Global Initiative of Academic Networks (GIAN)

A Two-week Course On

**Medical Informatics, Radiomics, and
Image Analysis for Computer-aided Diagnosis**

17 FEB 2025 – 28 FEB 2025

**Department of Electronics and Communication Engineering
National Institute of Technology Karnataka, Surathkal**
Srinivasnagar, Surathkal, Mangalore - 575025, INDIA

Course Information	
Course Number	2412136
Duration	10 Days
Foreign Faculty	Prof. Rangaraj Mandayam Rangayyan
Course Coordinators	
Principal Coordinator	Dr. Raghavendra B.S.
Course Coordinator	Dr. A.V. Narasimhadhan
Local GIAN Coordinator	Dr. Bibhuti Bhusan Das
Course Webpage	https://sites.google.com/view/nitkecelecture/home

Course Overview
Systems and techniques for medical informatics and image analysis for computer-aided diagnosis (CAD) are now in routine clinical use for improved and efficient diagnosis of several major diseases, such as breast cancer, lung cancer, retinopathy, and gastrointestinal diseases. Radiomics is a new emerging discipline and field of research for quantitative analysis of medical images and other information for advanced and improved medical diagnosis. This course provides details on the foundations of CAD in terms of the techniques and subject areas that contribute to the design of CAD systems. It is shown how the application of digital signal processing, digital image processing, pattern recognition, machine learning, and computational procedures can enhance biomedical images, segment and characterize parts of interest, identify normal patterns and structures, and detect abnormal features and diseases for CAD. The need for CAD systems, the objectives of CAD in several applications, the benefits of CAD, and methods to evaluate the usefulness of CAD systems are explained. Examples with several medical images are shown to demonstrate the design and development of engineering systems for improved health care. Details are presented on applications such as CAD of subtle and early signs of breast cancer and retinopathy of prematurity.

Course Objectives

- Learn about the nature and characteristics of biomedical images.
- Learn image processing techniques for filtering, noise removal, and enhancement of images.
- Design and implement techniques for detection and segmentation of regions of interest.
- Explore techniques for analysis of shape and texture of regions.
- Investigate feature extraction, pattern classification, and decision techniques for CAD.
- Understand the basics of medical informatics, radiomics, and quantitative analysis of medical images and related information.
- Design, develop, implement, and analyze computer methods for quantitative analysis of biomedical images.

Learning Outcomes

This course will enable attendees to identify appropriate methods and design suitable algorithms for representation, enhancement, detection, segmentation, characterization, and analysis of parts of medical images for CAD.

Course Details	
Course Number and Title	**2412136 Medical Informatics, Radiomics, and Image Analysis for Computer-aided Diagnosis**
Date	17 FEB 2025 TO 28 FEB 2025
Duration	10 Days
Mode	In-Person
Total Lecture Hours	50
Host Institute	NITK Surathkal
Foreign Faculty	Prof. Rangaraj Mandayam Rangayyan
Host Faculty	Dr. Raghavendra B.S. and Dr. A.V. Narasimhadhan
Max Number of Participants	50
Course Webpage	https://sites.google.com/view/nitkecelecture/home
Evaluation and Certificates	Participants will be evaluated through Assignments/Quiz. After satisfactory completion of the course, attendees will get certificates of participation. Attendance is mandatory.
Eligibility	- Students pursuing B.Tech./M.Tech./M.S./M.Sc./Ph.D. degrees in electrical, electronics, biomedical or related branches. - Faculty of science, engineering and technical institutions. - Researchers and executives working in biomedical-domain related-organizations including research laboratories.
Course Registration	Registering the course is a mandatory for all types of participants. **Registration information is provided in the course webpage**
Selection/Shortlisting	Only shortlisted participants will have to pay the registration fee.
Registration Fee	- Participants from abroad: US $200 - Industry/ Research Organizations: Rs. 10,000+GST - Academic Institutions/ Faculty: Rs. 3000+GST - Students/ Research Scholars: Rs. 2000+GST - NITK Students/ Faculty: NIL
Mode of Payment NEFT the Registration Fee	Beneficiary Name: NITK SURATHKAL Bank Name: STATE BANK OF INDIA, NITK Campus C/A No: 37772503911 IFSC Code: SBIN0002273
TA DA/ Accommodation	**No TA, DA will be provided** to the participants. - Participants have to make their **own accommodation** and food arrangements. However, limited shared accommodation may be made available (subject to availability) in the Institute Guest Rooms or Hostels on request on first come first serve basis. - Payment for accommodation and food is extra as per actuals.

Important Dates	
	▪ Start date of registration: 15 NOV 2024
	▪ End date of registration: 15 JAN 2025
	▪ Intimation to the shortlisted: 20 JAN 2025
	▪ Closing date for paying the registration fee: 25 JAN 2025

Course Modules and Tentative Lecture Schedule

Module 1	Introduction to Biomedical Image Representation and Enhancement: (Total Lecture: 10 Hours)
Module 2	Detection and Segmentation of Objects in Biomedical Images: (Total Lecture: 10 Hours)
Module 3	Analysis of Texture and Oriented Patterns in Biomedical Images: (Total Lecture: 10 Hours)
Module 4	Analysis of Shape in Biomedical Images: (Total Lecture: 5 Hours)
Module 5	Detection of Subtle Signs of Breast Cancer: Architectural Distortion in Prior Mammograms: (Total Lecture: 1 Hour)
Module 6	3D Image Processing Techniques for Landmarking and Segmentation of Computed Tomographic Images: (Total Lecture: 3 Hours)
Module 7	Digital Image Processing Techniques for Analysis of Vertebral Compression Fractures in Magnetic Resonance Images: (Total Lecture: 1 Hour)
	Each day there will be lectures/tutorials or lab sessions tutored by the coordinators.

Reference Text

▪ Rangaraj M. Rangayyan, "Biomedical Image Analysis," CRC Press, Boca Raton, FL. 1,306 pages. 2005. ISBN 0-8493-9695-6. www.crcpress.com

Additional Recommended References

▪ R.M. Rangayyan and S. Krishnan, "Biomedical Signal Analysis," Third Edition, IEEE Press and Wiley, New York, NY. 2024. 720 pages. ISBN 978-1-119-82587-6.

▪ P.M. Azevedo-Marques, A. Mencattini, M. Salmeri, R.M. Rangayyan, Editors, "Medical Image Analysis and Informatics: Computer-Aided Diagnosis and Therapy," 2018, CRC Press, Boca Raton, FL. www.crcpress.com

▪ P. Casti, A. Mencattini, M. Salmeri, R. M. Rangayyan, "Computerized Analysis of Mammographic Images for Detection and Characterization of Breast Cancer," Morgan & Claypool, Jun. 2017, 186 pages, www.morganclaypool.com.

Course Faculty

Prof. Rangaraj Mandayam Rangayyan

Rangaraj M. Rangayyan is Professor Emeritus of Electrical and Computer Engineering at the University of Calgary, Calgary, Alberta, Canada. He received the Bachelor of Engineering degree in Electronics and Communication Engineering in 1976 from the University of Mysore at the People's Education Society College of Engineering, Mandya, Karnataka, India, and the Ph.D. in Electrical Engineering from the Indian Institute of Science, Bangalore, Karnataka, India, in 1980. He served the University of Manitoba, Winnipeg, Manitoba, Canada and the University of Calgary in research, academic, and administrative positions from 1981 to 2016. His research interests are in digital signal and image processing, biomedical signal and image analysis, and computer-aided diagnosis.

Dr. Rangayyan has published more than 170 papers in journals and 270 papers in proceedings of conferences. He has supervised or cosupervised 27 Master's theses, 17 Doctoral theses, and more than 50 researchers at various levels. He has been recognized with the 1997 and 2001 Research Excellence Awards of the Department of Electrical and Computer Engineering, the 1997 Research Award of the Faculty of Engineering, appointment as "University Professor" (2003 to 2013) at the University of

Calgary, and an Outstanding Teaching Performance Award of the Schulich School of Engineering (2016). He is the author of two textbooks: "Biomedical Signal Analysis" (IEEE/ Wiley, 2002, and 2nd ed. 2015) and "Biomedical Image Analysis" (CRC, 2005). He has coauthored and coedited several other books, including "Color Image Processing with Biomedical Applications" (SPIE, 2011). He has been recognized with the 2013 IEEE Canada Outstanding Engineer Medal, the IEEE Third Millennium Medal (2000), and elected as Fellow, IEEE (2001); Fellow, Engineering Institute of Canada (2002); Fellow, American Institute for Medical and Biological Engineering (2003); Fellow, SPIE (2003); Fellow, Society for Imaging Informatics in Medicine (2007); Fellow, Canadian Medical and Biological Engineering Society (2007); Fellow, Canadian Academy of Engineering (2009); and Fellow, Royal Society of Canada (2016).

Dr. Rangayyan's research has been featured in many newsletters, magazines, and newspapers, as well as in several radio and television interviews. He has lectured in more than 20 countries and has held Visiting Professorships with the University of Liverpool, Liverpool, UK; Tampere University of Technology, Tampere, Finland; Universitatea Politehnica Bucureşti, Bucharest, Romania; Universidade de São Paulo, São Paulo, Brasil; Universidade Estadual Paulista, Sorocaba, São Paulo, Brasil; Cleveland Clinic Foundation, Cleveland, OH, USA; Indian Institute of Science, Bangalore, Karnataka, India; Indian Institute of Technology, Kharagpur, West Bengal, India; Manipal Institute of Technology, Manipal, Karnataka, India; Amity University, Noida, India; Beijing University of Posts and Telecommunications, Beijing, China; Xiamen University, Xiamen, Fujian, China; Kyushu University, Fukuoka, Japan; University of Rome Tor Vergata, Rome, Italy; and École Nationale Supérieure des Télécommunications de Bretagne, Brest, France. He has been recognized as a Distinguished Lecturer by the IEEE Engineering in Medicine and Biology Society (EMBS), the University of Toronto, and the Hong Kong Institution of Engineers.

Rangaraj M. Rangayyan, PhD, PEng
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Host Faculty

Dr. Raghavendra B.S.

Raghavendra B.S. received his PhD from the Dept of ECE, Indian Institute of Science, Bangalore, MTech from ECE NITK Surathkal, BE from RVCE, Bangalore University. He worked as a member of research staff of Samsung India, Bangalore, and was a post-doc fellow at NCBS TIFR Bangalore. He joined the Dept of ECE, NITK Surathkal, in 2013, and currently serving as an associate professor. He has been in the advisory board, technical program committee and technical paper reviewer of various international and national journals, conferences, workshops and symposia. He has a US patent, and several journal and conference publications to his credit. His research interests include medical signal/image processing, medical imaging and physics, pattern recognition and machine learning, informatics and computational biology.

Dr. A.V. Narasimhadhan

A.V. Narasimhadhan received BE degree in Electronics and Communication Engineering from Andhra University, in 2005 and MTech degree in Signal Processing from Indian Institute of Technology, Guwahati, India, in 2007. He received his Ph.D. degree from Indian Institute of Science, Bangalore, India, in 2012. He is presently working as an Associate Professor in the Department of Electronics and Communication Engineering at National Institute of Technology Karnataka, Surathkal, India. He has supervised seven Ph.D students and two Ph.D students are currently working under his supervision in the area of Signal Processing, Medical Image Processing and Computer Vision.

About GIAN

The Global Initiative of Academic Networks (GIAN) is a program of the Ministry of Education, Government of India. It is designed to tap the talent pool of scientists and entrepreneurs internationally to encourage their engagement with the institutes of higher education in India so as to augment the country's existing academic resources, accelerate the pace of quality reform, and elevate India's scientific and technological capacity to global excellence.

GIAN enables institutes of higher education in India to invite and host internationally renowned academicians and researchers, facilitating the co-teaching of advanced courses to Indian students and fostering collaborative relationships with experts from around the world.

The program offers great opportunities for Indian students to closely interact with international experts for a considerable duration. GIAN offers international experts a unique opportunity to familiarize themselves with India's academic environment. By interacting with local students and faculty, these experts can explore potential collaborations, share their expertise, and contribute to the advancement of knowledge across diverse fields.

Contact Information	
Course Webpage	https://sites.google.com/view/nitkecelecture/home
Query Email	Queries will be addressed via the email: **nitkecelecture@gmail.com**
Coordinators	**Dr. Raghavendra B.S.** Associate Professor, ECE NITK Surathkal, INDIA Mob.: +91 9480051826 URL.: https://ece.nitk.ac.in/faculty/raghavendra-b-s **Dr. A.V. Narasimhadhan** Associate Professor, ECE NITK Surathkal, INDIA Mob.: +91 9113989303 URL.: https://ece.nitk.ac.in/faculty/v-narasimhadhan
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