UNIVERSITY OF IOWA

Curriculum Vitae

Date: January 3, 2016

PUNAM KUMAR SAHA, PHD

Home Address: 2103 Timber Lane
Coralville, IA 52241

Office Address: Department of Electrical and Computer Engineering
Department of Radiology
University of Iowa
3314 Seamans Center
Iowa City, IA 52242

Citizenship: U.S. citizen

Education:

1987	B.E.	Jadavpur University, India (Computer Science and Engineering)
1989	M.E.	Jadavpur University, India (Computer Science and Engineering)
1997	Ph.D.	Indian Statistical Institute, India (Computer Science)

Postgraduate Training and Fellowship Appointments:

1997-1999	Postdoctoral Fellow, Medical Image Processing Group and Laboratory for Structural Nuclear Magnetic Resonance Imaging, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104
1999-2001	Research Associate, Medical Image Processing Group and Laboratory for Structural Nuclear Magnetic Resonance Imaging, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104

Faculty Appointments:

1993-1997	Lecturer, Electronics and Communication Sciences Unit, Indian Statistical Institute, Calcutta, India
2001-2006	Research Assistant Professor, Medical Image Processing Group and Laboratory for Structural Nuclear Magnetic Resonance Imaging, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104

2006-2011	Associate Professor, Department of Electrical and Computer Engineering, Department of Radiology, University of Iowa, Iowa City, IA 52242
2011-2013	Tenured Associate Professor, Department of Electrical and Computer Engineering, Department of Radiology, University of Iowa, Iowa City, IA 52242
2013-present	Tenured Full Professor, Department of Electrical and Computer Engineering, Department of Radiology, University of Iowa, Iowa City, IA 52242

Awards, Honors and Membership in Honorary Societies:

1996	Young Scientist award, 83rd Indian Science Congress Association, India
2001	Honorable Mention, Scientific Exhibit, "Software Package for Separate Visualization of Arteries and Veins in CE-MRA Images," T Lei, JK Udupa, D Odhner and **PK Saha**, SPIE Medical Imaging (Image Display), San Diego, California.
2002	Honorable Mention, Scientific Exhibit, "Vectorial Scale-Based Fuzzy Connectedness for Segmenting Anatomical Structures in Visible Human Color Data Sets," Y Zhuge, JK Udupa and **PK Saha**, SPIE International Symposium on Medical Imaging (Image Processing), San Diego, California.

Memberships in Professional and Scientific Societies:

Senior Member, Institute of Electrical and Electronic Engineering (IEEE)

Member, American Society for Bone and Mineral Research (ASBMR)

Member, The international society for optics and photonics (SPIE)

Member, The Medical Image Computing and Computer Assisted Intervention Society (MICCAI)

Member, International Association of Pattern Recognition (IAPR)

Member, Governing Body of Indian Unit for Pattern Recognition and Artificial Intelligence

Editorships of Journals

2013-2015	**Managing Editor,** Special Issue on **Skeletonization and its Applications (SkelApp),** Pattern Recognition Letters**,** Elsevier Science Journal
2015-Present	**Associate Editor**, Pattern Recognition Letters**,** Elsevier Science Journal
2010-Present	**Associate Editor**, IEEE Transactions on Biomedical Engineering
2006-2010	**Associate Editor**, Computerized Medical Imaging and Graphics, Elsevier Science Journal
2002-2005	**Associate Editor**, Pattern Recognition, Elsevier Science Journal

Membership/Positions held in Scientific Committees and Meetings

2016	**Chair – Special Sessions,** International Symposium on Biomedical Imaging: From Nano to Macro, Prague, Czech Republic, April 13-16, 2016
2004-Present	**Member of Program Committee**, Image Processing, SPIE International Symposium on Medical Imaging, San Diego, CA

2014 **Member of International Program Committee**, 4th International Conference on Emerging Applications of Information Technology (EAIT), Indian Statistical Institute, Kolkata, India, December 19-21, 2014

2014 **Track Chair: Biomedical Image Analysis**, 22nd International Conference on Pattern Recognition (ICPR), Stockholm, Sweden, August 24-28, 2014

2014 **Tutorial: Digital Topology, Geometry, and Applications**, Speakers: G Borgefors, R Strand, PK Saha, G Sanniti di Baja, 22nd International Conference on Pattern Recognition (ICPR), Stockholm, Sweden, August 24-28, 2014

2014 **Member of Program Committee**, IEEE International Symposium on Biomedical Imaging, China, 2014

2014 **Session Chair**, Shape session (2/17/2014: 10:10 am to 12:10 am), Image Processing Conference, SPIE International Symposium on Medical Imaging, San Diego, CA, February, 2014

2013 **Member of International Program Committee**, 5th International Conference on Pattern Recognition and Machine Intelligence (PReMI), Indian Statistical Institute, Kolkata, India, December 10-14, 2013

2013 **Session Chair**, Segmentation session (2/10/2013: 8:00 am to 9:40 am), Image Processing Conference, SPIE International Symposium on Medical Imaging, San Diego, CA, February, 2013

2012 **Research Grant Reviewer**, Physical Sciences Free Competition, The Netherlands Organization for Scientific Research2012

2012 **Member of Program Committee**, 14th IAPR International Workshops on Structural and Syntactic Pattern Recognition (SSPR 2010), Miyajima-Itsukushima, Hiroshima, 7th-9th November, 2012

2012 **Member of Program Committee**, 2011 IEEE International Conference on Computational Intelligence and Software Engineering (CISE 2012), December 14-16, 2011 Wuhan, China

2011 **Member of Program Committee**, 4th International Conference on Contemporary Computing, 8 to 10 August 2011, Noida, India

2011 **Member of Program Committee**, 7th International Symposium on Multispectral Image Processing and Pattern Recognition, Guilin, China, 4 November - 6 November, 2011

2011 **Member of Program Committee**, 2011 IEEE International Conference on Intelligent Computation and Bio-Medical Instrumentation (ICBMI 2011), December 14-17, 2011 Wuhan, China

2011 **Member of Program Committee**, 23rd SIBGRAPI – Conference on Graphics, Patterns and Images, Brazil

2011 **Member of Program Committee**, The 3rd International Workshop on Machine Learning for Vision-based Motion Analysis (MLvMA-2011), Colorado Springs, CO, USA, June-25-2011, in conjunction with IEEE CVPR 2011

2011 **Session Chair**, Skeletal and Orthopedic Applications, 14th February, SPIE International Symposium on Medical Imaging, Orlando, FL

2010 **Member of Program Committee**, Joint IAPR International Workshops on Structural and Syntactic Pattern Recognition (SSPR 2010), Cesme, Izmir, Turkey, August 18-20, 2010

2009 **Session Chair**, Image Processing Poster Session, SPIE International Symposium on Medical Imaging, San Diego, CA

2009	**Program Committee Member**, 6th International Symposium on Multispectral Image Processing and Pattern Recognition, Yichang, China, 30 October-1 November, 2009
2007	**Review Committee Member**, Information Processing in Medical Imaging, Netherlands, 2007
2007	**Program Committee Member**, 20th Brazilian Symposium on Computer Graphics and Image Processing, October 7-20, 2007, Brazil
2006	**Area chair**, 19th IEEE International Symposium on Computer-Based Medical Systems, Salt Lake City, Utah, June 22-23, 2006.
2006	**Member of the Program Committee**, International Conference on Advances in Pattern Recognition, January 2-4, 2007, Calcutta, India
2006	**Session Chair**, Segmentation III, SPIE International Symposium on Medical Imaging, 14th February, 2006, San Diego, CA
2005	**Session Chair**, Shape and Scale, SPIE International Symposium on Medical Imaging, 17th February, 2005, San Diego, CA
2003	**Member of Program Committee**, 5th International Conference on Advances in Pattern Recognition, December 10-13, 2003, Calcutta, India
2003	**Member of Program Committee**, 11th International Conference on Discrete Geometry for Computer Imagery, 19-21 November, 2003, Naples, Italy
1997-2001	**Coordinator**, Weekly seminars at Medical Image Processing Group, Department of Radiology, University of Pennsylvania
1996-Present	**Regular reviewer**, (1) IEEE Transactions on Medical Imaging, (2) Computer Vision and Image Understanding, (3) Graphical Models and Image Processing, (4) Pattern Recognition, and (5) Pattern Recognition Letters, (6) Magnetic Resonance in Medicine, (7) IEEE Transactions on Image Processing, (8) Academic Radiology

Departmental Administrative/Academic Services:

1) **2010-2011: Member**, Graduate committee, ECE Department
2) **2009-2010: Member**, Undergraduate committee, ECE Department
3) **2009: Reviewer**, CoE Research Openhouse posters, University of Iowa
4) **2008-2009: Faculty Secretary**, ECE Department

PhD and MS Thesis Review Committee

(1) Subhadip Basu, PhD, Jadavput University, Kolkata, India, 2006
(2) Jiamin Liu, PhD, University of Pennsylvania, Philadelphia, PA, 19104, 2006
(3) X. Sherry Liu, PhD, University of Columbia, New York City, NY 10027, 2007
(4) X. Henry Zhang, PhD, University of Columbia, New York City, NY 10027, 2009
(5) Xu Ziyue, MS, University of Iowa, Iowa City, IA 52242, 2009 (Chair)
(6) Yinxia Liu, MS, University of Iowa, Iowa City, IA 52242, 2009 (Chair)
(7) Jared J Snell, MS, University of Iowa, Iowa City, IA 52242, 2010
(8) David Welch, MS, University of Iowa, Iowa City, IA 52242, 2010
(9) Yin Yin, PhD, University of Iowa, Iowa City, IA 52242, 2010
(10) Magnus Gedda, PhD, Uppsala University, Uppsala, Sweden, 2010

(11) Zhiyun Gao, PhD, University of Iowa, Iowa City, IA 52242, 2010 (Chair)
(12) Swetha S. R. Thakur, PhD, Jadavpur University, Kolkata, India, 2010
(13) Austin J Ramme, PhD, University of Iowa, Iowa City, IA 52242, 2011
(14) Kaustubh Patwardhan, MS, University of Iowa, Iowa City, IA 52242, 2011
(15) Dakshina Ranjan Kisku, PhD, Jadavpur University, Kolkata, India, 2011
(16) Qi Song, PhD, University of Iowa, Iowa City, IA 52242, 2011
(17) Gaurav V Sharda, MS, University of Iowa, Iowa City, IA 52242, 2011 (Chair)
(18) Xu Ziyue, PhD, University of Iowa, Iowa City, IA 52242, 2012 (Chair)
(19) B. Rajesh Kanna, PhD, SASTRA University, Thanjavur, India, 2012
(20) Samantha K N Dilger, MS, University of Iowa, Iowa City, IA 52242, 2013
(21) Cheng Li, MS, University of Iowa, Iowa City, IA 52242, 2013 (Chair)
(22) Yinxiao Liu, PhD, University of Iowa, Iowa City, IA 52242, 2013 (Chair)
(23) Kyle Taylor, PhD, University of Iowa, Iowa City, IA 52242, (in process)
(24) Ayatullah Faruk Mollah, PhD, Jadavpur University, Kolkata, India, 2013
(25) Satadal Saha, PhD, Jadavpur University, Kolkata, India, 2014
(26) Mrinal Kanti Bhowmik, PhD, Jadavpur University, Kolkata, India, 2014
(27) Kyle Taylor, PhD, University of Iowa, Iowa City, IA 52242, 2014

Teaching History:

Classroom teaching

Year 2015

057:017 Fall'14 Computers in Engineering

Year 2014

057:017 Spring'14 Computers in Engineering
057:017 Fall'14 Computers in Engineering

Year 2013

057:017 Spring'13 Computers in Engineering
Summer'13: Physics Review Course for Radiology Residents (three lectures)

Year 2012

055:098 Summer'12 Individual Investigations Electrical Engineering

Year 2011

055:145 Fall'11 Pattern Recognition
055:248 Spring'11 Advanced Digital Image Processing
055:198 Fall'11 Individual Investigations Electrical Engineering

Year 2010

057:017 Spring'10 Computers in Engineering

Year 2009

055:145 Fall'09 Pattern Recognition

Summer'09 Three lectures for Radiology Residents on CT Physics

055:046 Spring'09 Digital Signal Processing

055:191 Spring'09 Graduate Seminar Elect & Computer Eng

Year 2008

Summer'08 Three lectures for Radiology Residents on CT Physics

055:046 Spring'08 Digital Signal Processing

Year 2007

Summer'07 Three lectures for Radiology Residents on CT Physics

055:248 Spring'07 Advanced Digital Image Processing

M.S. thesis supervised

(1) **Ziyue Xu**, "Recent improvements in tensor scale computation and new applications to medical image registration and interpolation" M.S. Thesis. May, 2009.

(2) **Yinxiao Liu**, "A new method of threshold and gradient optimization using class uncertainty theory and its quantitative analysis", M.S. Thesis. May, 2009.

(3) **Gaurav Vinodkumar Sharda**, "Cerebral aneurysm morphometrics from 2D biplane angiograms", M.S. Thesis, Nov, 2011.

(4) **Cheng Li**, "A new algorithm for cortical bone segmentation with its validation and applications to in vivo imaging", M.S. Thesis. May, 2012.

(5) **Cheng Chen**, "Finite element modeling of trabecular bone from multi-row detector CT imaging", M.S. Thesis. Dec, 2014.

Ph.D. thesis supervised

1) **Yinxiao Liu**, "New algorithms for *in vivo* characterization of human trabecular bone: development, validation, and applications" Ph.D. thesis defense on June 15th 2013.

2) **Ziyue Xu**, "An analytic approach to tensor scale with efficient computational solution and applications to medical imaging" Ph.D. thesis successfully defended on May 17th 2012.

3) **Zhiyun Gao**, "Novel multi-scale topo-morphologic approaches to pulmonary medical image processing", Ph.D. thesis successfully defended on November 10th 2010.

4) **Yan Xu**, "Research on computer-aided clinical applications of coronary artery based on X-ray and CTA images, International visiting PhD scholar during 2007-2008, completed her PhD degree from the Tsinghua University, China in 2009, my role: associate supervisor.

Ongoing students/scholars

MS and PhD students:

(1) **Mr. Dakai Jin (PhD)**
Joined in Fall'11

(2) **Mr. Cheng Chen (MS+PhD)**
Joined in Fall'11

(3) **Mr. Xiaoliu Zhang (MS+PhD)**
Joined in Fall'15

(4) **Mr. Syed Ahmed Nadeem (MS+PhD)**
Joined in Fall'15

Post-doctoral fellows:

(1) **Dr. Zhiyun Gao, PhD**
Joined in November 2010

(2) **Dr. Ryan E Amelon, PhD**
Joined in August 2012

Past Students and scholars

Postdoctoral fellows supervised

(1) Dr. Binquan Wang (2000-2001) Current affiliation: unknown

(2) Dr. Bipul Das (2002-2005) Current affiliation: Leading Research Scientist, GE Global Research Center in Imaging Technology Group, Bangalore, India

(3) Dr. Andre Souza (2005-2006) Current affiliation: Postdoctoral fellow, Department of Radiology, Unversity of Pennsylvania

(4) Dr. Chamith Rajapakse (2006-2006) Current affiliation: Postdoctoral fellow, Department of Radiology, University of Pennsylvania

(5) Dr. Jamuna Kanta Sing (2005: visiting for 5 weeks; 2005-2006: visiting for one year) Current affiliation: Associate Professor, Department of Computer Sc. & Engg., Jadavpur University, Kolkata, India

(6) Dr. Hong Duan, PhD (2008-2009) Current affiliation: Assistant Professor, Xiamen University, China

(7) Dr. Subhadip Basu (2010-2011: visiting for one year) Current affiliation: Assistant Professor, Department of Computer Sc. & Engg., Jadavpur University, Kolkata, India

(8) Dr. Guoyuan Liang (Post-doctoral fellow: 2007-2010, Assistant research engineer: 2011) Current affiliation: Associate Professor, Center for Intelligent and Biomimetic Systems, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences¸1068 Xueyuan Blvd, University Town of Shenzhen, Xili Nanshan, Shenzhen, 518055, China

(9) Dr. Zhiyun Gao (Post-doctoral fellow: 2010-2013) Current affiliation: Software engineer, Niksun Inc, Princeton, New Jersey

(9) Dr. Ryan E Amelon (Post-doctoral fellow: 2012-2013) Current affiliation:

Summer trainee:

(1) Dr. Jake Elkins, MD (Summer MSTP lab rotation for two months during 09/01/07 to 11/01/07)

International students/post-doctoral fellows:

(1) Dr. Jamuna Kanta Sing (2005: visiting for 5 weeks; 2005-2006: visiting for one year; 2007: visiting for 2 months)

(2) Dr. Yan Xu (2007-2008: visiting graduate student for one year)

(3) Dr. Hong Duan (2008-2009: postdoctoral fellow for one year)

(4) Dr. Subhadip Basu (2010-2011: postdoctoral fellow for one year)

Patents and copyrights:

(6) **PK Saha** and M Sonka, "Apparatus and method for computing regional statistical distribution over a mean anatomic space", US patent # 8,189,885, issued on 5-29-2012.

(5) FW Wehrli, **PK Saha**, BR Gomberg, Method for measuring structural thickness from low-resolution digital images, US patent # 7,769,214, issued on 08-03-2010.

(4) **PK Saha** and JK Udupa, "Scale-based image filtering of magnetic resonance data", US patent # 6,885,762, issued on 4-26-2005.

(3) FW Wehrli, **PK Saha**, BR Gomberg, "Digital topological analysis of trabecular bone MR images and prediction of osteoporosis fractures", US patent # 6,975,894, issued on 12-13-2005 (licensed by Enhanced Vision Systems, Ontario, Canada and Micro MRI Inc, Philadelphia, PA).

(2) **PK Saha**, "Virtual bone processing software: versions I & II", copyrighted by the Center for Technology Transfer, University of Pennsylvania (licensed by Micro MRI Inc, Philadelphia, PA).

(1) JK Udupa, T Lei, **PK Saha**, D Odhner, and LG Nyúl, "Artery-vein separation via MRA", copyrighted by the Center for Technology Transfer, University of Pennsylvania.

Lectures by Invitation:

(42) **PK Saha,** "Digital Topology and Geometry in Medical Imaging", University Grants Commission (India Govt.) Course Lecture, Jadavpur University, Kolkata, India, 2nd January, 2014.

(41) **PK Saha,** "Fuzzy Digital Topology and Geometry and Their Applications to Medical Imaging", Indian Statistical Institute, Kolkata, India, 14th December, 2013.

(40) **PK Saha,** "Digital Topology, Geometry and Their applications", Jadavpur University, Kolkata, India, 9th December, 2013.

(39) **PK Saha,** "Fuzzy Digital Topology and Geometry and their Applications to Medical Imaging", at Centre for Interdisciplinary Mathematics, Uppsala University, Uppsala, 1st October, 2013.

(38) **PK Saha,** "Fuzzy Digital Topology and Geometry in Medical Imaging – Skeletonization and Other Approaches", Centre for Image Analysis, Uppsala University, Uppsala, 9th September, 2013.

(37) **PK Saha,** "Multi-Scale Topo-Morphologic Approaches to Biomedical Imaging", Interdisciplinary Centre for Mathematical and Computational Modelling, University of Warsaw, Poland, 12th August, 2013.

(36) **PK Saha,** "Local morphometric scale – a new perspective and its applications to medical imaging", Beihang University, Beijing, China, 2nd July, 2012.

(35) **PK Saha,** "Advanced technologies for quantitative bone quality assessment and their applications", The 121st Academic Seminar on Integration Science and Technology, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences¸ Shenzhen, China, 28nd June, 2012.

(34) **PK Saha,** "Advanced technologies for quantitative bone quality assessment and their applications", Beihang University, Beijing, China, 22nd June, 2012.

(33) **PK Saha,** "Multi-scale topo-morphologic approaches to medical imaging", Indian Statistical Institute, Kolkata, India, 6th January, 2012.

(32) **PK Saha,** "Multi-scale topo-morphometric approaches to biomedical imaging", Iowa Institute of Biomedical Imaging, The University of Iowa, Iowa City, IA, 3rd November, 2011.

(31) **PK Saha**, "Multi-scale topomorphologic opening: a novel approach to separate conjoined structures," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, May 27, 2011.

(30) **PK Saha,** "Multi-scale topo-morphologic approaches and their applications to medical imaging", Centre for Image Analysis, Uppsala University, Uppsala, Sweden, 21st May, 2010.

(29) **PK Saha,** "Topo-morphologic separation of fused iso-intensity objects via multi-scale opening: separating arteries and veins in 3-d pulmonary CT", Graduate Seminar, Department of Electrical & Computer Engineering, Department of Electrical and Computer Engineering, The University of Iowa, Iowa City, IA, 11th March, 2010.

(28) **PK Saha,** "Volumetrc topological analysis: a new approach to assess quantitative trabecular bone quality at *in vivo* resolution", Laboratory for Structural NMR Imaging, University of Pennsylvania, 10th August, 2009.

(27) **PK Saha,** "The theory of object class uncertainty and its applications to image segmentation", Graduate Seminar, Department of Electrical & Computer Engineering, Department of Electrical and Computer Engineering, The University of Iowa, Iowa City, IA, 11th November, 2006.

(26) **PK Saha**, "Advanced methods for assessment of trabecular bone quality," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, May 8, 2006.

(25) **PK Saha,** "New methods for image-based assessment of trabecular bone quality", Department of Electrical & Computer Engineering, Texas Tech University, Lubbock, TX, 6th February, 2006.

(24) **PK Saha**, "Theory of object class uncertainty and its application to image segmentation" Department of Mathematics and Computer Science, Saint Joseph's University, 11th October, 2005.

(23) **PK Saha**, "Tensor scale: a local morphometric parameter with applications to image processing", *IEEE Gold Affinity Group*, Jadavpur University, Calcutta, India, September 12, 2005.

(22) **PK Saha**, "Theory of object class uncertainty and its application to image segmentation," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, April 18, 2005.

(21) **PK Saha**, "Predicting mechanical competence of trabecular bone using 3d tensor-scale based parameters", MMRRCC, University of Pennsylvania, B1 Stellar Chance Labs, 422 Curie Blvd, Philadelphia, PA 19104, 15th April, 2005.

(20) **PK Saha**, "Medical image segmentation using object class uncertainty theory", ECSU, Indian Statistical Institute, Calcutta, India, September 4th, 2004.

(19) **PK Saha**, "Theory of object class uncertainty and its application to image segmentation", GOLD Affinity Group of IEEE, Jadavpur University, Calcutta, India, August 10, 2004.

(18) **PK Saha**, "Class uncertainty induced snake for carotid plaque segmentation", Laboratory for Structural NMR Imaging, Department of Radiology, University of Pennsylvania, Philadelphia, PA, July, 2004.

(17) **PK Saha**, "New approaches for image-based assessment of bone architecture", Merck & Co., Inc., 770 Sumneytown Pike, West Point, PA 19486, 16th June, 2004.

(16) **PK Saha**, "Tensor scale-based diffusive filtering of medical images," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, April 5, 2004.

(15) **PK Saha**, "Theory of object class uncertainty and its application to image segmentation", Section of Biomedical Image Analysis, University of Pennsylvania, University Science Center, 3600 Market Street, Philadelphia, 7th April, 2004.

(14) **PK Saha**, "Recent developments on tensor scale-based medical image analyses", Laboratory for Structural NMR Imaging, Department of Radiology, University of Pennsylvania, Philadelphia, PA, March, 2004.

(13) **PK Saha**, "New approaches to quantify the morphology of trabecular networks", Department of Biomedical Engineering, Columbia University, New York, NY, September 5th, 2003.

(12) **PK Saha**, "Recent developments on tensor scale-based medical image analyses", Laboratory for Structural NMR Imaging, Department of Radiology, University of Pennsylvania, Philadelphia, PA, March, 2003.

(11) **PK Saha**, "Tensor scale: theory, algorithms, and applications of a novel local morphometric parameter," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, March 3, 2003.

(10) **PK Saha**, "Three-dimensional digital topology and its application to evaluate structural disordering of human trabecular bone via *in vivo* MR images and its implications to osteoporosis," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, October 7, 2002.

(9) **PK Saha**, "Digital topological analysis of trabecular bone micro-MR images"Workshop on Digital Topology, City College of CUNY and the Graduate Center of CUNY, New York, NY, USA, organizers: GT Herman, Graduate Center, CUNY, R Kopperman, City College, CUNY, March 22-23, 2002.

(8) **PK Saha**, "Strong normality of digital grids in *N* dimensions," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, September 17, 2001.

(7) **PK Saha**, "Bone free renditions of cerebral aneurysms via 3d computed tomographic angiography," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, January 29, 2001.

(6) **PK Saha**, "Optimum threshold selection using an uncertainty-homogeneity based model," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, November 13, 2000.

(5) **PK Saha**, "Optimum thresholding using class uncertainty and region inhomogeneity," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, April 17, 2000.

(4) **PK Saha**, "Scale-based image filtering approaches preserving boundary sharpness and fine structures," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, October 18, 1999.

(3) **PK Saha**, "Near automatic segmentation and quantification of mammographic glandular tissue density," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, October 19, 1998.

(2) **PK Saha**, "A scale based formulation of affinity relation for fuzzy connected object definition," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, April 13, 1998.

(1) **PK Saha**, "Three dimensional digital topology and its applications to image processing," Medical Image Processing Group, Department of Radiology, University of Pennsylvania, Philadelphia, PA 19104, October 20, 1997.

Tutorials and Workshops:

(1) G Borgefors, R Strand, **PK Saha**, G Sanniti di Baja, "Digital Topology, Geometry, and Applications" *22nd International Conference on Pattern Recognition (ICPR)*, Stockholm, Sweden, August 24-28, 2014

Keynote/Plenary Presentations:

(1) **PK Saha,** "Novel Theories and Algorithms of Multi-Scale Quantitative Topo-Morphometry and Their Applications to Biomedical Imaging" International Conference on Computational Intelligence and Software Engineering, December 9-11, 2011, Wuhan, China

(2) **PK Saha,** "Novel Approaches to Multi-Scale Quantitative Topo-Morphometry and Their Applications to Biomedical Imaging", IEEE International conference on Intelligent Computation and Bio-Medical Instrumentation, December 14-17, 2011, Wuhan, China.

(3) **PK Saha,** "Quantitative approaches to multi-scale shape, topology and geometry: Theory, algorithms and applications to medical imaging" International Conference on Recent Trends in Information Systems, December 21-23, 2011, Kolkata, India

Bibliography (no overlap among different categories):

Saha has co-authored 95 papers in highly reputed international journals and 150 conference papers/abstract among which 47 journal papers were published since his joining to the University of Iowa in 2006. His research works are widely internationally known and highly cited; current H-indices of his journal publication, only, are 31 (as per the web-of-knowledge) and 41 (as per the Google Scholar). Also, he has co-invented six US patents.

BOOKS:

(1) **PK Saha**, U Maulik, S Basu: Advanced Computational Approaches to Biomedical Engineering, Springer, February 5, 2014.

PEER REVIEWED JOURNAL ARTICLES:

In Press:

(95) J Guo, C Wang, K-S Chan, D Jin, **PK Saha**, JP Sieren, RG Barr, MLK Han, E Kazerooni, CB Cooper, D Couper, JD Newell Jr, EA Hoffman, "Improved scanner surveillance in a multi-center longitudinal lung study by limiting test-object-based sources of variability. The SubPopulations and InteRmediate Outcome Measures in COPD Study (SPIROMICS)", Medical Physics, accepted under revision.

(94) KS Iyer, JD Newell-Jr, D Jin, MK Fuld, **PK Saha**, S Hansdottir, EA Hoffman, "Quantitative dual energy computed tomography supports a vascular etiology of smoking induced inflammatory lung disease" *American Journal of Respiratory and Critical Care Medicine*, in press.

(93) S Dudley-Javoroski, MA Petrie, CL McHenry, RE Amelon, **PK Saha**, RK Shields, "Bone architecture adaptations after spinal cord injury: impact of long-term vibration of a constrained lower limb", *Osteoporosis International*, in press.

(92) **PK Saha**, S Basu, E Hoffman, "Multi-scale opening of conjoined fuzzy objects: theory and applications", *IEEE Transactions of Fuzzy Systems*, in press.

(91) D Jin, KS Iyer, C Chen, EA Hoffman, **PK Saha**, "A Robust and Efficient Curve Skeletonization Algorithm for Tree-Like Objects Using Minimum Cost Paths", *Pattern Recognition Letters*, in press.

(90) **PK Saha**, G Borgefors, G Sanniti di Baja, "A survey on skeletonization algorithms and their applications", *Pattern Recognition Letters*, in press.

Year 2015:

(89) A Hotca, CS Rajapakse, C Cheng, S Honig, K Egol, RR Regatte, **PK Saha**, G Chang, "In vivo measurement reproducibility of femoral neck microarchitectural parameters derived from 3T MR images", *Journal of Magnetic Resonance Imaging*, **42**(5), 1339-1345, 2015.

(88) **PK Saha**, R Strand, G Borgefors, "Digital topology and geometry in medical imaging: a survey", *IEEE Transactions on Medical Imaging*, **34**(9), 1940-1964, 2015 (invited paper).

(87) **PK Saha**, Y Liu, C Chen, D Jin, EM Letuchy, Z Xu, RE Amelon, TL Burns, JC Torner, SM Levy, CA Calarge, "Characterization of trabecular bone plate-rod micro-architecture using multi-row detector CT and the tensor scale: algorithms, validation, and applications to pilot human studies", *Medical Physics*, **42**(9), 5410-5425, 2015.

(86) C Li, D Jin, C Chen, EM Letuchy, KF Janz, TL Burns JC Torner, SM Levy, **PK Saha**, "Automated cortical bone segmentation for multirow-detector CT imaging with validation and application to human studies", *Medical Physics*, **42**(8), 4553-4565, 2015.

(85) N Das, R Sarkar, S Basu, **PK Saha**, M Kundu, M Nasipuri, "Handwritten Bangla character recognition using a soft computing paradigm embedded in two pass approach", *Pattern recognition*, **48**(6), 2054-2071, 2015.

(84) G Chang, D Xia, C Chen, G Madelin, SB Abramson, JS Babb, **PK Saha**, RR Regatte, "7T MRI detects deterioration in subchondral bone microarchitecture in subjects with mild knee osteoarthritis as compared with healthy controls", *Journal of Magnetic Resonance Imaging*, **41**(5), 1311-1317, 2015.

Year 2014:

(83) SK Adhikari, JK Sing , DK Basu, M Nasipuri, **PK Saha**, "A nonparametric method for intensity inhomogeneity correction in MRI brain images by fusion of Gaussian surfaces", *Signal, Image and Video Processing*, **9**(8), 1945-1954, 2014.

(82) S Dudley-Javoroski, RE Amelon, Y Liu, **PK Saha**, RK Shields, "High bone density masks architectural deficiencies in an individual with spinal cord injury", *The Journal of Spinal Cord Medicine*, **37**(3), 349-354, 2014.

(81) KC Ciesielski, R Strand, F Malmberg, **PK Saha**, "Efficient algorithm for finding the exact minimum barrier distance", *Computer Vision and Image Understanding*, **123**, 53-64, 2014.

(80) Y Liu, D Jin, C Li, KF Janz, TL Burns JC Torner, SM Levy, **PK Saha**, "A robust algorithm for thickness computation at low resolution and its application to in vivo trabecular bone CT imaging", *IEEE Transactions on Biomedical Engineering*, **61**(7), 2057-2069, 2014.

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(2) JK Udupa, **PK Saha,** "Fuzzy connectedness", in Insight into Images Principles and Practice for Segmentation, Registration, and Image Analysis, Terry Yoo (Editor), A K Peters, Ltd, 2004.

(1) BR Gomberg, **PK Saha,** HK Song, SN Hwang, FW Wehrli, "Three-dimensional Digital Topological Analysis of Trabecular Bone," in Noninvasive Assessment of Trabecular Bone Architecture and the Competence of Bone (Advances In Experimental Medicine and Biology) Eds. S. Mujumdar and B. K. Bay., Volume 496. New York, Kluwer Academic/Plenum Publishers, 2001.

Grant pages

Active:

(1) Title: Tensor Scale-based Methods for Assessment of Trabecular Bone Quality
Grant Number: NIH R01 AR054439
PI: PK Saha
Duration: 04/01/2009 – 03/31/2013
Efforts: 3.6 months/calendar year
Total project cost: $1,416K

Summary: This project will develop an advanced technology for trabecular bone (TB) quality assessment via in vivo imaging using tensor scale which will enable early detection of TB micro-architectural changes in response to treatment or bone disease including osteoporosis. The technology proposed in the project will be helpful to diagnose osteoporotic patients at early stage of the disease and routinely monitor their disease status or effects of therapeutic treatments.

(2) Title: Fluoride and Other Factors in Childhood Bone Development – Supplement
Grant Number: NIH 3 R01 DE012101-13S1
PI: SM Levy
My Role: Co-I; CT based quantitative bone quality assessment
Duration: 09/01/2011 – 08/31/2014
Efforts: 2.4 months/calendar year
Total project cost: $1,954K

Summary: Although osteoporosis is generally considered a disease of older adults, there is increased recognition of the importance of adequate bone accrual in childhood, adolescence, and early adulthood for prevention of bone disease later in life. However, many gaps remain in our understanding of how bone develops during childhood/adolescence/early adulthood, including the effects of modifiable and non-modifiable factors. Continued follow-up of the Iowa Bone Development Study cohort to age 19 provides a unique opportunity to assess the relative importance of fluoride and other dietary, physical activity, body composition, and genetic factors on bone development, maturation and bone properties to near peak bone mass. Findings will improve our understanding of the best strategies to optimize skeletal health and prevent future bone disease.

(3) Title: Cartilage, Bone and Marrow Interactions in Knee OA
Grant Number: NIH R01 AR056260
Overall PI: R. Regatte, New York University, New York
Subcontract PI: PK Saha
Duration: 07/01/2010 – 06/30/2015
Efforts: 1.8 months/calendar year
Total project cost: $398K

Summary: The major goal of this project is to develop advanced image-processing and visualization technologies employing fuzzy distance transform (FDT), digital topological analysis (DTA) and tensor analysis suitable for trabecular bone micro-structural analyses via in vivo MR imaging.

(4) Title: Mechanical Stress and Skeletal Plasticity after Spinal Cord Injury in Humans
Grant Number: NIH R01 HD062507
PI: R. K. Shields, Physical therapy and rehab science
My Role: Co-I; analysis of bone using CT imaging

Duration: 07/24/2010-05/31/2015
Efforts: 0.6 months/calendar year
Annual direct cost under my supervision: ~$60K

Summary: Goal is to improve bone architecture and density in people with spinal cord injury

(5) Title: Multi-center Structural & Functional Quantitative CT Pulmonary Phenotyping
Grant Number: NIH 1 R01 HL112986-01
(Bioengineering Research Partnership grant)
PI: Eric Hoffman
My Role: PI of the image processing core
Duration: 08/01/2012-5/31/2016
Efforts: 1.8 months/calendar year
Annual direct cost under my supervision: ~$100K

Summary: This proposed bioengineering research partnership seeks to take advantage of the emerging acquisition technique of multi-spectral computed tomography (currently dual energy CT: DECT), careful evaluation of dose lowering methods, and novel approaches to statistical cluster analysis to expand the biomarkers used in multi-center studies to identify sub-populations of lung disease.

Pending:

(1) Title: Quantitative Bone Micro-Architecture: Characterization In Young Adults
Grant Number: NIH 1 R21 AR062894-01
Status: Resubmitted
PI: PK Saha
Duration: 4/01/2013-03/31/2015
Efforts: 1.2 months/calendar year
Total project direct cost:$275K

Summary: The major goals of this project are to evaluate a new multi-detector based technology to quantitatively assess trabecular bone micro-architecture in vivo and to fully understand its potential and limitations in a human study to facilitate designing and executing future large scale clinical trials, fulfilling our long-term goal of understanding trabecular bone micro-architectural alterations due to different clinical conditions, interventional or preventive procedures and their relationships to fracture risk.

(2) Title: An integrative statistics-guided image-based multi-scale lung model
Grant Number: NIH 1U01HL 114494-01
Status: Scored; not awarded; planning for resubmission
PI: Chin-Long Lin
My Role: Co-I
Duration: 08/01/12-07/31/17
Efforts: 1.8 months/calendar year
Annual direct cost under my supervision: ~$60K

Summary: Dr. Saha will oversee the research involving vessel tree segmentation, quantification, and analysis. Dr. Saha been working on basic and translational research related to segmentation, quantitative structural analysis, and statistical modeling in various medical applications including pulmonary and bone imaging. He has taken the leading role in developments of several new technologies including digital topological analysis, fuzzy distance approach, tensor scale, multi-scale morphological opening, class uncertainty theory, which have been being used by multiple research institutes and have been successfully applied to various research and clinical studies. His valuable knowledge and expertise with wide range medical image analytic methods and applications especially with regards to multi-scale topological and geometric approaches to vascular image analysis.

(3) Title: Novel Imaging Biomarkers of Acute Joint Injury and Early PTOA
Grant Number: NIH 1 R01 AR063682-01
Overall PI: G. Chang, New York University, New York
Status: Scored; not awarded; planning for resubmission.
Subcontract PI: PK Saha
Duration: 4/01/2013-05/31/2018
Efforts: 2.4 months/calendar year
Total project cost: $51K

Summary: To develop new imaging biomarkers for acute joint injury and early PTOA.

Completed:

(1) Title: Treatment effects on quantitative in vivo trabecular bone micro-architectural measures in young adults
Grant Number: ICTS/CTSA pilot grant # 1557
PI: PK Saha
Duration: 6/1/2011 – 5/31/2012
Efforts: no faculty support allowed
Total project (direct) cost: $50K
Summary: Overall aim of this project is to conduct MDCT-based 3-D volumetric BMD and TB micro-architectural assessments, and obtain conventional DXA-based areal BMD measurements (hip, lumbar spine, and whole body), along with pQCT-based volumetric BMD at the 4% distal tibia sit in four groups of young adults (age: 18-21 years) with anticipated differences in bone mineralization

(2) Title: Micro-mechanical Modeling of Trabecular Bone
Grant Number: NIH 1 R01 AR051376
Overall PI: X. E. Guo, Columbia University, New York
Subcontract PI: PK Saha
Duration: 7/1/2006 – 6/30/2011
Efforts: 2.4 months/calendar year
Total project cost: $422K
Summary: To develop a new, efficient, micro-structural finite-element modeling techniques

(3) Title: Quantification of Osteophytes in a Rabbit Model of Osteoarthritis
Grant Number:
PI: PK Saha
Duration: 4/9/2007-4/9/2008
Efforts: 0.12 months/calendar year
Total project cost: $30K
Funding agent: Merck & Co., Inc.
Summary: The major goals of this project are to develop, validate, and apply new image processing and analysis tools for quantifying volume and thickness of osteophytes formed on the cortical surface of the distal rabbit femur and to assess the induced architectural modifications caused by altered stress, derived from regional structure analysis of subcortical trabecular bone.

(4) Title: Quantification of Osteophytes in a Rabbit Model of Osteoarthritis
Grant Number: LKR25567
PI: PK Saha
Duration: 4/13/2005-2/17/2007
Efforts: 0.6 months/calendar year
Total project cost: $76K
Funding agent: Merck & Co., Inc.
Summary: The major goals of this project are to develop, validate, and apply new image processing and analysis tools for quantifying volume and thickness of osteophytes formed on the cortical surface of the distal rabbit femur and to assess the induced architectural modifications caused by altered stress, derived from regional structure analysis of subcortical trabecular bone.

(5) Title: Image and Model-Based Analysis of Lung Diseases
Grant Number: • R01 HL64368
PI: E. Hoffman
Role: Co-I, participating in image analysis efforts

Duration: 9/1/2005 - 8/31/2010
Efforts: 0.36 months/calendar year
Total project cost under my supervision: $111K

Summary: The main goal is to study normal pulmonary physiology and develop a suite of image analysis tools for a complete quantitative analysis of human lungs from MDCT and MR.