

# Single Frame Super Resolution: Fuzzy Rule-Based and Gaussian Mixture model-based Approaches

Date: 23 May 2024 (Thursday)

Time: 10:00am - 11:00am

Venue: Rm 6-211, Lau Ming Wai Academic Building,  
City University of Hong Kong

## ABSTRACT

High quality image zooming is an important problem. There are many methods that use multiple low-resolution (LR) frames of the same scene with different sub-pixel shifts as input to generate high-resolution (HR) images. Nowadays single-frame super-resolution (SR) methods that use just one LR image to obtain the HR image have become popular. In this talk, we shall discuss a novel fuzzy rule-based single-frame super-resolution method. This is a patch-based method, where each LR patch is replaced by an HR patch generated by a Takagi-Sugeno-type fuzzy rule-based system. We shall discuss in detail the generations of the training data, the initial generation of the fuzzy rules, their refinement, and how to use the rules for the generation of SR images. In this context, we shall also discuss a Gaussian Mixture Regression (GMR) model for the same problem. Both the fuzzy rule-based system and GMR are found to be quite effective. These methods can be easily used for videos. We shall also discuss how the fuzzy Rule-based method can be extended to improve temporal resolution in videos. Comparison of the performance of the fuzzy rule-based system with five existing methods as well as with the GMR method in terms of the several quality criteria demonstrates the superior performance of the fuzzy rule-based system.



## Professor Nikhil R. Pal

### GUEST SPEAKER'S PROFILE

Nikhil R. Pal was a Professor in the Electronics and Communication Sciences Unit and was the founding Head of the Center for Artificial Intelligence and Machine Learning of the Indian Statistical Institute. His current research interest includes brain science, computational intelligence, machine learning and data mining. He was the Editor-in-Chief of the IEEE Transactions on Fuzzy Systems for the period January 2005-December 2010. He has served/been serving on the editorial /advisory board/ steering committee of several journals including the International Journal of Approximate Reasoning, Applied Soft Computing, International Journal of Neural Systems, Fuzzy Sets and Systems, IEEE Transactions on Fuzzy Systems and the IEEE Transactions on Cybernetics. He is a Fellow of the West Bengal Academy of Science and Technology, Institution of Electronics and Tele Communication Engineers, National Academy of Sciences, India, Indian National Academy of Engineering, Indian National Science Academy, International Fuzzy Systems Association (IFSA), The World Academy of Sciences, and a Fellow of the IEEE, USA.