

CONTACT

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BACKGROUND SUMMARY

Technical (> 12 years): Computer Vision, Medical image analysis, signal processing, machine learning, and pattern recognition.

Leadership (> 6 years): Currently - **hands-on Strategic Architect** - managing development and execution of clinical apps NPIs for Philips IGT - Mobile Surgery. In previous roles - Cross-functional team lead for 3 Medical Apps teams (Cardiac, Ob/Gyn, Point-of-Care; ~18 members covering Algorithms, UI/UX, Clinical Apps). **Functional manager for Advanced Imaging Algorithms R&D team**; responsibilities included hiring, coaching, technical mentorship, career planning and performance assessment, while delivering consistently high engagement scores exceeding 70/100 (~4 years, team size 10, all MS/PhD from top Universities worldwide).

Clinical (> 8 years): Led clinical collaborations with KOLs from different clinical specialties: UCSD - Neonatology, Mayo Clinic - Hepatocellular Carcinoma, Univ. of Rochester - Rheumatology, Mass. General Hospital - Hepatocellular Carcinoma, Narayana Hridayalaya - Cardiology and MSK. Over 3 conference and 1 journal publication co-authored with clinical collaborators (along with multiple internal white-papers). Certified completion of NIH Course on "*Protection of Human Research Participants*". Experienced in preparation of IRB review and Informed Consent documents according to GCP.

Publications/Talks (> 15 years): Over 23 publications in esteemed journals and conferences and 2 book-chapters. An average of one talk every year (since 2003) at an international technical conference. Experienced in clearly articulating advanced technical concepts to audiences from varying backgrounds (engineering, clinical, management).

Patents: Over 18 submitted patent applications (since 2008), 4 issued. Lead author in over 9 patent applications.

Research Grants (> 8 years): Experienced in grant proposal preparation for government (NIH, NSF, DARPA, NIJ, NASA) as well as industry (GE, Samsung); led the development of image analysis narratives of these grant proposals. Over \$12MM funding received across these grants over the last 9 years.

EDUCATION

Ph.D., Electrical Engineering, October 2007

Thesis Title: "Video Inpainting And Scene Analysis"

Advisor: Prof. Guillermo Sapiro

University of Minnesota, Minneapolis, MN

M.S., Electrical Engineering (*Minor in Mathematics*), April 2004

Thesis Title: "Techniques For Automatic Image Inpainting"

Advisor: Prof. Guillermo Sapiro

University of Minnesota, Minneapolis, MN

B.E., Instrumentation and Control Engineering, August 2001

First Class with Distinction (summa cum laude)

Final Project: "Auscultation Assistant"

Govt. College of Engineering, University of Pune (GCOEP), Pune, India

COMPUTER SKILLS

- Hands-on programming in: C++ and Python
- Libraries: opencv, ITK, vxl, scikit-learn
- Version Control: git, svn

RESEARCH AND
EXPERIENCE

Clinical Applications Architect,
Image Guided Therapy Systems R&D.
Pune, India 411018

Philips Healthcare
Jan 2019 – Present

Leading Clinical Applications NPD for IGT Mobile Surgery. Responsible for:
(a) Creating a strategy for realizing the clinical application roadmap and ensuring that they are brought to the market as soon as possible, (b) Define scope of clinical applications in a crisp and structured way with clinical marketing, product marketing, regulatory and other stakeholders, (c) To set up clinical sites that can be used to get user feedback on the clinical application space, and (d) Lead transformation towards innovation driven high performance team

Sr. Chief Engineer,
Healthcare and Medical Equipment Division.
Bangalore, India 560037

Samsung Research Institute
June 2015 – Dec 2018

- **Overview:** Senior Engineering Manager - technical and people management of Ultrasound R&D team towards development 4D Ultrasound applications for automated clinical quantification of anatomical structures. Responsible for developing an R&D roadmap of clinical applications for Samsung-Medison's premium line of Ultrasound scanners for Cardiac, Ob/Gyn and Point-of-Care Applications. Recognized as key expert in the areas of image analysis, machine learning and clinical research for medical applications.
- **Key Product highlights:** Apps for - 5D Follicle, Fetal R-MPI, Cardiac Quantification, Panoramic Imaging (all released or announced to be released in premium to value segment Ultrasound systems).

Lead Scientist,
Biomedical Image Analysis Lab.
1 Research Circle, Niskayuna, NY 12065

GE - Global Research
Nov 2007 – May 2015

- **Overview:** Senior member of a multidisciplinary team and responsible for leading image analysis efforts for identification, extraction and quantification of clinically relevant features from medical imagery; inventing and implementing algorithms; developing intuitive visualization approaches to present quantified information to user.
- **Key Work:** Multi-modality (ultrasound and fluoroscopy) fusion for interventional procedures, real-time segmentation and tracking of anatomical features using cascade of boosted classifiers, automated detection of anatomical structures. Led the development of algorithms for automated assessment of rheumatoid arthritis from 3D ultrasound images of finger-joints. Developed automated algorithms for real-time detection and Kalman-Filter based tracking of blood vessels as well as embedded catheters in 4D ultrasound images for enabling interventional procedure guidance (led the transition to product). Key personnel in securing the funding for and leading engineering efforts on MR-Ultrasound fusion for automated assessment of intracranial pressure in astronauts (funded by NASA). Led the image analysis narrative in the development of a *successful NIH R01 proposal for "real-time tumor localization and guidance for radiotherapy using US and MRI"*.

Research Assistant - Image and Video Processing,
Image Processing Laboratory
200 Union St SE, Minneapolis, MN 55455

University of Minnesota
June 2002 – Oct 2007

- Developed an automatic background subtraction and foreground detection algorithm that uses "layers" to model the scene using **Kernel Density Estimation**.
- Developed a novel and fast technique for automatic object removal and occlusion filling-in for video using a **Markov Random Field** based object appearance model. A priority based inpainting rule, with an automatic stopping criterion, is used to complete the occluded moving foreground.

**Research Intern - CT Colon
Segmentation**

6580 Via del Oro, San Jose, CA 95119

Developed a learning based framework for colon segmentation from series of DICOM images. Implemented algorithms for colon segmentation using ITK and VTK libraries. Defined testing protocols for said algorithms. Proposed methodology for extracting or generating surface mesh from a segmented colon DICOM stack.

Supervisor: Sergio A. Valencia (President)

Echopixel Technologies Inc.

June 2007 – August 2007

**Research Intern - Video Analysis,
Automatic Control Solutions Lab.**

3600 Technology Dr., Minneapolis, MN 55418

Design of an algorithm for “example based query” type of people detection in multiple cameras.**Supervisor: Dr. Vassilios Morellas (Principal Scientist)**

Honeywell

May 2006 – August 2006

**Research Intern - Video Analysis,
Automatic Control Solutions Lab.**

3600 Technology Dr., Minneapolis, MN 55418

Developed a fast algorithm for automatic segmentation of color images into homogeneous regions or layers.

Supervisor: Dr. Vassilios Morellas (Principal Scientist)

Honeywell

June 2005 – August 2005

**Research Assistant - Heart Sound
Analysis,**

Biomechanical Engineering Laboratory

200 Union St SE, Minneapolis, MN 55455

(In Collaboration With 3M Corp.)

Developed a pattern recognition based automatic technique to segment Heart Sounds into four parts - S1, systolic period, S2 and the diastolic period. Implemented in MATLAB.

Supervisor: Dr. Marie Guion

University of Minnesota

June 2003 – October 2003

Teaching Assistant,

Dept. Of Electrical Eng.

200 Union St SE, Minneapolis, MN 55455

Assisted the instructor in preparing material, web-tutorials, and conducting experiments for various under-graduate laboratory courses: Fundamentals of Electrical and Electronics Engineering, Senior Design Project.

University of Minnesota

September 2001 – December 2003

PATENTS

> 18 Patents filed (> 9 as *Lead Inventor*).

Below is a sample of patents available on the web:

K. A. Patwardhan, D. Mills, “Method and system for ultrasound based automated detection, quantification and tracking of pathologies”

T. Foo, L. Smith, K. Thomenius, S. Gupta, L. Marinelli, **K. A. Patwardhan**, D. Graziani, “Methods and systems using magnetic resonance and ultrasound for tracking anatomical targets for radiation therapy guidance”.

K. A. Patwardhan, D. Mills, J. Kim, “System and method for assessing bowel health”.

K. A. Patwardhan, S. Gupta, Y. Yu, A. Dentinger, D. Mills, “Method and System for Automatic Segmentation and Temporal Tracking of Blood Vessels”

K. A. Patwardhan, N. Krahnstoever, T. Yu, “Method and System for Object Tracking Using Appearance Model”

A. Dentinger, **K. A. Patwardhan**, R. Hocter “Method and System for Non-Invasive Monitoring of Patient Parameters”

**JOURNAL
PUBLICATIONS**

K. Cao, D. Mills, R. G. Thiele, **K. A. Patwardhan**, “Towards Automated Assessment of Rheumatoid Arthritis with Volumetric Ultrasound”, *IEEE Transactions on Biomedical Engineering*, Volume 63, Issue 2, Feb 2016, pp:449-458 *Impact Factor : 2.47*

CONFERENCE
PUBLICATIONS

K. A. Patwardhan, G. Sapiro, and V. Morellas, "A Pixel Layering Framework For Robust Foreground Detection In Video" *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Volume 30, Issue 4, April 2008, pp:746-751 *Impact Factor : 3.58*

K. A. Patwardhan, G. Sapiro, and M. Bertalmio, "Video Inpainting Under Constrained Camera Motion," *IEEE Transactions on Image Processing*, Volume 16, Issue 2, Feb. 2007, pp:545 - 553, *Impact Factor : 2.46*

A. Tiwari, **K. A. Patwardhan**, "HoDOR: histogram of differential orientations for rigid landmark tracking in medical images", *Medical Imaging 2018: Image Processing, International Society for Optics and Photonics*, Houston USA, February 2018.

S. Chechani, R. Suresh, **K. A. Patwardhan**, "Aortic root segmentation in 4D transesophageal echocardiography", *Medical Imaging 2018: Image Processing, International Society for Optics and Photonics*, Houston USA, February 2018.

N. Narayan, S. Sivanandan, S. Kudavelly, **K. A. Patwardhan**, G. Ramaraju, "Automated detection and segmentation of follicles in 3D ultrasound for assisted reproduction", *Medical Imaging 2018: Image Processing, International Society for Optics and Photonics*, Houston USA, February 2018.

A. Tiwari, **K. A. Patwardhan**, "Mitral Valve Annulus Localization in 3D Echocardiography", *IEEE Engineering in Medicine and Biology Conference*, Orlando USA, August 17-21 2016.

S. Chechani, **K. A. Patwardhan**, "Aortic Root Center-Line Detection in 3D Echocardiography", *IEEE Engineering in Medicine and Biology Conference*, Orlando USA, August 17-21 2016.

K. Cao, B. Bednarz, L. S. Smith, T. K. F. Foo, **K. A. Patwardhan**, "Respiration induced fiducial motion tracking in ultrasound using an extended SFA approach", accepted for *oral presentation* at SPIE Medical Imaging 2015: Ultrasonic Imaging and Tomography.

K. Cao, D. Mills, **K. A. Patwardhan**, "Automated Catheter Detection in Volumetric Ultrasound", accepted for *oral presentation* at IEEE ISBI, San Fransisco USA, April 2013

D. Mills, K. Cao, R. G. Thiele, **K. A. Patwardhan**, "Volumetric Ultrasound and Computer-Assisted Analysis At The Point-of-Care: A Musculoskeletal Exemplar", **invited talk** *IEEE Engineering in Medicine and Biology Conference*, San Diego USA, August 28-31 2012.

K. A. Patwardhan, "Automated symmetry based feature detection in Ultrasound", *Proceedings, IEEE Engineering in Medicine and Biology Conference* 2012.

K. A. Patwardhan, Y. Yu, S. Gupta, A. Dentinger, D. Mills, "Fast 4D vessel segmentation and tracking in Ultrasound", *Proceedings, IEEE Intl. Conference on Image Processing* 2012.

K. A. Patwardhan, K. Cao, D. Mills, R. G. Thiele, "Automated bone and joint-region segmentation in volumetric ultrasound", *IEEE Intl. Symposium on Biomedical Imaging (ISBI)*, Barcelona Spain, May 2-5 2012.

R. G. Thiele, **K. A. Patwardhan**, K. Cao, D. Mills, "Feasibility of Volumetric Ultrasound and Automated Analysis for Rheumatic Disease", *Arthritis and Rheumatism* 2011; Vol 63; no.10

N. Krahnstoever, P. Tu, T. Yu, **K. A. Patwardhan**, D. Hamilton, B. Yu, C. Greco, G. Doretto, "Intelligent video for protecting crowded sports venues" (2009) 6th IEEE International Conference on Advanced Video and Signal Based Surveillance, AVSS 2009, art. no. 5279520, pp. 116-121.

N. Krahnstoever, T. Yu, **K. A. Patwardhan**, D. Gao, "Multi-camera person tracking in

crowded environments” (2009) Proceedings of the 12th IEEE International Workshop on Performance Evaluation of Tracking and Surveillance, PETS-Winter 2009, art. no. 5399731.

N. Krahnstoever, T. Yu, S. Lim, **K. A. Patwardhan** and P. Tu, “Collaborative real-time control of active cameras in large scale surveillance systems”, ECCV Workshop On Multi-camera and Multi-modal Sensor Fusion Algorithms and Applications 2008, ($\approx < 25\%$ acceptance rate, CiteSeer impact factor rankings in the top 7%)

D. Rother, **K. A. Patwardhan**, I. Aganj and G. Sapiro, “3D Priors For Scene Learning From A Single View”, S3D Workshop, IEEE Conference on Computer Vision and Pattern Recognition 2008, ($\approx < 25\%$ acceptance rate one of top 3 Computer Vision Conferences)

D. Rother, **K. A. Patwardhan** and G. Sapiro, “What Can Casual Walkers Tell Us About A 3D Scene?”, Intl. Conference on Computer Vision 2007, ($\approx 23\%$ acceptance rate)

K. A. Patwardhan, G. Sapiro, and V. Morellas, “A Graph-based Foreground Representation and its Application in Example Based People Matching in Video,” *IEEE Intl. Conference on Image Processing* Sep. 2007 ($\approx < 45\%$ acceptance rate)

K. A. Patwardhan, G. Sapiro, and M. Bertalmio, “Video Inpainting Of Occluding And Occluded Objects,” *Proceedings of IEEE Intl. Conference on Image Processing*, Genova, Italy, Sept. 2005, Vol. 2, pp:69-72 ($\approx < 45\%$ acceptance rate)

K. A. Patwardhan, and G. Sapiro, “Automatic Image Decomposition,” *Proceedings, IEEE Intl. Conference on Image Processing*, Singapore, Sept. 2004, Vol. 1, pp:645-648 ($\approx < 45\%$ acceptance rate)

K. A. Patwardhan, and G. Sapiro, “Projection Based Image And Video Inpainting,” *Proceedings, IEEE Intl. Conference on Image Processing*, Barcelona, Spain, Sept. 2003, Vol. 1, pp:857-860 ($\approx < 45\%$ acceptance rate)

BOOK CHAPTERS

G. Brooksby, G. Doretto, D. Hamilton, N. Krahnstoever, J. Laffen, X. Liu, **K. A. Patwardhan**, T. , Y. Tong, J. Tu, P. Tu, F. Wheeler, C. Wynnyk, Y. Yao, and T. Yu, Chapter - “Video Analytics for Force Protection” In Book Titled - “Distributed Video Sensor Networks” (Springer, 2009). Editors - B. Bhanu, C. V. Ravishankar, A. K. Roy-Chowdhury, D. Terzopoulos, and H. Aghajan

N. Krahnstoever, T. Yu, S. Lim, **K. A. Patwardhan** and P. Tu, Chapter - “Collaborative Control of Active Cameras in Large-Scale Surveillance” in Book Titled - “Multi-Camera Networks: Concepts and Applications” (ELSEVIER). Editors - H. Aghajan and A. Cavallaro

AWARDS AND HONORS

- **Article highlighting research on Video-Inpainting published in Scientific American in October 2006.**
- Ranked 4th among > 100000 high-school science majors in state of Maharashtra, India.

PROFESSIONAL ACTIVITIES

- Reviewer for esteemed journals and peer-reviewed conferences like *IEEE Transactions on Image Processing*, *IEEE Signal Processing Letters*, *ACM-SIGGRAPH*, *Journal of Visual Communication and Image Representation Registration*, *IEEE Transactions on Circuits and Systems for Video Technology*, *ACM SIGGRAPH*, *Pacific Graphics*, *IEEE ICIP*, *IEEE ICME*, etc.
- Member of technical program committee for IEEE ICME 2008.

INVITED TALKS

- Symbiosis Institute of Technology, Pune India, September 2018 (Host: Prof. Neela Rayavarapu)
- Adobe Research, Bangalore India, December 2014 (Host: Dr. Shriram Revankar)

- Samsung Research Center, San Jose, CA, August 2014 (Host: Dr. Vikram Vij)
- Children's Healthcare of Atlanta, Cardiac Care Unit, November 2013 (Host: Dr. Ritu Sachdeva)
- Image Processing group, HP Research, Palo Alto, CA, August 2007 (Host: Bruce Culbertson)
- Intelligent Systems Research Center at Kodak Research Laboratories, Rochester, NY, May 2007 (Host: Dr. Amit Singhal)
- Minerva Research Group, Georgia Tech, April 2007 (Host: Prof. Allen Tannenbaum)

REFERENCES

Available upon request.