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香港浸會大學
HONG KONG BAPTIST UNIVERSITY

Institute for Computational Mathematics

Lecture Series

Speaker : Dr. Xavier Bresson
Department of Mathematics
University of California
Los Angeles

Date : 5 December 2008 (Friday)

Venue : FSC1217, Fong Shu Chuen Library
Ho Sin Hang Campus
Hong Kong Baptist University

	Time	**Title**
Lecture 1	10:00 a.m. - 11:00 a.m.	Convex Formulation of Image Segmentation Models and Applications
Lecture 2	11:15 a.m. - 12:15 p.m.	Fast Numerical Schemes for Geometry Processing
Lecture 3	2:30 p.m. - 3:30 p.m.	Color Image Processing and Image Completion

– All interested are welcome –

For further information, please visit **http://www.math.hkbu.edu.hk/ICM/lectures**, or call 34115056.

Lecture 1 : Convex Formulation of Image Segmentation Models and Applications

Abstract : I will introduce a convex formulation for a large class of variational segmentation models known as active contour models. Standard approaches use the Level Set Method (LSM) to implement the active contour model. Although the LSM holds many good properties s.a. natural changes of topology and stable numerical schemes, it also suffers from two serious limitations. First, the level set energy is not convex, which makes the choice of the initial condition critical to get a satisfying solution. Second, standard LSM schemes are slow to converge. We propose a new approach that overcomes these two limitations by computing a global minimizer in a fast way. Since local minimizers can also be useful in some applications s.a. medical imaging in which we want to extract specific objects, we will also introduce a fast numerical scheme to determine a local minimizer.
Applications are given for segmentation and for a free boundary problem. Joint work with Stanley Osher and Tony Chan.

Lecture 2 : Fast Numerical Schemes for Geometry Processing

Abstract : Fast algorithms are crucial to develop real-world applications such as object detection in medical images, noise removal, or object tracking in video surveillance. Variational models offer strong mathematical tools to define well-posed algorithms but they are not as fast as discrete optimization techniques s.a. graph cut techniques. We recently propose to define very fast continuous minimization algorithms, close or better than graph cut performances. These algorithms, based on the Bregman iterative scheme, provide fast geometry processing algorithms. Applications to segmentation, surface reconstruction from a set of points and surface interpolation are presented. Joint work with Tom Goldstein, Stanley Osher and Tony Chan.

Lecture 3 : Color Image Processing and Image Completion

Abstract : In this lecture, I will talk about two topics. The first topic will be focused on a fast and well-posed regularization algorithm for color/vectorial images based on a dual formulation of the vectorial Total Variation (VTV). This model is the vectorial extension of Chambolle projection algorithm for scalar images. The proposed model minimizes the exact VTV norm whereas standard approaches use a regularized norm. The numerical scheme is straightforward to implement and finally, the algorithm is fast. Finally, and maybe more importantly, the proposed VTV minimization scheme can be easily extended to many standard applications s.a. inpainting, deblurring, image decomposition, etc.
The second topic will be centered on image completion. Image completion aims at recovering lost information in digital images. Many deterministic and stochastic approaches have been proposed to solve the completion problem. We will define a local variational model to recover the geometry following Gestalt's principle of good continuation. We will also introduce a non-local variational model to recover the lost textures. Results are presented on synthetic and natural images. Joint work with Tony Chan.