

INFOTECH OULU DOCTORAL PROGRAM AND RESCUE PROJECT

SUMMER SCHOOL ON DISTRIBUTED COMPRESSION WITH APPLICATIONS

24-27 August, 2015

Lecture Hall A2, University of Oulu, Finland

The summer school is targeted to graduate students, postdocs and other researchers in the field of information theory, signal processing and communications engineering. It is organized by the University of Oulu Centre for Wireless Communications (CWC) and Infotech Oulu Doctoral Program in co-operation with Links-on-the-fly Technology for Robust, Efficient and Smart Communication in Unpredictable Environments (RESCUE) FP7 Project.

The course consists of two main parts:

- Basic information theory lectures by Professor Gerhard Kramer
- Presentations of recent results from RESCUE

The objective is to introduce a basic information theoretical framework of distributed lossy and lossless source compression. Furthermore, the summer school aims at presenting applications of the information theoretical foundations to lossy decode-and-forward relay networks. In the poster session participants can demonstrate their results and get feedback from experts.

1. INFORMATION THEORETIC FOUNDATIONS OF DISTRIBUTED COMPRESSION (18 H)

With the increasing interest toward wireless sensor networks due to increasing practical relevance of the internet of things, there is also a revived interest in joint optimization of distributed compression, communications and networking. The information theoretic foundations of those are relatively well understood when the problems are viewed in separation, but important open problems also exist. The fundamental understanding of information theoretic limits is of fundamental importance in future research of big data problems over wireless internet of things in general and wireless sensor networks in particular.

SCOPE: AND CONTENTS:

Distributed data compression, source coding, rate distortion theory and compressive sensing with information theory approach in wireless networks

INSTRUCTOR:

[Prof. Gerhard Kramer, TU München, Germany](#)

2. RECENT RESULTS AND ACHIEVEMENTS IN LOSSY DECODE-AND-FORWARD RELAY NETWORKS: FROM THEORY TOWARDS PROOF-OF-CONCEPT (7 H)

Current communication standards and systems are not optimally prepared for their application in unpredictable environments which occur for example in serious disaster scenarios such as earthquakes or tsunamis. Cellular communications systems are planned using accurate/strict link budget allocation mechanisms, in order to keep the probability of outage in an acceptable range. The whole communication chain (coding, signaling chain, but as well as higher layer protocols) is optimized for the operation in this range. Therefore, communication services perform poorly or fail completely in unpredictable environments.

Participation in lectures and other scientific sessions is free of charge. Lunches are available at own cost in university campus restaurants.

Summer School Social Event on Thursday 27th of August is open for all summer school participants for a fee of 50 € incl. dinner and possibility to sauna bath (traditional Finnish smoke sauna available). Payment instructions are provided in [registration form](#).

RESCUE is an EU project proposing an integrated concept “links on the fly” which encompasses the key technologies of distributed joint source/channel coding in lossy wireless networks, exploitation of multi-path information transfer in wireless mesh networks, distributed and centralized MAC/network protocols for channel access, and routing, cross-layer design for interference management and error control.

Some recent results will be presented from each work package of the technical part of RESCUE project:

- WP1: Theoretical analyses for limit and rate-distortion region
- WP2: Code and algorithm design and optimization
- WP3: Message transfer
- WP4: Validation, integration and field trials

SCOPE AND CONTENTS:

Following topics are considered in the context of lossy decode-and-forward relaying network: rate region and outage probability analysis, coding/decoding and power allocation algorithms, MAC layer protocols, validation and verification concepts.

KEY SPEAKERS:

Prof. Tadashi Matsumoto, Japan Advanced Institute of Science and Technology, Japan

Dr. Yi Ma, University of Surrey, UK

TIMETABLE:

Monday 24.8.2015

BASICS

Time	Session	Lecturer
8:30-10:00	Entropy, Divergence, and Information	Professor Gerhard Kramer
10:30-12:00	Typical Sequences and Sets	Professor Gerhard Kramer
12:00-13:15	<i>Lunch Break</i>	
13:15-14:45	Rate Distortion Theory	Professor Gerhard Kramer
15:00-15:30	Wrap up	Professor Gerhard Kramer

Tuesday 25.8.2015 in

DISTRIBUTED SOURCE CODING

Time	Session	Lecturer
8:30-10:00	Lossless Distributed Source Coding	Professor Gerhard Kramer
10:30-12:00	Lossy Source Coding with Side Information	Professor Gerhard Kramer
12:00-13:15	<i>Lunch Break</i>	
13:15-14:45	Lossy Distributed Source Coding	Professor Gerhard Kramer
15:00-15:30	Wrap up	Professor Gerhard Kramer

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Wednesday 26.8.2015

NETWORKS

Time	Session	Lecturer
8:30-10:00	Multiple Description Source Coding	Professor Gerhard Kramer
10:30-12:00	Compress-Forward Relaying	Professor Gerhard Kramer
12:00-13:15	<i>Lunch Break</i>	
13:15-14:45	Noisy Network Coding	Professor Gerhard Kramer
15:00-15:30	Wrap Up	Professor Gerhard Kramer
15:30-16:30	Poster Session	

Thursday 27.8.2015

RECENT RESULTS AND ACHIEVEMENTS IN LOSSY DECODE-AND-FORWARD RELAY NETWORKS: FROM THEORY TOWARDS PROOF-OF-CONCEPT

Time	Session	Organizer
8:30-9:15	Links-on-the-fly technologies: from the correlated source coding theorem viewpoint	Professor Tadashi Matsumoto
9:30-10:30	Towards terabits per second wireless communications	Dr. Yi Ma, University of Surrey
10:30-11:30	Theoretical analysis for lossy decode-and-forward relay networks	RESCUE WP1
11:30-12:30	<i>Lunch Break</i>	
12:30-13:15	Physical and lower MAC layer code design and power allocation	RESCUE WP2
13:15-14:00	Organizing Message Transfer over Links-on-the-Fly	RESCUE WP3
14:15-15:00	Validation and Verification Concepts within RESCUE	RESCUE WP4
18:00-22:00	<i>Summer School Social Event "Finnish Evening" (participation fee € 50)</i>	