Guest Lectures on Image Analysis

by

Dr. Rangaraj M. Rangayyan

Dr. Rangaraj M. Rangayyan is Professor Emeritus of Electrical and Computer Engineering at the University of Calgary, Calgary, Alberta, Canada is scheduled to visit JUIT from 19th – 20th January, 2017. In addition to interactions with Faculty and Students, he will deliver two following lectures:

Date and Time	Topic of Lecture	Venue
19/01/17, 3-5 PM	Detection of Architectural Distortion in Prior Mammograms: Subtle Signs of Breast Cancer	LT-3
20/01/17,11AM-1 PM	Computer-aided Diagnosis of Retinopathy of Prematurity	LT-3

Dr. Rangayyan is a well known researcher in image processing and analysis. He has published more than 160 papers in journals and 270 papers in proceedings of conferences. He is the author of two textbooks: "Biomedical Signal Analysis" (IEEE/ Wiley, 2002, 2015) and "Biomedical Image Analysis" (CRC, 2005). He has co-authored and co-edited 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). Detailed information about Dr. Rangayyan is available at http://people.ucalgary.ca/~ranga/.

Students interested to discuss on Research or Prospects of Higher Studies at Canada (including University of Calgary, Calgary, Alberta, Canada) with Dr. Rangayyan may contact

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Detection of Architectural Distortion in Prior Mammograms: Subtle Signs of Breast Cancer

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Architectural distortion is a subtle sign of breast cancer that could be missed in screening mammography. This seminar will present several computer techniques for the detection of architectural distortion in mammograms based on the analysis of oriented texture using Gabor filters, modeling of orientation fields by phase portraits, and modeling of the oriented structure of breast tissues.

Screening mammograms obtained prior to the detection of cancer could contain subtle signs of breast cancer, in particular, architectural distortion. Several methods will be described for the characterization architectural distortion based on the analysis of the angular spread of power and other characteristics, fractal analysis, texture analysis, and measures of divergence. With a dataset of 106 prior mammograms of 56 interval-cancer cases and 52 mammograms of 13 normal cases, area under the receiver operating characteristic curve of up to 0.78 has been obtained. Free-response receiver operating characteristics have indicated sensitivity of 0.80 at fewer than 4 false positives per patient.

The results indicate that digital image processing and pattern recognition techniques can help in the detection of breast cancer at early stages.

Computer-aided Diagnosis of Retinopathy of Prematurity

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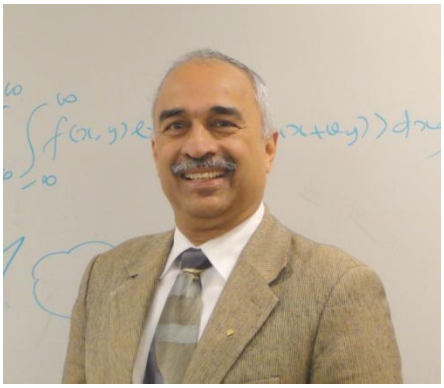
The structure of the blood vessels in the retina is affected by diabetes, hypertension, arteriosclerosis, retinopathy of prematurity (RoP), and other conditions through modifications in shape, width, and tortuosity. Quantitative analysis of the architecture of the vasculature of the retina could assist in monitoring the evolution and stage of pathological processes, their effects on the visual system, and the response to treatment. Computer-aided detection, modeling, and quantitative analysis of features related to the retinal vascular architecture could assist in consistent, quantitative, and accurate assessment of pathological processes by ophthalmologists.

This seminar provides details on digital image processing and pattern recognition techniques for the detection and analysis of retinal blood vessels, detection of the optic nerve head, modeling of shape for quantitative analysis of the temporal arcades, measurement of the thickness of retinal vessels, and detection of tortuous vessels. The techniques include methods for the detection of curvilinear structures, the Hough transform, Gabor filters, phase portraits, and specific algorithms for quantitative analysis of patterns of diagnostic interest. Analysis of a dataset of retinal fundus images of 19 premature infants with plus disease, a proliferative stage of RoP, and 91 premature infants without plus disease resulted in an area under the receiver operating characteristic curve of up to 0.98 using our parameter to quantify tortuosity. A graphical user interface is being developed to facilitate clinical application of the methods. The methods should assist in computer-aided diagnosis, follow up, and clinical management of premature infants possibly affected by RoP.



Dr. 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 160 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, by appointment as “University Professor” (2003 to 2013) at the University of Calgary, and with 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, 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. He was an invited lecturer at the prestigious 11th IEEE EMBS International Summer School on Biomedical Imaging, Saint-Jacut de la Mer, Bretagne, France, 2014.

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