RAJ RANGAYYAN, PhD, PEng
FIEEE, FEIC, FAIMBE, FSPIE, FSIIM, FCMBES, FCAE, FRSC

CURRENT POSITION: Professor Emeritus of Electrical and Computer Engineering, University of Calgary.

RESEARCH: Dr. Rangayyan has developed several algorithms for biomedical signal and image processing applications, including analysis of mammograms for computer-aided diagnosis of breast cancer, analysis of collagen alignment and fine vascular anatomy to study ligament healing and treatment, high-resolution image data compression for digital teleradiology, computer-aided diagnosis of cartilage pathology via analysis of knee-joint vibration signals, and analysis of retinal vascular architecture in fundus images. He has more than 170 journal papers and more than 270 conference publications to his credit, and has completed the supervision or cosupervision of 27 Master's and 17 Doctoral theses. His research has been featured in many newsletters, magazines, and newspapers, as well as in several radio and television interviews.

Methods and software developed by Dr. Rangayyan have been used by researchers in Canada, the U.S.A., U.K., Brazil, Argentina, Malaysia, Spain, France, Italy, Romania, India, and China. He has brought to the University of Calgary more than 40 international visiting researchers. He is collaborating (or has collaborated) with researchers not only in Calgary, Alberta, and Canada, but also in Brazil, Russia, India, China, Italy, France, Spain, Romania, Croatia, Malaysia, the U.S.A., and the U.K.

TEACHING: ENGG 213 Engineering Computation; ENGG 215 Engineering Practice, Design, and Communication; ENGG 233 Computing for Engineers I; ENGG 303 Electrical Circuits and Machines; ENGG 323 Systems and Instrumentation; ENGG 333 Computing for Engineers II; ENEL 327 Signals and Systems; ENEL 563 Biomedical Signal Analysis; ENEL 593 Digital Filters; ENEL 599 Electrical Engineering Project; ENEL 697 Digital Image Processing. 24.208 Electric Circuits; 24.358 Signal Analysis IIIE; 24.426 Communication Systems; 24.815 Digital Signal Processing; 24.822 Digital Image Processing. *Outstanding Teaching Performance Award of the Schulich School of Engineering (2016).*

Dr. Rangayyan is the author of two textbooks: "Biomedical Signal Analysis" (516 pages, IEEE and Wiley, 2002; 2nd ed., 672 pages, IEEE and Wiley, 2015) and "Biomedical Image Analysis" (1306 pages, CRC, 2005), and the coauthor or coeditor of several other books, including "Color Image Processing with Biomedical Applications" (434 pages, SPIE, 2011).

Dr. Rangayyan has lectured in more than 20 countries. He 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, Brasil; Cleveland Clinic Foundation, Cleveland, OH; Indian Institute of Science, Bangalore, India; Indian Institute of Technology, Kharagpur, India; Manipal Institute of Technology, Manipal, 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, Bretagne, France, 2014.

AWARDS AND RECOGNITION: *Fellow*, Royal Society of Canada (2016); *Outstanding Engineer,* IEEE Canada (2013); *Fellow, CAE* (2009); *Fellow, CMBES* (2007); *Fellow, SIIM* (2007); *Fellow, SPIE* (2003); *Fellow, AIMBE* (2003); *Fellow, EIC* (2002); *Fellow, IEEE* (2001); IEEE Third Millennium Medal (2000); "University Professor" (2003-2013); Killam Resident Fellowship (1999, 2002, 2007); *Research Excellence Awards*, Department of Electrical and Computer Engineering (1997, 2001); *Research Excellence Award*, Faculty of Engineering (1997); Outstanding Service Award, India-Canada Association of Calgary (1997); Excellence in Professional Field Award, India-Canada Association of Calgary (2002).

INTERACTION WITH INDUSTRY: Dr. Rangayyan has consulted for and provided expert advice for many companies, corporations, and institutions.

SERVICE AND LEADERSHIP: *Associate Vice-President (Research)* (2000-2002). Acting Head (1991-92) and Associate Head for Undergraduate Studies (1993-94), Department of Electrical and Computer Engineering. *Associate Editor*, IEEE Transactions on Biomedical Engineering (1989-96). *Program Chair*, 15th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS), San Diego, CA, 1993. Program Co-Chair, 20th Annual International Conference of the IEEE EMBS, Hong Kong, 1998. Co-Chair and Co-Editor, IASTED International Conference on Telehealth, Banff, AB, 2005. Program Committee, International Congress on Computer Assisted Radiology and Surgery, 2008-2016.
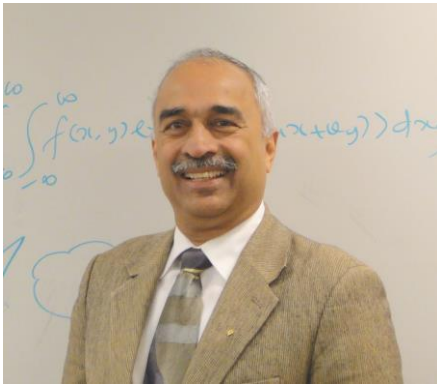
Rangaraj (Raj) Mandayam RANGAYYAN
Professor Emeritus of Electrical and Computer Engineering
Schulich School of Engineering
University of Calgary
Calgary, Alberta, Canada T2N 1N4
e-mail: ranga@ucalgary.ca
website: http://people.ucalgary.ca/~ranga/

Education:

Ph.D., Electrical Engineering, Indian Institute of Science, Bangalore, India (1980).

Bachelor of Engineering (B.E.), Electronics and Communication Engineering, University of Mysore, India (1976).

Positions Held:

Professor Emeritus of Electrical and Computer Engineering (2016-)

"University Professor," University of Calgary (2003-2013).

Associate Vice-President (Research) (2000-2002).

Professor, Department of Electrical and Computer Engineering (1989-2016).

Adjunct Professor, Departments of Surgery and Radiology (1992-2018).

Fellow, Latin American Research Centre (2006-present).

Associate Head (Undergraduate Studies), Department of Electrical and Computer Engineering (1993-94).

Acting Head, Department of Electrical and Computer Engineering (1991-92).

(Please see Sections K and R for Institutions Visited and Visiting Appointments held.)

Associate Professor, Department of Electrical Engineering, University of Calgary (1984-89).

Assistant Professor, Department of Electrical Engineering, University of Manitoba, Winnipeg, Canada (1982-84).

Systems Analyst, Department of Pathology, University of Manitoba, Winnipeg, Canada (1981-82).

Project Assistant, School of Automation, Indian Institute of Science, Bangalore, India (1980-81).

Registered Professional Engineer in the Province of Alberta, Canada, (1986-present).

Professional Interests:

Research and teaching in the areas Biomedical Engineering, Digital Signal Processing, Digital Image Processing, Signals and Systems, Biomedical Signal and Image Analysis, Computer Vision, Pattern Recognition, Medical Imaging, and Computer-aided diagnosis.

Other Interests:

Classical Music of India, Bansuri, Sitar, Rudra Veena, Chinese Music (Gu-zheng), Percussion, Fusion Music, Photography.

A. Papers in Refereed Journals

Numbering of entries in each category, in reversed chronological order, starts with the first such item in my career. The top-most entry number is my career total in each category. <u>The names of my research students/ trainees are underlined.</u>

172. M.C. Faleiros, M.H. Nogueira-Barbosa, V.F. Dalto, J.R. Ferreira Júnior, A.P. Magalhães Tenório, R. Luppino-Assad, P. Louzada-Junior, R.M. Rangayyan, P.M. Azevedo-Marques, "Machine learning techniques for computer-aided classification of active inflammatory sacroiliitis in magnetic resonance imaging," Advances in Rheumatology (2020) 60:25, https://doi.org/10.1186/s42358-020-00126-8

171. F.C.F. Dionísio, L.S. Oliveira, M.A. Hernandes, E.E. Engel, R.M. Rangayyan, P.M. Azevedo-Marques, M.H. Nogueira-Barbosa, "Manual and semiautomatic segmentation of bone sarcomas on MRI have high similarity," Brazilian Journal of Medical and Biological Research, 2020, 53(2): e8962, DOI: 10.1590/1414-431X20198962

170. <u>J. Chakraborty</u>, A. Midya, S. Mukhopadhyay, R. M. Rangayyan, A. Sadhu, V. Singla, N. Khandelwal, "Computer-Aided Detection of Mammographic Masses using Hybrid Region Growing Controlled by Multilevel Thresholding," DOI: 10.1007/s40846-018-0415-9. Journal of Medical and Biological Engineering, June 2019, Volume 39, Issue 3, pp 352–366

169. I. Cardoso, <u>E. Almeida</u>, H. Allende-Cid, A. C. Frery, R. M. Rangayyan, P. M. Azevedo-Marques, H. S. Ramos, "Analysis of Machine Learning Algorithms for Diagnosis of Diffuse Lung Diseases," Methods of Information in Medicine, 2018 Nov., 57(5-6):272-279. doi: 10.1055/s-0039-1681086.

168. Y. F. Wu, Y. C. Yao, Y. G. Xiao, X. Q. Ye, P. Chen, L. F. Liao, M. H. Wu, R. M. Rangayyan, "Separation and identification of rhythm components of local field potential signals in awake mice using ensemble empirical mode decomposition," Biomedical Engineering: Applications, Basis and Communications, 2017, 29(4): 1750029. https://doi.org/10.4015/S1016237217500296

167. Y. F. Wu, P. Chen, X. Luo, M. H. Wu, L. F. Liao, S. S. Yang, R. M. Rangayyan, "Measuring signal fluctuations in gait rhythm time series of patients with Parkinson's disease using entropy parameters," Biomedical Signal Processing and Control 31: 265–271, January 2017, http://dx.doi.org/10.1016/j.bspc.2016.08.022.

166. <u>F. Oloumi</u>, R.M. Rangayyan, and A.L. Ells, "Computer-aided Diagnosis of Retinopathy in Retinal Fundus Images of Preterm Infants via Quantification of Vascular Tortuosity," SPIE Journal of Medical Imaging 3(4): paper no. 044505 (Oct-Dec 2016), doi: 10.1117/1.JMI.3.4.044505.

165. M. Mustra, M. Grgic, and R.M. Rangayyan, "Review of recent advances in segmentation of the breast boundary and the pectoral muscle in mammograms," Medical and Biological Engineering and Computing, 54(7):1003–1024, July 2016. DOI 10.1007/s11517-015-1411-7.

164. <u>L. Frighetto-Pereira</u>, R. M. Rangayyan, G. A. Metzner, P. M. Azevedo-Marques, and M. H. Nogueira-Barbosa, "Shape, texture, and statistical features for classification of benign and malignant vertebral compression fractures in magnetic resonance images," Computers in Biology and Medicine, 73(2016):147–156, 2016.

163. Y. F. Wu, P. Chen, X. Luo, H. Huang, L. Liao, Y. Yao, M. Wu, R. M. Rangayyan, "Quantification of Knee Vibroarthrographic Signal Irregularity Associated with Patellofemoral Joint Cartilage Pathology Based on Entropy and Envelope Amplitude Measures," Computer Methods and Programs in Biomedicine, 130:1-12, July 2016. DOI: http://dx.doi.org/10.1016/j.cmpb.2016.03.021

162. <u>P. Casti</u>, A. Mencattini, M. Salmeri, A. Ancona, F. F. Mangieri, M. L. Pepe, R. M. Rangayyan, "Contour-Independent Detection and Classification of Mammographic Lesions," Biomedical Signal Processing and Control, 25:165-177, March 2016.

161. <u>I. Cruz-Aceves</u>, <u>F. Oloumi</u>, R. M. Rangayyan, J. G. Aviña-Cervantes, and A. Hernandez-Aguirre, "Automatic segmentation of coronary arteries using Gabor filters and thresholding based on multiobjective optimization," Biomedical Signal Processing and Control, 25:76-85, March 2016.

160. <u>F. Oloumi,</u> R. M. Rangayyan, <u>P. Casti</u>, A. L. Ells, " Computer-aided Diagnosis of Plus Disease via Measurement of Vessel Thickness in Retinal Fundus Images of Preterm Infants," Computers in Biology and Medicine, 66:316-329, Nov. 2015.

159. <u>P. Casti</u>, A. Mencattini, M. Salmeri, R. M. Rangayyan, "Analysis of Structural Similarity in Mammograms for Detection of Bilateral Asymmetry," IEEE Transactions on Medical Imaging, 34(2):662-671, February 2015. DOI 10.1109/TMI.2014.2365436

158. <u>J. Chakraborty</u>, A. Midya, S. Mukhopadhyay, R. M. Rangayyan, A. Sadhu, V. Singla, N. Khandelwal, P. Bhattacharyya, and P. M. Azevedo-Marques, "Detection of the Nipple in Mammograms with Gabor Filters and the Radon Transform," Biomedical Signal Processing and Control, 15:80-89, January 2015. doi:10.1016/j.bspc.2014.09.001

157. <u>F. Oloumi</u>, R.M. Rangayyan, and A.L. Ells, "Quantification of the Changes in the Openness of the Major Temporal Arcade in Retinal Fundus Images of Preterm Infants with Plus Disease," Investigative Ophthalmology & Visual Science, 55:6728-6735, October 2014. doi:10.1167/iovs.13-13640.

156. <u>F. Oloumi, A. K. Dhara,</u> R. M. Rangayyan, and S. Mukhopadhyay, "Detection of Blood Vessels in Retinal Fundus Images," Computer Science Journal of Moldova, Invited Article, 22(2:65):155-185, 2014.

155. L. C. Pereyra, S. M. Pereira, J. P. Souza, M. A. C. Frade, R. M. Rangayyan, P. M. Azevedo-Marques, "Characterization and pattern recognition of color images of dermatological ulcers: a pilot study," Computer Science Journal of Moldova, Invited Article, 22(2:65):211-235, 2014.

154. <u>F. Oloumi</u>, R. M. Rangayyan, and A. L. Ells, "Computer-aided Diagnosis of Proliferative Diabetic Retinopathy via Modeling of the Major Temporal Arcade in Retinal Fundus Images." Journal of Digital Imaging, 26(6): 1124-1130, December 2013. DOI 10.1007/s10278-013-9592-9.

153. <u>P. Casti</u>, A. Mencattini, M. Salmeri, A. Ancona, F. Mangeri, M. L. Pepe, R. M. Rangayyan, "Estimation of the breast skin-line in mammograms using multidirectional Gabor filters." Computers in Biology and Medicine, 43(11): 1870-1881, November 2013.

152. <u>P. Casti</u>, A. Mencattini, M. Salmeri, A. Ancona, F. Mangeri, M. L. Pepe, R. M. Rangayyan, "Automatic detection of the nipple in screen-film and full-field digital mammograms using a novel Hessian-based method ." Journal of Digital Imaging, 26(5): 948-957, October 2013. DOI 10.1007/s10278-013-9587-6

151. R. M. Rangayyan, <u>S. Banik</u>, and J. E. L. Desautels, "Detection of Architectural Distortion in Prior Mammograms via Analysis of Oriented Patterns," invited article, Journal of Visualized Experiments, August 2013, e50341, article with 19 pages and online video. URL: http://www.jove.com/video/50341. DOI: doi:10.3791/50341.

150. R. M. Rangayyan, <u>S. Banik, J. Chakraborty,</u> S. Mukhopadhyay, and J. E. L. Desautels, "Measures of Divergence of Oriented Patterns for the Detection of Architectural Distortion in Prior Mammograms," International Journal of Computer Assisted Radiology and Surgery, 8(4):527-545, July 2013. DOI 10.1007/s11548-012-0793-3.

149. <u>K.Y. Liu</u>, M.R. Smith, E. Fear, and R.M. Rangayyan, "Evaluation and Amelioration of Computer-Aided Diagnosis with Artificial Neural Networks Utilizing Small-Sized Sample Sets," Biomedical Signal Processing and Control, 8(3):255-262, May 2013.

148. S. M. Pereira, M. A. C. Frade, R. M. Rangayyan, P. M. Azevedo-Marques, "Classification of color images of dermatological ulcers," IEEE Journal of Biomedical and Health Informatics, 17(1):136-142, January 2013. DOI 0.1109/TITB.2012.2227493

147. <u>S. Banik</u>, R. M. Rangayyan, and J. E. L. Desautels, "Measures of Angular Spread and Entropy for the Detection of Architectural Distortion in Prior Mammograms," International Journal of Computer Assisted Radiology and Surgery, 8(1): 121-134, January 2013. DOI 10.1007/s11548-012-0681-x.

146. R. M. Rangayyan, <u>F. Oloumi</u>, Y.F. Wu, and S.X. Cai, "Fractal Analysis of Knee-joint Vibroarthrographic Signals via Power Spectral Analysis," Biomedical Signal Processing and Control, 8(1):23-29, January 2013. DOI 10.1016/j.bspc.2012.05.004.

145. <u>S. Banik</u>, R. M. Rangayyan, and J. E. L. Desautels, "Detection of architectural distortion using statistical measures of correlation and stationarity," Rendiconti del Circolo Matematico di Palermo, Serie II, Suppl. 84, pp. 33-42, 2012.

144. F. Oloumi, R. M. Rangayyan, and A.L. Ells, "Parabolic Modeling of the Major Temporal Arcade in Retinal Fundus Images," IEEE Transactions on Instrumentation & Measurement, 61(7): 1825-1838, July 2012. DOI 10.1109/TIM.2012.2192339.

143. J. Chakraborty, R. M. Rangayyan, S. Banik, S. Mukhopadhyay, and J. E. L. Desautels, "Statistical Measures of Orientation of Texture for the Detection of Architectural Distortion in Prior Mammograms of Interval-Cancer," Journal of Electronic Imaging, 21(3), 033010:1-13, July 2012. DOI: 10.1117/1.JEI.21.3.033010.

142. R. M. Rangayyan and F. Oloumi, "Fractal analysis and classification of breast masses using the power spectra of signatures of contours," Journal of Electronic Imaging, 21(2), 023018:1-9, April 2012. DOI: 10.1117/1.JEI.21.2.023018.

141. S. Banik, R. M. Rangayyan, and J. E. L. Desautels, "Detection of Architectural Distortion in Prior Mammograms," IEEE Transactions on Medical Imaging, 30(2):279-294, February 2011. DOI 10.1109/TMI.2010.2076828. **Winner of Canadian Institutes of Health Research: Institute of Cancer Research Publication Prize for 2011.**

140. Y.F. Wu, S. Krishnan, and R.M. Rangayyan, "Computer-aided Diagnosis of Knee-joint Disorders via Vibroarthrographic Signal Analysis: A Review," CRC Critical Reviews in Biomedical Engineering, 38(2):201-224, 2010.

139. R.M. Rangayyan, S. Banik, and J.E.L. Desautels, "Computer-aided Detection of Architectural Distortion in Prior Mammograms of Interval Cancer," Journal of Digital Imaging, 23(5):611-631, October 2010. DOI 10.1007/s10278-009-9257-x.

138. R.M. Rangayyan, T. M. Nguyen, F.J. Ayres, and A. K. Nandi, "Effect of Pixel Resolution on Texture Features of Breast Masses in Mammograms," Journal of Digital Imaging, 23(5):547-553, October 2010. DOI 10.1007/s10278-009-9238-0.

137. R.M. Rangayyan, X. Zhu, F.J. Ayres, and A.L. Ells, "Detection of the Optic Nerve Head in Fundus Images of the Retina with Gabor Filters and Phase Portrait Analysis," Journal of Digital Imaging, 23(4):438-453, August 2010. doi:10.1007/s10278-009-9261-1.

136. I. Kamenetsky, R.M. Rangayyan, and H. Benediktsson, "Analysis of the Glomerular Basement Membrane in Images of Renal Biopsies Using the Split-and-Merge Method: A Pilot Study," Journal of Digital Imaging, 23(4):463-474, August 2010. DOI 10.1007/s10278-009-9233-5

135. R.M. Rangayyan, I. Kamenetsky, and H. Benediktsson, "Segmentation and Analysis of the Glomerular Basement Membrane in Renal Biopsy Samples Using Active Contours: A Pilot Study," Journal of Digital Imaging. doi: 10.1007/s10278-009-9188-6. 23(3):323-331, June 2010.

134. S. Banik, R.M. Rangayyan, and G.S. Boag, "Automatic Segmentation of the Ribs, the Vertebral Column, and the Spinal Canal in Pediatric Computed Tomographic Images," Journal of Digital Imaging, doi: 10.1007/s10278-009-9176-x, 23(3):301-322, June 2010.

133. X. Zhu, R.M. Rangayyan, and A.L. Ells, "Detection of the Optic Nerve Head in Fundus Images of the Retina Using the Hough Transform for Circles," Journal of Digital Imaging. doi: 10.1007/s10278-009-9189-5. 23(3):332-341, June 2010.

132. R.M. Rangayyan and Y.F. Wu, "Screening of Knee-joint Vibroarthrographic Signals Using Probability Density Functions Estimated with Parzen Windows," Biomedical Signal Processing & Control, January 2010, 5(1):53-58. doi:10.1016/j.bspc.2009.03.008.

131. Y.F. Wu and R.M. Rangayyan, "An Unbiased Linear Adaptive Filter with Normalized Coefficients for the Removal of Noise in Electrocardiographic Signals," International Journal of Cognitive Informatics and Natural Intelligence, vol. 3, no. 4, pp. 73-90, Oct.-Dec. 2009. DOI: 10.4018/jcini.2009062305.

130. D. Guliato, R.S. Bôaventura, M. Maia, R.M. Rangayyan, M.S. Simedo, and T.A.A. Macedo, "INDIAM - An e-Learning System for the Interpretation of Mammograms," Journal of Digital Imaging, 22(4):405–420, August 2009, doi: 10.1007/s10278-008-9111-6.

129. S. Banik, R.M. Rangayyan, G.S. Boag, R.H. Vu, "Segmentation of the Pelvic Girdle in Pediatric Computed Tomographic Images," Journal of Electronic Imaging, 18(3), article number 033005:1-11, (July – September 2009). DOI: 10.1117/1.3184783.

128. R. do Espírito Santo, R. de Deus Lopes, and R.M. Rangayyan, "Classification of breast masses in mammograms using radial basis functions and simulated annealing," International Journal of Cognitive Informatics and Natural Intelligence, 3(3): 27-38, July-September 2009.

127. M.R. Smith, X. Wang, R. M. Rangayyan, "Evaluation of the Sensitivity of a Medical Data-mining Application to the Number of Elements in Small Databases," Biomedical Signal Processing & Control. doi:10.1016/j.bspc.2009.04.001. 4 (3):262–268, July 2009.

126. R.M. Rangayyan, S. Banik, G.S. Boag, "Landmarking and Segmentation of Computed Tomographic Images of Pediatric Patients with Neuroblastoma," International Journal of Computer Assisted Radiology and Surgery. DOI 10.1007/s11548-009-0289-y. May 2009. 4(3):245-262.

125. D. Guliato, E.V. de Melo, R.M. Rangayyan, and R.C. Soares, "POSTGRESQL-IE: An Image-handling Extension for PostgreSQL," Journal of Digital Imaging. DOI: 10.1007/s10278-007-9097-5, 22(2): 149-165, April 2009.

124. J. Tang, R. M. Rangayyan, J. Xu, I. El Naqa, Y. Yang, "Computer-Aided Detection and Diagnosis of Breast Cancer with Mammography: Recent Advances," IEEE Transactions on Information Technology in Biomedicine, March 2009, 13(2):236-251. DOI: 10.1109/TITB.2008.2009441.

123. C. Serrano, B. Acha, R.M. Rangayyan, and J.E.L. Desautels, "Detection of microcalcifications in mammograms using error of prediction and statistical measures," Journal of Electronic Imaging 18(1), 013011:1-10, Jan.–Mar. 2009. DOI: 10.1117/1.3099710.

122. Y.F. Wu, R.M. Rangayyan, Y. Zhou, and S.C. Ng, "Filtering electrocardiographic signals using an unbiased and normalized adaptive noise reduction system," Medical Engineering & Physics, 31(1):17-26, January 2009. DOI:10.1016/j.medengphy. 2008.03.004. Correction: 31(5):614, June 2009.

121. R.M. Rangayyan and Y.F. Wu, "Analysis of vibroarthrographic signals with features related to signal variability and radial-basis functions," Annals of Biomedical Engineering, 37(1):156-163, Jan. 2009. DOI: 10.1007/s10439-008-9601-1.

120. R.M. Rangayyan, R.H. Vu, and G.S. Boag, "Automatic Delineation of the Diaphragm in Computed Tomographic Images," Journal of Digital Imaging, vol. 21, supplement 1, pp S134-S147, doi: 10.1007/s10278-007-9091-y, November 2008.

119. T. Mu, A. K. Nandi, and R.M. Rangayyan, "Screening of Knee-joint Vibroarthrographic Signals Using the Strict 2-Surface Proximal Classifier and Genetic Algorithm," Computers in Biology and Medicine, 38(10):1103-1111, October 2008. doi:10.1016/j.compbiomed.2008.08.009.

118. T. Mu, A. K. Nandi, and R.M. Rangayyan, "Classification of Breast Masses Using Selected Shape, Edge-sharpness, and Texture Features with Linear and Kernel-based Classifiers," Journal of Digital Imaging, doi: 10.1007/s10278-007-9102-z, 21(2):153—169, June 2008.

117. D. Guliato, J. Daloia de Carvalho, R.M. Rangayyan, S. A. Santiago, "Feature Extraction from a Signature based on the Turning Angle Function for the Classification of Breast Tumors," Journal of Digital Imaging, DOI: 10.1007/s10278-007-9069-9, 21(2): 129 – 144, June 2008.

116. P.M. de Azevedo-Marques, N.A. Rosa, A.J.M. Traina, C. Traina Junior, S.K. Kinoshita, and R.M. Rangayyan, "Reducing the Semantic Gap in Content-based Image Retrieval in Mammography with Relevance Feedback and Inclusion of Expert Knowledge," International Journal of Computer Assisted Radiology and Surgery, DOI 10.1007/s11548-008-0154-4. 3(1-2):123-130, June 2008.

115. R.M. Rangayyan, F.J. Ayres, Faraz Oloumi, Foad Oloumi, and P. Eshghzadeh-Zanjani, "Detection of Blood Vessels in the Retina with Multiscale Gabor Filters", Journal of Electronic Imaging, 17(2), 023018:1-7, Apr–Jun 2008. DOI: 10.1117/1.2907209.

114. R.M. Rangayyan, D. Guliato, J. Daloia de Carvalho, S. A. Santiago, "Polygonal Approximation of Contours based on the Turning Angle Function," Journal of Electronic Imaging, 17(2), 023016:1-14, Apr–Jun 2008. DOI 10.1117/1.2920413.

113. R.M. Rangayyan, S. Prajna, F.J. Ayres, and J.E.L. Desautels, "Detection of Architectural Distortion in Prior Mammograms Using Gabor Filters, Phase Portraits, Fractal Dimension, and Texture Analysis," International Journal of Computer Assisted Radiology and Surgery, DOI 10.1007/s11548-007-0143-z. 2(6): 347-361, April 2008. Correction:

International Journal of Computer Assisted Radiology and Surgery, DOI 10.1007/s11548-010-0408-9. 5(4): 421-423, July 2010.

112. R.M. Rangayyan and Y.F. Wu, "Screening of Knee-joint Vibroarthrographic Signals Using Statistical Parameters and Radial Basis Functions," Medical and Biological Engineering and Computing, DOI 10.1007/s11517-007-0278-7, 46(3):223–232, March 2008.

111. S. K. Kinoshita, P.M. de Azevedo-Marques, R.R. Pereira Júnior, J.A.H. Rodrigues, and R.M. Rangayyan, "Radon-domain detection of the nipple and the pectoral muscle in mammograms," DOI 10.1007/s10278-007-9035-6. Journal of Digital Imaging, 21(1): 37 – 49, March 2008.

110. L.A. Silva, E. del Moral Hernandez, and R.M. Rangayyan, "Classification of breast masses using a committee machine of artificial neural networks," Journal of Electronic Imaging, 17(1), 013017:1-10, Jan.–Mar. 2008.

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30. S. Chaudhuri, R.M. Rangayyan, S Walsh and C.B. Frank, 1987, "The Role of the Supercomputer in Image Processing: Quantitative Analysis of Collagen Alignment in Ligaments," Supercomputing Symposium, Calgary, June 1987, pp. 165-172.

29. S. Chaudhuri, R.M. Rangayyan, S. Walsh and C.B. Frank, 1987, "Quantitative Analysis of Ligament Healing via Directional Filtering," Proc. 13th Canadian Medical and Biological Engineering Conference, Halifax, June 1987, pp. 109-110.

28. R.M. Rangayyan and H.N. Nguyen, 1987, "Pixel-independent image processing techniques for noise removal and feature enhancement," IEEE Pacific Rim Conference on Communications, Computers, and Signal Processing, Victoria, BC, pp. 81-84.

27. R.M. Rangayyan and T. Hon, 1987, "Restoration of emission CT images," 13th Northeast Bioengineering Conference, (IEEE), Philadelphia, PA, pp. 16-18.

26. D.K. Mitchell and R.M. Rangayyan, 1987, "Restoration of limited-data seismic tomography images," Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing, Dallas, TX, pp. 2221-2224.

25. R.M. Rangayyan, 1987, "Multichannel phonocardiography for localization of heart sound sources," Proc. SPIE, Vol. 768, Intl. Symp. on Pattern Recognition and Acoustical Imaging, Newport Beach, CA, pp. 248-252.

24. R.M. Rangayyan and H. Nguyen, 1986, "Pixel-independent Image Processing Techniques for Enhancement of Features in Mammograms," Proc. 8th IEEE Engineering in Medicine and Biology Conf., Fort Worth, TX, pp. 1113-1117.

23. Nguyen, H., R. Rangayyan, S. Walsh, C. Frank, 1986, "Directional Filtering for Quantification of Collagen Alignment in Normal Ligaments," Proc. of 12th Northeast Bioengineering Conference, Yale University, New Haven, Connecticut, pp. 141-144.

22. R.J. Lehner and R.M. Rangayyan, 1985, "Microcomputer system for quantification of the phonocardiogram," IEEE-EMBS Frontiers of Engineering and Computing in Health Care, Chicago, September, 1985, pp. 849-854.

21. R. Lehner and R.M. Rangayyan, 1984, "Use of the carotid pulse in identification of the second heart sound," International Conference on Computers, Systems, and Signal Processing, IEEE Indian Institute of Science, Bangalore, India, December 1984, pp. 1414-1417.

20. R.M. Rangayyan, A.P. Dhawan and R. Gordon, 1984, "Algorithms for limited-view computed tomography: A survey," International Conference on Computers, Systems, and Signal Processing, IEEE Indian Institute of Science, Bangalore, India, December 1984, pp. 1540-1545, INVITED PAPER.

19. A.P. Dhawan, R. Gordon and R.M. Rangayyan, 1984, "Computed tomography by transillumination to detect early melanoma," IEEE Frontiers of Engineering and Computing in Health Care, Los Angeles, CA, September 1984, pp. 518-522.

18. A.P. Dhawan, R.M. Rangayyan and R. Gordon, 1984, "Image restoration by two-dimensional deconvolution in limited-view computed tomography," Optical Society of America topical meeting on "Industrial Applications of Computed Tomography and NMR Imaging," Hecla Island, Manitoba, Canada, Aug. 1984, pp Tu A5-1 to Tu A5-3.

17. A.P. Dhawan, R.M. Rangayyan and R. Gordon, 1984, "Wiener filtering for deconvolution of geometric artifacts in limited-view image reconstruction," IEEE Computer Society International Symposium on Medical Images and Icons, Arlington, July 1984, pp. 168-172.

16. R. Lehner and R.M. Rangayyan, 1983, "A microcomputer system for quantitative analysis of the phonocardiogram," Proc. MEDCOMP-83 (IEEE), Athens, September.

15. R. Gordon, R.M. Rangayyan, D.H. Wardrop and T.M. Beeman, 1983, "Improving image quality in teleradiology and tele-computed tomography," Proc. IEEE Systems, Man, and Cybernetics Society Conference, December 30, 1983 - January 7, 1984, Bombay/New Delhi, pp. 908-913.

14. R. Gordon and R.M. Rangayyan, 1983, "Radiographic feature enhancement, information content, and dose reduction in mammography and cardiac angiography," Proc. 5th Annual Conference on Frontiers of Engineering and Computing in Health Care (IEEE-EMBS), Columbus, September, 8.4.1-8.4.5.

13. R.M. Rangayyan and R. Gordon, 1983, "Geometric deconvolution of artifacts in limited view computed tomography," Digest of Optical Society of America topical meeting on "Signal recovery and synthesis with incomplete information and partial constraints," Incline Village, Nevada, January 12-14, FA2-1: FA2-3.

12. R. Gordon and R.M. Rangayyan (M.R. Rangaraj), "Computed tomography from a few ordinary radiographs," Proc. of IEEE COMPMED-82, Philadelphia, Sept. 1982, pp. 54-58.

11. R. Gordon and R.M. Rangayyan (M.R. Rangaraj), "Experiments on streak prevention in image reconstruction from a few views," Proc. 4th National Conference of Canadian Society for Computational Studies of Intelligence, Saskatoon, May 1982, pp. 41-47.

10. R.M. Rangayyan (M.R. Rangaraj) and R. Gordon, 1982, "Computed tomography for remote areas via teleradiology," Proc. SPIE, Vol. 318, pp. 182-185, Proc. 1st Intl. Conf. on Picture Archival and Communication Systems for Medical Applications, Newport Beach, Jan. 18-21.

9. R. Gordon and R.M. Rangayyan (M.R. Rangaraj), 1981, "The need for cross-fertilization between the fields of profile inversion and computed tomography," Proc. Seventh Canadian Symposium on Remote Sensing, Winnipeg, pp. 538-540, September.

8. I.S.N. Murthy and R.M. Rangayyan (M.R. Rangaraj), 1978, "Homomorphic deconvolution of EMG signals," Proceedings of VII All India Symposium on Biomedical Engineering, Hyderabad, India, pp. S.4-1 to S.4-4, June.

7. R.M. Rangayyan (M.R. Rangaraj) and D. Narayana Dutt, 1978, "Speech processing techniques for the analysis of heart sounds, Proceedings of VII All India Symposium on Biomedical Engineering, Hyderabad, India, pp. S.4-9 to S.4-12.

6. I.S.N. Murthy, R.M. Rangayyan (M.R. Rangaraj) and K.J. Udupa, 1978, "R-R interval determination by cepstrum techniques," Proceedings of VII All India Symposium on Biomedical Engineering, Hyderabad, India, pp. S.4-15 to S.4-18.

5. R.M. Rangayyan (M.R. Rangaraj) and I.S.N. Murthy, 1978, "Classification of PCG via pole-zero modelling," Proceedings of VII All India Symposium on Biomedical Engineering, Hyderabad, India, pp. S.7-26 to S.7-29.

4. I.S.N. Murthy, R.M. Rangayyan (M.R. Rangaraj), K.S. Prabhu and A.K. Goyal, 1978, "ECG waveform typing for PVC detection," Intl. Symp. and Workshop on Biomedical Engineering, New Delhi, India, pp. 110-111, February.

3. R.M. Rangayyan (M.R. Rangaraj) and I.S.N. Murthy, 1978, "Cepstral filtering of phonocardiogram signal," Intl. Symp. and Workshop on Biomedical Engineering, New Delhi, India, pp. 118-119.

2. R.M. Rangayyan (M.R. Rangaraj) and I.S.N. Murthy, 1977, "Analysis and modelling of phonocardiogram," Proc. First Mediterranean Conf. Medical and Biological Engineering, Sorrento, Italy, pp. 8-53 to 8-56, September.

1. K.J. Udupa, I.S.N. Murthy and R.M. Rangayyan (M.R. Rangaraj), 1977, "Epoch analysis of ECG and PCG signals," Proc. First Mediterranean Conf. Medical and Biological Engineering, Sorrento, Italy, pp. 8-57 to 8-60.

G. Communications (lectures, tutorials, displays, abstracts) at Conferences and Workshops

88. "Computer-aided Diagnosis: Engineering Improved Health Care," XVI Semana Brasileira de Informática Biomédica, Universidade de São Paulo, Ribeirão Preto. 17-19 September 2018.

87. "Computer-aided Diagnosis: Engineering Improved Health Care" and "Classification of Benign and Malignant Vertebral Compression Fractures in Magnetic Resonance Images," Invited Lectures, XXIII Brazilian Congress of Medical Physics, IX Gaucho Medical Physics Meeting, and IV South Brazilian Symposium of Medical Physics, Porto Alegre, RS, Brazil, 5-8 September 2018.

86. "Engineering Education: Preparing Professionals for the Betterment of Humanity." Keynote Address, 13 January 2018, International Conference on Current Trends in Higher Education, Adamas University, Kolkata, West Bengal, India.

85. Chief Guest, invited address to graduating students at PES College of Engineering, Mandya, Karnataka, India, 12 August 2017.

84. Invited inaugural address as Chief Guest on "Current trends in biomedical image and signal processing," and Keynote Address on "Computer-aided Diagnosis of Retinopathy of Prematurity," International Conference on Signal Processing and Communication, Karunya University, Coimbatore, Tamil Nadu, India, 28-29 July 2017.

83. Computer-aided Diagnosis: Engineering Improved Health Care, Meeting of the Royal Society of Canada, November 2016, Kingston, ON, Canada.

82. Computer-aided Detection of Subtle Signs of Breast Cancer in Mammograms, Keynote talk, International Conference on Signal and Information Processing (IConSIP-2016), October 2016, Nanded, Maharashtra, India.

81. Tutorial on analysis of texture and oriented patterns in biomedical images, European Conference on Signal Processing EUSIPCO 2016, Budapest, Hungary, 29 August - 2 September 2016.

80. Invited Speaker, 2nd International Conference on Control, Instrumentation, Energy & Communication (CIEC 16), January 28-30, 2016, Department of Applied Physics, University of Calcutta, Calcutta, India.

79. Computer-aided Detection of Subtle Signs of Breast Cancer in Mammograms, IEEE CBMS 2015, Sao Carlos, Brazil, June 2015, Keynote Lecture.

78. Analysis of Texture and Oriented Patterns, IEEE CBMS 2015, University of Sao Paulo Ribeirao Preto, Brazil, June 2015.

77. Analysis of Shape, IEEE CBMS 2015, University of Sao Paulo Ribeirao Preto, Brazil, June 2015.

76. Computer-aided Detection of Subtle Signs of Breast Cancer in Mammograms, Our Genes Conference, Hereditary Breast and Ovarian Cancer Society, Edmonton, Alberta, September 2014.

75. Invited lectures (six hours) on "Oriented tissue analysis in medical imaging," IEEE EMBS 11th International Summer School on Biomedical Imaging, St. Jacut de la Mer, Bretagne, France, June 2014.

74. Invited keynote speech, "Digital Image Processing and Pattern Recognition Techniques for the Analysis of Fundus Images of the Retina," IEEE 5th Biosignals and Biorobotics Conference, Salvador, Bahia, Brazil, May 2014.

73. Invited Plenary Speech, "Computer-aided Detection, Modeling, and Analysis of Retinal Vascular Architecture for the Diagnosis of Retinopathy," IEEE International Conference on e-Health and Bioengineering, Iaşi, Romania, November 2013, Iaşi, Romania, November 2013.

72. Keynote Speech, "Computer-aided Detection of Subtle Signs of Breast Cancer in Mammograms," IASTED International Conference on Signal and Image Processing, Banff, Alberta, Canada, July 2013.

71. J. Chakraborty, S. Mukhopadhyay, R. M. Rangayyan, and V. Karale, "Computer-aided Detection of Mammographic Lesions," Shastri Indo-Canadian Institute, New Delhi, India, June 2013.

70. Special Guest and Invited Keynote Speaker, "Computer-aided Detection, Modeling, and Analysis of Retinal Vascular Architecture for the Diagnosis of Retinopathy," at the International Conference on Emerging Research in Electronics, Computer Science and Technology (ICERECT-12), Golden Jubilee Celebrations of the P.E.S. College of Engineering, Mandya, India, December 2012.

69. Invited lectures on Analysis of Shape in Biomedical Images; Computer-aided Detection, Modeling, and Analysis of Retinal Vascular Architecture for the Diagnosis of Retinopathy; Computer-aided Detection of Subtle Signs of Breast Cancer in Mammograms; and Color Image Processing with Biomedical Applications; at Workshop on Selected Topics in Medical Imaging, IEEE Communications and Signal Processing Societies Joint Chapter and University College of Engineering, Osmania University, Hyderabad December 2012.

68. Invited lecture on "Color Image Processing with Biomedical Applications," Workshop on Image and Speech Processing, C.R. Rao Advanced Institute of Mathematics, Statistics, and Computer Science, and the International Institute of Information Technology, Hyderabad, December 2012.

67. Invited lectures at Workshop on Biomedical Signal Analysis, IIT, Roorkee, India, December 2012.

66. Invited Plenary Lecture on "Computer-aided Detection of Subtle Signs of Early Breast Cancer: Detection of Architectural Distortion in Mammograms," International Conference on Biomedical Engineering and Assistive Technologies (BEATS 2012), Dr. B.R. Ambedkar National Institute of Technology, Jalandhar, India, December, 2012.

65. Invited lectures at Workshop on Medical Image and Signal Processing and presented two seminars on "Color Image Processing with Biomedical Applications" and "Computer-aided Detection of Subtle Signs of Breast Cancer in Mammograms," IIT Guwahati, December, 2012.

64. Invited lectures at Workshop on Medical Imaging, IIT Kharagpur, India, on "Introduction to Medical Imaging," "Digital Image Processing Techniques for Ophthalmology," and "Computer-aided detection of architectural distortion in mammograms," December, 2012.

63. Plenary Lecture on "Computer-aided Detection, Modeling, and Analysis of Retinal Vascular Architecture for Diagnosis of Retinopathy," XXIII Congresso Brasileiro em Engenharia Biomédica – XXIII CBEB, Porto de Galinhas, PE, October 2012.

62. Panelist, Panel Discussion Session on "Clinical needs, clinical evaluation, technical evaluation, and technical requirements for development of practical CAD systems," 26th International Congress and Exhibition on Computer Assisted Radiology and Surgery, Pisa, Italy, June 2012.

61. Invited talk on "CAD techniques for the detection of architectural distortion in mammograms," 26th International Congress and Exhibition on Computer Assisted Radiology and Surgery, Pisa, Italy, June 2012.

60. Organized a panel discussion session on "Considerations in the Design of Advanced Technological Systems for Health Care in India" for the conference on "Engaging India: Human and Social Dimensions of Science and Technology," Shastri Indo-Canadian Institute, June, 2012, Calgary, Alberta, Canada, including a presentation on "Considerations in the Design of Systems for Computer-aided Diagnosis for Health Care in India," with contributions by S. Mukhopadhyay, P. Bhattacharyya, A. Sadhu, A. Gupta, and R. Bansal.

59. Invited Centenary Lecture, Department of Electrical Engineering, Indian Institute of Science, Bangalore, India, on "Computer-aided Detection of Early Signs of Breast Cancer in Mammograms," May 2012.

58. Invited lecture, "Mathematical Models and Methods for the Detection of Diverging and Spiculating Patterns in Medical Images," VIII International Conference on Stochastic Geometry, Convex Bodies, Empirical Measure, and Applications to Mechanics Engineering of Train Transport, Taormina, Sicily, Italy, September 2011.

57. Invited member in a special panel discussion session on "Clinical needs, clinical evaluation, technical evaluation, and technical requirements for the development of practical CAD systems," Computer Assisted Radiology and Surgery, Berlin, Germany, June 2011.

56. Invited Keynote Lecture on "Computer-aided detection of subtle signs of early breast cancer: Detection of architectural distortion in mammograms," Canadian Medical and Biological Engineering Conference, Toronto, ON, Canada, June 2011.

55. Invited Plenary Lecture on "Digital Image Processing and Pattern Recognition Techniques for the Analysis of Fundus Images of the Retina," IEEE International Symposium on Medical Measurements and Applications, Bari, Italy, May 2011.

54. Invited Tutorial, "Digital image processing in biomedical image analysis," at the All India Council for Technical Education Workshop on Medical Imaging, Indian Institute of Technology, Kharagpur, India, 3-7 January 2011.

53. Invited Tutorial, "Computer-Aided Diagnosis of Breast Cancer: Towards the Detection of Early and Subtle Signs," at the All India Council for Technical Education Workshop on Medical Imaging, Indian Institute of Technology, Kharagpur, India, 3-7 January 2011.

52. Invited Tutorial, "Three-dimensional Image Processing Techniques for Landmarking and Segmentation of Computed Tomographic Images," at the All India Council for Technical Education Workshop on Medical Imaging, Indian Institute of Technology, Kharagpur, India, 3-7 January 2011.

51. Invited Tutorial, "Digital Image Processing Techniques for the Detection and Analysis of Diagnostic Features in Fundus Images of the Retina," at the International Conference on Communication, Computers and Devices (ICCCD), Indian Institute of Technology, Kharagpur, India, 9 December 2010.

50. Invited Tutorial, "Computer-Aided Diagnosis of Breast Cancer: Towards the Detection of Early and Subtle Signs," at the Quality Improvement Programme Workshop on Medical Signal & Image Processing, Electrical Engineering Department, Indian Institute of Technology, Roorkee, India, 15 December 2010.

49. Invited Tutorial, "Three-dimensional Image Processing Techniques for Landmarking and Segmentation of Computed Tomographic Images," at the Quality Improvement Programme Workshop on Medical Signal & Image Processing, Electrical Engineering Department, Indian Institute of Technology, Roorkee, India, 15 December 2010.

48. Invited Plenary Talk, "Computer-aided detection of subtle signs of early breast cancer: Detection of architectural distortion in mammograms," at the International Conference on Biomedical Engineering and Assistive Technologies, National Institute of Technology, Jalandhar, India, 18 December 2010.

47. Invited tutorial, "Computer-Aided Diagnosis of Breast Cancer: Towards the Detection of Early and Subtle Signs," Third International Symposium on Applied Sciences in Biomedical and Communication Technologies, ISABEL 2010, Rome, Italy, 7 November 2010.

46. Plenary lecture, "Three-dimensional image processing techniques for landmarking and segmentation of computed tomographic images," First Workshop on Scientific Computing in Health Applications, National Institute of Science and Technology in Medicine Assisted by Scientific Computing, National Laboratory for Scientific Computing, Petrópolis, RJ, Brazil, June 2010.

45. Invited lecture, "CAD for detection of architectural distortion in prior mammograms," Computer Assisted Radiology and Surgery, Geneva, Switzerland, June 2010.

44. Invited lecture, "Detection of architectural distortion in prior mammograms using Gabor filters, phase portraits, fractal analysis, and texture analysis," Techniche di Analisi Frattale – Applicazione alla mammografia, Bari, Italy, 23 April 2009.

43. P.M. de Azevedo-Marques, N.A. Rosa, A.J.M. Traina, C. Traina Junior, S.K. Kinoshita, and R.M. Rangayyan, "Reducing the Semantic Gap in Content-based Image Retrieval in Mammography with Relevance Feedback and Inclusion of Expert Knowledge," poster and abstract in Proc. Computer Assisted Radiology and Surgery, Barcelona, Spain, June 2008. Springer. International Journal of Computer Assisted Radiology and Surgery, vol. 3, Suppl. 1, page S382.

42. R.M. Rangayyan, "Detection of architectural distortion in prior mammograms using Gabor filters, phase portraits, fractal analysis, and texture analysis," Fifth International Symposium on Fractals in Biology and Medicine, 12-15 March, 2008, Locarno, Switzerland, one-page abstract in program.

41. R.M. Rangayyan, invited lecture, "Fractal diagnosis of breast tumours from radiographic images," Fifth International Symposium on Fractals in Biology and Medicine, 12-15 March, 2008, Locarno, Switzerland, one-page abstract in program.

40. R.M. Rangayyan, invited lecture, "Computer-Aided Diagnosis of Breast Cancer: Towards the Detection of Early and Subtle Signs," II Workshop de Telessaude, Universidade Estadual de Ciencias da Saúde de Alagoas, Maceió, AL, Brasil, October 2007.

39. R.M. Rangayyan, invited talk and panel discussion on "Education in Biomedical Engineering: crossing professional and national boundaries," 29th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, August 2007, Lyon, France.

38. "Computer-aided Diagnosis - CAD - (Diagnóstico Auxiliado por Computador – CAD)," Câncer de mama: Epidemiologia, diagnóstico e tratamento, Centro de Ciências das Imagens e Física Médica, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brasil, February 2006.

37. R.M. Rangayyan, Keynote address on "Computer-aided detection of signs of early breast cancer," at the Third IEE International Seminar on Medical Applications of Signal Processing, London, UK, 3 – 4 November 2005.

36. R.M. Rangayyan, F.J. Ayres, and J.E.L. Desautels, "Computer-aided diagnosis of early breast cancer: Detection of signs of architectural distortion," Invited talk and abstract in program booklet, Workshop on Alternatives to Mammography, Copenhagen, Denmark, September, 2005.

35. R.M. Rangayyan, F.J. Ayres, and J.E.L. Desautels, "Computer-aided diagnosis of breast cancer: Toward the detection of early and subtle signs," The First World Experts' Congress on Women's Health Medicine and Healthcare, World Academy of Biomedical Technologies, Paris, France, 14 pages, Invited talk, March 2005.

34. R.M. Rangayyan, H. Alto, N.R. Mudigonda, and J.E.L. Desautels, "Content-based retrieval and analysis of breast masses in mammograms," one-page summary on CDROM, paper no. 1170, World Congress on Medical Physics and Biomedical Engineering, Sydney, Australia, August 2003.

33. R.M. Rangayyan, "Computer-aided diagnosis of breast cancer," XIII Brazilian Symposium on Computer Graphics and Image Processing, Gramado, Rio Grande do Sul, Brazil, October, 2000.

32. R.M. Rangayyan, "Computer-aided diagnosis of breast cancer," Congresso Brasileiro de Engenharia Biomédica, Florianôpolis, Santa Catarina, Brazil, September, 2000.

31. N.R. Mudigonda, R.M. Rangayyan, J.E.L. Desautels, and O. Menut, "Segmentation of breast masses in mammograms: A multi-resolution and hierarchical density propagation approach," Proc. 13th Annual International Conference and Exhibition on Computer Assisted Radiology and Surgery, Paris, France, 23-26 June 1999, p 1014.

30. R.M. Rangayyan, "High-performance computing for computer-aided diagnosis of breast cancer," High-performance Computing Symposium, Kingston, ON, June 1999.

29. R.M. Rangayyan and N.R. Mudigonda, "Perception-based measures for computer-aided analysis of mammograms," Proc. Eighth Far West Image Perception Conference, Morley, AB, May 1999, p 4.

28. R.M. Rangayyan, Presentation on "Computer-aided diagnosis of breast cancer," opening ceremony of the Multimedia Advanced Computational Infrastructure (MACI) facility at the Rozsa Centre, University of Calgary, 28 September 1998.

27. R.M. Rangayyan, Member of Panel Discussion on "Info Era," Fenasoft, São Paulo, Brazil, 21 July 1998.

26. R.M. Rangayyan, N.M. El-Faramawy, J.E.L. Desautels, and O.A. Alim, 1997, "Measures of acutance and shape for classification of breast tumors," Shape Modeling International '97, Aizu-Wakamatsu, Japan, 3-6 March 1997.

25. C.B. Frank, Y.T. Zhang, G.D. Bell, K.O. Ladly, and R.M. Rangayyan, 1994, "Effects of joint angular velocity on vibroarthrographic signals in evaluation of knee function and pathology," abstract PS05-1.15, p128, World Congress on Medical Physics and Biomedical Engineering, 21-26 August 1994, Rio de Janiero, Brazil.

24. Y.T. Zhang, Y.P. Shen, C.B. Frank, G.D. Bell, K.O. Ladly, and R.M. Rangayyan, 1994, "Modeling of vibroarthrographic transfer function for the knee joint system: A cadaver study," abstract PS05-1.8, p124, World Congress on Medical Physics and Biomedical Engineering, 21-26 August 1994, Rio de Janiero, Brazil.

23. R.M. Rangayyan, C.B. Frank, Y.T. Zhang, and K.O. Ladly, Exhibit on Knee Sounds for the Sport Science Exhibits at the Edmonton Space and Science Centre, presented in March 1994.

22. D. Boulfelfel, R.M. Rangayyan, L.J. Hahn, and R. Kloiber, 1993, "Three-dimensional restoration of single photon emission computed tomography images using a Kalman-Metz filter," CT'93, International Symposium on Computerized Tomography, Novosibirsk, Russia, 10-14 August 1993, p33.

21. L. Shen, R.M. Rangayyan, and J.E.L. Desautels, 1993, "Computer detection and analysis of mammographic calcifications," presented at the Biennial Meeting of the International Association for Breast Cancer Research, April 1993, Banff, Alberta.

20. L. Shen, R.M. Rangayyan, and J.E.L. Desautels, 1992, "Shape analysis of mammographic calcifications," 55th Annual Scientific Meeting of the Canadian Association of Radiologists, Halifax, 21-25 June 1992, p.88.

19. R.M. Rangayyan, "Region-based enhancement and analysis of mammograms," lecture presented at the 13th Ann. Intl. Conf. IEEE Engineering in Medicine and Biology Society, Orlando, Florida, USA, Oct. 1991.

18. Y.T. Zhang, C.B. Frank, R.M. Rangayyan, G.D. Bell, and K.O. Ladly, "Step size optimization of nonstationary adaptive filtering for knee sound signal analysis," Proc. World Congress on Medical Physics and Biomedical Engineering, Kyoto, Japan 7-12, July 1991, (Medical and Biological Engineering and Computing, Vol. 29, Supplement 1991), p 836.

17. K. Eng, R.M. Rangayyan, P. Veale, R.C. Bray, C.B. Frank, and L. Anscomb, "Image processing techniques for analysis of the vascular structure of ligaments" Proc. World Congress on Medical Physics and Biomedical Engineering, Kyoto, Japan, July 1991, (Medical & Biological Engineering & Computing, Vol. 29, Suppl. 1991), p 836.

16. R.C. Bray, P. Veale, K. Eng, R. Rangayyan, C. Frank, "Quantitative analysis of ligament vascularity by image analysis," The Canadian Orthopaedic Association and The Canadian Orthopaedic Research Society Annual Meeting, Calgary, 2-6 June 1991, p25:20.

15. W.M. Morrow, R. Paranjape, R.M. Rangayyan, and J.E.L. Desautels, "Region-based image processing with applications in mammography," Annual Meeting - Canadian Association of Radiologists, Hamilton, June 1991.

14. R.M. Rangayyan, two invited seminars: "A tutorial on computed tomography," and "Image processing techniques for quantitative analysis of ligament healing and treatment procedures" at the conference "Jornada EPUSP/IEEE em Computação Visual," University of São Paulo, São Paulo, Brazil, 4-7 December, 1990.

13. Y.T. Zhang, K.O Ladly, S. Tavathia, C.B. Frank, R.M. Rangayyan, and G.D. Bell, Display on "Knee Sound Analysis" at the "University of Calgary Science and Technology Week," Health Sciences Centre, Calgary, 20 October 1990.

12. Y.T. Zhang, K.O Ladly, S. Tavathia, C.B. Frank, R.M. Rangayyan, and G.D. Bell, Display on "Joint Sounds" at "Chautauqua: The Science Circuit," Science Alberta Foundation, Calgary, 12-13 October 1990.

11. R.M. Rangayyan, "Introduction," IEEE Western Canada Conference and Exhibition on Telecommunication for Health Care: Telemetry, Teleradiology, and Telemedicine, July 6-7, 1990, Calgary, Canada, Proc. SPIE Vol. 1355, p vi.

10. R.M. Rangayyan, Attendee (by invitation), Franco-Canadian Colloquium on "Telecommunications, Optoelectronics, Image and Signal Processing," organized by the Conference des Grandes Ecoles (France) and the National Committee of Deans of Engineering and Applied Sciences (Canada), Montpellier, France, 10-15 December 1989.

9. R.M. Rangayyan, invited talk on "Approaches to teleradiology in Alberta," and participated in a panel discussion at "Executive Symposium on Telehealth," University of Victoria, 7 November 1989.

8. R.M. Rangayyan, "Digital image processing techniques for quantitative analysis of ligament healing and treatment methods," Electronic Imaging West '89, Pasadena, 10-13 April 1989.

7. R.M. Rangayyan, "Restoration of Nuclear Medicine Images," "Digital Image Processing - A Tutorial" and "Computed Tomography - A Tutorial," Symposium and Workshop on Advances in Imaging and Image Processing, B.A.R.C., Bombay, India, December, 1988.

6. A.P. Dhawan, R. Gordon and R.M. Rangayyan, 1984, "Image restoration in limited-view computed tomography," 70th Scientific Assembly of the Radiological Society of North America, November 25-30, 1984, Washington, D.C.

5. R.M. Rangayyan, 1984, "Tutorial on iterative and object-dependent algorithms for limited-view computed tomography," Optical Society of America. Topical meeting on "Industrial Applications of computed Tomography and NMR Imaging," Hecla Island, Manitoba.

4. R. Gordon and R.M. Rangayyan, 1982, "Computed tomography for remote areas via digital teleradiology," Proc. of 45th Annual Meeting of Canadian Assoc. of Radiologists, Winnipeg, p. 179.

3. R.M. Rangayyan and R. Gordon, 1982, "Expanding the dynamic range of x-ray video-densitometry for digital mammography and teleradiology," Proc. of 45th Annual Meeting of Canadian Assoc. of Radiologists, Winnipeg, p. 189.

2. R.M. Rangayyan (M.R. Rangaraj) and I.S.N. Murthy, 1980, "On the use of signal length criterion for quantification of PCG signal features," MATSCIENCE Conference, Mysore, March.

1. I.S.N. Murthy and R.M. Rangayyan (M.R. Rangaraj), 1979, "Extraction of action potential from surface EMG," ICS-79 Salzburg, Austria, September.

H. Other Publications

6. Z.Q. Liu, R.M. Rangayyan, and C.B. Frank, 1990, "Linear pattern analysis using scale-space techniques," The Big Byte, University of Calgary, vol. 23, no. 5, November, 1990, pp 4-7.

5. D. Boulfelfel, R.M. Rangayyan, J.A.R. Blais, and L.J. Hahn, 1990, "Nuclear medicine image processing," The Big Byte, University of Calgary, vol. 23, no. 5, November, 1990, pp 8-10.

4. G.R. Kuduvalli and R.M. Rangayyan, 1990, "Linear predictive coding techniques for reversible compression of medical images," The Big Byte, University of Calgary, vol. 23, no. 4, July 1990, pp 12-15.

3. W.M. Morrow and R.M. Rangayyan, 1990, "High-resolution image processing on the Myrias SPS-2," The Big Byte, University of Calgary, vol. 23, no. 4, July 1990, pp 9-11.

2. R.M. Rangayyan, 1988, "An introduction to Indian classical music," Canadian Music Educator, Vol. 29, No. 4, October 1988, pp. 27-33.

1. S. Chaudhuri, R.M. Rangayyan, S. Walsh, and C. Frank, 1987, "The Role of the Supercomputer in Image Processing: Quantitative Analysis of Collagen Alignment in Ligaments," Super*C, Super Computing Services, University of Calgary, pp. 4-9 (invited feature article).

I. Research Reports

6. T. Strecker, R. Rangayyan and L.E. Turner, 1985, "A digital image acquisition and processing system," Report #25 CO TSRRLT 1985, Department of Electrical Engineering, University of Calgary.

5. R. Gordon, R.M. Rangayyan and D.W. MacEwan, 1982, "Digital mammography for the National breast screening study," Progress Report submitted to the Manitoba Medical Services Foundation, August.

4. V.V.S. Sarma and R.M. Rangayyan (M.R. Rangaraj), 1980, "Pattern classification techniques for speech decryption," Research Report for DRDO project "SPAN," School of Automation, Indian Institute of Science, Bangalore, October.

3. V.V.S. Sarma and R.M. Rangayyan (M.R. Rangaraj), 1980, "Speech analysis and synthesis by linear prediction: A state-of-the-art report," Research Report for DRDO project "SPAN," School of Automation, Indian Institute of Science, Bangalore, April.

2. I.S.N. Murthy and R.M. Rangayyan (M.R. Rangaraj), 1978, "New concepts for PVC detection" and "New techniques for PCG analysis," Department of Electrical Engineering, Indian Institute of Science, Bangalore, September.

1. I.S.N. Murthy, R.M. Rangayyan (M.R. Rangaraj), K.J. Udupa, A.K. Goyal and K.S. Prabhu, "Biosignal processing techniques and hardware," Research Report and Documentation Manual on "Homomorphic analysis and modelling of ECG signals," Dept. of Electrical Engineering, Indian Institute of Science, Bangalore, India, July 1977.

J. Awards and Distinction

Fellow, Royal Society of Canada, 2016.

Outstanding Teaching Performance Award, Schulich School of Engineering, University of Calgary, 2016.

"Guest of Honor," Third International Conference on Signal Processing and Integrated Networks SPIN 2016, Amity University, Noida, India, February 2016.

"Honorary Professor," Amity University, Noida, India, February 2016.

"Pride of Canada: For making Canadian Kannadigas proud through your outstanding achievement in your field of profession and personal services to the community at large," Canadian Organization of Kannadigas and Kannada Sangha, Toronto, 2014.

"High-level Foreign Expert Visiting Professor," 2014, High-level Foreign Expert Visiting Professor, State Administration of Foreign Experts Affairs and Xiamen University, Xiamen, Fujian, China.

"Diploma of Honor", IEEE International Conference on eHealth and Bioengineering, EHB, Iaşi, Romania, November 2013.

"Outstanding Engineer" medal, IEEE Canada, 2013.

"Achievement in Innovation," Innovate Calgary, February 2013.

Distinguished Alumni Award, International Conference on Emerging Research in Electronics, Computer Science and Technology (ICERECT-12), held in connection with the Golden Jubilee Celebrations of the P.E.S. College of Engineering, Mandya, India, 21-22 December 2012.

Award of Honour, International Conference on Biomedical Engineering and Assistive Technologies (BEATS 2012), held in connection with the Silver Jubilee Celebrations of the Dr. B.R. Ambedkar National Institute of Technology, Jalandhar, India, 6-7 December, 2012.

Invited Centenary Lecturer, Department of Electrical Engineering, Indian Institute of Science, Bangalore, India, May 2012.

Guest of Honour, International Conference on Biomedical Engineering and Assistive Technologies, National Institute of Technology, Jalandhar, India, 17 December 2010.

Faculty Mobility Program Award of the Shastri Indo-Canadian Institute, 2010-2011.

Fellow, Canadian Academy of Engineering, 2009.

Killam Resident Fellowship, University of Calgary, 2007.

Fellow, Canadian Medical and Biological Engineering Society, 2007.

Fellow, Society for Imaging Informatics in Medicine, 2007.

"University Professor," University of Calgary (2003 – present).

Distinguished Lecturer, IEEE Engineering in Medicine and Biology Society, 2009-2011

Fellow of SPIE: International Society for Optical Engineering, 2003.

Fellow of AIMBE: American Institute for Medical and Biological Engineering, 2003.

Killam Resident Fellowship, University of Calgary, 2002.

Distinguished Lecturer, University of Toronto, 2002.

Excellence in Professional Field Award, India-Canada Association of Calgary, 2002.

Fellow of EIC: Engineering Institute of Canada, 2002.

Research Excellence Award, Department of Electrical and Computer Engineering, University of Calgary, 2001.

Fellow of IEEE: Institute of Electrical and Electronics Engineers, 2001.

IEEE Third Millennium Medal, 2000.

Killam Resident Fellowship, University of Calgary, 1998.

Research Excellence Award, Department of Electrical and Computer Engineering, University of Calgary, 1997.

Research Excellence Award, Faculty of Engineering, University of Calgary, 1997.

Outstanding Service Award, India-Canada Association of Calgary, 1997.

Distinguished Lecturer, Hong Kong Institution of Engineers, 1996.

Promoted to Senior Member grade in IEEE, 1983.

First prize in All India Student paper contest conducted by IEEE India Council, Bombay, February 1979.

First prize in Student paper contest conducted by IEEE Bangalore Section, February 1979.

Third prize in All India Student paper contest conducted by IEEE India Council, Madras, February 1978.

Second prize in Student paper contest conducted by IEEE Bangalore Section, January 1978.

Best Cadet, National Cadet Corps, 1976 (Served 1970-1976).

Seventh Rank holder, University of Mysore Bachelor of Engineering Examinations, 1976.

Government of India National Merit Scholar, 1970-76.

K. Institutions Visited to Provide Lectures and Courses (Outside Canada)

Universidade de São Paulo, São Paulo, SP, Brasil

Universidade Federal de São Carlos, São Carlos, SP, Brasil

Universidade de São Paulo, São Carlos, SP, Brasil

Universidade de São Paulo, Ribeirão Preto, SP, Brasil

Universidade Estadual de Ciencias da Saúde de Alagoas, Maceió, AL, Brasil

Universidade Federal de Alagoas, Maceió, AL, Brasil

Universidade Estadual de Campinas, Campinas, SP, Brasil

Universidade Federal de Uberlândia, Uberlândia, MG, Brasil

Radioclínica, Uberlândia, MG, Brasil

Instituto do Coração, São Paulo, SP, Brasil

Instituto da Criança, São Paulo, SP, Brasil

Universidade Estadual Paulista, Sorocaba, SP, Brasil

Faculdade de Engenharia de Sorocaba, Sorocaba, SP, Brasil

Laboratório Nacional de Computação Científica, Petrópolis, RJ, Brasil

Universidade Federal do Pernambuco, Recife, PE, Brasil

Universidade Federal do Rio Grande do Sul, RS, Brasil

Faculdade SENAC de Ciências Exatas e Tecnologia, (SENAC College of Computational Sciences and Technology), São Paulo, SP, Brasil

University of Zimbabwe, Harare, Zimbabwe

Universidad de Sevilla, Sevilla, Spain

École Nationale Supérieure des Télécommunications de Bretagne, Brest, France

Université de Paris VI, Paris, France

Institut Polytechnique de Lyon, Lyon, France

Université de Savoie, Annecy, France

Université de Rennes, Rennes, France

University of Zagreb, Zagreb, Croatia

University of Bari, Italy

Italian Institute of Technology, Genoa, Italy

University of Rome Tor Vergata, Rome, Italy

University of Genoa, Genoa, Italy

Universitatea Politehnica Bucureşti, Bucharest, Romania

State Optical Institute, St. Petersburg, Russia

AZ Corporation and Tomography Association, Moscow, Russia

Tampere University of Technology, Tampere, Finland

University of Manchester, Manchester, UK

Imperial Cancer Research Fund, London, UK

University of Liverpool, Liverpool, UK

Royal Marsden Hospital, London, UK

University of Twente, Enschede, The Netherlands

Uniklinik RWTH Aachen University, Aachen, Germany

Alexandria University, Alexandria, Egypt

University Hospital, Kuala Lumpur, Malaysia

Universiti Sains Malaysia (KCP), Tronoh, Malaysia

Universiti Sains Malaysia, Penang, Malaysia

National University of Singapore, Singapore

King Mongkut's Institute of Technology, Bangkok, Thailand

University of Hong Kong, Hong Kong

Shanghai Jiao Tong University, Shanghai, China

The Ninth People's Hospital, Shanghai, China

Northern Jiao Tong University, Beijing, China

Tsinghua University, Beijing, China

Beijing University of Posts and Telecommunications, Beijing, China

Xiamen University, Xiamen, Fujian, China

Tokyo Institute of Technology, Tokyo, Japan

Nagoya Institute of Technology, Nagoya, Japan

Niigata University, Niigata, Japan

Kyushu University, Fukuoka, Japan

Gifu University, Gifu, Japan

Indian Institute of Science, Bangalore, India

Indian Institute of Technology, Kharagpur, India

Indian Institute of Technology, Roorkee, India

National Institute of Technology, Warangal, India

Jaypee University of Information Technology, Waknaghat, India

Dr. B.R. Ambedkar National Institute of Technology, Jalandhar, India

Tata Institute of Fundamental Research, Bombay, India

Indian Institute of Technology, Bombay, India

Indian Institute of Technology, New Delhi, India

Indian Statistical Institute of Technology, Kolkata, India

College of Engineering, Pune, India

S.J. College of Engineering, Mysore, India

P.E.S. College of Engineering, Mandya, India

Adamas University, Kolkata, India

G.E. India Technology Centre, Bangalore, India

Philips Innovation Campus, Bangalore, India

Siemens Information Systems Ltd., Bangalore, India

M.S. Ramaiah School of Advanced Studies, Bangalore, India

Post-Graduate Institute for Medical Education and Research, Chandigarh, India

Manipal Institute of Technology, Manipal, India

Cleveland Clinic Foundation. Cleveland, OH, USA

Fischer Imaging, Denver, CO, USA

L. Technology Transfer, Patents, and Consulting Activities

U.S. Patent 6,537, 233 on "Auditory display of knee joint vibration signals," awarded March 25, 2003. R.M. Rangayyan, S. Krishnan, G.D. Bell, and C.B. Frank. Assignee: University Technologies International Inc. (UTI #435.1).

AHFMR Technology Commercialization Grant, "Development of a non-invasive device for diagnosing knee-joint injury," $34,925, 2000-2001. (With Mind to Market Solutions Inc., Calgary.)

Government of Alberta, Department of Technology, Research and Telecommunications; Grant received for the 1st stage of the project on "High resolution Digital Teleradiology" (Economic Analysis), with I.T.T. Export Corporation, Calgary (Dr. N.A. Goswami), $20,000, 1988.

Served as consultant to several companies, corporations, and institutions.

M. Teaching and Curriculum Development

At the Tampere University of Technology, Tampere, Finland: Advanced Biomedical Image Analysis, 2011.

At the Ragnar Granit Institute of Biomedical Engineering, Helsinki, Finland, Biomedical Image Analysis, 2008.

At the Tampere University of Technology, Tampere, Finland: Biomedical Signal Analysis, 2000, 2007.

At the University of São Paulo, São Paulo, SP, Brazil: PEE830 Digital Image Processing, 1994.

At the University of Calgary: ENGG 213- Engineering Computation; ENGG 215- Engineering Practice, Design, and Communication; ENGG 233- Computing for Engineers I; ENGG 333- Computing for Engineers II; ENGG 303- Electrical Circuits and Machines; ENGG 323- Systems and Instrumentation; ENEL 327- Signals and Systems; ENEL 563- Biomedical Signal Analysis; ENEL 599- Electrical Engineering Project; ENEL 593- Digital Filters; ENEL 697- Digital Image Processing.

"Indian Classical Music," lecture-demonstrations on the flute, sitar, and tabla: Guest Lectures for GNST 359 Introduction to World Music; SAST 315 Understanding South Asia; MUED 671.06 Culture Studies and World Music (with U. Mazumdar).

At the Indian Institute of Science, Bangalore, India: ES9-202- Digital Signal Processing.

At the University of Manitoba: 24.208- Electric Circuits; 24.358- Signal Analysis IIIE; 24.426- Communication Systems; 24.815- Digital Signal Processing; 24.822- Digital Image Processing;

Developed a new Fourth-year B.Sc. Electrical and Computer Engineering elective course ENEL 563 Biomedical Signal and Image Analysis, including a textbook, lecture notes, lab exercises, and problem-solution sets, 1997.

Developed the curriculum for a graduate program on Computer Vision for Universiti Sains Malaysia, Ipoh, 1994.

Developed the curriculum for a new course ENGG333 Advanced Engineering Computation, as member of a subcommittee, 1990.

Developed a graduate program curriculum in Biomedical Engineering at The University of Calgary, as Chairman of a sub-committee, 1985-89.

Developed a new set of computer program examples and lab assignments for ENGG 327/213 Engineering Computation, 1985.

Developed a new graduate course ENEL 697 "Digital Image Processing" at Electrical Engineering Department, University of Calgary, 1985. Laboratory facilities were also developed to support the course.

Developed procedures on the HP9816 computer for lab experiments on Fourier analysis, AM, and FM, for course 24.358, 1984 (with R. Lehner).

Formulated new graduate courses 24.830 "Computer Vision," 24.829 "Imaging in Biomedical Engineering" (with R. Gordon), and "Image Processing for Remote Sensing" (with Working Group for "Imaging and Remote Sensing"), at University of Manitoba, Department of Electrical Engineering, 1984.

Developed a new lab experiment on "Threshold effects in FM systems" for course 24.426 Communication Systems, 1983 (with R. Lehner).

Developed a new graduate course 24.822 "Digital Image Processing" at the University of Manitoba, Department of Electrical Engineering, 1983.

N. Student and Staff Supervision

N1. Graduate Theses Completed:

44. Ashis Kumar Dhara, (Ph.D., Cosupervisor, Indian Institute of Technology Kharagpur, India, 2015), "Development of a self-learning tool for radiologists using content-based image retrieval techniques."

43. Faraz Oloumi, (Ph.D., 2015), "Computer-aided Diagnosis of Plus Disease via Quantitative Analysis of the Vascular Architecture in Retinal Fundus Images of Preterm Infants."

42. Paola Casti, (Ph.D., Cosupervisor, University of Rome Tor Vergata, Italy, 2015), "Computerized analysis of mammographic images for detection and characterization of breast cancer."

41. Jayasree Chakraborty, (Ph.D., Cosupervisor, Indian Institute of Technology Kharagpur, India, 2013), "Computer-aided detection of mammographic lesions: masses and architectural distortion."

40. Sansira Seminowich (M.Sc., 2012), "Digital Image Processing Techniques for Analysis of Images of Renal Biopsy Samples."

39. Paola Casti, (M.Sc., Cosupervisor, University of Rome Tor Vergata, Italy, 2011), "Development and validation of a computer-aided detection system for the identification of bilateral asymmetry in mammographic images."

38. Faraz Oloumi, (M.Sc., 2011), "Analysis of the Vascular Architecture in Fundus Images of the Retina."

37. Shantanu Banik (Ph.D., 2011), "Computer-aided Detection of Architectural Distortion in Prior Mammograms of Interval-cancer Cases."

36. Thanh Minh Cabral (Nguyen) (M.Sc., 2010), "Analysis of the Shape and Texture of Breast Masses in Mammograms."

35. Douglas Frey (M.Sc., Cosupervisor, 2009), "The derivation of the acoustical impulse response function of a music performance hall."

34. Xiaolu (Iris) Zhu (M.Sc., 2008), "Detection of the optic nerve head in images of the retina."

33. Yunfeng Wu (Ph.D., Beijing University of Posts and Telecommunications, Cosupervisor, 2008), "Novel Computational Intelligent Technologies and their Applications in Biomedical Signal Analysis."

32. Shantanu Banik (M.Sc., 2008) "Three-dimensional Image Processing Techniques to Perform Landmarking and Segmentation of Computed Tomographic Images."

31. Ilya Kamenetsky (M.Sc., 2008), "Digital Image Processing Techniques for Analysis of the Glomerular Basement Membrane."

30. Shormistha Prajna (M.Sc., 2007), "Detection of architectural distortion in prior mammograms using Gabor filters, phase portraits, fractal dimension, and texture analysis."

29. Fábio José Ayres (Ph.D., 2007), "Computer-aided Diagnosis of Architectural Distortion in Mammograms."

28. Randy Hoang Vu (M.Sc., 2006), "Strategies for three-dimensional segmentation of the primary tumor mass in computed tomographic images of neuroblastoma."

27. Yuhong (Kay) Liu (M.Sc., Cosupervisor, 2005), "Application of Efron's bootstrap methods to evaluate the performance of neural networks in the classification of mammographic features."

26. Xiaozheng (Eileen) Wang (M.Sc., Cosupervisor, 2004), "Application of data mining to mammographic data."

25. Hanford John Deglint (M.Sc., 2004), "Image processing algorithms for three-dimensional segmentation of the tumor mass in computed tomographic images of neuroblastoma."

24. Margaret Hilary Alto (Ph.D., 2003), "Indexed atlas of mammograms for computer-aided diagnosis of breast cancer."

23. Ricardo José Ferrari (Ph.D., Co-supervisor, University of São Paulo, São Carlos, SP, Brazil, 2002), "Computational detection of asymmetry between mammograms" (in Portuguese).

22. Naga Ravindra Mudigonda (Ph.D., 2001), "Image analysis methods the detection and classification of mammographic masses."

21. Sridhar Krishnan (Ph.D., 1999), "Adaptive signal processing techniques for analysis of knee joint vibroarthrographic signals."

20. Liang Shen (Ph.D., 1998), "Region-based adaptive image processing techniques for mammography."

19. Roseli de Deus Lopes (Ph.D.- University of Sao Paulo, Brazil, 1998), "Region-based techniques for processing three-dimensional images with applications in volume visualization."

18. Antonio Cesar Germano Martins (Ph.D.- University of Sao Paulo, Brazil, 1997), "Auditory display and sonification of images with texture."

17. Nema El-Faramawy (Ph.D.- Alexandria University, Egypt, 1996), "Measures of acutance and shape for classification of breast tumors."

16. Arup Das (M.Sc., 1996), "Region-based image processing."

15. Sridhar Krishnan (M.Sc., 1996), "Adaptive filtering, modeling, and classification of knee joint vibroarthrographic signals."

14. William Rolston (M.Sc., 1994), "Directional Image Analysis."

13. Yiping Shen (M.Sc., 1994), "Transmission Characteristics and Localization of Vibroarthrographic Signals."

12. Zahra Kazem-Moussavi (M.Sc., 1993), "Analysis of Knee Sound Signals via Least Squares Modeling."

11. Joseph Provine (M.Sc., 1992), "Peanoscanning for Image Compression."

10. Hieu N. Nguyen (M.Eng., 1992), "Object-based Contrast Enhancement."

9. Djamel Boulfelfel (Ph.D., 1992), "Restoration of Nuclear Medicine Images."

8. Tamer F. Rabie (M.Sc., 1992), "Adaptive-Neighborhood and Iterative methods for Image Restoration."

7. Liang Shen (M.Sc., 1992), "Shape analysis of mammographic calcifications."

6. Gopinath R. Kuduvalli (Ph.D., 1992), "Image data compression for high-resolution digital teleradiology."

5. Sanjeev Tavathia (M.Sc., 1991), "Analysis of Knee Joint Vibration Signals by Linear Prediction."

4. William M. Morrow (M.Sc., 1990), "Region-based Image Processing Techniques with Application to Mammography."

3. Timothy C. Hon (M.Sc., 1988), "Restoration of Gamma Camera-Based Nuclear Medicine Images."

2. Subhasis Chaudhuri (M.Sc., 1987), "Digital Image Processing Techniques for Quantitative Analysis of Collagen Fibril Alignment in Ligaments."

1. Richard J. Lehner (M.Sc., 1985), "A three-channel microcomputer system for quantitative analysis of the phonocardiogram, electrocardiogram and carotid pulse signals."

N2. Undergraduate Theses/ Projects:

18. Chad Erven, "Implementation of a statistical analysis method for vibroarthrographic signals on an embedded TigerSHARC processor," 2007.

17. Foad Oloumi, Faraz Oloumi, and Peyman Eshghzadeh-Zanjani, "Detection and Analysis of Blood Vessels in the Retina," 2007.

16. Thanh Minh Nguyen, "Fractal analysis of mammographic masses," 2004.

15. Heather Bosnak, Ramanpreet Grewal, James Howland, and Ben Liu, "An indexed atlas of digital mammograms for computer-aided diagnosis of breast cancer," 2005.

14. Howard Lau, Kelvin Mok, Donald So, and Courtney Tse, "An indexed atlas of digital mammograms for computer-aided diagnosis of breast cancer," 2004.

13. Leslie Anderson, Jackalynn Sproat, Diane Janzen, Wai Ki Chau, "Computer workstation for analysis and classification of knee joint vibroarthrographic signals for non-invasive diagnosis of articular cartilage pathology," 1999 (with G.D. Bell).

12. Philip Arsenault, Sharon Ellingsen, Shanif Lakhani, Paul Thomson, Mike Mulligan, Minesh Kuttlerywala, John Liu, "Computer workstation for analysis and classification of knee joint vibroarthrographic signals for non-invasive diagnosis of articular cartilage pathology," 1998 (with G.D. Bell).

11. Ram Reddy, "A study of the optimal threshold for the recursive least squares method of segmentation," 1994.

10. Salahuddin Elkadiki, "Objective characterization of image acutance," 1993.

9. Kenny Tse, "Quantitative wellbore fracture analysis from electrical images," 1992.

8. Terry Baydock, "Image coding and compression for digital teleradiology," 1984 (with R. Gordon and J. Dunning).

7. Patricia Palanuk, "Homomorphic deconvolution of EMG signals," 1984.

6. A. Wong, "Microcomputer system for arrhythmia monitoring," 1984.

5. H.K. Wong, "Microcomputer system for adaptive neighborhood image processing," 1984 (with R. Gordon and J. Dunning).

4. Brent Kizuik, "Automated control of a rotating microscope system," 1983 (with R. Gordon).

3. Kirby Jaman, "Optimal display of limited-view computed tomograms in 3D," 1983 (with R. Gordon).

2. Richard Lehner, "Microprocessor-based heart sound analyzer," 1983.

1. Curtis Quinn, "Video simulation of steerable x-ray microbeam imaging," 1983 (with R. Gordon).

N3. Supervision of Other Research Staff:

43. Lucas Frighetto Pereira, 2016, FAPESP scholar, from University of São Paulo, Ribeirão Preto, SP, Brazil. Classification of benign and malignant vertebral compression fractures in MR images.

42. Eliana Silva de Almeida, 2015, CNPq Science Without Borders Postdoctoral Fellow, from Federal University of Alagoas, Maceio, Brazil.

41. Ivan Cruz Aceves, 2013, Visiting PhD student, División de Ingenierías, Campus Irapuato-Salamanca, Universidad de Guanajuato, Mexico.

40. Shantanu Banik , 2012, NSERC CREATE postdoctoral fellow, "Computer-aided Detection of Architectural Distortion in Prior Mammograms of Interval-cancer Cases."

39. Denise Guliato, Post-doctoral Fellow from the Federal University of Uberlândia, Brazil, 2007, "Computer-aided diagnosis of breast cancer."

38. Begoña Acha Piñero, Visiting Researcher from the University of Seville, Spain, 2004, "Detection of calcifications in mammograms."

37. María del Carmen Serrano Gotarredona, Visiting Researcher from the University of Seville, Spain, 2004, "Detection of calcifications in mammograms."

36. Randy Hoang Vu, "Medical image analysis," NSERC USRA, 2004.

35. Túlio César Soares dos Santos André, from Universidade de São Paulo, Ribeirão Preto, SP, Brazil, "Neural networks for the detection of breast cancer," 2003.

34. Antonio Cesar Germano Martins, from the Faculty of Engineering, Sorocaba, São Paulo, SP, Brazil, 2001, "Analysis of texture in images."

33. Fábio José Ayres, from the University of São Paulo and Faculdade SENAC de Ciências Exatas e Tecnologia, (SENAC College of Computational Sciences and Technology), São Paulo, SP, Brasil, "Segmentation and estimation of the histological composition of the tumor mass in computed tomographic images of neuroblastoma," 2001, 2002.

32. Sílvia Delgado Olabarriaga, from the Federal University of Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil, 2000, "Subjective and objective analysis of image sharpness."

31. Jérôme Jouffroy, Internship Student from Université de Savoie, Annecy, France, 1999, "Analysis of asymmetry in mammographic images."

30. Hilary Alto, 1998, Part-time Research Associate, "Computer-aided Diagnosis of Breast Cancer" (with J.E.L. Desautels).

29. Begoña Acha Piñero, Visiting Researcher from the University of Seville, Spain, 1998, "Medical Image Processing."

28. María del Carmen Serrano Gotarredona, Visiting Researcher from the University of Seville, Spain, 1998, "Medical Image Processing."

27. Denise Guliato, Visiting Researcher from the Federal University of Uberlandia, Brazil, 1998, "Segmentation of breast tumor regions in mammographic images."

26. Mihai Ciuc, Visiting Research Associate from University of Bucharest, Romania, 1997, "Adaptive neighborhood filtering of color images."

25. Marcelo Knörich Zuffo, Visiting Research Associate from Universidade de São Paulo, São Paulo, SP, Brasil, 1997, "Iconographic display of mammographic features for computer-aided diagnosis of breast cancer."

24. Olivier Menut, Internship Student from Institut National Polytechnique de Grenoble, France, 1997, "Detection, shape analysis, and classification of breast tumors in mammographic images," (with J.E.L. Desautels).

23. Yiping Shen, Research Assistant, 1995, "Clinical evaluation of computer-aided enhancement and analysis of mammograms for the diagnosis of early breast cancer," (with J.E.L. Desautels).

22. Umi Kalthum Ngah, Visiting Research Associate, Universiti Sains Malaysia, Tronoh, Malaysia, "Digital Image Processing with applications to Mammography," 1993.

21. Salahuddin Elkadiki, "Image Acutance," 1993.

20. Yiping Shen, Research Assistant, "Analysis of ligament vascularity," 1991 (with Dr. R.C. Bray).

19. William Rolston, Research Assistant, "Directional Image Processing," 1991.

18. Sanjeev Tavathia, Research Assistant, "Heart sound signal analysis," 1991.

17. Kevin Eng, Summer Research Assistant, "Digital image processing techniques for the analysis of vascularization of ligaments in response to injury," 1990 (with Dr. R.C. Bray).

16. Dr. Raman Paranjape, Post-doctoral Research Associate, "Digital Image Processing Techniques for the Analysis of Mammograms," 1992 (with Dr. J.E.L. Desautels).

15. Theo Smit, Research Associate, "Digital Signal Processing Techniques for Non-invasive Detection and Classification of Cartilage Pathology in the Knee," 1989 (with Dr. C. Frank and Dr. G.D. Bell).

14. Dr. Yuanting Zhang, Post-doctoral Research Associate, "Digital Signal Processing Techniques for Non-invasive Detection and Classification of Cartilage Pathology in the Knee," 1994 (with Dr. C. Frank and Dr. G.D. Bell).

13. Dr. Zhi-Qiang Liu, Post-Doctoral fellow (CDC PACER Fellow and AHFMR Fellow), "Quantitative analysis of collagen alignment in ligaments for optimization of healing," 1990 (with Dr. C. Frank)

12. Richard Smith, "Knee joint sound signal analysis," 1987 (with C. Frank and D. Bell).

11. Richard Smith, "Biomedical Signal Analysis - Electrodiagnosis and Acoustodiagnosis," 1986, (with C. Frank and D. Bell).

10. D. Mitchell, 1986, "Reconstruction and restoration of seismic tomography in bore holes."

9. Hieu Nguyen, "Adaptive Neighbourhood Image Processing Applied to Mammograms," 1985, 1986.

8. Hieu Nguyen, Duane Webb, "Digital Processing of Electron Micrographs of Rabbit Ligament Collagen Fibers," 1985 (with C. Frank).

7. Mike Bauer, Ed Block, "Phonocardiogram Signal Processing," 1985.

6. Doug Den Hoed, Bill Royan, "Digital Image Processing using Adaptive Neighbourhoods," 1985.

5. Tim Strecker, Part-time Research Engineer, "Digital Image Processing," 1985.

4. R.J. Lehner (with R. Gordon), 1984 "Digital subtraction angiography using adaptive neighborhood image processing."

3. M.L. Miller, 1984, "Identifying and locating heart sound sources in 3D: A preliminary study."

2. Greg Kozier, Part-time Research Associate, "Evaluation of the SPARTAF algorithm on the EMI CT scanner," 1983 (with R. Gordon).

1. Paul Soble, Part-time Research Associate, "Homomorphic deconvolution of geometric artifacts in limited-view computed tomography," 1984 (with R. Gordon).

O. External Administrative and Organizational Service (Selected Items)

Program Committee, International Congress on Computer Assisted Radiology and Surgery, 2008-2016.

Journal Advisory Board, International Journal of BioSciences and Technology, 2008 - 2009.

Co-Chair and Co-Editor of proceedings, IASTED International Conference on Telehealth, Banff, Alberta, Canada. 19 – 21 July 2005.

External Examiner, Chinese University of Hong Kong, Electronics Engineering, 2003 – 2006.

Associate Editor: IEEE Transactions on Biomedical Engineering, 1989-96.

Program Co-Chair, 20th Annual International Conference of the IEEE EMBS, Hong Kong, October 1998.

Track Chair for Imaging, 18th Annual International Conference of the IEEE EMBS, Amsterdam, The Netherlands, October 1996.

Organized and Chaired a session on "Biomedical Engineering Education: An International Perspective," ASEE Conference, Edmonton, 26-29 July 1994 (with Z. Koles).

Member, IEEE EMBS Conference Committee, 1992-99.

Member, Scientific Program Committee and Editorial Board, International Symposium on Computerized Tomography, Novosibirsk, Russia, 10-14 August, 1993.

Program Chair and Co-Editor, 15th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 28-31, 1993, San Diego, CA.

Chairman (founding), IEEE EMBS Southern Alberta (Calgary) Chapter, 1991-93.

Canadian Regional Representative to the Administrative Committee (AdCom) of the Engineering in Medicine and Biology Society of the IEEE, 1990-93.

Member, Canadian Standards Association- Committee on Programming Languages- Fortran Working Group (on the development of the new standard Fortran90), 1989-94.

Program Chairman, Organizing Committee for the IEEE Western Canada Exhibition and Conference on "Telecommunication for Health Care: Telemetry, Teleradiology, and Telemedicine," July 6-7, 1990, University of Calgary, 1988-90.

Chairman, Local Arrangements Committee, Optical Society of America Topical Meeting on "Industrial Applications of Computed Tomography," Hecla Island, Manitoba, August 1984.

P. University Administrative and Organizational Service (Selected Items)

Associate Vice-President (Research), 2000-2002.

Associate Head (Undergraduate Studies), Department of Electrical and Computer Engineering, University of Calgary, 1993-94.

Acting Head, Department of Electrical and Computer Engineering, University of Calgary, 1991-92.

Chair, Faculty of Engineering Infomatics Committee, 1996-97.

Chair, Faculty Advisory Committee on Computing, 1986-87, Member 87-88.

Chair, Committee for Graduate Studies Curriculum in Biomedical Engineering, Faculty of Engineering, University of Calgary, 1985-90.

IEEE Student Branch Counselor, University of Calgary, 1985-90.

Q. Community Service (Selected Items)

Music Teacher, School of Indian Languages and Performing Arts, Calgary, 2009-2011, 2013-...

President, Raga Mala Music Society of Calgary, 1991-93, Treasurer 1989-91.

Judge, 1988 Science Fair, St. Stephen's School and Father Whelihan School.

President, Southern India Cultural Association, Calgary, 1985, (1986).

Volunteer Tutor, Kendriya Vidyalaya (Central School), Indian Institute of Science, Bangalore, 1979-80.

R. Visiting, Honorary, or Adjunct Professorships

Amity University, Noida, India, 2016.

State University of São Paulo (Universidade Estadual Paulista, UNESP), Sorocaba, Brazil, 2012.

Department of Electronic Engineering, University of Rome Tor Vergata, Rome, Italy, June 2012.

Department of Electronics and Electrical Communication Engineering, Indian Institute of Technology, Kharagpur, India, November 2010 – January 2011.

Kyushu University, Fukuoka, Japan, October 2011.

Xiamen University, Xiamen, Fujian, China, 2010 – 2013.

University of Liverpool, Liverpool, UK, 2007 – 2013.

Beijing University of Posts and Telecommunications, Beijing, China, 2006 – 2009.

Manipal Institute of Technology, Manipal, Karnataka, India, 2006 – 2009.

Tampere University of Technology, Tampere, Finland, April 1999, April 2000.

Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, OH, December 1999.

Universitatea Politehnica din Bucureşti, Bucharest, Romania, April 1996, 1997, 1998.

Escola Politécnica, Universidade de São Paulo, São Paulo, SP, Brasil, 1994-...

Department of Electrical Engineering, Indian Institute of Science, Bangalore, India, August 1994, July-December 1988.

Département Image et Traitement de l'Information, Télécom Bretagne- École Nationale Supérieure des Télécommunications de Bretagne, Brest, France, May-June 1995, July 1999.

S. International Research Collaboration and Developmental Activities

I have given many lectures, research seminars, and tutorials on digital image processing, computer vision, medical imaging and image analysis, biomedical signal analysis, and related topics, as well as collaborated with researchers at universities, institutes, and research organizations in India, Canada, U.S.A., Brazil, Argentina, Uruguay, Chile, Zimbabwe, U.K., Russia, The Netherlands, Egypt, France, Germany, Spain, Italy, Croatia, Romania, Finland, Malaysia, Thailand, Japan, Hong Kong, Singapore, and China.

Computer programs and datasets we have developed for medical image analysis and other applications have been used or are being used by research groups in Canada, the U.S.A., the U.K., India, China, Brazil, Argentina, France, Italy, Spain, Romania, and Malaysia.

T. News Media Coverage – Articles and Interviews

Live performance and interview with John Reid on CJSW radio, Calgary, 26 April 2017, Classical Music of India on the bamboo flute bansuri, with Utpal Mazumdar on the tabla, air time for CD "Eons to Eternity."

Live performance and interview with Helen Young on CJSW radio, Calgary, 28 September 2016, Classical Music of India on the bamboo flute bansuri, with Utpal Mazumdar on the tabla, "Twilight Concert Series."

Live performance and interview on Sursangam radio, Calgary, 14 July 2015, Classical Music of India on the bamboo flute bansuri with Harjeet Singh on the tabla.

Live performance and interview with John Reid on CJSW radio, Calgary, 7 July 2015, Classical Music of India on the bamboo flute bansuri, with Utpal Mazumdar on the tabla, air time for CD "Mystical Melodies."

EE Web, Electrical Engineering Community, "Featured Engineer," http://www.eeweb.com/spotlight/interview-with-rangaraj-m.-rangayyan, 21 April 2014.

"Researchers working toward early cancer detection," by Erica Howes, The Charlatan, Carleton, ON, Canada, April 09 2014. http://www.charlatan.ca/2014/04/researchers-working-toward-early-cancer-detection/#

"Digital imaging could help University of Calgary software detect cancer even earlier," metro, Calgary, 1 April 2014. By Robson Fletcher.

"New Schulich software helps spot breast cancer earlier," UToday, March 19, 2014.

"Raj Rangayyan: Master of Many Crafts," interview article by Sara Tehranian, pp10-13, Schulich Engineer, Spring 2013.

"Professional Engineers help make medical breakthroughs," p14, National Engineering and Geoscience Month, Special Advertising Feature, APEGA, 2013-02-28, Calgary Herald and several Canadian newspapers.

"O computador e a flauta," interview article by Cínthia Leone, UNESP journal (in Portuguese), on "The computer and the flute: Professor of University of Calgary discusses both the use of digital images in medicine and the characteristics of Indian music," November 2012.

"New steps forward in cancer research," Schulich Engineer, Spring 2012, p34.

Interview on computer-aided diagnosis of breast cancer on the CTV Alberta Prime Time Show with Jennifer Martin, 2012-04-02.

Interview on computer-aided diagnosis of breast cancer on the CTV national Health Segment Show with Marcia MacMillan, 2012-04-02.

Interview on computer-aided diagnosis of breast cancer with Dave Rutherford on QR77 radio, 2012-04-02.

Interviews on computer-aided diagnosis of breast cancer broadcast on CTV, CBC TV, and Global TV, 2012-03-30

"University of Calgary software detects cancer before tumour forms," Amanda Stephenson, Postmedia NewsMarch, 2012-03-30. This article was carried by several newspapers across Canada, including the Edmonton Journal, Vancouver Sun, and Montreal Gazette.

"Program advances breast-cancer detection," Amanda Stephenson, Calgary Herald, 2012-03-30.

"New breast cancer screen could find other cancers," Michael Wood, Calgary Sun, 2012-03-30.

"Engineers at the University of Calgary have won a Publication Prize...." Interview with Jennifer Keene, CBC Radio, Calgary Eyeopener, 2012-03-29.

"Computer technology key to early detection of breast cancer," by Jennifer Sowa, UToday, University of Calgary, 2012-03-29.

Interview with Arun Dev, DNA, Bangalore, India, on computer-aided diagnosis, published 3 January 2011.

"Soothing Sounds." Interview with Gil Tucker, Global TV, on my CD "Totally Peaceful" and the classical music of India. 11 January 2010.

"Totally Peaceful." Live interview with John Reid, Canadian Music Centre, Prairie Region, on CJSW Radio, on my CD and the classical music of India. 5 January 2010.

"University professor the first in Canada to receive acknowledgement from major international society," by Laurie Wang, Newsletter of the Faculty of Medicine, University of Calgary, July 24, 2007.

"Um software amigo do peito," interview article by Arlete Mattos, with Dr. Paulo Mazzoncini de Azevedo Marques, published in USP-Ribeirão, newspaper of the University of São Paulo, Ribeirão Preto, 13 March 2006. The same matter was also published on the website of the Clinical Hospital of the University of São Paulo, Ribeirão Preto.

"Programa de compuatdor no combate ao câncer de mama," interview article by Angelo Davanço, with Dr. Paulo Mazzoncini de Azevedo Marques, published in Jornal a Cidade Ribeirão Preto, SP, Brazil, 9 March 2006.

TV Clube (Bandeirantes) interview by Roberto Ribeiro, 10 Feb. 2006, on computer-aided diagnosis of breast cancer, with Dr. Paulo Mazzoncini de Azevedo Marques, Ribeirão Preto, SP, Brazil.

RP9 TV interview by Angela Pepe, 9 Feb. 2006, on computer-aided diagnosis of breast cancer, with Dr. Paulo Mazzoncini de Azevedo Marques, Ribeirão Preto, SP, Brazil.

"A Second Opinion," interview article by Malwina Gudowska, Avenue magazine, November 2005, pp 26 – 28.

"Group Creates an Information Autobahn," part of Feature Article by Nordahl Flakstad, in The PEGG: Newsletter of the Association of Professional Engineers, Geologists, and Geophysicists of Alberta, 32(2):18, February 2004.

"U of C Salutes its Stars," On Campus, University of Calgary, 14 November 2003.

"SPIE's in the Faculty?," Enginuity, Faculty of Engineering, University of Calgary, Fall 2003.

"Engineering prof named SPIE Fellow," On Campus, University of Calgary, 3 October 2003.

"Listen, Honey…." Interview on CBC Radio on my CD and the classical music of India. April 2003. (With Utpal Mazumdar.)

"Listen, Honey…." Live interview and performance on CJSW Radio on my CD and the classical music of India. April 2003. (With Utpal Mazumdar.)

"If you have the time…." Interview with CBC Radio on my CD and the classical music of India. November 2000. (With Utpal Mazumdar.)

"Engineering better breast cancer screening," CBC Radio interview with Jeff Collins, June 2000.

"The Music of North India." Cranbrook Daily Townsman. 22 September 1999. Cover-page photo and caption on concert sponsored by the College of the Rockies, Cranbrook, BC.

"Engineer Enhances Cancer Screening," Robert Walker, Interview article, Calgary Herald, 24 April 1999.

"Better Breast Cancer Screening," Interview article, Alberta Heritage Foundation for Medical Research (AHFMR) Newsletter, March/April 1999, p7.

"Computer-aided diagnosis of breast cancer." Major media event was organized on 23 April 1999 by the Alberta Foundation for Medical Research (AHFMR): about 10 news, radio, and TV reporters visited our laboratory. According to Rhonda Lothammer of the AHFMR, the interview was broadcast or published by the A Channel, Calgary Herald, Calgary Sun, CFCN, CICT, QR77, Shaw TV, CBC News, CHQR, CHQT, and CISN (Edmonton).

"Computer-aided diagnosis of breast cancer." Live interview via telephone for QR77 Radio, 23 April 1999.

"Engineering computers to diagnose breast cancer earlier." Featured in "Selected Alberta Science and Research Success Stories: Volume III," published by ASRA: Alberta Science and Research Authority, September 1999, p29.

"Increasing precision in mammograms," Progressions… AHFMR Funded Cancer Research. Alberta Heritage Foundation for Medical Research Triennial Report. 1999, p22.

"Seeing Mammomograms More Clearly." Arch, 1999 Summer, p7.

"In Tune With You." Interview with CBC Radio on the classical music of India and my CD, 25 November 1998. (With Utpal Mazumdar.)

"Computer-aided diagnosis of breast cancer," Presentation at the opening ceremony and media event of the Multimedia Advanced Computational Infrastructure (MACI) facility at the Rozsa Centre, University of Calgary, 28 September 1998.

"Computer-aided diagnosis of breast cancer," Interview with the television station "A Channel," 28 September 1998.

"Classical music of India," Interview and live performance on the flute, CJSW Radio, 15 March 1998. (With Utpal Mazumdar.)

"Just In Time ...just for you!" Interview with CBC Radio on the classical music of India and my CD, 10 February 1998. (With Utpal Mazumdar.)

Classical music of India and the bamboo flute, TV news-hour interview with Renata Canales (in Portuguese), EPTV Ribeirão Preto, São Paulo, Brazil, July 1998.

"Computer-aided diagnosis of breast cancer," Interview with CBC Radio (live broadcast), 24 March 1998.

"Engineering Tools for Breast Cancer Screening," Enginuity: Newsletter of the Faculty of Engineering and the Engineering Associates Program, University of Calgary, Spring 1998, p1,3.

"Prof engineers better tools for breast cancer screening," University of Calgary Gazette, Interview article, 23 March 1998, p1,2.

"Os incríveis sons que vêm da Índia" (The incredible sounds that come from India – in Portuguese), Gustavo Guimarães, Interview article, Jornal da Universidade de São Paulo, São Paulo, Brazil, 3-9 April 1995, p12.

"Computers Lend Healing Hand," Sharon Pearce, Interview article, The PEGG: Newsletter of the Association of Professional Engineers, Geologists, and Geophysicists of Alberta, October 1993.

"A twist of fate: Researchers at University of Calgary train electron microscopes and a supercomputer on the problem of ligament injuries," J. Thornton (interviewing R.M. Rangayyan and C.B. Frank), Logic: Control Data Corporation, 1987 Autumn Issue, pp. 8-13.