

# **2003 RYERSON WORKSHOP SERIES:**

## **LECTURES ON IMAGE, VIDEO AND MULTIMEDIA SIGNAL PROCESSING**

*Sponsored by:*  
Canada Research Chair Program  
Ryerson Multimedia Research Laboratory  
Ryerson Faculty of Engineering and Applied Science  
Ryerson University

### **LECTUER 1:**

#### **WIRELESS AD HOC SENSOR NETWORK: AN OVERVIEW**

**PROFESSOR YU HEN HU, UNIVERSITY OF WISCONSIN-MADISON**

### **LECTURE 2:**

#### **TRACING TRAITORS: COLLUSION RESISTANT MULTIMEDIA FINGERPRINTING**

**PROFESSOR K.J. RAY LIU, UNIVERSITY OF MARYLAND, COLLEGE PARK**

### **LECTURE 3:**

#### **DATA MINING AND VISUALIZATION OF DNA MICROARRAY DATA**

**PROFESSOR SUN-YUAN KUNG, PRINCETON UNIVERSITY**

### **LECTURE 4:**

#### **A FRAMEWORK FOR MODELING AND RECOGNIZING HUMAN MOTION**

**PROFESSOR LING GUAN, RYERSON UNIVERSITY**

#### **Agenda**

**Date: Friday October 10, 2003**

<b>09:00-10:30</b>	<b>Lecture 1</b>
<b>10:30-10:50</b>	<b>Coffee Break</b>
<b>10:50-12:20</b>	<b>Lecture 2</b>
<b>12:20-13:40</b>	<b>Lunch Break (On your own)</b>
<b>13:40-15:10</b>	<b>Lecture 3</b>
<b>15:10-15:30</b>	<b>Coffee Break</b>
<b>15:30-17:00</b>	<b>Lecture 4</b>

#### **Registration:**

**Student:** CAN \$10

**Regular:** CAN \$20

Attendees may pay the fee on site either by cash or check, but must register in advance by 07-10-03 via email due to limited space availability.

*For more information and registration please contact by:*

Email: [dls@ee.ryerson.ca](mailto:dls@ee.ryerson.ca)

#### **Venue:**

Session 1&2 : Carlton Theatres  
Room No # CAR-05

Session 3&4 : Rogers Communication Centre  
Room No # RCC 201

➤ Please refer to the attached map for directions

# Lecture Abstracts and Biographies of the Speakers

Lecture 1

Professor Yu Hen Hu

## WIRELESS AD HOC SENSOR NETWORK: AN OVERVIEW

Wireless ad hoc sensor network is an emerging information technology for remote distributive monitoring. Unlike conventional sensor arrays, in an environmental monitoring sensor network, power conservation and wireless channel bandwidth conservation is of utmost importance. These energy and bandwidth constraints present fundamental challenges in developing distributive, collaborative, multi-modality networked sensing and actuation in a wide-area, unattended application. In this presentation, recent progresses in ad hoc wireless sensor network information technology will be surveyed. Technical challenges in developing next generation ad hoc wireless sensor network applications will be discussed.

*Yu Hen Hu is a professor at the Department of Electrical and Computer Engineering, University of Wisconsin, Madison. He received BSEE from National Taiwan University, and MSEE and PhD degrees from University of Southern California. His research interests include multimedia signal processing, artificial neural networks, fast algorithms and design methodology for application specific micro-architectures, as well as computer aided design tools. He has published more than 180 technical papers in these areas. Dr. Hu was an associate editor (1988-1990) for the IEEE Transaction of Acoustic, Speech, and Signal Processing. He is currently associate editor of IEEE Signal Processing Letters, Journal of VLSI Signal processing, and the European Journal of Applied Signal Processing. He is a founding member of IEEE SP Society Neural Network Signal Processing Technical Committee and served as chair from 1993-1996. He is a former member of IEEE SP Society VLSI signal processing technical committee. He served as the Secretary of the IEEE SP Society (1996-1998). Currently, he serves as the Secretary of the IEEE SP Society Multimedia Signal Processing Technical Committee. Dr. Hu is a fellow of IEEE.*

Lecture 2

Professor K. J. Ray Liu

## TRACING TRAITORS: COLLUSION RESISTANT MULTIMEDIA FINGERPRINTING

Digital fingerprinting is an emerging technology for identifying users who have legitimate access to plaintext content but may use the content for unintended purposes, such as duplication and redistribution. For multimedia, fingerprints can be put into the content using embedding techniques that are typically concerned with robustness against a variety of attacks mounted by an individual. The global nature of the Internet has made it easy for a group of users with differently marked versions of the same content to work together and collectively mount attacks against the fingerprints. These collusion attacks provide adversaries a cost-effective method for removing an identifying fingerprint. In this talk, tracing traitors using collusion-resistant fingerprinting for multimedia that jointly considers the encoding, embedding, and detection of fingerprints will be presented. The proposed framework of Anti-Collusion Codes (ACC) and algorithms for gathering forensic evidence of the guilt and for identifying colluders will be discussed.

*Ray Liu received Ph.D. degree from UCLA in 1990 in electrical engineering. He is Professor of Electrical and Computer Engineering Department and Institute for Systems Research of the University of Maryland, College Park. His research interests span broad aspects of signal processing algorithms and architectures; multimedia communications and signal processing; wireless communications and networking; information security; and bioinformatics, in which he has published over 280 refereed papers, books, and book chapters. Dr. Liu is the recipient of numerous awards and honors, including IEEE Signal Processing Society 2004 Distinguished Lecturer, the 1994 National Science Foundation Young Investigator Award, and the IEEE Signal Processing Society's 1993 Senior Award. Dr. Liu is a Fellow of IEEE. Dr. Liu is the Editor-in-Chief of IEEE Signal Processing Magazine and was the founding Editor-in-Chief of EURASIP Journal on Applied Signal Processing. He has been an Associate Editor of IEEE Transactions on Signal Processing and Journal of VLSI Signal Processing Systems. He guest-edited special issues for numerous journals, including Proceedings of the IEEE. He is the Editor-in-Chief of EURASIP book series on signal processing and communications.*

# Lecture Abstracts and Biographies of the Speakers

## Lecture 3

Professor Sun-Yuan Kung

### DATA MINING AND VISUALIZATION OF DNA MICROARRAY DATA

DNA microarrays are nowadays the most common and promising instrument for DNA analysis. An experiment with a single DNA chip can simultaneously show information on thousands of genes and provide a visual display on how a family of genes is "expressed". The most challenging research facing us is how to effectively process such a huge amount of data from DNA microarray for critical pathogenetical applications such as Drug Design and Disease Classification. In this talk, we shall address three major issues: (1) *Cluster Discovery: Detection/validation of previously unrecognized tumor subtypes.* (2) *Gene Selection - Identification of the most relevant gene subset involving the biological process.* (3) *Phenotype Prediction - Assigns unknown tumor sample to known tumor classes.* The principle of machine learning and statistic pattern recognition will be vital for all the three major issues pertaining to the gene expression data analysis. It will in turn demonstrate that the bioinformatics is a novel, challenging and promising research front for information scientists in the coming decades.

**Sun-Yuan Kung** received his Ph.D. Degree in Electrical Engineering from Stanford University. From 1977 to 1987, he was a Professor of Electrical Engineering-Systems of the University of Southern California. Since 1987, he has been a Professor of Electrical Engineering at the Princeton University. Since 1990, he has served as an Editor-In-Chief of *Journal of VLSI Signal Processing Systems*. He served as a founding member and General Chairman of various international conferences, including the First IEEE Workshops on Multimedia Signal Processing in 1997(Princeton). Dr. Kung is a Fellow of IEEE. He was the recipient of 1992 IEEE Signal Processing Society's Technical Achievement Award. He was appointed as an IEEE-SP Distinguished Lecturer in 1994. He received 1996 IEEE Signal Processing Society's Best Paper Award. He was a recipient of the IEEE Third Millennium Medal in 2000. He has authored more than 300 technical publications, including three books "VLSI Array Processors", Prentice Hall, 1988 (with Russian and Chinese translations), "Digital Neural Networks", Prentice Hall, 1993, and "Principal Component Neural Networks", John Wiley, 1996.

## Lecture 4

Professor Ling Guan

### A FRAMEWORK FOR MODELING AND RECOGNIZING HUMAN MOTION

This talk presents a new framework of Continuous Human Movement Recognition (CHMR) system for generalized biometric analysis of continuous human motion. A novel 3D color model is dynamically sized and texture mapped to each person for robust tracking using a Particle filter with the search space optimized by utilizing feedback from the CHMR system. A new paradigm defines an alphabet of *dynemes*, units of full-body movement skills, to enable recognition of diverse skills. Using multiple HMM, the CHMR system attempts to infer the human movement skill that could have produced the observed sequence of dynemes. The model and dyneme paradigm presented in this work enable the CHMR system to track and recognize hundreds of full-body movement skills thus laying the basis for effective biometric authentication associated with full-body motion and body proportions. Applications to the biometric authentication of gait, anthropometric data, human activities and movement disorders will be presented to demonstrate the performance of the system.

**Ling Guan** received his Ph.D. Degree from University of British Columbia, Canada in 1989. Dr. Guan was on the Faculty of Engineering at the University of Sydney from 1993-2001. He is currently a Professor of Electrical Engineering at Ryerson University, Canada. He held visiting positions at British Telecom (1994), Tokyo Institute of Technology (1999), Princeton University (2000), and Microsoft Research Asia (2002). Dr. Guan's research interest lies in the field of human-centered computing for multimedia processing and technology innovation. He has published more than 170 technical articles, three patents and two books in this field. In 2001, he was appointed to the position of Canada Research Chair in Multimedia. In 2002, he received an Ontario Distinguished Researcher Award. Dr. Guan is a Senior Member of IEEE, and a member of IEEE SP Society Technical Committee on Multimedia Signal Processing. He has been an associate editor/guest editor for numerous international journals, including *Proceedings of the IEEE*, and serves on the editorial board of CRC Press' Book Series on Image Processing. He was the Founding General Chair of IEEE Pacific-Rim Conference on Multimedia.

