USC Viterbi School of Engineering
Ming Hsieh Department of Electrical Engineering

Seminar Announcement

Compression of Signal on Graphs with Application to Image and Video Coding

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Date: September 5th (Tuesday)
Time: 4:00pm to 6:00pm
Location: EEB-248

Abstract:
Graph is a generic data structure that is useful in representing signals in various applications. In this thesis, we discuss several transform designs based on graph representation and the application in multimedia compression. Graphs can adapt to local characteristics, e.g. edges, and therefore provide more flexibilities than conventional transforms, e.g. Discrete Cosine Transform(DCT). A frequency interpretation for signal on graphs can be derived using Graph Fourier Transform (GFT). By properly adjusting the graph structure based on signal characteristics, GFT can provide compact representation even for signals with discontinuities. However, the transform requires high complexity in implementation, making it less applicable in signals of large size, e.g. video sequences. In our work, we develop a transform coding scheme based on a low complexity lifting transform on graphs. More specifically, we focus on two problems in the design of lifting transform, namely the design of bipartition and bipartite graph approximation. For the application, we consider two types of multimedia signals, including regular signals on 2D grid and signals that are irregularly distributed. For the former one, we consider the compression of intra-predicted video residuals. The data contain significant edge structures, which are difficult to be represented efficiently with existing transform coding standards. We also discuss different types of edge models for intra and inter-predicted video residuals in terms of the coding efficiency in GFT. For the other type of signal, we discuss the coding scheme for un-demosaicked light field images. Without demosaicking from the raw data captured using Color Filter Array (CFA) to full-color sub-aperture images, we can avoid large redundancies introduced from color interpolation. However, the pixels of each color channel will be distributed irregularly within each sub-aperture image, and therefore motivates the application of graph representation. A novel intra-prediction scheme and graph construction based on sparsely distributed pixels are proposed. Theoretical interpretation and comprehensive experimental results are presented for proposed methods.

Bio:
Yung-Hsuan (Jessie) Chao is a Ph.D. candidate in Department of Electrical Engineering at University of Southern California (USC), Los Angeles, USA. She received her B.S. degree in Electronics Engineering from National Chiao Tung University, Hsinchu, Taiwan. Her research interests are signal transformation and compression using graph signal processing and particularly focus on the application of image and video coding.

Defense Committee: Prof. Antonio Ortega (Chair), Prof. C.-C. Jay Kuo and Prof. Ramesh Govindan (outside member)