In the past decade, a significant progress has been reported in
the field of error control coding. In particular, the innovation of
turbo codes and rediscovery of LDPC codes have been
recognized as two significant breakthroughs in this field.
The distinct features of these capacity approaching codes
have enabled them to be widely proposed and/or adopted
in existing wireless standards. Furthermore, the invention
of space time coding significantly increased the capacity of
wireless systems and these codes have been widely applied
in broadband communication systems. Recently, new coding
concepts, exploiting the distributed nature of networks, have
been developed, such as network coding and distributed
coding techniques. They have great potential applications
in wireless, sensor, and ad hoc networks. Despite recent
advances, many challenging problems still remain. This
special issue is intended to present the state-of-the-art results
in the theory and applications of coding techniques.

The special issue has received twenty six submissions, and
among them, thirteen papers have been finally selected after
a rigorous review process. They reflect recent advances in the
area of error control coding.

In the first paper, “Structured LDPC codes over integer
residue rings,” Mo and Armand designed a new class of
low-density parity-check (LDPC) codes over integer residue
rings. The codes are constructed based on regular Tanner
graphs by using Latin squares over a multiplicative group
of a Galois ring, rather than a finite field. The proposed
approach is suitable for the design of codes with a wide
range of rates. One feature of this type of codes is that
their minimum pseudocodeword weights are equal to their
minimum Hamming distances.

The next two-part series of papers “Differentially
encoded LDPC codes—Part I: general case and code optimization,” by I. Tiffany
Li, study the theory and practice of differentially encoded
low-density parity-check (DE-LDPC) codes in the context of
noncoherent detection. Part I studies a special class of DE-
LDPC codes, product accumulate codes. The more general
case of DE-LDPC codes, where the LDPC part may take
arbitrary-degree profiles, is studied in Part II. The analysis
reveals that a conventional LDPC code is not fitful for
differential coding, and does not in general deliver a desirable
performance when detected noncoherently. Through extrin-
sic information transfer (EXIT) analysis and a modified
“convergence constraint” density evolution (DE) method,
a characterization of the type of LDPC degree profiles is
provided. The convergence-constraint method provides a
useful extension to the conventional “threshold-constraint”
method, and can match an outer LDPC code to any given
inner code with the imperfectness of the inner decoder taken
into consideration.

In the fourth paper, “Construction and iterative decoding
of LDPC codes over rings for phase-noisy channels,” by
Karuppasami and Cowley, a design and decoding method for
LDPC codes for channels with phase noise is proposed. The
new code applies blind or turbo estimators to provide signal
phase estimates over each observation interval. It is resilient
to phase rotations of $2\pi/M$, where $M$ is the number of phase
symmetries in the signal set and estimates phase ambiguities
in each observation interval.

A novel approach for enhancing decoder performance
in presence of trapping sets by introducing a new concept
called trapping set neutralization is proposed in the fifth
paper “New technique for improving performance of LDPC
codes in the presence of trapping sets” by E. Alghonaim et al.
The effect of a trapping set can be eliminated by setting its
variable nodes intrinsic and extrinsic values to zero. After a
trapping set is neutralized, the estimated values of variable nodes are affected only by external messages from nodes outside the trapping set. Most harmful trapping sets are identified by means of simulation. To be able to neutralize identified trapping sets, a simple algorithm is introduced to store trapping sets configuration information in variable and check nodes.

Design of efficient distributed coding schemes for cooperative communications networks has recently attracted significant attention. A distributed generalized low-density (GLD) coding scheme for multiple relay cooperative communications is developed by Han and Wu in the sixth paper “Distributed generalized low-density codes for multiple relay cooperative communications.” By using partial error detecting and error correcting capabilities of the GLD code, each relay node decodes and forwards some of the constituent codes of the GLD code to cooperatively form a distributed GLD code. It can work effectively and keep a fixed overall code rate when the number of relay nodes varies. Furthermore, the partial decoding at relays is allowed and a progressive processing procedure is proposed to reduce the complexity and adapt to the source-relay channel variations. Simulation results verify that distributed GLD codes with various number of relay nodes can obtain significant performance gains in quasistatic fading channels compared with the strategy without cooperation.

Since the early 1990s, a progressive introduction of inline optical amplifiers and an advent of wavelength division multiplexing (WDM) accelerated the use of FEC in optical fiber communications to reduce the system costs and improve margins against various line impairments, such as beam noise, channel crosstalk, and nonlinear dispersion. In contrast to the first and second generations of FEC codes for optical communications, which are based on Reed-Solomon (RS) codes and the concatenated codes with hard-decision decoding, the third generation FEC codes with soft-decision decoding are attractive to reduce costs by relaxing the requirements on expensive optical devices in high-capacity systems. In this regard, the seventh paper “Reed-Solomon turbo product codes for optical communications: from code optimization to decoder design” by Bidan et al. investigates the use of turbo-product codes with Reed-Solomon codes as the components for 40 Gb/s over optical transport networks and 10 Gb/s over passive optical networks. The issues of code design and novel ultra-high-speed parallel decoding architecture are developed. The complexity and performance trade-off of the scheme is also carefully addressed in this paper.

Recently, there has been renewed interest in decoding Reed-Solomon (RS) codes without using syndromes. In the eighth paper “Complexity analysis of Reed-Solomon decoding over GF(2^n) without using syndromes,” Chen and Yan investigated the complexity of a type of syndrome-less decoding for RS codes, and compared it to that of syndrome-based decoding algorithms. The complexity analysis in their paper mainly focuses on RS codes over characteristic-2 fields, for which some multiplicative FFT techniques are not applicable. Their findings show that for high-rate RS codes, syndrome-less decoding algorithms require more field operations and have higher hardware costs and lower throughput, when compared to syndrome-based decoding algorithms. They also derived tighter bounds on the complexities of fast polynomial multiplications based on Cantor’s approach and the fast extended Euclidean algorithm.

In the ninth paper “Efficient decoding of turbo codes with nonbinary belief propagation” by Pouliiat et al., a new approach of decoding turbo codes by a nonbinary belief propagation algorithm is proposed. The approach consists in representing groups of turbo code binary symbols by a nonbinary Tanner graph and applying a group belief iterative decoding. The parity check matrices of turbo codes need to be preprocessed to ensure the code good topological properties. This preprocessing introduces an additional diversity, which is exploited to improve the decoding performance.

The tenth paper, “Space-time convolutional codes over finite fields and rings for systems with large diversity order” by Uchoa-Filho and Noronha-Neto, propose a convolutional encoder over the finite ring of integers to generate a space-time convolutional code (STCC). Under this structure, the paper has proved three interesting properties related to the generator matrix of the convolutional code that can be used to simplify the code search procedure for STCCs over the finite ring of integers. The properties establish equivalences among STCCs, so that many convolutional codes can be discarded in the code search without losing anything.

Providing high-quality multimedia service has become an attractive application in wireless communication systems. In the eleventh paper, “Joint decoding of concatenated VLEC and STTC system,” Chen and Cao proposed a joint source-channel coding scheme for wireless fading channels, which combines variable length error correcting codes (VLECs) and space time trellis codes (STTCs) to provide bandwidth efficient data compression, as well as coding and diversity gains. At the receiver, an iterative joint source and space time decoding algorithm is developed to utilize redundancy in both STTC and VLEC to improve overall decoding performance. In their paper, various issues, such as the inseparable systematic information in the symbol level, the asymmetric trellis structure of VLEC, information exchange between bit and symbol domains, and a rate allocation between STTC and VLEC, have been investigated.

In the twelfth paper, “Average throughput with linear network coding over finite fields: the combination network case,” Al-Bashabsheh and Yongacoglu extend the average coding throughput measure to include linear coding over arbitrary finite fields. They characterize the average linear network coding throughput for the combination network with min-cut 2 over an arbitrary finite field, and provide a network code, which is completely specified by the field size and achieves the average coding throughput for the combination network.

The MacWilliams identity and related identities for linear codes with the rank metric are derived in the thirteenth paper “MacWilliams identity for codes with the rank metric” by Gadouleau and Yan. It is shown that similar to the MacWilliams identity for the Hamming metric, the rank weight distribution of any linear code can be expressed as a functional transformation of that of its dual code, and the
rank weight enumerator of the dual of any vector depends only on the rank weight of the vector and is related to the rank weight enumerator of a maximum rank distance code.

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Special Issue on
Enhancing Privacy Protection in Multimedia Systems

Call for Papers

The right to privacy has long been regarded as one of the basic universal human rights. In the last thirty years, advances in computing technologies have brought dramatic improvement in collecting, storing, and sharing personal information among government agencies and private sectors. The combination of ubiquitous sensors, wireless connectivity, and powerful recognition algorithms make it easier than ever to monitor every aspect of our daily activities. From the use of sophisticated pattern recognition in surveillance video to the theft of biometric signals and personal multimedia contents—people have become increasingly worried about the privacy of their multimedia data. To mitigate public concern about privacy violation, it is imperative to make privacy protection a priority in current and future multimedia systems.

Even though research on privacy enhancing technologies (PETs) began twenty years ago, most of the existing schemes focus on textual or categorical data and are inadequate to protect multimedia. The particular challenges include but are not limited to the difficulty in extracting semantic information for protection, the ability to apply cryptographic primitives to high data-rate multimedia streams, basic signal processing algorithms for protecting privacy without destroying the perceptual quality of the signal, and privacy models for governing and handling privacy rights in multimedia systems. In the last few years, there has been much exciting new theoretical and practical work to tackle these challenges by combining expertise from multimedia, pattern recognition, cryptography, and computer security. This work has the potential of not only providing enhanced level of privacy, but also revolutionizing the research frontier in the fundamental studies of multimedia and security. The goal of this special issue is to collect cutting-edge research work in privacy protection technologies for multimedia, and to provide a high-quality forum for researchers from different areas to explore future opportunities in this area.

We seek submissions from academia and industry presenting novel research and field experiments on topics which include, but are not limited to:

- Privacy in multimedia database systems
- Privacy in multimodal biometric systems
- Privacy in multimodal surveillance systems
- Privacy in mobile multimedia systems
- Privacy preserving digital right management systems
- Privacy preserving feature extraction
- Privacy preserving pattern recognition
- Privacy threat and attack models
- Signal-based obfuscation
- Reversibility in signal-based obfuscation
- Signal processing in encrypted domains
- Subject identification for privacy protection
- Location and tracking privacy in multimedia signals
- Multimedia sensor protocols that preserve anonymity/privacy
- Application of multimedia scrambling and data hiding for privacy protection
- Usability issues in privacy-protected multimedia systems
- Legality and economics of privacy in multimedia systems

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| Deadline                  | Date          |
|---------------------------|---------------|
| Manuscript Due            | March 1, 2009 |
| First Round of Reviews    | June 1, 2009  |
| Publication Date          | September 1, 2009 |

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Special Issue on Femtocell Networks

Call for Papers

Recently, there has been a growing interest in femtocell networks both in academia and industry. They offer significant advantages for next-generation broadband wireless communication systems. For example, they eliminate the dead-spots in a macrocellular network. Moreover, due to short communication distances (on the order of tens of meters), they offer significantly better signal qualities compared to the current cellular networks. This makes high-quality voice communications and high data rate multimedia type of applications possible in indoor environments.

However, this new type of technology also comes with its own challenges, and there are significant technical problems that need to be addressed for successful deployment and operation of these networks. Standardization efforts related to femtocell networks in 3GPP (e.g., under TSG-RAN Working Group 4 and LTE-Advanced) and IEEE (e.g., under IEEE 802.16m) are already underway.

The goal of this special issue is to solicit high-quality unpublished research papers on design, evaluation, and performance analysis of femtocell networks. Suitable topics include but are not limited to the following:

- Downlink and uplink PHY/MAC design for femtocells in 3G systems, WiMAX systems, and LTE systems
- Interference analysis, avoidance, and mitigation
- Coexistence between a macrocellular network and femtocell network
- Resource allocation techniques
- Closed subscriber group (CSG) versus open-access femtocells
- Power control and power saving mechanisms (e.g., sleep/idle mode etc.)
- Mobility support and handover
- Time synchronization
- Multiple antenna techniques
- Tradeoffs between femtocells, picocells, relay networks, and antenna arrays
- Comparison with other fixed-mobile convergence (FMC) approaches such as UMA/GAN and dual-mode terminals
- Self-organizing networks and issues in self maintenance and self install
- Issues related to enterprise femtocells

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Call for Papers

The 15th International Multimedia Modeling Conference (MMM2009) was held January 7–9, 2009 at EURECOM, Sophia-Antipolis, France. MMM is a leading international conference for researchers and industry practitioners to share their new ideas, original research results, and practical development experiences from all multimedia-related areas. MMM2009 is held in co-operation with the ACM Special Interest Group on MultiMedia (ACM SIGMM). This 15th edition of MMM marks the return of the conference to Europe after numerous years of activity in Asia, and we are proud to organize such a prestigious conference on the French Riviera.

MMM2009 features a comprehensive program including three keynote talks, six oral presentation sessions, three poster sessions, and one demo session. The 135 submissions included a large number of high-quality papers in multimedia content analysis, indexing, coding, as well as applications and services. We thank our 153 Technical Program Committee members and reviewers who spent many hours reviewing papers and providing valuable feedbacks to the authors. Based on the 3 or 4 (sometimes even 5) reviews per paper, the Program Chairs decided to accept only 22 as oral papers and 20 as poster papers. The acceptance rate of 32% follows the MMM tradition of accepting only the papers of the highest technical quality. Additionally, one award for the best paper was chosen.

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