Dr. Kausik Basak

Biography

My research domain focuses on imaging of human and animal organs in superficial and deep-tissue at visible and near infra-red regime, aiming to non-invasive, *in vivo* and label-free assessment of various anatomical and functional parameters in health and pathology. It encompasses various imaging modalities like laser speckle imaging, multispectral imaging, optoacoustic imaging etc. to articulate characteristic response of tissue-photon interaction using computational algorithms. During the tenure of my research, I worked on developing imaging modalities through electro-optical system designs, enabling the imaging of organs and deep-tissues with centimetre to micron resolutions. It also combines a great deal in signal and image processing with significant thrust in de-noising, image reconstruction, segmentation, clustering and machine learning. With progressive applications of scientific deductions and engineering algorithms, it comes to my deep interest to implement and manifest resident knowledge to innovate newer technological solutions for various biomedical applications.

I have gained my experience in optoacoustic imaging while working as a postdoctoral fellow at TU Munich (2018 – 2019). Prior to this, I worked as an Assistant Professor at Mahindra Ecole Centrale, Hyderabad, India in the department of electrical and electronics engineering during 2014 – 2018. Further, I have also worked as a visiting professor for two months at CentraleSupelec, Paris. On a special note, I am also one of the founder directors of SkinCurate Research Private Limited (India), a start-up organization focuses on developing technologies towards providing efficient diagnostics for skin pathologies.

Research Areas

Medical imaging: Laser speckle contrast imaging, optoacoustic imaging, optical coherence tomography, multispectral imaging.

Image processing and computer vision: Spatiotemporal and adaptive filtering, transform domain processing, multiresolution analysis, image segmentation and morphological processing, image registration, object localization, object tracking – optical flow.

Machine learning: Supervised and unsupervised classifications, probabilistic graphical models, clustering, estimation techniques, neural networks.

Education

Ph.D., Laser Speckle Contrast Imaging and Biomedical Applications
Indian Institute of Technology Kharagpur, WB, India — *2010 – 2015*

M. Tech, Medical Imaging and Image Analysis
Indian Institute of Technology Kharagpur, WB, India — *2008 – 2010*
CGPA – 9.13/10

B. Tech, Electronics and Instrumentation Engineering
West Bengal University of Technology, WB, India — *2004 – 2008*
CGPA – 9.0/10

Professional Experiences

Postdoctoral Research Consultant — *March 2019 – May 2019*
Dept. of Electrical Engineering, IIT Kharagpur, India

Postdoctoral Fellow, Multiscale Functional and Molecular Imaging Group, *TUM School of Medicine, Germany* — *March 2018 – Feb 2019*

Assistant Professor, Electronics and Electrical Engg. Dept. — *Nov 2015 – Jan 2018*
Mahindra Ecole Centrale, Hyderabad, India

Visiting Professor, Center for Visual Computing, — *June 01 – July 31, 2017*
CentraleSupelec Paris, France

Visiting Researcher, Multiscale Functional and Molecular Imaging Group, *TUM School of Medicine, Germany* — *March 20 – 24, 2017*

Academic Associate, Electronics and Electrical Engg. Dept. — *July 2014 – Oct 2015*
Mahindra Ecole Centrale, Hyderabad, India

Founder and Director (Operation) — *Feb 2014 – Present*
SkinCurate Research Private Limited, Kharagpur, India

Awards and Achievements

- TUM University Foundation Fellowship (Mar 2018 – Feb 2019), TUM Germany.
- Visiting Professor Program (June – July 2017), CentraleSupelec Paris, France.
- Postdoc Mobility Grant (March 2017), TUM Germany.
- Dean's Travel Grant (April 2014), IIT Kharagpur, India.
- Winner of GE Edison Challenge 2013 (December 2013), GE India.
- MHRD Doctoral Scholarship (July 2010 – June 2014), MHRD, Govt. of India.
- MHRD Post-graduate Scholarship (July 2008 – May 2010), MHRD, Govt. of India.
- University medal for 3rd position in EIE (August 2008), WBUT, India.
- All India Rank 59 (percentile 98.51) in GATE – 2008, India.

Patent

- Sheet D, Basak K, Ojha T, Karri SPK. *Multispectral optical imaging device and computational techniques for contactless functional imaging*. Indian Patent No. 201731022695 dt. 28 June 2017, PCT App. No. PCT/IN2018/050418 dt. 26 June 2018.

Book

- Basak K, Dutta PK, Mahadevappa M. *In vivo speckle imaging of microvasculature and tissue perfusion*, Lambert Academic Publishing, Germany, 2016.

Journals

- Basak K, Deán-Ben XL, Gottschalk S, Reiss M, Razanksy D. Non-invasive determination of murine placental and fetal functional parameters with multispectral optoacoustic tomography. (Under review in Nature: Light Science and Application)
- Basak K, Dey G, Mahadevappa M, Mandal M, Sheet D, Dutta PK. Learning of speckle statistics for *in vivo* and noninvasive characterization of cutaneous wound regions using laser speckle contrast imaging. *Microvas. Res.* 2016; 107: 6-16. [IF: 2.465]
- Basak K, Dey G, Mahadevappa M, Mandal M, Dutta PK. *In vivo* Laser speckle imaging by adaptive contrast computation for microvasculature assessment. *Opt. and Lasers in Engg.* 2014; 62: 87–94. [IF: 3.388]
- Basak K, Mahadevappa M, Dutta PK. Review of Laser Speckle-based analysis in Medical Imaging. *Med. Bio. Engg. Comp.* 2012; 50(6): 547-558. [IF: 1.971]
- Basak K, Mahadevappa M, Dutta PK. Pyramidal Refinement of Lucas – Kanade Optical Flow based Tracking of Peripheral Air Embolism in OCT Contrast Imaging. *Int. Jr. Com. App.* 2012; 52(12): 7-12. [IF: 0.702]
- Mandal S, Basak K, Mahadevappa M, Chatterjee J, Ray AK. Development of a Cardiac Pre-Screening Device for Rural Population in Emerging Economies using Ultra-Low Power Embedded System. *IEEE Trans. Biomed. Engg*. 2011; 58(3): 745-749. [IF: 4.288]

Conferences

- Basak K, Dey G, Sheet D, Mahadevappa M, Mandal M, Dutta PK. Probabilistic graphical modeling of speckle statistics in laser speckle contrast imaging for noninvasive and label-free retinal angiography. *Proc. Int. Conf. IEEE Engg. Med. Bio. Soc. (EMBC)*, 2015.
- Basak K, Sheet D, Karri SPK, Mahadevappa M, Chatterjee J, Dutta PK. Learning of Tissue Photon Interaction in Laser Speckle Contrast Imaging for Label-free Retinal Angiography. *Int. Symp. Biomed. Img. (ISBI)*, 2014.
- Basak K, Mahadevappa M, Dutta PK. Multiscale Noise-Adaptive Homomorphic Filtering based Speckle Denoising in Laser Speckle Imaging. *Proc. Nat. Conf. Comp. Vis. Patt. Recog. Img. Proces. Graph. (NCVPRIPG)*, 2013.
- Basak K, Patra R, Mahadevappa M, Dutta PK. Automated Detection of Air Embolism in OCT Contrast Imaging: Anisotropic Diffusion and Active Contour based Approach. *Proc. Int. Conf. Emerg. App. Inf. Tech. (EAIT)*, 2012.
- Mandal S, Martis RJ, Acharya UR, Basak K, Chakraborty C, Mandana KM, Ray AK. A Framework for Early Automated Diagnosis of Coronary Artery Disease using Data Fusion of Electrocardiogram and Phonocardiogram Signals. *Proc. IEEE EMBS Spl. Topic Conf. Point-of-Care Healthcare Tech*. *(PoCHT)*, 2012.
- Basak K, Mandal S, Mahadevappa M, Chatterjee J, Ray AK. A Comparative Study of Phonocardiogram Analysis Techniques based on Mixed Signal Processor. *Proc. INDICON*, 2010.
- Basak K, Mandal S, Mahadevappa M, Chatterjee J, Ray AK. Phonocardiogram Signal Analysis using Adaptive Line Enhancer Methods on Mixed Signal Processor. *Proc. Int. Conf. Sig. Proces. Comm. (SPCOM)*, 2010.
- Mandal S, Basak K, Mahadevappa M, Chatterjee J, Ray AK. A Wavelet Based Approach to Heart Sound De-noising and Segmentation. *Proc. Int. Conf. Elect. Desig. Sig. Proces. (ICEDSP)*, 2009.

- Patra R, Basak K, Chakraborty C. CADLID: Pattern Classification Approach to Computer Aided Diagnosis of Liver Disease. *Proc. Innov. Conf. Emb. Sys. Mob. Comm. Comp.* 2010.
- Basak K, Mondal S, Hajzra S, Das A, Bera MK. Rapid Software Prototyping and Verification of Railway Interlocking System using State chart. *Proc. Nat. Conf. Emerg. Tech. Tech. Edu. (ET & TE)*, 2008.

Article

- Kausik Basak, Debmitra Ghosh. Imaging of Microvasculature in Optical Territory. Elsevier. 2015.

Research Talks and Seminars

- Optics and Optoacoustic in Biomedical Applications --- Institute of Biological and Medical Imaging, Helmholtz Zentrum, Munich, Germany. September 2018.
- Tissue-optical response: An evolution in photonics imaging --- Institute of Medical Engineering, Otto-von-Guericke-Universität Magdeburg, Germany. May 2018.
- Speckle imaging paradigm: From microcirculation to functional characterization --- TUM Institute of Biological and Medical Imaging, Helmholtz Zentrum, Germany. March 2018.
- Characterization of cutaneous tissues in health and pathology: A non-invasive, real-time and non-contact approach using speckle imaging --- Centre for Visual Computing, CentraleSupelec Paris, France. July 2017.
- Laser speckle imaging and its applications in biomedical field --- Centre for Visual Computing, CentraleSupelec Paris, France. June 2017.
- Speckles: Is it information or noise? --- Centre for Visual Computing, CentraleSupelec Paris, France. June 2017.
- Microcirculation imaging in optical regime. --- TUM Institute of Biological and Medical Imaging, Helmholtz Zentrum, Germany. March 2017.