Department of Computer Science
Distinguished Lecture 2011 Series

Machine Intelligence, F-granulation and Generalized Rough Sets:
Uncertainty Analysis in Pattern Recognition and Mining

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Prof. Sankar K. Pal (www.isical.ac.in/~sankar) is a Distinguished Scientist of the Indian Statistical Institute and a former Director. He is also a J.C. Bose Fellow of the Goverment of India. He founded the Machine Intelligence Unit and the Center for Soft Computing Research: A National Facility in the Institute in Calcutta. He received a Ph.D. in Radio Physics and Electronics from the University of Calcutta in 1979, and another Ph.D. in Electrical Engineering along with DIC from Imperial College, University of London in 1982. He joined his Institute in 1975 as a CSIR Senior Research Fellow where he later became a Full Professor in 1987, Distinguished Scientist in 1998 and the Director for the term 2005-10.

He worked at the University of California, Berkeley and the University of Maryland, College Park in 1986-87; the NASA Johnson Space Center, Houston, Texas in 1990-92 & 1994; and in US Naval Research Laboratory, Washington DC in 2004. Since 1997 he has been serving as a *Distinguished Visitor* of IEEE Computer Society (USA) for the Asia-Pacific Region, and held several visiting positions in Italy, Poland, Hong Kong and Australian universities.

Prof. Pal is a *Fellow* of the IEEE, USA, the Academy of Sciences for the Developing World (TWAS), Italy, International Association for Pattern Recognition, USA, International Association of Fuzzy Systems, USA, and all the four National Academies for Science/Engineering in India. He is a co-author of seventeen books and more than four hundred research publications in the areas of Pattern Recognition and Machine Learning, Image Processing, Data Mining and Web Intelligence, Soft Computing, Neural Nets, Genetic Algorithms, Fuzzy Sets, Rough Sets and Bioinformatics.

He has received the *1990 S.S. Bhatnagar Prize* (which is the most coveted award for a scientist in India), and many prestigious awards in India and abroad including the *1999 G.D. Birla Award, 1998 Om Bhasin Award, 1993 Jawaharlal Nehru Fellowship, 2000 Khwarizmi International Award from the Islamic Republic of Iran, 2000-2001 FICCI Award, 1993 Vikram Sarabhai Research Award, 1993 NASA Tech Brief Award (USA), 1994 IEEE Trans. Neural Networks Outstanding Paper Award (USA), 1995 NASA Patent Application Award (USA), 1997 IETE-R.L. Wadhwa Gold Medal*, the *2001 INSA-S.H. Zaheer Medal, 2005-06 Indian Science Congress-P.C. Mahalanobis Birth Centenary Award (Gold Medal) for Lifetime Achievement, 2007 J.C. Bose Fellowship of the Government of India* and *2008 Vigyan Ratna Award from Science & Culture Organization, West Bengal.*

Prof. Pal is/ was an *Associate Editor* of IEEE Trans. Pattern Analysis and Machine Intelligence (2002-06), IEEE Trans. Neural Networks [1994-98 & 2003-06], Neurocomputing (1995-2005), Pattern Recognition Letters, Int. J. Pattern Recognition & Artificial Intelligence, Applied Intelligence, Information Sciences, Fuzzy Sets and Systems, Fundamenta Informaticae, LNCS Trans. On Rough Sets, Int. J. Computational Intelligence and Applications, IET Image Processing, J. Intelligent Information Systems, and Proc. INSA-A; *Editor-in-Chief*, Int. J. Signal Processing, Image Processing and Pattern Recognition; a *Book Series Editor*, Frontiers in Artificial Intelligence and Applications, IOS Press, and Statistical Science and Interdisciplinary Research, World Scientific; a *Member, Executive Advisory Editorial Board*, IEEE Trans. Fuzzy Systems, Int. Journal on Image and Graphics, and Int. Journal of Approximate Reasoning; and a *Guest Editor* of IEEE Computer.

Date: **March 3, 2011 (Thursday)**

Time: **14:45**

Venue: **Lecture Theatre 2 (LT2)**

Ho Sin Hang Campus, HKBU

Abstract:
Different components of machine intelligence are explained. The role of rough sets in uncertainty handling and granular computing is described. The significance of its integration with other soft computing tools and the relevance of rough-fuzzy computing, as a stronger paradigm for uncertainty handling, are explained. Different applications of rough granules, significance of /f/-granulation and certain important issues in their implementations are stated. Generalized rough sets using the concept of fuzziness in granules and sets are defined both for equivalence and tolerance relations. Different tasks such as case generation, class-dependent rough-fuzzy granulation for classification, rough-fuzzy clustering and defining entropy and various ambiguity measures for image analysis are then addressed in this regard, explaining the nature and characteristics of granules used therein.

While the method of case generation with variable reduced dimension is useful for mining data sets with large dimension and size, class dependent granulation coupled with neighborhood rough sets for feature selection is efficient in modeling overlapping classes. Significance of a new measure, called "dispersion" of classification performance, which focuses on confused classes for higher level analysis, is explained in this regard. Superiority of rough-fuzzy clustering is illustrated for determining bio-bases (c-medoids) in encoding protein sequence for analysis. Image ambiguity measures, which take into account both the fuzziness in boundary regions, and the rough resemblance among nearby gray levels and nearby pixels, are useful for various image analysis operations. Merits of incorporating the concept of rough granules in addition to fuzziness in gray level in entropy is extensively demonstrated for image segmentation problem.

The talk concludes with stating the future directions of research and challenges.

ALL ARE WELCOME