Department of Computer Science
Distinguished Lecture Series 2016/17

Prof. Sankar K. Pal

Distinguished Scientist &
Former Director
Indian Statistical Institute

15 May 2017 (Monday)
5:00 - 6:00pm

LT1 (SCT501), Cha Chi-ming Science Tower,
Ho Sin Hang Campus, HKBU

50+ Years of Fuzzy Sets:
Machine Intelligence and Data to Knowledge

💬 Abstract

The theory of fuzzy sets (FS) was first explained in 1965 by Lotfi A. Zadeh, University of California, Berkely. The theory has been explored as a model of uncertainty analysis during the last fifty years by scientists over the globe for developing methodologies for decision-making problems of various kinds. The successful application areas and systems developed broadly include: fuzzy logic control based systems, fuzzy expert systems, and fuzzy pattern recognition and image processing systems. While the aims were to emulate and replace human operators and human expertise respectively in the first two categories, generalization and uncertainty handling were the objectives in the other.

The talk addresses the characteristic features of fuzzy pattern recognition and image processing systems, mentioning the associated growth and evolution of the discipline. It highlights the contributions made towards this from Indian Statistical Institute, Kolkata since early 1975. The talk starts with the concept of membership function, impact on different disciplines, relevance of FS to pattern recognition problems, and explains with examples the significance of multi-valued recognition systems and the notion of embedding. Data mining and knowledge discovery from pattern recognition perspectives is explained. Then it follows the objective of synergistic integrations of FS with artificial neural networks, genetic algorithms and rough sets, among others, in soft computing for improved performance, computational intelligence and decision-making. Emergence of granular mining in rough-fuzzy framework is explained along with the concepts of f-information granules and rough knowledge encoding, as well as the perception granules and Z-numbers. All these features are demonstrated through example experimental results in various domains ranging from speech recognition, image and video analysis, to bio-informatics and social networks.

The talk concludes with future directions of research and relevance to CTP (computational theory of perceptions), natural computing and Big data analysis.

ⓘ Biography

Sankar K. Pal (www.isical.ac.in/~sankar) is a *Distinguished Scientist* and former *Director* of Indian Statistical Institute. He is currently a DAE Raja Ramanna Fellow and J.C. Bose National Fellow. 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 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 *Life Fellow* of the IEEE, and *Fellow* of the World Academy of Sciences (TWAS), International Association for Pattern recognition, International Association of Fuzzy Systems, International Rough Set Society, and all the four National Academies for Science/Engineering in India. He is a co-author of twenty 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, Cognitive Machine and Bioinformatics. He visited forty plus countries as a Keynote/ Invited speaker or an academic visitor.

He has received the 1990 *S.S. Bhatnagar Prize* (which is the most coveted award for a scientist in India), 2013 *Padma Shri* (one of the highest civilian awards) by the President of 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 President 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*, 1995 *NASA Patent Application Award* (USA), 1997 *IETE-R.L. Wadhwa Gold Medal*, 2001 *INSA-S.H. Zaheer Medal*, 2005-06 *Indian Science Congress-P.C. Mahalanobis Birth Centenary Gold Medal* from the Prime Minister of India for Lifetime Achievement, 2007 *J.C. Bose Fellowship* of the Government of India, 2013 *Indian National Academy of Engineering (INAE) Chair Professorship*, 2013 *IETE Diamond Jubilee Medal*, 2014 *IEEE Fellow Class Golden Jubilee Medal*, 2015 *INAE-S.N. Mitra Award*, and 2017 *INSA-Jawaharlal Nehru Birth Centenary Lecture award*.

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 (1993-2011), Int. J. Pattern Recognition & Artificial Intelligence, Applied Intelligence, Information Sciences, Fuzzy Sets and Systems, Fundamenta Informaticae, LNCS Trans. Rough Sets, Int. J. Computational Intelligence and Applications, IET Image Processing, Ingeniería y Ciencia, and J. Intelligent Information Systems; *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, IEEE SMC and Theoretical Computer Science.