory Course for ECE 620, Pattern Recognition)
8. ECE 641: Introduction to Medical Imaging
9. ECE 643: Introduction to Biocomputing
10. ECE 500: Introduction to AI Robotics
11. ECE 523: Introduction to Biometrics (first taught during Fall 05 under ECE 500-78).

In addition, Dr. Farag has sponsored a number of short courses at the ECE department in the past four years, including Video Compression (Prof. Edward Delp, Purdue University), Surface Registration (Dr. Paul Besl, Alias WaveFront), Parallel Programming (Professor Eric Dumens, University of Florida), Statistical Modeling (Dr. David Banks, Duke University).

### **3. Laboratory development**

Facilities at the CVIP Lab are being used for teaching EE600-01 a one-hour laboratory course that has been taught in conjunction with EE618, EE619 and EE620 since 1996. Class projects use the state-of-the-art facilities at the laboratory. Intensive efforts have been spent in developing these experiments. Permanent listing for these lab courses is now in the university catalog under ECE 521, ECE 635, 645 and ECE655.

## **IV. SERVICE ACTIVITY**

### **1. Professional Activities**

- a) General Co-Chair, IEEE International Conference on Image Processing (ICIP-09) Cairo, Egypt, 2009
- b) Associate editor, *IEEE Transactions on Image Processing* 2000-2004.
- c) Regular reviewer for the following journals: *IEEE Transactions on Pattern Analysis and Machine Intelligence* (PAMI), *IEEE Transactions on Image Processing* (IP), *IEEE Transactions on Medical Imaging* (MI), *IEEE Transactions on Signal Processing* (SP), *Methods of Information in Medicine*, and *Pattern Recognition Letters*.
- d) Regular reviewer for NSF, NIH and other funding organizations in the US and abroad.
- e) General Chair, Graphics, Vision and Image Processing Conference (GVIP 05), Cairo, Egypt

## **2. University Committees**

- a) School of Engineering Academic Integrity Committee 2007- Present
- b) ECE Faculty Activity Committee 2007 – Present
- c) School of Engineering Technology Committee 2006 – Present
- d) ECE Faculty Search Committee (Chair of the Communications, AI Robotics and Bioimaging Search Committees)
- e) ECE Strategic Hiring Committee 2000 – Present
- f) University-wide Selection Committee for President's Distinguished Faculty Awards, 1999-2000.
- g) School of Engineering Grievance Committee, 1994-1996
- h) University wide Educational Support Services Committee, 1995
- i) Kersey Library Committee, 1992-1994.

Dr. Farag has been member of hiring committees, of faculty and staff, at the Schools of Engineering, Arts & Science, Dentistry, and Medicine since 1994. Dr. Farag has interviewed over 30 candidates during the past five years.

## **3. Community Service**

- a) 2003- Present: Chief Judge for Engineering, Annual Louisville Science Fair for Middle and High Schools
- b) 2000-Present: President, Islamic School of Louisville
- c) Member, Religious and Educational Committees, Louisville Islamic Center at River Road (1992-2002)
- d) Member, Spiritual Life Committee, Louisville Heritage Foundation (1996-1998)
- e) Regular invited lecturer at various civic organizations, including Louisville Science Center, a number of local High Schools, Churches and social gatherings.
- f) Volunteer, refugee help efforts in Louisville to assist refugees from overseas who are victims of wars.