IEEE Information Theory Society Newsletter

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President's Column

Frank R. Kschischang

Collegiality (*n*): cooperative interaction among colleagues.

One of the most precious attributes of our Society, and one that perhaps distinguishes it from many other IEEE Societies, is the strong sense of collegiality that exists among our members. This spirit of "cooperative interaction" was established by the earliest workers in the field starting, I am told, with Shannon himself, and continues to persist today in some of our very best traditions and practices.

One example is the quality of the reviews that one receives for papers submitted to the IEEE Transactions on Information Theory. Reviews are almost invariably generous, offered in a spirit of helpfulness to the author (and ultimately to the reader). I have seen examples where the total length of the reviews exceeded that of the paper itself, or where, in light of a particularly incisive insight, a reviewer was invited to join the paper as co-author. One often reads, in papers published in our Transactions, acknowledgments to the anonymous reviewers for their helpful comments. We should all strive to see that this tradition continues.

Another great example of our spirit of collegiality and generosity is the support that we show to our "junior" colleagues. The Society's student committee, led by Aylin Yener, maintains a web site with helpful career information, including pointers to job openings, and the committee has organized numerous successful events including a variety of Research Roundtables and panel discussions at conferences. And, as reported in the previous Newsletter, under the leadership of Aylin and Gerhard Kramer (and with the help of a large cast of volunteers), the Society last year sponsored a highly successful Second Annual North American School of Information Theory.

Initiated by Muriel Médard, and now led by Todd Coleman, the Society's Outreach committee has organized some very popular panel discussions at conferences and symposia, and sponsors a growing "mentorship network" and the "WITHITS" (Women in the Information Theory Society), led by Christina Fragouli. These initiatives will, I believe, help us to perpetuate the spirit of generous collegiality that sets this Society apart.

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Sub-to-Pub (*n*, colloq.): the time between submission and publication of a journal paper.

Of course, it is the high technical quality of the papers published in the IEEE Transactions on Information Theory that also sets the Society apart. According to the latest available ISI Journal Citation Report, the Transactions continues to rank first among all journals in Electrical and Electronic Engineering and Computer Science in total citations, a statistic in which all contributors to the Transactions can take pride.

Despite its high quality, the vitality of the Transactions is threatened by a lengthy "sub-to-pub." Society President Andrea Goldsmith reported in her column in the previous Newsletter the troubling fact that the average is on the *increase* (having risen from 97.2 weeks in January to 99 weeks in December of 2009), despite a concerted effort by Andrea and by Editor-in-Chief Ezio Biglieri to reduce it. Recently a prominent member of the Signal Processing Society took me aside to tell me that he actively *discourages* his students from submitting to our Transactions due to the overly lengthy review process that he has endured in the past, and, unfortunately, I have heard similar complaints from others. Is our Transactions missing out on excellent papers because of our review process? As Andrea described in her column, the Society will be taking a number of administrative steps to curtail sub-to-pub, but a dramatic impact will be achievable only with a significant cultural shift (by reviewers, editors, and authors).

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From the Editor

Tracey Ho

Dear IT Society members,

I hope you have had a productive start to 2010! Among the articles in this issue, we have Frank Kschischang's first column as IT Society President, where one of the issues discussed is the lengthy "sub-to-pub" time of the IT Transactions. This concern is also addressed in the set of recommended editorial practices recently put together by IT Transactions Editor-in-Chief Ezio Biglieri, which is included in this issue to let authors know what to expect in terms of how submissions will be handled. We have the announcement of the 2010 IEEE medal winners and newly elevated IEEE Fellows from our society – warmest congratulations to all on your achievements and recognition! This issue also includes the summary by David Tse of his ISIT 2009 plenary talk "It's Easier to Approximate". I hope you will find this issue informative and enjoyable.

As a reminder, announcements, news and events intended for both the printed newsletter and the website, such as award announcements, calls for nominations and upcoming conferences, can be submitted jointly at the IT Society website http://www.itsoc.org/, using the quick links "Share News" and "Announce an Event". Articles and columns intended only for the printed newsletter should be e-mailed to me at tho@caltech.edu, with a subject line that includes the words "IT newsletter". The deadlines for the next few issues are:

Issue	Deadline
June 2010	April 10, 2010
September 2010	July 10, 2010
December 2010	October 10, 2010

Please submit ASCII, LaTeX or Word source files; do not worry about fonts or layout as this will be taken care of by IEEE layout specialists. Electronic photos and graphics should be in high resolution and sent as separate files.

I look forward to your contributions and suggestions for future issues of the newsletter.

Tracey Ho

IEEE Information Theory Society Newsletter

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The Historian's Column

Anthony Ephremides

The time has come to reveal a "secret" side-activity of a small subgroup of members of our Society. It has been known as ITSW, which stands for Information Theory Skiing Workshop. This workshop belongs to the class of "extra-curricular" activities in which some of our colleagues engage and does not have "technical" content. It simply started some time in the early nineties at the initiative of its inventor, host, and "pater familias", Dick Blahut.

Dick owns a large, beautiful "ski house" in Vermont just off the famous Route 100 corridor of New England ski resorts. In particular, it is within a few miles from Mount Snow, a massive resort of substantial vertical drop and considerable mix of trails. For many years in a row, around St. Patrick's Day, or earlier, Dick invited a group of friends to spend a long weekend, along with their families, at his house and engage in full-time down-hill exercises in a number of parallel sessions. The sessions were formed based on the skiing abilities of the participants. There were no coffee breaks but lunch was included, along with a nightly banquet at the house that was preceded by a fireside cocktail and wine reception. Please also note that there was no registration fee.

The number of participants and the composition of the group varied considerably from year-to-year. However, there was a hard core of regulars that included Dave Forney, the Hajeks (Bruce, Beth, Brittany, and Briana), the O'Sullivans (Jody, his wife, and a growing number of children), and the Ungerboecks (Gottfried and Sonni). My wife and I were also privileged to be included in these gatherings. A number of other, more sporadic, attendees participated as well. Bixio Rimoldi, the late Ralf Koetter, Ed Palo, and even Sergio Verdu were some of them.

The program started with a late Thursday evening arrival. A roaring fire was "de rigeur" and the presence of the New York Times on the living room table indicated that Dave Forney had arrived. The Hajek family would arrive late (that is early the next day – like 3:00am) after a dinner in Boston's little Italy at the North End.

At the crack of dawn on Friday, Dick's stentorian voice bellowed: "The lifts open in 90 minutes". This call-to-arms marked a frantic level of activity as everyone scrambled to get ready amidst the sizzling aromas of coffee, eggs, pancakes, and other griddle goodies being prepared by the morning shift. Generally, the practice was that the women would prepare the food and the men would wash the dishes. However, there were some exceptions. Notably, Dick would officiate in the preparation of breakfast and Bruce in the preparation of dinner.

After the morning injection of energy, the group would venture out and fight its way through the snow to free the cars, get them started, and start the convoy to the Mt. Snow parking lot. Some mornings were glorious; sunshine, crisp temperatures, and good cheer. Some others were gloomy, icy, wet, and dark. No matter. The group was always in good spirits.

Hours of non-stop skiing ensued, interrupted only by lunch (prepared sandwiches) at the noisy base lodge of the resort. As the lifts were about to close, the group would gather, board the cars, and head home. Some runs on Mt. Snow were frightfully steep and sculptured with porcelain bumps. Others were easy, delightful cruising promenades. And then, there were the trees for the truly adventuresome (e.g. Bruce) and the fearless (e.g. Jody).

Back at the house, the first thing was to light the fire and pour the drinks. In many ways, this was the apex of the day. Joke-telling, camaraderie, games (from "Simon Says" to all sorts of puzzles), music, darts, etc., followed by a hearty dinner around a long, rustic table were the order of the evening. Then, after a night cap, everyone retreated early for a restful sleep.

Saturday was a carbon copy of Friday, and on Sunday morning some of the participants would bid farewell, while the insatiable ones would squeeze half-a-day of skiing before heading home.

As you can imagine, this was pure, delightful, unadulterated fun that fostered friendship and good fellowship. It represented the social side of the interaction that brings us together in the professional arena. It allows us to see each other as more complete human beings. And it is an example of the many other ways in which we interact outside our profession. It permits us to appreciate qualities that we never imagined our colleagues possessed. From the cooking and athletic skills to displays of admirable courage. For example, in one of these workshops, Jody was lured to a steep bumpy trail in which the blasting rock music from the loudspeakers elevated the adrenaline of the skiers. As it often happens in skiing, a slight mistake coupled with bad luck resulted in an unintended aerial display that ended up with a fractured shoulder. The injury was rather serious. It eventually required an operation and long recuperation time. Nonetheless, that evening, around the dinner table, there was a celebratory mood. Jody himself led the cheer and everyone had a great time reversing the pain of the injury. Needless to say that the following year Jody was back, undeterred and as determined as ever.

Such events foster bonds that cannot break. And they create memories that cannot pale. They are part of the magical web and human-professional-social relationships that form the backbone of our Society.

New IEEE Fellows as of January 2010

The following list of IT Society members have been elected to the grade of IEEE Fellow as of January 2010. The society memberships and the endorsing society are indicated for each individual.

Martin Bastiaans	IT::SP	SP
Roy Cideciyan	COM::IT	COM
Hesham El-Gamal	SP::COM::IT	IT
Bart Kosko	CIS::IT::SMC::SP	CIS
Gerhard Kramer	IT::COM	IT
Ping Li	COM::IT	IT
Victor Miller	COM::IT	IT
Aria Nosratinia	IT::SP::COM	COM
Robert Nowak	IT::COM::SP	SP
Ramesh Rao	COM::IT	COM
Christian Schlegel	IT::COM	COM
Robert Schober	VT::COM::IT::SP	COM
Madhu Sudan	none	IT
Giorgio Taricco	none	IT
Mahesh Varanasi	IT::COM	COM
Howard Yang	VT::CAS::CE::COM::SP::IT::ED::BT::SSC	CAS
Ram Zamir	IT	IT
Zoran Zvonar	VT::COM::IT	COM

IT Society BoG Member Nominations

The Board of Governors (BoG) is the governing body of the IEEE Information Theory Society. The Nomination and Appointments Committee welcomes suggestions for candidates for the BoG. Suggestions should be sent to Dave Forney (forneyd@comcast.net), preferably before April 1. Members may also make nominations directly by petition; see the IT Society website.

President's Column *continued from page 1*

It is my honor and privilege to serve as the 2010 IEEE Information Theory Society president. I am delighted to be surrounded by an excellent group of officers in Senior Past President Dave Forney, Junior Past President Andrea Goldsmith, First Vice President Giuseppe Caire and Second Vice President Muriel Médard. I am grateful to outgoing treasurer Anant Sahai for his deft handling of the Society's finances in the past three years, and for providing me with a good overview of the financial picture. I welcome incoming treasurer Nihar Jindal and look forward to working both with him and with Society Secretary Aria Nosratinia this year. The Board of Governors of the Society is an outstanding and dedicated group who will see to it that the Society continues on a trajectory that supports technical excellence in a tradition of collegial interaction.

Finally, I wish to thank my predecessor, Andrea Goldsmith, for her leadership and tireless efforts on behalf of the Society, both during her Presidency and before. Hers will be a tough act to follow.

If you would like to get more involved in the activities of the Society or share your comments, please contact me at frank@comm.utoronto.ca.

2010 IEEE Medal Recipients

IEEE Medal of Honor

for an exceptional contribution or an extraordinary career in the IEEE fields of interest, sponsored by IEEE Foundation to:

Andrew J. Viterbi (LF' IEEE)
President, Viterbi Group, LLC
San Diego, CA, USA

"For seminal contributions to communications technology and theory."

IEEE Alexander Graham Bell Medal

for exceptional contributions to the advancement of communications sciences and engineering, sponsored by Alcatel-Lucent Bell Labs to:

John M. Cioffi (F' IEEE)
Hitachi America Professor of Electrical Engineering
Stanford University
Stanford, CA, USA

"For pioneering discrete multitone modem technology as the foundation of the global DSL industry."

IEEE Richard W. Hamming Medal

for exceptional contributions to information sciences, systems and technology, sponsored by QUALCOMM, Inc. to co-recipients:

Whitfield Diffie (A' IEEE)
Vice President, Fellow
and Chief Security Officer
Sun Microsystems
Menlo Park, CA, USA

and

Martin Hellman (F' IEEE)
Professor Emeritus of Electrical Engineering
Stanford University
Stanford, CA, USA

and

Ralph Merkle (M' IEEE)
Senior Research Fellow, Institute for Molecular Manufacturing
Cupertino, CA, USA

"For the invention of public key cryptography and its application to secure communications."

IEEE Jack S. Kilby Signal Processing Medal

to Ronald Schafer (LF'IEEE)
HP Fellow,
Hewlett Packard, Palo Alto, CA, USA

"For leadership and pioneering contributions to the field of digital signal processing."

It's Easier to Approximate

Plenary talk presented at the 2009 IEEE International Symposium on Information Theory, Seoul, South Korea

David Tse

Abstract

Shannon provided an exact characterization of the fundamental limits of point-to-point communication. After almost 40 years of effort, meeting the same goal for networks proved to be far more difficult. In this talk, we argue that much broader progress can be made in network information theory when instead one seeks *approximate* solutions with a guarantee on the gap to optimality. We discuss a specific approach focusing on the practically important models of linear Gaussian channels and Gaussian sources.

I. Introduction

In his seminal paper [1], Shannon provided a complete solution to the fundamental limits of point-to-point communication. Since the coding schemes allowed are of arbitrary block lengths, the original design problem is an infinite-dimensional optimization problem. Yet, the optimal solution can be expressed as that of a finite-dimensional optimization problem ("single-letter" characterization). Moreover, for many specific channels and sources, this finite-dimensional optimization problem can be solved explicitly in closed form. This desirable state of affairs is remarkable and almost unique among engineering fields, but it also sets a high standard for the information theory field.

A holy grail of information theory is to extend Shannon's point-to-point result to the network setting. The general network information theory problem is to analyze the fundamental limits of communication when multiple senders want to communicate with multiple receivers with the help of intermediate nodes. The first success came in the earlier 1970's, when Ahlswede [2] and Liao [3] independently provided a single-letter characterization of the capacity region of the multiple access channel. In this network, K users want to send information to a common receiver across a noisy channel. This result is rather general in the sense that it holds for arbitrary number of users as well as arbitrary channel statistics. It led to much excitement in the field at that time. However, as it turned out, there have been essentially no other network information theory results of such generality since then. Most of the other results, for example, hold for only two users (such as the degraded message set problem for broadcast channels) or for specific class of channel or source statistics (such as degraded broadcast channels). Even these results are few in number. So despite almost forty years of effort, it is fair to say that we are still very far from solving the general network information theory problem.

A class of channels and a class of sources that have received much attention are linear Gaussian channels with quadratic cost constraint and Gaussian sources with quadratic distortion measure respectively. Not only are these models practically relevant for applications such as wireless and sensor networks, the physically meaningfulness of their structures give some hope that Gaussian problems are easier to solve than the general case. Indeed, as is well-known, the capacity of the point-to-point Gaussian channel and the rate-distortion function of the Gaussian source are known in closed form. Can this luck help us make more progress in Gaussian network problems than in the general case? The answer is yes for broadcast channels. While the capacity region of the general broadcast channel is open even in the case of two users, the capacity region of Gaussian broadcast channels with arbitrary number of users is known. However, it seems that the luck ran out rather quickly as most Gaussian network problems are still open. Examples are interference channels (even the two-user case is open), relay networks (even the single-relay channel is open), multiple description and distributed lossy source coding (both open for more than 2 users). So it seems that Gaussian network problems are not too much easier than the general ones.

In this talk, we outline a recent approach to make progress in Gaussian network information theory problems. The idea is to *approximate*. Rather than asking for *exactly optima*l solutions for network problems, we recognize that network problems are far more difficult than point-to-point problems and are willing to settle for *approximate* solutions. Not any old approximate solutions however, but approximate solutions with a hard guarantee on the gap to optimality.

Approximate solutions to information theory problems are not new. However, they are by and far isolated results each with its own proof technique. What distinguishes the approach we advocate here with these results is that it is a systematic approach that can be applied to *many* problems.

The approach consists of four steps:

- *Noisy* channel coding problems are approximated by *noiseless* problems. Lossy source coding problems are approximated by *lossless* problems.
- Analyze the simplified problem.
- Use insights to find new schemes and/or outer bounds to the original Gaussian problem.
- Derive a worst-case gap of the performance of the proposed scheme to optimality, universal for all values of the channel parameters.

What is the rationale for this approach? Take channel coding problems for example. In the point-to-point case, the noise is the central object of interest and it occupies the sole attention of Shannon's point-to-point theory. In networks, however, in addition to the noise there is also the interaction between the signals of multiple users. To try to solve the problem in one shot is fighting two battles at the same time. Approximating the noisy problem by a noiseless (deterministic) one allows us to first focus on the signal interaction. Noiseless problems are often easier than noisy problems. For example, while the general noisy broadcast channel

problem is open, the deterministic broadcast channel is solved (independently by Pinsker [4] and Marton [5]). Similarly, lossless source coding problems are often easier than lossy ones. For example, while the general lossy distributed source coding problem is open (even for two users), the lossless distributed source coding problem is solved (the celebrated Slepian-Wolf Theorem [6]).

Because this approach in effect decouples the effect of the noise and the signal interaction, it does not in general yield exactly optimal solution. (Although sometimes one can get lucky, as we will see.) The approximation becomes relatively more accurate when the noise is small compared to the signals (interference-limited or low-noise regime). So while the worst-case gap holds for all parameter ranges, the performance gap is more meaningful in the low-noise regime where the achievable rates are high. The dual statement for source coding is that the approximation using this approach becomes relatively more accurate when the target distortion levels are small and the required rates are high.

In the rest of the talk, we will illustrate this approach using the four open problems mentioned above.

II. Interference Channels

A. Strong Interference

The capacity region of the 2-user Gaussian interference channel (IC) (Fig. 1(a)) is one of the long-standing open problems in network information theory. Two users interfere with each other through cross talk. The problem is to determine the set of all rates (R_1, R_2) that are simultaneously achievable by the two users. This channel was first considered in the 1970's and the capacity region of the Gaussian IC in the *strong interference* regime was quickly figured out (independently by Sato [7] and Han and Kobayashi [8]). In this regime, transmitter 1(2) has a better channel to receiver 2(1) than to receiver 1(2). In any working system for this channel, receiver 2 can decode its own message m_2, and therefore can cancel off m_2's contribution. Now, receiver 2 has a clear view of transmitter 1's signal, and since receiver 2 has a better channel than receiver 1 from transmitter 1 and receiver 1 can decode its own message m_1, then receiver 2 can decode the message m_1 as well. Similarly, receiver 1 can decode the message m_2. So although the communication system is designed only to deliver the message m_1 to receiver 1 and the message m_2 to receiver 2, these messages are automatically *public*, i.e. decodable at the other receiver. This converts the strong interference channel to a *compound* multiple access channel, i.e. both messages have to be decodable at each of the receivers, and the capacity region of the Gaussian IC is simply the intersection of the capacity regions of the two multiple access channels, one at each receiver.

B. El-Gamal-Costa Deterministic IC

The strong interference regime was quickly solved, but very little progress has been made on the other parameter regimes for many years since then. When the channel to the other receiver is weaker than to your own receiver, requiring the other receiver to decode your message is obviously sub-optimal. But what is the right strategy? In fact, the only non-trivial IC whose capacity region is fully solved is the *deterministic* IC studied by El Gamal and Costa [9]. This is shown in Fig. 1(b). The channel output Y_1 is a function of the input X_1 from transmitter 1 and V_2, which in turn is a function of the input X_2 from transmitter 2. This would just have been a general deterministic IC but for an important property they assumed: that V_2 is a function of X_1 and Y_1 (and similar for V_1). What is the optimal strategy for this channel? In any working system, receiver 2 can decode its own message. Therefore, receiver 2 knows X_2. From X_2 and Y_2, it has a clear view of V_1. So the part of the message from transmitter 1 that is on V_1 will also be decodable by receiver 2, i.e. is public. This argument is similar to that used in the strong interference regime, except that now only a part of the message, the part on V_1, is public. The rest is private. This strategy is a special case of the Han-Kobayashi achievable scheme [8] with a specific prescription on how to do the private-public split.

C. Connection with Gaussian IC

The El-Gamal-Costa channel seems to have nothing to do with the Gaussian IC, but in 2006, Raul Etkin, Hua Wang and myself observed a connection. The key is to *approximate* how the Gaussian IC behaves. Consider an example of a Gaussian IC where $h_{11} = 2^n$, $h_{12} = 2^m$, and $m < n$ so that we are not in the strong interference regime. Suppose X_1 has a binary expansion $0 \cdot b_1 b_2 b_3 \ldots$. The resulting signal at receiver 1, before adding noise and interference, is $b_1 b_2 \ldots b_n . b_{n+1} \ldots$, and the corresponding signal at receiver 2 is $b_1 b_2 \ldots b_m . b_{m+1} \ldots$. The noises at both receivers are normalized to have unit variance, so the decimal point in the above expansions is the "noise level". One can divide the transmitted bits $b_1, b_2, b_3 \ldots$ into three groups:

- $b_1, b_2, \ldots b_m$, which appear above the noise level at both receivers.
- $b_{m+1}, b_{m+2}, \ldots b_n$, which appear above the noise level at receiver 1 but below noise level at receiver 2.

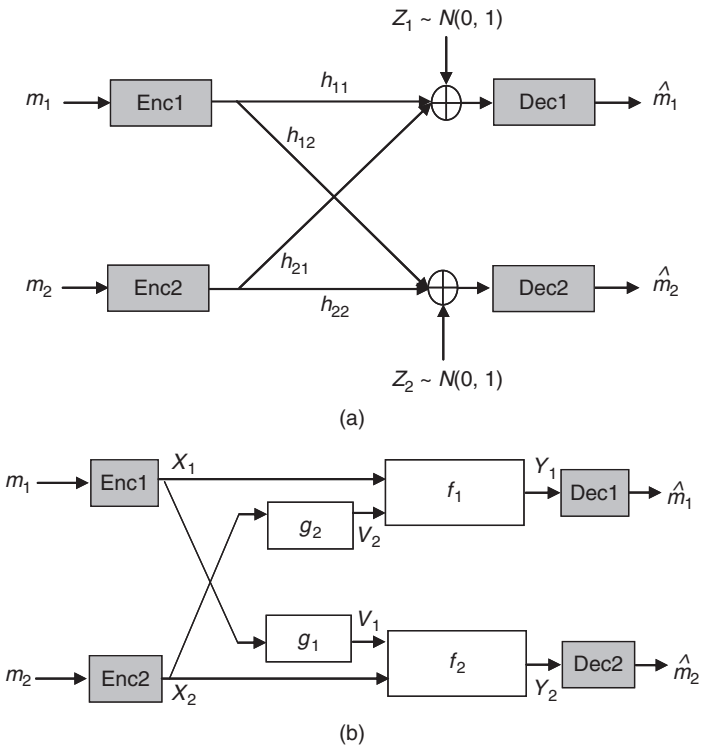

Fig. 1 (a) Gaussian IC; (b) Deterministic IC.

- $b_{n+1}, b_{n+2}, \ldots$ appear below the noise level at both receivers.

This decomposition suggests a way to approximate the Gaussian IC by a El-Gamal-Costa IC. Since $b_{n+1}, b_{n+2}, \ldots$ are below the noise level at both receivers, they convey little information but also have little interfering effect, being masked by the noise. Let's ignore them entirely and assume the transmit signal X_1 is just $(b_1, b_2, \ldots b_n)$. Of these bits, $b_1, \ldots, b_m$ are observed at both receivers while the rest appear below noise level at receiver 2 and so also have little interfering effect. So we can let $V_1 = (b_1, \ldots, b_m)$. The key property of the El-Gamal-Costa IC is approximately satisfied: given the input X_2 and the output Y_2, the interference V_1 above the noise level can be (approximately) determined. The El-Gamal-Costa result then tells us that user 1 should split its message into a public and a private message, the public message conveyed in $b_1, \ldots, b_m$ while the private message conveyed in $b_{m+1}, \ldots, b_n$.

D. Gaussian Capacity to within 1 Bit

Once this correspondence is established, it is clear what is the natural scheme to try on the Gaussian IC. Split each transmitter's message into a public message and a private message. Allocate power to the private message such that it is received just below the noise level at the other receiver. The rest of the power is allocated to the public message. Use independently generated Gaussian codebooks to convey the public and the private messages. In [10], it was shown that this strategy can achieve to within 1 bit/s/Hz (i.e. 0.5 bit per real dimension) of the capacity region. This gap holds for all values of the channel parameters. To show this result, new outer bounds are obtained for the Gaussian IC to match (approximately) the performance of the proposed scheme. Like the scheme, the outer bounds were also inspired by the corresponding outer bounds of the El-Gamal-Costa IC.

The correspondence between the Gaussian IC and the deterministic IC described above is approximate but not exact. In the deterministic IC, bits are either perfectly observed or are completely invisible. In the noisy Gaussian IC, such is not the case. This accounts for why there is a gap between the performance of the proposed scheme and the outer bound. Somewhat surprisingly, subsequently works [11], [12], [13] showed that by further tightening one of the new outer bounds in [10], an *exact* characterization of the sum rate of the Gaussian IC can be obtained in a certain very weak interference regime.

E. Lattice Codes for Interference Alignment

The within-1-bit strategy is a special case of the general Han-Kobayashi scheme with randomly generated Gaussian codebooks for both the private and the public messages (and a specific power split). Since Han-Kobayashi allows arbitrary input distributions for the private and the public messages, what we showed is that Gaussian input distribution is "nearly" optimal for the 2-user IC. This is consistent with the folklore in information theory that "Gaussian inputs are good for Gaussian problems". But does this continue to hold true for IC with more users?

Consider an example of a many-to-one Gaussian IC in Figure 2. Here, there are three users and the top user is interfered by the other two. We consider a particular operating point, and show in the figure the binary expansion of the signals in the deterministic approximation of this Gaussian IC. Both transmitter 2 and transmitter 3 are sending two bits above noise level at their respectively receivers. In this example, the channels from both these transmitters to receiver 1 are stronger than their own direct channels and so the bits from these transmitters are shifted upwards at receiver 1 relative to receiver 2 and 3. We make two observations:

- The two most significant bits at receiver 1 are un-usable for transmitter 1 as long as one of the other two transmitters send information at those levels. So if one is sending, the other might as well send as well. This is the phenomenon of *interference alignment.*

- The next three significant bits are left empty by both users 2 and 3. So now user 1 can send 3 bits on those levels.

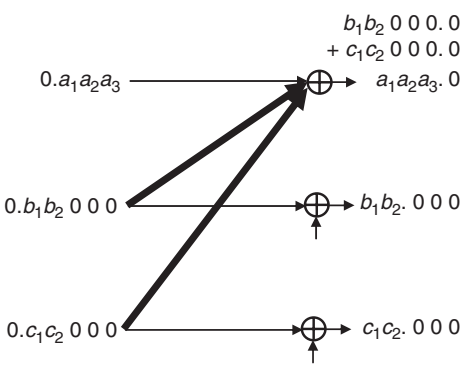

Fig. 2 Many-to-one IC.

How can we translate this picture back to the Gaussian world? A natural strategy would be for both users 2 and 3 to use a capacity-achieving Gaussian code on their own link. Because of the strong channel to receiver 1, the codewords in each of the Gaussian codes will be spaced far apart there. However, the *summed* codewords will be close together. This is because the summed codewords will be all distinct and so the size of the summed codebook is the square of the size of each user's codebook. This means that while the *individual* interference is confined within the most significant two bits, the *aggregate* interference leaks to the next three bits, making these levels unusable for user 1. But if instead we use the same *lattice* code for both users 2 and user 3, then interference alignment can be achieved. This is because the summed codewords will remain on the lattice. Now the space in between the codewords is preserved for user 1 to transmit information. Thus, unlike in the two-user case, Gaussian codes are no longer good when there are more users. Generalizing from this example, it is shown in [14] that lattice codes can achieve the capacity of the many-to-one Gaussian to within constant gap universal of the values of the channel gains.

III. Relay Networks

Consider a relay network with a single sender node who wants to transmit information to a single destination node with the help of a number of relay nodes in between. The received signal at a node is a superposition of the (attenuated) signals transmitted at other nodes plus Gaussian noise. What is the capacity, the maximum rate of information transfer from the sender to the destination?

This problem has a very long history, but even the simplest case with a single relay node (the so-called relay channel) is open. The best known achievable strategies were obtained by Cover and El Gamal in 1979 [15].

If instead of Gaussian channels, the nodes are connected via noiseless, orthogonal links, then we have a wireline network and the capacity is given by the famous max-flow min-cut theorem of Ford and Fulkerson. The Gaussian problem is significantly more complex due to the superposition of the signals as well as the additive noise at

each of the node. A natural generalization of the min-cut of wireline networks to general networks is the cutset bound:

$$C_{\text{cutset}} = \max_{p_{X_1,\ldots,X_n}} \min_{\Omega} I(X_\Omega; Y_{\Omega^c} \mid X_{\Omega^c}) \tag{1}$$

where Ω is a cut in the network (a set of nodes including the sender) and the maximization is over all joint distributions on the transmit signals at the nodes. $I(X_\Omega; Y_{\Omega^c} \mid X_{\Omega^c})$ is the information flow across the cut assuming full cooperation of the nodes in Ω to send information and full cooperation of the nodes outside of Ω to decode the information. In the wireline network, the cutset bound evaluates to the minimum cut of the network and yields the capacity. In the Gaussian network, however, the cutset bound only provides an upper bound. How tight is this bound?

In the Fall of 2006, Salman Avestimehr, Suhas Diggavi and myself started to study this question. Fresh after the 1-bit gap result on the 2-user Gaussian IC, we naturally seek a constant-gap result for relay networks as well. Our first observation is that for the (single) relay channel, the decode-forward strategy proposed by Cover and El Gamal in 1979 actually achieves within 1 bit/s/Hz of the cutset bound, universally for all values of the channel gains. But what about for general networks with more than 1 relay? It is clear that requiring each relay to decode the entirety of the sender's information is not the right thing to do in general. So what to forward? How to forward?

In the work on the two-user Gaussian IC [10], we found a good scheme and new outer bounds by drawing an approximate analogy with the El Gamal-Costa deterministic IC. However, this analogy was of a heuristic nature and in that work we actually never introduced a specific deterministic channel to approximate the Gaussian IC. In the relay work, we took this approach one step further and introduced a specific deterministic channel model as a bridge between the Gaussian and the wireline models. This allows us to leverage off insights from the wireline network to solve the Gaussian relay problem.

One insight from our earlier discussion on interference channels is that bits received above noise level can be approximated as clean and bits below the noise level as useless. This insight can be converted into a deterministic channel model as follows. In the Gaussian model, the received signal at a relay node j is:

$$Y_j^G = \sum_i h_{ij} X_i + W_j, \qquad W_j \sim N(0,1),$$

where X_i is the signal sent at node i and h_{ij} is the gain from node i to node j. Since noise is normalized to be unit variance, the integer part of the received signal can be considered as the part above noise level. This yields the following deterministic channel:

$$Y_j^D = \left\lfloor \sum_i h_{ij} X_i \right\rfloor.$$

The next step is the analysis of this deterministic network. In earlier works, Aref [16] and Ratner and Kramer [17], had looked at deterministic networks but with broadcast only and no superposition of the signals at the nodes. They showed that a random forwarding strategy at each relay (randomly mapping the received signal to a transmit codeword) is sufficient to achieve the cutset bound. This strategy is reminiscent of the random network coding strategy of Ahlswede et al [18] for wireline networks and in fact deterministic networks with broadcast only is a generalization of the wireline model. But in our deterministic channel model, there is superposition of signals as well. This led us to prove the following generalization of these results to *general* deterministic relay networks: the rate

$$R = \max_{p_{X_1} \cdot p_{X_2} \cdot, \ldots, p_{X_n}} \min_{\Omega} I(X_\Omega; Y_{\Omega^c} \mid X_{\Omega^c}) \tag{2}$$

is achievable [19], [20]. We see that this is identical to the cutset bound (1) *except* that in the maximization, the input distribution is constrained to be independent across the nodes. For wireline and deterministic networks with broadcast only, it is optimal to have independent inputs at each node and (2) matches the cutset bound. For the deterministic network derived from the Gaussian network, we showed that this achievable rate is a constant gap from the cutset bound, irrespective of channel gain parameters. So not allowing the correlation of inputs results only in bounded loss.

Finally, we brought back these insights to the original Gaussian relay network. The answers to our earlier questions is now clear: 1) What to forward at each relay? The received signal quantized at the noise level; 2) How to forward? Each relay randomly maps the quantized received signal into a Gaussian codeword to transmit. In [20] we showed that this strategy achieves within a constant gap κ from the cutset bound for the Gaussian network.

Among all the schemes proposed in [15], our scheme is philosophically most similar to compress-forward. There is one important difference, however. In the compress-forward scheme discussed in [15], the destination is required to decode the quantized signal at the relay and then, with the help of the quantized signal and the direct reception from the sender, decodes the sender's message. In our scheme, the quantized signals are never decoded anywhere. at the relays or the final destination. Instead, the sender's message is decoded directly at the final destination based on all the forwarded information. These two approaches yield identical performance on single relay networks, but the latter approach is superior for more than 1 relay nodes. In fact, it is not even clear how the first approach can be naturally generalized to more than 1 relay. In recent work, Lim et al [21] generalized our scheme from the Gaussian case to general noisy networks and coined it "network compress-forward".

Finally, a comment about the gap κ to the cutset bound. This gap does not depend on the values of the channel gains, but unfortunately it depends on the number of nodes n in the networks. It grows like $n \log n$, and so our result is not very good when the network is large. Basically, each quantized signal at a relay contains noise, and with increasing number of relay stages, noise gets accumulated more and more and the performance of the scheme degrades. An interesting open question is to either find another scheme that has a network-size-independent gap to the cutset bound, or find a better upper bound than the cutset bound.

IV. Source Coding

We approximate the Gaussian channel by a deterministic channel by assuming the bits of the received signal above the noise level are completely clean and bits below are completely useless. In a dual way, we can approximate a Gaussian lossy source coding problem with quadratic distortion measure by viewing a source sample X in terms of its binary expansion $0.b_1b_2\ldots$, and the goal of the source decoder as recovering the first n most significant bits, where $n = \frac{1}{2}\log_2 d$ and d is the distortion requirement. Hence, the

source encoder only has to focus on the first n bits and the lossy problem of recover X to distortion d is replaced by a *lossless* problem of recovering $(b_1, b_2, \ldots, b_n)$ exactly. This approximation is applied to two source coding problems below.

A. Multiple Description (MD)

A source has to be described using K descriptions, such that the decoder that receives a subset S of the descriptions can recover the source to within distortion d_S. Given distortion requirement for every subset $S \subset \{1, \ldots, K\}$, what are the set of rates $(R_1, \ldots, R_K)$ needed to generate the descriptions? Let us focus on Gaussian sources with squared error distortion. In the case of 2 descriptions, Ozarow [22] showed that an achievable rate region by El Gamal and Cover for general sources [23] is tight. The problem for more than 2 descriptions is open.

For simplicity, let us focus on the *symmetric* MD problem, where the same distortion d_m is required for *any* subset of m descriptions, and $d_1 < d_2 \ldots < d_K$. The approximating lossless source coding problem is as follows [26]. Let $n_i = \frac{1}{2}\log d_i$, $i = 1, \ldots K$. The source X is $(b_1, b_2, \ldots b_{n_K})$, and any decoder that receives i descriptions have to recover $b_1, b_2, \ldots b_{n_i}$. Note that the bits that needed to be recovered at different "levels" are nested. This lossless source coding problem had been considered before: it is called "multilevel diversity coding" [24], [25]. The optimal coding strategy breaks up the source into $V_1, V_2, \ldots V_K$, where $V_i = (b_{n_{i-1}}, \ldots b_{n_i})$ are the additional bits in level i beyond those in level $i-1$, codes V_i using a (K, i) MDS code, and constructs the descriptions as shown in Figure 3. This ensures that whenever one receives i descriptions, $V_1, \ldots V_i$ can be recovered.

The V_i's can be thought of as successive refinement layers of the source: V_1 is the base layer (most significant bits), V_1 are additional refinement bits, and so forth. Thus, the above lossless approximation suggests a natural strategy for the original Gaussian MD problem: use a successive refinement code to generate layers $V_1, V_2, \ldots V_K$, such that with $V_1, \ldots V_i$ the source can be reconstructed with distortion d_i, and then apply multilevel diversity coding to generate the descriptions as above. Using the successive refinability of Gaussian sources, it is shown in [26] that this strategy achieves within 1.48 bits/sample of the symmetric rate point for any number of descriptions. A more sophisticated scheme by Puri et al [27] has a gap of 0.92 bits/sample.

B. Distributed Lossy Source Coding

K sources $Y_1, \ldots Y_1$ are distributedly encoded at rates $R_1, \ldots R_K$ respectively. Using the encodings, a central decoder has to reconstruct these sources with distortions $d_1, \ldots d_K$ respectively. What is the achievable rate region? In the case when the sources are correlated Gaussian and the distortion measure is quadratic, this problem for 2 sources was recently solved by Wagner et al [28], building on earlier work by Oohama [29]. The optimal strategy is Gaussian quantization of the sources followed by Slepian-Wolf binning. The problem is wide open for three or more sources, but progress can be made using the approximation approach.

Consider an example of 3 tree sources Y_1, Y_2, Y_3, i.e. there exists a Gaussian $X \sim N(0, 1)$, such that $Y_i = X + Z_i$, $i = 1, 2, 3$ with $Z_i \sim N(0, \sigma_i^2)$ and X, Z_1, Z_2, Z_3 are independent. Approximately, we can think of the Z_i's as "noises" which make the less significant bits of the Y_i's independent while keep the more significant bits identical. For example:

$$X = 0.a_1a_2a_3a_4 \ldots,$$

$$Y_1 = 0.a_1a_2b_1b_2 \ldots,$$

$$Y_2 = 0.a_1a_2a_3c_1c_2 \ldots,$$

$$Y_3 = 0.a_1a_2a_3a_4d_1d_2 \ldots,$$

for the case when $\sigma_1^2 > \sigma_2^2 > \sigma_3^2$.

In the approximating lossless problem, each encoder has to deliver the significants bits of its Y_i up to the target distortion level. But because there is correlation (like the a_1 bit that appears in all of the Y_i's in the above example), rate can be saved by only sending one copy of each independent bit. In the lossless problem, this can be pre-arranged by making sure each independent bit is delivered only by one encoder. Alternatively, all the encoders can do random binning into bins of appropriate size to remove the redundancy in the encodings.

This latter strategy naturally yields a strategy for the original lossy problem. First, each encoder does Gaussian quantization up to the distortion requirement of its observation Y_i. This in effect extract the significant bits that the decoder needs. Then, the index of the quantized vector is randomly binned. It is shown in [30] that this strategy is within 2.4 bit/sample of the optimal rate region.

The strategy above is exactly the same as the Gaussian-quantize-and-bin strategy that is optimal for the 2-source case. So what was shown is that this strategy is within a constant gap to optimality for *tree* sources. Is this strategy good for *any* jointly Gaussian sources?

Consider the follow example. Y_1, Y_2 are correlated and $Y_3 = Y_1 - Y_2$, and our goal is to recover Y_3 at a certain distortion d_3 with encodings from Y_1 and Y_2 only. We can write out the binary expansions:

$$Y_1 = 0.a_1a_2a_3b_1b_2b_3 \ldots$$

$$Y_2 = 0.a_1a_2a_3c_1c_2c_3 \ldots$$

$$Y_1 - Y_2 = 0.000e_1e_2e_3 \ldots$$

where $e_i = a_i - b_i$, $i = 1, 2, 3$. Suppose we want to recover Y_3 up to the 5th significant bit. The Gaussian-quantize-and-bin strategy will first yield the first 5 bits from each of the sources via Gaussian

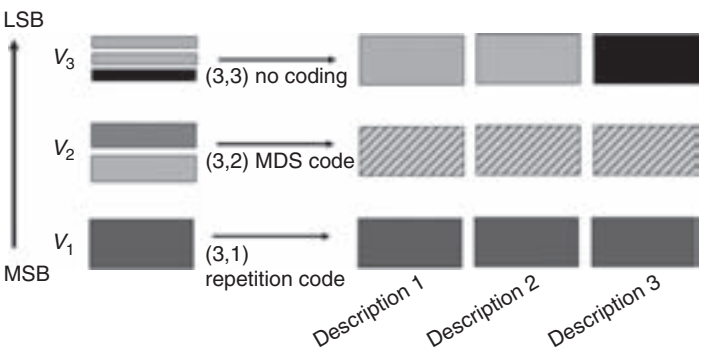

Fig. 3 Multi-level coding.

quantization, and use Slepian-Wolf binning to remove the redundancy in the encodings. So in effect, only one copy of a_1, a_2, a_3 are sent.

But this is still wasteful! The decoder does not actually need any copy of a_1, a_2, a_3; it only needs b_1, b_2, c_1, c_2 to compute the difference bits e_1, e_2. So what is needed is a quantizer for Y_1 to extract only the less significant bits b_1, b_2 and a quantizer for Y_2 to extract c_1, c_2. A (random) Gaussian quantizer will not do; the five significant bits are all mixed up in the representation. Rather, what is needed is a lattice quantizer, consisting of a coarse lattice representing the most significant bits (a_1, a_2, a_3) and a fine lattice representing the less significant bits (b_1, b_2 for Y_1, and c_1, c_2 for Y_2). Each encoder only needs to send the fine lattice index of the quantized vector. This scheme was proposed by Krithivasan and Pradhan [31] and shown to be within 1 bit/sample to optimality by Wagner [32].

V. Conclusion

Traditionally, *exact* analysis of Gaussian network information theory proceeds by finding a good Gaussian scheme and then proving a converse using an extremal information inequality for which Gaussian is tight. This approach is problematic because: 1) we don't have too many such inequalities in our arsenal (basically entropy-power inequality and its variants) and inventing new ones is difficult; 2) Gaussian schemes may be very far away from being optimal (as we saw); 3) the analysis is very much tied to the details of the Gaussian noise/source model. The approximation approach tries to circumvent these difficulties. Moreover, it has the added bonus of connecting Gaussian problems with other problems such as network coding and lossless source coding, and thus helps to shed more light into the structure of the network information theory field as a whole.

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GOLOMB'S PUZZLE COLUMN™

Calendar Puzzles

Solomon W. Golomb

The ancient Egyptian calendar (E) had 365 days in every year. This accumulated a large error by the time of Julius Caesar, who proclaimed the Julian calendar (J) for the entire Roman Empire, where a "normal year" had 365 days, but every fourth year was a "leap year" with 366 days. In J, calendar date (e.g. May 12) and day of week (e.g. Tuesday) are statistically independent.

Since a "true" Astronomical year (A) is 365d, 5h, 48m, 46s, or about 365.2422 days, by 1582 A.D. Pope Gregory XIII decided that the J calendar had drifted 10 days since the time of the Council of Nicaea in 325 A.D., and proclaimed the Gregorian calendar (G), which differs from J in that years with numbers divisible by 100 are *not* leap years unless divisible by 400. (Thus 2000 was a leap year, but 1900 was not, and 2100 will not be, in G.)

1) The period of the Julian calendar (when all calendar dates repeat, with the same days of the week) is 28 years. What is the period of the Gregorian calendar?

2) Show that in G, calendar date and day of the week are *not* statistically independent.

3) In the long run, between May 1 and November 30 of a given year, what is the expected number of months having a Friday the 13th? (This is the same in J and G.)

4) Julius Caesar was assassinated on the Ides of March (March 15) in 44 B.C. How many years will have elapsed from that date to March 15, 2010 A.D.?

5) In Latin, "septem" means *seven*, "octo" means *eight*, "novem" means *nine*, and "decem" means *ten*. Why then are September, October, November and December the 9th, 10th, 11th, and 12th months, respectively?

Originally a *month* meant one synodic period of the moon around the earth (the time from one new moon to the next). The length of the month, as given in the Talmud (and which is accurate to a fraction of a second) is 29d, 12 h, 44 m, 3⅓ s, or 29.530594136 days.

6) A year in the Moslem calendar (M) is always 12 (synodic) lunar months. How much shorter is a year in M than a year in G?

7) Year 1 in M was 622 A.D., from the date that Mohammed fled from Mecca to Medina. When will the year number be the same in M and in G?

8) The Hebrew calendar (H), is a "luni-solar calendar" (like the Chinese calendar, the "Easter calendar" of the Catholic Church, and others) that reconciles lunar months with solar years. In H it is assumed that 19 solar years is exactly 235 lunar months. (In the 19-year cycle of H, normal years have 12 lunar months and leap years have 13 lunar months. Since $235 = 19 \times 12 + 7$, there are seven leap years in every 19-year period of H, occurring in years 3, 6, 8, 11, 14, 17, and 19. (The current year 5770 in H is year 13 of the current 19-year cycle.) What is the average length of a year in H?

9) Arrange in order, from shortest to longest, the years in E, J, G, A, M, and H. (Extra credit: express the lengths of these years decimally in days.)

10) Given the difference in year length between G and A, when will G have gained a full day on A?

Notes: Ignore the fact that the lengths of days, lunar months, and solar years are all changing, since these changes are very small over intervals of only a few tens of thousands of years.

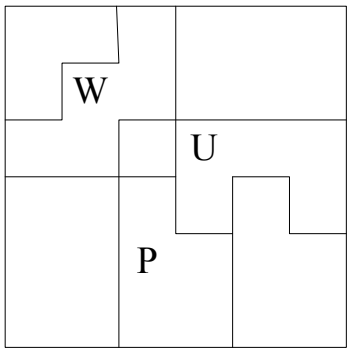
Whether or not calendars currently in use (G, M, H, and even J in many Eastern Orthodox churches) are still used in the distant future, the mathematical descriptions stated above remain valid for those calendars.

GOLOMB'S PUZZLE COLUMN™

More Pentomino Exclusion Solutions

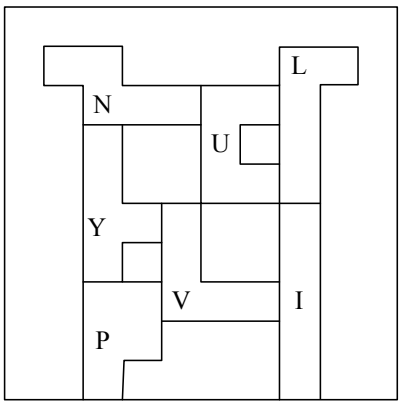
Solomon W. Golomb

1)



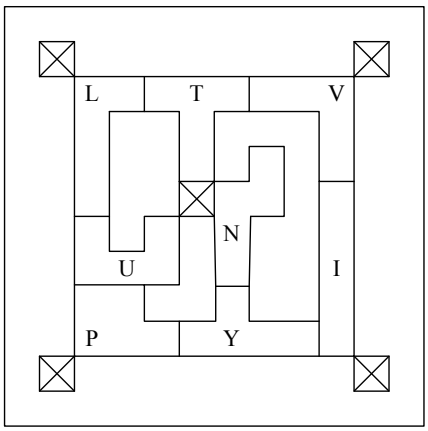
Here, the P, U, and W prevent any of the other 9 pentominoes from fitting on the 6 × 6 board. (The challenge was to avoid using any of the I, L, or V.)

2)



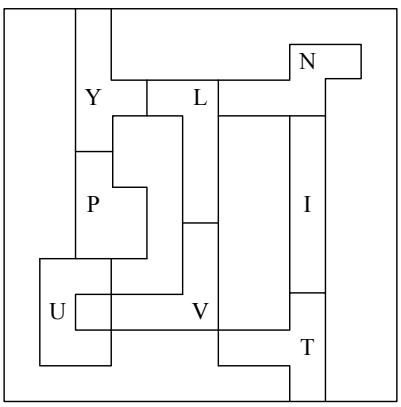
7 PENTOMINOES KEEP THE OTHERS (F, T, W, X, Z) OFF THE 10 × 10 BOARD.

4)



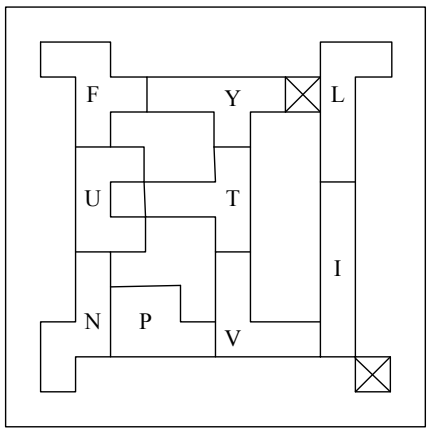
ONLY 8 PENTOMINOES, PLUS 5 MONOMINOES, EXCLUDE F, W, X, Z on the 12 × 12 BOARD.

3)



8 PENTOMINOES KEEP THE OTHER 4 (F, W, X, Z) OFF THE 11 × 11 BOARD.

5)



9 PENTOMINOES + 2 MONOMINOES EXCLUDE W, X, and Z, on the 12 × 12 BOARD.

Best Editorial Practices

Ezio Biglieri

Introduction

In the following, I have collected a set of recommendations for Associate Editors as for the best practices that they should follow in their editorial activity for the IEEE Transactions on Information Theory. These are mainly aimed at improving the average quality of the papers published, and at reducing the time elapsed from manuscript submission to journal publication. All in all, the aim of the volunteer staff of this journal can be summarized by saying that we want to publish good papers quickly. Some comments are appropriate here.

The general philosophy of scholarly publishing is that papers should be published mainly for the benefit of their readers, who are entitled to access to well-written manuscripts at the forefront of their discipline. This does not mean that the benefit of the author (often an academic person whose career depends on the quality and the amount of papers published) should be forgotten, but it should be stressed that a scientific journal is published for the advancement of science, not of authors. To benefit its readers, a paper should be *good*. This means that it should be esthetically satisfactory, and scientifically sound. The esthetics of scientific writing requires that a manuscript satisfy the criteria of being *complete, balanced, and clear* (these are just the three criteria for beauty set forth by Thomas Aquinas in his Summa Theologiæ: *integritas, proportio, claritas*). "Balance" also means conciseness: the paper should be long enough to convey the most important ideas, but no longer. Background material, as well as variations on the main theme, should be reduced to the minimum necessary. Scientific soundness essentially means that publication of the manuscript can advance the discipline. In a discipline in constant motion, it is important that results be delivered in an efficient and quick way. In these days, most papers are circulated through the Internet and made available to the scientific community very quickly after their redaction. In this environment, the role of a scientific journal is to guarantee, thanks to the peer reviewing process, the correctness of the information conveyed. ("One of the strictures of the scientific ethos is that a discovery does not exist until it is safely reviewed and in print." E. O. Wilson, *Consilience*). I could add that the features of a good paper bear a close resemblance to those listed by David Hilbert to characterize a good mathematical problem:

- Clear and easy to comprehend ("for what is clear and easily comprehended attracts, the complicated repels")
- Difficult ("in order to entice us"), yet not completely inaccessible ("lest it mock our efforts")
- Significant ("a guidepost on the tortuous paths to hidden truths")

A Disclaimer

It is a tradition of the T-ITs that its Associate Editors are given considerable leeway in their editorial practice. Thus, the guidelines that follow should not be taken as mandatory, but rather indications that could be overcome whenever the AE is convinced that a different procedure should be preferred for better results. The only strict rule is that no rule should be followed too strictly. For example, standard templates should be used only as rough guidelines; the AEs are encouraged to send personal e-mails to authors and reviewers, phrased in their own words.

On Grammar

To preserve precious political correctness while reducing awkwardness to a minimum, every "he" in this manuscript should be read as "he/she," and every "his" as "his/her."

Step 1: Manuscript Is Submitted To The EiC

As soon as a manuscript is submitted for possible publication, the EiC:

1) Verifies that none of its authors are in the list of IEEE prohibited authors. This is a collection of names of authors who have been banned from submitting manuscripts to some or all IEEE publications due to a finding of publishing misconduct.

2) Skims the paper to verify that it is complete and legible, and that its nature and scope match those of the T-ITs (otherwise the manuscript is rejected out of hand, with a detailed explanation to the authors).

3) Assigns the paper to an Associate Editor (AE), basing this choice on the AE's competence, workload, preferences, and the absence of a manifest conflict of interest. **Assignment should be made typically within 1–2 days from submission.**

Immediately upon assignment, the EiC sends *to all authors* an acknowledgment of receipt.

Step 2: AE Accepts Assignment

Immediately upon assignment, the AE examines the manuscript and decides if he can process it or send it back to the EiC for reassignment to another AE. The reason for the latter choice may be:

1) The AE feels that the manuscript is out of his competence. In this case, the EiC should be provided with specific details, so that further assignments will be more on the mark (for example, an AE in Source Coding may be uncomfortable with papers on lossy compression).

2) The AE has a conflict of interest, undetected by the EiC. This occurs when the AE has a specific personal interest in having the manuscript accepted or rejected, so that his judgment is likely (or can be suspected) to be biased. Precise rules are hard to formulate, but in general the AE should return the submission whenever he feels uncomfortable with handling it. Coauthorship with a submitter is in itself no compelling reason for not accepting an assignment.

3) The AE is overwhelmed by previous assignments, or he has duties preventing him from attending his editorial job with due diligence. In this case, the EiC should be promptly informed about the time interval in which assignments to that AE should be slowed down or suspended.

The request of a reassignment should be made within no more than 2–3 days after submission.

Step 3: AE Decides on the Suitability of the Manuscript

Before looking for potential reviewers, the AE reads the paper and returns it to its authors without reviews if one or more of the following situations occur:

1) The manuscript is badly written. Although the review process can assist with fine tuning of the presentation of an acceptable article (especially when the authors' mother tongue is not English), neither the AE nor the reviewers are expected to convert the paper into an appropriate style. The *Information for Authors* clearly states that "the body of the paper should be understandable without undue effort by its intended audience."

2) The paper is out of scope, as it has no information- or communication-theoretic relevance. In this case, rejection should be carefully motivated, and whenever possible the authors should be referred to other journals where the manuscript could be submitted.

3) The manuscript is unsuitable for technical reasons (for example, it contains a weak idea supported only by simulation results with no mathematical analysis, or its technical or theoretical contents are too shallow).

If the AE decides that the manuscript will be sent out for review, it might be appropriate to inform its authors. *This decision should be made within one week after assignment.*

Step 4: AE Sends Manuscript out for Review

This, along with making the editorial decision, is the hardest part of the process. Here, the substeps are (i) Identifying good potential reviewers, (ii) Soliciting the reviews, (iii) Getting reviewer agreement, and (iv) Getting the reviews back. The typical number of reviews which the AE should obtain to make an informed editorial decision is 3 (less than three is generally not a good option), with reviewers chosen among knowledgeable colleagues, authors of referenced papers, and authors on related topics (to be searched in IEEE Xplore and possibly Google). More than three might be identified initially in case one or more declines. When contacting reviewers, the AE should include a deadline for reviewers to accept the review, with reminders if they do not respond one way or another within a few days. It is recommended that the AE negotiate the review deadline with reviewers (this could range from 5–6 weeks for an average paper to maybe 8 weeks for longer or denser papers), but once a deadline has been agreed upon the AE should keep on soliciting – politely but firmly – the reviewer, with wording getting more and more urgent, and even making a phone call when email reminders do not suffice**.** I strongly recommend avoiding automated reminders, as in many cases they tend to be disregarded, or worse cause a good deal of irritation. Review reminders should be sent immediately after a deadline has passed, to make it clear that the deadline was a firm one. In some cases the AE may want to submit his own review, which can be done either anonymously or (better) openly.

A typical time for all four substeps involving a standard submission should not exceed three months.

Step 5: AE Makes The First Editorial Decision

This is a most critical step. Once all reviews requested are in (or there is no hope of receiving more), the first editorial decision should be made. It will be based on the reviews obtained, but most of all on the AE's judgment (remember that *the reviewers are expert witnesses, not the judges, and hence publication decisions need not be made by majority vote*). There are at least six types of editorial decisions:

1) Accept as is. This occurs very seldom, and requires no further comment.

2) Accept with recommended changes. This occurs when only cosmetic changes are needed. The AE will list them, and ask the authors to upload the final version of their revised manuscript. No further round of review will be necessary, only AE reading.

3) Accept with mandatory changes. If the manuscript is very likely to be accepted, but major changes are needed, the AE will list these carefully, and ask the authors to upload their revised copy for additional review, along with their rebuttal and a list of the changes made. *It is important that the AE make it clear that a necessary condition for final acceptance is that the authors comply with his requests. Other optional, recommended changes should be clearly categorized as such.* The AE should examine the revised manuscript and, whenever possible, exercise his own judgment to decide if his original requests were complied with. If not possible, he will send the manuscript out for rereview to all or a subset of the original reviewers, with very specific requests for comments. The AE should avoid the practice of forwarding the revised manuscript to all reviewers and asking them to assess if it is now ready for publication, as in this case the reviewers feel obligated to read the entire paper rather than a specific part, which typically causes long review delays.

4) Conditionally accept/reject. This kind of decision should occur seldom, and be made only when the original manuscript contains technical flaws. If the paper is a nice contribution, the paper should be conditionally accepted, if not then the paper should be rejected. The action required from the authors may need some discussion (via the AE) between the authors and the reviewer identifying the flaw. In any case, the action required from the authors for possible acceptance must be made explicit and clear. The observations under point 3 *supra* are also valid in this case.

5) Reject, and recommend resubmission. If the amount of mandatory changes needed is very large, and probably requires a revised manuscript that differs widely from the original submission, the decision should be a "reject," accompanied by the recommendation that the paper be overhauled and resubmitted afresh.

6) **Reject without recommending resubmission**. If the paper cannot be fixed up because of fatal flaws or other imperfections, it should be rejected without any hint to a possible resubmission.

a) The most relevant features of a manuscript that should be considered for an editorial decision are:

   – The weight of its technical contribution, compared with its length (should the manuscript be shortened without impairing legibility, or lengthened?).

   – The quality of the technical writing.

   – The organization of the material.

   – Sufficiency of abstract and bibliography.

b) Note that simply relaying the reviews to the authors, without describing explicitly what changes should be made to the manuscript and categorizing each of them as either mandatory or recommended, is *unacceptable practice*.

c) The authors should be given a *deadline for returning their revised manuscript*. The time allowed for revision depends on the amount of changes needed and is negotiable, but in any case should be enforced strictly. Two-three months is a reasonable time.

d) Paraphrasing a famous quote from Tolstoj's Anna Karenina, *"All accepted papers resemble one another, but every rejected paper is flawed in its own way."* This means that the reasons for rejection should be carefully summarized by the AE, rather than simply left to a reading of the reviews.

e) Overaggressive reviews *("this paper should be thrown in the garbage, its authors beaten up, and their laboratory vandalized")* should be rejected outright, bowdlerized, or summarized by the AE to prevent unnecessary contention.

f) If a reviewer feels that a manuscript is plagiarized (or *self-plagiarized*, which means that it is published or submitted elsewhere *in toto* or in part), the EiC should be immediately informed.

g) Please respond quickly to authors' inquiries. A lot of the grief the EiCs deal with comes from the fact that some AEs had terrible email etiquette, and simply do not respond to authors' inquiries. Not only is this behavior unacceptable in today's world of electronic communications, but it tends to exacerbate situations that are already difficult. More generally, AEs should give regular status updates to authors when papers are delayed. This is likely to defuse many problems.

Step 6: AE Makes Final Decision On Revised Manuscript

Once the revised manuscript is submitted, the AE should verify that his requests are satisfied by reading the manuscript and the rebuttal. Some light editing may be necessary, for example to repair a problem with a technical overtone that IEEE will not spot.

A very frustrating situation for authors, and one that should be avoided, is when an AE does not take a stand on a point of contention between authors and reviewers. There is no reason why the author should necessarily be considered wrong, and the reviewer right, in such a situation. Lack of AE decisiveness is a major source of delay, and also a major source of annoyance to the EIC.

It is appropriate, albeit not mandatory, to copy the EiC on final decision letters.

In the case of a strong disagreement between AE and author(s), the EiC should immediately intervene to prevent them from engaging in a quarrel.

Acknowledgments

I wish to thank my colleagues Helmut Bölcskei, Giuseppe Caire, Dave Forney, Larry Greenstein, Vince Poor, Paul Siegel, Alex Vardy, several Associate Editors, and especially Andrea Goldsmith, for their generosity in providing me with comments and suggestions for improvement.

Workshop Report: ITW'09 in Taormina, Sicily, Italy

Yi Hong, Ezio Biglieri, and Emanuele Viterbo

The Workshop, held at the Hotel Villa Diodoro, kicked off with a welcome cocktail reception on the evening of Sunday, Oct. 11. About 175 participants came from 20 countries all over the world, distributed as shown in the table below:

Country	Participants
USA	51
Israel	14
Switzerland	14
Germany	13
France	12
Italy	11
Japan	9
United Kingdom	8
Australia	6
Sweden	6
Spain	5
Canada	4
Iran	3
Norway	3
Finland	2
Singapore	2
South Africa	2
South Korea	2
Belgium	1
Brazil	1
China	1
India	1
Ireland	1
Netherlands	1
Qatar	1
Taiwan	1
Total	**175**

The technical program featured five plenary talks, mainly focused on coding with applications to information-theoretic security, iterative schemes, compressed sensing, wireless networking, and bioinformatics. On Monday, Steve McLaughlin presented a talk entitled "Coding for reliability and security on the wiretap channel." On Tuesday, Pascal Vontobel gave his talk on "Graph-Based Codes and Iterative Decoding." The Wednesday talk featured Helmut Bölcskei on "Mathematical Roots of Compressed Sensing." On Thursday, Muriel Médard presented the talk "Network Coding as Cooperation in Wireless Networks." On Friday, Joachim Hagenauer talked about "An Information Theorist's Contribution to Genetics". The program also included five invited sessions, each including three presentations of topics connected to those illustrated in plenary talks. There were thirteen sessions of contributed papers, and three poster sessions on various topics of information theory and coding. On Monday afternoon, Andrea Goldsmith chaired an interesting panel session on "The Impact of Information Theory on Technology Development." Its participants included Meir Feder (Tel Aviv/Amimon), Ari Hottinen (Nokia), Helmut Bölcskei (ETH Zurich), Gottfried Ungerboeck (Broadcom) and Andrew Viterbi (Viterbi Group). The panelists shared their point of views and personal experiences on the relevance of information theory on practical implementation of today technology. A total of 125 papers were selected for presentation at the Workshop, out of 181 submitted. We sincerely thank the technical program

Gala Dinner (from left to right: Joachim and Johanna Hagenauer, Ezio Biglieri, and H. Vincent Poor)

Panel Session (from left to right: Helmut Bölcskei, Gottfried Ungerboeck, Ari Hottinen, Meir Feder, Andrew Viterbi, and Andrea Goldsmith)

Friday Award Buffet (from left to right: Emanuele Viterbo and Ezio Biglieri)

Poster Award (from left to right: Dan Costello, Daniela Tuninetti, and Frédérique Oggier)

committee, the invited session organizers, and the poster session organizer, for their painstaking work.

On Wednesday afternoon, social events include tours to the Etna mountain (the highest active volcano in Europe) and Taormina city (including the Greek-Roman theatre, the Roman Odeon, Palazzo Corvaja dated 1300, and corners of the medieval centre) tours. On Thursday evening, a gala dinner was held in San Domenico Palace Hotel, built on the site of a 15th century monastery. During the dinner, the IEEE Donald G. Fink Prize Paper Award, sponsored by IEEE Life Members Committee, was presented by the Society President Andrea J. Goldsmith to Daniel J. Costello, Jr. and G. David Forney, Jr., for their paper entitled "Channel coding: the road to channel capacity".

On Friday afternoon, a poster-award buffet was organized. Best-poster awards were given to the following two papers: "Higher Dimensional Perfect Space-Time Coded Modulation," by Frédérique Oggier and Patrick Solé, and "On optimal constellations for BICM at low SNR," by Erik Agrell and Alex Alvarado.

All volunteers involved in ITW'09 Taormina should be thanked for their work, which resulted in a smoothly run and technically rewarding workshop.

Meeting Report: Paths Ahead in the Science of Information and Decision Systems

Laboratory for Information and Decision Systems (LIDS), Massachusetts Institute of Technology

November 12–14, 2009

Alan S. Willsky

A significant meeting, the symposium on "Paths Ahead in the Science of Information and Decision Systems" was held November 12–14, 2009 at MIT. This meeting was organized and run by MIT's Laboratory for Information and Decision Systems (LIDS), the oldest continuing laboratory at MIT. LIDS has played and continues to play a major role in the development of our field, responding to critical national and societal needs; developing fundamental and path-breaking advances in theory, methodology, and practice; and serving as a focal point for activities involving the best across MIT, the nation, and the world.

The science of information and decision systems encompasses a substantial and exceptionally pervasive set of interrelated disciplines, ranging from signal and image processing; to embedded control systems; to the analysis, design, and optimization of complex distributed systems and networks. Thanks both to the richness of the challenges throughout engineering and the physical, biological and social sciences, and the continuing developments of the foundations of our disciplines, the information and decision sciences stand today as an exciting, continually evolving, and critical domain of intellectual inquiry.

Consistent with that history and mission, LIDS organized the Paths Ahead Symposium, bringing together leading researchers from all around the world who have been influential in shaping the vision of and leading this broad field. The meeting, which was sponsored by MIT's School of Engineering, by a number of private companies and laboratories, and by NSF, AFOSR, and ARO, consisted of several panel-oriented sessions, providing both context and history as well views toward the challenges of the future. While each of these sessions had a specific theme, an overall objective of each session was to look across disciplines for challenges and opportunities across disciplines.

The meeting, which attracted 340 registrants, began with a reception on Nov. 12 at the MIT Museum, and the technical sessions began on Friday, Nov. 13 with welcoming remarks by Symposium General Chair and LIDS Director, **Alan Willsky**.

The morning session on Friday was organized in honor of **Sanjoy Mitter**, a major leader in the field and former Director of LIDS, who recently retired from MIT (although one would not know that from his continuing presence). This session was chaired by **Thomas Magnanti** (MIT), former Dean of Engineering at MIT and long-time collaborator with Sanjoy, and the panelists were **Karl Johan Åström** (Lund Inst.), **Dimitri Bertsekas** (MIT), **Roger Brockett** (Harvard), **Y.C. (Larry) Ho** (Harvard), **Thomas Kailath** (Stanford), **Petar Kokotovic** (UC Santa Barbara), **Pravin Varaiya** (UC Berkeley), and **Jan Willems** (Cath. U. of Leuven). The presentations and discussion in this section ranged from personal perspectives on the past history of research in this broad field, on some of the challenges and exciting opportunities that are

before us, and on the challenge of educating our students in a field with the breadth that the information and decision sciences possess. Among the challenges for the future brought up by the panel were those central to the social agenda and the exciting areas of research of today, including energy, transportation, biology, and health care. Intellectual challenges including developing new methods to deal with compositional descriptions of complex systems and the broad area of networks, information, and control were also discussed, as were continuing areas such as robotics, embedded systems, and autonomy. The intellectual vibrancy of our field and its ability to move with agility into new domains, were evident throughout.

The Friday afternoon session had as its "center of gravity" systems, control, and optimization. The session was chaired by LIDS Co-Associate Director, **Munther Dahleh** (MIT), with a panel consisting of principal speaker **Keith Glover** (Cambridge) and panelists **Albert Benveniste** (INRIA), **Vincent Blondel** (Cath. U. of Louvain), **Stephen Boyd** (Stanford), **Jonathan How** (MIT), **Richard Murray** (Cal. Tech.), and **Pablo Parrilo** (MIT). Keith Glover gave an overview of the field and its central elements, including feedback, dealing with uncertainty, approximation, and verification and certification of performance, as well as a discussion of areas appropriate for academic research, ranging from design methodologies for particular applications to development of verification tools. The other presentations in the session spanned topics including a discussion of the central role that computational methods play in our field (and in particular in redefining what we mean by a "solution"); a presentation of grand challenges (including robust and certifiably correct control of networked systems such as smart grids, the need for learning algorithms that lead to safe performance in a nonstationary world, and NASA's Green Flight Challenge; a discussion of the challenges in controlling complex systems, with examples including the DARPA Urban Challenge and the stunningly robust, computationally limited, and slow control system that allows a fly to maintain stable flight in the presence of sudden changes such as wind gusts; and a presentation on the challenges of "componentizing" control systems as is generally specified in the system engineering of complex and often safety-critical man-made systems and the clear need for researchers in systems and control to contribute to the overall system-wide issues as well as to the components.

The Symposium banquet was held Friday evening and included a banquet talk by **Alan Willsky** on the long and celebrated history of LIDS, beginning with its days as the Servomechanism Laboratory extending back to the period prior to the Second World War up through the present. The talk presented a picture of the major figures whose contributions fueled the Laboratory's major role in academia and society, as well as highlighting many of the contributions over the years including the development of high-performance fire control systems, the invention of magnetic core memory, major advances in numerically controlled machines, some of the earliest efforts in CAD and database systems, a leadership role in the development of modern control and the development of robust control methods, the broadening of its agenda to include networked systems ranging from communication and transportation networks to power grids as well as the expansion of efforts in statistical signal processing and learning, continuing advances in optimization algorithms, and through this entire history, a strong record of theoretical advances, influential texts, and an impressive array of former students, colleagues, and visitors.

This photo shows Willsky, the current Director of LIDS, with a pair of photos in the background of Sanjoy Mitter (MIT).

Saturday morning, Nov. 14, began with a plenary talk by **Sanjoy Mitter**, entitled "System Theory: A Retrospective and Prospective Look." This far-reaching lecture provided both concrete and philosophical remarks about revolutionary science and argued that such a revolution took place in system theory in the 1960's, with its key elements being the emerging central role of computation, a new language leading to state space models, and the exploitation of this language to gain a far deeper understanding of systems as well as powerful new methods. Mitter argued that the challenges of today, in particular networked systems, might require some new elements and lead to new structural insights and methods. The talk also touched on pattern recognition and artificial intelligence and their close intellectual ties to information and decision systems as well as ties of Bayesian inference to statistical mechanics, a topic that resonates with the role of physics in understanding some of the core models and methods in machine learning. Mitter also discussed the challenges and opportunities that arise when one brings the constraints of communication systems into the design of control systems and closed with a list of challenges that could, by itself, fuel the field for a very long time.

The Saturday morning panel discussion had networks and information, broadly defined, as its center of gravity. This session was chaired by LIDS Co-Associate Director, **John Tsitsiklis**

This is the panel for the session focused on networks and information. From left to right: Asuman Ozdaglar (MIT), P.R. Kumar (Illinois), H. Vincent Poor (Princeton), John Doyle (Cal Tech), Balaji Prabhakar (Stanford), David Tse (UC Berkeley), and Jeff Shamma (Georgia Tech).

(MIT). **John Doyle** (Cal. Tech.) was the lead speaker in the session, together with a panel consisting of **P.R. Kumar** (Illinois), **Asuman Ozdaglar** (MIT), **H. Vincent Poor** (Princeton), **Balaji Prabhakar** (Stanford), **Jeff Shamma** (Georgia Tech.), and **David Tse** (UC Berkeley). In his presentation John Doyle gave a far-reaching discourse on networks, layered systems, their fragility and challenges in their design, as well as a contrasting view of some man-made networks (the Internet, power grids, etc.) and biological systems (e.g., bacteria), pointing out similarities, differences, and challenges for those of us in the information and decision sciences. The presentations of other panelists included: an examination of application and domain challenges (including wireless security and multimedia communications) to "pull" the development of methodology and the "push" of specific technical challenges (e.g., in information theory and finite-block-length capacity); an examination, through example, of why it is worthwhile to continue examining very hard problems and looking for ways in which to reformulate them creatively in ways that overcome technical difficulties and lead to new results and insights; an examination of the serious challenges in the interplay of networks and information (including control of distributed systems over unreliable networks, methods for verifying performance, and distributing information processing as a problem blending computation, communication, and inference); the design of incentive systems for complex transportation networks in order to influence behavior and reduce congestion; challenges and opportunities in network games and in understanding dynamics, learning, and decision-making in social and economic networks.

Photo of Sanjoy Mitter, who was honored at the meeting on the occasion of his retirement and also served as Plenary Speaker on November 14, 2009.

The Saturday afternoon panel discussion, focusing on signal processing, inference, and learning, was chaired by **Alan Willsky.** The lead speaker in this session was **Michael Jordan** (UC Berkeley), who was joined on the panel by **Alfred Hero** (Michigan), **Sanjeev Kulkarni** (Princeton), **Robert Nowak** (Wisconsin), **Pietro Perona** (Cal. Tech.), **Devavrat Shah** (MIT), and **Martin Wainwright** (UC Berkeley). Mike Jordan's presentation provided an overview of the broad area of machine learning and its ties to problems in a vast array of fields. In this presentation he provided a view of current trends in machine learning including: Nonparametric Bayesian methods (with applications in signal and image processing highlighted), the challenges that the availability of massive data sets presents to those in learning and modeling; the investigation of "Objective Bayes" methods which provide a unifying blend between Bayesian and frequentist views of statistics, with many ties to information theory; the great interest in methods that capture or recover "sparsity" in one form or another; and the challenge of bringing control and statistics together in the same synergistic way as optimization and statistics. Other presentations provided discussions of machine learning challenges in computer vision (e.g., so that one can search on parts of images or so that we can capture a human's ability to recognize new objects quickly); the challenging dynamic learning problems embedded in the operation of engineered networks (e.g., medium access control) and the role of so-called message passing algorithms; the challenges and opportunities in confronting increasingly high-dimensional data sets (with applications in learning graphical models) and the "blessings" as well as the well-known curses of dimensionality (with applications in sparse reconstruction and the uncovering of scaling laws) as well as the posing of a question seen in other sessions as well, namely the tradeoff between computational effort and performance; the challenges in distributed or networked learning, and the fusion or aggregation of heterogeneous and nontraditional signal and data sources (ranging from sensor outputs to written text to forecasts of multiple agents); integrative modeling, prediction, and uncertainty assessment with predictive health and disease detection as a motivating application and challenge, characterized by heterogeneous data and diverse outputs (ranging from individual predictions to drug effectiveness assessment); and the use of feedback in sensing systems, i.e., the control or selection of measurements to be taken driven by the information state resulting from data already collected.

As indicated, the meeting attracted a substantial number of researchers from around the world, leading to lively discussions

This is the panel for the session focused on inference, signal processing, and learning. From left to right: Alan Willsky (MIT), Mike Jordan (UC Berkeley), Sanjeev Kulkarni (Princeton), Devavrat Shah (MIT), Martin Wainwright (UC Berkeley), Pietro Perona (Cal Tech), and Al Hero (Michigan). (One of the panelists, Rob Nowak (Wisconsin) was unable to attend)

that prompted our inviting participants to continue this conversation and to provide short perspective and position papers through the end of 2009. The website for this meeting http://paths.lids.mit.edu includes not only a statement of purpose, agenda, list of sponsors, etc., but also a complete collection of files generated by this meeting. This includes (a) video of the entire meeting; (b) all panelist slides; (c) short perspectives and position papers submitted by attendees; and (d) a summary document produced by Munther Dahleh, John Tsitsiklis, and Alan Willsky.

Minutes of BoG Meeting, Taormina 2009

October 13, 2009, Taormina, Italy

Muriel Medard and Aria Nosratinia

Attendees: Andrea Goldsmith, Dave Forney, Muriel Médard, Dan Costello, Gerhard Kramer, Vince Poor, Hans-Andrea Loeliger, Nihar Jindal, Giuseppe Caire, Helmut Bölcskei, Nick Laneman, Ezio Biglieri. The following attended by phone: Michelle Effros, Ken Zeger, Frank Kschischang, Prakash Narayan, Tracey Ho, Aylin Yener.

The meeting was called to order at 19:00 hours by the Society President Andrea Goldsmith, who greeted the members of the board.

1. By consent, the board approved the minutes of the previous meeting with the following changes: Emina Soljanin and Dave Forney were not present at the last BoG meeting.

2. The agenda was approved by consent.

3. The president presented her report. The society is in good shape, with a great number of activities. The finances are in good shape. The looming issues include new changes to the IEEE Explore revenue due to new rules, which could put the society in the red. The end of the term of the Editor in Chief of the Transactions is on the horizon. Other issues include changes in paper handling system (Manuscript Central) for our Transactions. The new distinguished lecture program will start next year.

   Our Transactions continues to be highly prestigious and highly cited, although the "sub to pub" time (publication delay) has remained essentially unchanged so far despite our efforts. The committees are very active, society members get many awards per capita, new chapters have been instituted, and the society's new website is very successful.

   We still have a large budget surplus. It is unlikely there will be a large proposal to spend the surplus this year, which otherwise goes to our reserves, whence spending is heavily limited by the IEEE rules. Reserves are down by $1.2M and now stand at $1.8M, taking us to 2006 levels. Market recovery is likely to be reflected later in our reserves. Reduced IEEE Explore fees may reduce our income by about $120K, which is a substantial hit. Library subscriptions are also generally trending downwards. Among the possibilities to be considered for increasing the surplus: new publications, tutorials or magazines, increase print charges, as well as sponsorship for IT School and Distinguished Lecturer program.

   On the subject of governance: we need to push BoG members to become more involved in committees. Most BoG members have expressed their interests and preferences in service in committees to the president, who will make use of this information

and forward it to the Nominations and Appointments Committee. The Publications Committee by rule consists of associate editors, publication editors, and newsletter editor. Should we change the by-laws and include (some) BoG members in the Publications Committee? There is little flexibility from bylaws in assigning members to some of these committees (e.g. Shannon Award Committee).

A subcommittee is being considered to help with sub-to-pub time. Ezio Biglieri has put considerable effort in the sub-to-pub effort, and the President has made this a central issue of her tenure. Our current sub-to-pub is the highest in the IEEE. The reduction of publication delay involves both cultural and administrative challenges in our society.

There have been initiatives to address this problem: The number of associate editors has been increased. Moving our web-based manuscript handling from Pareja to Manuscript Central should allow better tracking of papers. A new "best practices" document is being developed. Budget has been assigned for a half-time person as managing editor, who helps track papers and sends reminders to associate editors about the status of papers. A task force is being contemplated to monitor and improve sub-to-pub, which might become a standing Steering Committee. The president indicated that we must become more businesslike in our paper processing; develop an editorial policy for authors and reviewers; create and impose firm deadlines, while leaving leeway for editor judgment; track the statistics on associate editors, reviewers, and authors. There have been suggestions to publish the statistics and highlight the issue to the community at large. The task force for sub-to-pub is generally well received by the BoG.

There have been changes to IT paper awards process (bylaw). Open call nominations go to the Awards Committee chair. The Publications Committee generates a separate list of nominations. The Awards Committee recommends up to 3 papers (3 weeks before ISIT). In the annual BoG meeting, the BoG votes to accept Awards Committee report or asks for revision; if accepted a vote is taken.

The Baker prize was endorsed by the IEEE TAB and Awards Board. It will be submitted to IEEE Board of Directors at their November meeting. The Baker prize will recognize, in the 3-5 year window prior to nomination, contributions to the fundamentals of electrical engineering, computing and related arts and sciences within the IEEE. This prize went from a near-dead proposal to one co-sponsored technically by 19 societies, with great help from Jose Moura (SP).

The new officers for 2010 are as follows. President Frank Kschischang, 1st VP Giuseppe Caire, 2nd VP Muriel Médard, Junior Past President Andrea Goldsmith, Senior Past President G. David Forney, Secretary Aria Nosratinia, Treasurer Nihar Jindal. The service of the outgoing treasurer Anant Sahai was recognized. In addition, Bixio Rimoldi was recognized for his exceptional service over his five year officer term, which ends this year. Election for 6 new BoG members closed the day before the current BoG meeting. Results will be known by Oct 12. For the first time web-based voting was used for this election. The BoG meetings for the next year have been announced by Frank Kschischang. The BoG meetings take place at noon Sunday January 31 just before the ITA workshop, at noon Sunday June 13 at ISIT in Austin, TX, and 6:30pm on Tuesday Sept. 28 at Allerton in Monticello, IL.

The President thanked the BoG and fellow officers, and commended the new initiatives. The BoG warmly recognized the service of the current president.

4. The treasurer's report was presented by Nihar Jindal, the incoming treasurer, for current treasurer Anant Sahai. The society has approximately $100K surplus, so that shifting expenses to this year would be beneficial. Otherwise the surplus will go into reserves controlled by IEEE which does not allow ready access for projects. ISIT and ITW did well financially and the current ITW will be close to breaking even.

   There is long term uncertainty about our finances. About $200,000 in print subscriptions, mostly by university libraries at approximately $1,000 per institution, is in doubt (example: MIT and UC Berkeley). We expect that IEEE Explore revenue sharing may be decreased by $120K starting next year.

   We effectively subsidize member print transactions, costing us $70K. Reduction in this subsidy some years ago was intended to phase out subsidies eventually. For long term stability we need to increase transactions revenue (reducing sub-to-pub should help), maybe also increase surplus in conference fees, membership dues, sponsorship for IT schools and the distinguished lecturer program.

5. The Constitution and Bylaws Committee report was presented by the Junior Past President Dave Forney. The amendments will be published on the society website. The changes in the bylaws are modest except in prize paper category, as discussed in the President's report. Nominations and Appointments Committee will not appoint any of its members to any committee. For the Awards Committee language, listing of the specific awards was removed and replaced with category of awards. Ezio Biglieri has suggested changes in the Publications Committee. Frank Kschischang and Andrea Goldsmith have revised the prize paper awards to reflect the discussion at the ISIT BoG meeting. All proposed changes were approved by the BoG.

6. The Publications Committee report was presented by the IT Transactions Editor in Chief, Ezio Biglieri. At this time we have 46 associate editors, up from 26 in June 2007. The Editor-in-Chief highlighted the dichotomy of senior vs junior associate editors. Junior editors are more eager and motivated, while senior people often do not even accept the appointment.

   The following appointments to associate editor were proposed and approved: Gerard Cohen, Navin Kashyap, Jean-Pierre Tillich, Pascal Vontobel.

   Several questions were raised by the editor in chief. Should only tenured individuals be appointed to associate editor? (Noting that several of the recent appointments are not from academia.) The question of loading untenured junior faculty was raised, as well as the potential for unwanted influence, for example getting recommendation letters for tenure from people whose papers they may have handled. There is no hard and fast rule, but it is preferable that editors be tenured, although there may be extenuating circumstances (for instance previous career in industry). The question was raised whether a BoG vote is necessary for appointment of editors, which was answered in the affirmative. The question was raised whether appointments can be done by e-mail or only in BoG meetings. Some preference was expressed for BoG meetings, with the possibility of appointing acting associate editors.

   A Best Editorial Practices document is being prepared with instructions for new associate editors, with the goal of the reduction of sub-to-pub time. A training session may be organized for associate editors at the ISIT.

   A new special issue is being considered on IT and Interference Networks. Among guest editors are Syed Jafar and Sennur Ulukus who are already associate editors. The special issue is scheduled for March 2011. Another special issue is scheduled for

Feb 2011, two years after passing of Ralf Koetter and also marking the tenth anniversary of codes on graphs special issue that Ralf co-edited. This can be linked with Fest for Ralf Koetter in Fall 2010. Authors will be invited to submit to both the fest and the special issue, but not necessarily with full overlap. The BoG expressed support of the two special issues and puts the details into the hands of the Editor-in-chief.

Regarding web-based manuscript management: migration of all data from Pareja to Manuscript Central (MC) is not automatically feasible, so both will co-exist until all Pareja papers arrive at the end of their editorial life. In the mean time associate editors will use two websites. Pareja will be progressively offloaded, and hence more stable (disk size a major problem currently). At some point in the future, all new papers will be submitted on MC; this will start by the end of the year or may be delayed until the term of the next Editor-in-Chief begins in June 2010.

Some recent statistics were presented by the EiC. Sub to pub time average was 97.2 weeks in July 2009 and 99 weeks in October 2009 (the latter average reduces to 85 weeks after removing 3 outliers).

IEEE is preparing a new author gateway in October, to help keep track of papers. Authors can pay a certain (yet unknown) sum of money to allow open access of their paper. IEEE wants to abandon paper-based issues (although they will still print them) in favor of single article publications.

7. The Conference Committee report was presented by Bruce Hajek. The final report for ISIT 2008 Toronto has been received. The report for ISIT 2009 Seoul is uploaded. Vince Poor presented a short report on ISIT 2009, indicating that 589 papers were accepted out of 955 submissions from 47 countries. (For comparison, at ISIT 2008 603 out of 993 were accepted.) Special sessions and tutorials were very successful. There were 375 registrations for the tutorial and 805 for the symposium, a total of 841 attendees. The banquet registration count was 700. $490 was provided for student support to each of 78 graduate students. The budget surplus is expected to be approximately $64K at the current exchange rate.

   Turning to the future ISITs: ISIT 2010 Austin is moving forward satisfactorily. For ISIT 2011 Saint Petersburg the dates are firmed up July 31–July 5. Muriel Médard reported on ISIT 2012, indicating that everything is moving forward well. ISIT 2013 Turkey has been able to reduce the costs by changing the dates from June to July. They are currently considering the Hilton where ICC 2006 was held. This group will either indicate firm intention or withdraw by January. The predicted registration rate is 700 Euros, which the BoG considers to be high, but encourages the committee to continue their efforts.

   Regarding ITW's: for ITW 2008 Porto the report is needed. ITW 2009 Volos anticipates a $2.5K surplus. Update received for ITW 2009 Taormina. ITW 2010 Dublin has changed venue to Radisson Hotel. ITW 2010 Cairo program is nearly complete and the BoG is asked for approval of its budget. There are 125 submissions to ITW Cairo. The plan is to accept 45 as regular papers and 25 in poster sessions. In addition there are 35 invited papers and 8 plenary talks.

   Sueli Costa has proposed a workshop October 16–20 2011 in Paraty Brazil, focusing on coding and cryptography (which is the strength of local organizing committee). Workshop co-chairs are Amin Shokrollahi and Valdemar Cardoso da Rocha. TPC co-chairs are Joao Barros, Max Costa, and Jaime Portugheis. Financial co-chairs are Marcelo Pinho and Charles Cavalcante.

The workshop was proposed to be located in Paraty, a small village and a historical heritage location. It is 4 hours from both main Brazilian Airports, Sao Paulo and Rio de Janeiro. Preliminary budget is on the order of $55K. It is proposed to use Stilema as conference agents. Projected surplus is on the order of $6.6K, with regular registration on the order of $600. The BoG expressed concern about the remoteness of the site and urged the organizers to consider an alternate venue.

For the longer term, there has been interest in ITW 2014 from Hawaii and in ISIT 2015 from China.

Four workshops have asked for technical co-sponsorship: CISS 2011, WiOpt 2010, NetCod 2010, and Turbocodes 2010. All have been technically co-sponsored before and all were approved

8. The Online Committee report was presented by Nick Laneman. The committee consists of several volunteers as well as some ex-officio members from BoG. Committee members Matthieu Bloch and Anand Sarwate have been very active in interacting with conferences and chapters to get the relevant information on the website. The website has over 250 visits per day, the school page is the #2 location (in terms of visits) on the website.

   The committee requested feedback about incorporating both the Newsletter editor and the society secretary into the committee (does not require a vote).

   Some policy issues were discussed, among them the question of whom we allow to register on the website to post profiles. The recommendation is that this privilege should be granted to all members of the IT Society, IT authors, and also graduate students whose advisors work in the area. The BoG indicated the preference that the contents be visible to all, but that only members be allowed to post. It was noted that the students at IT school submit their slides through the website, and a tight policy would require membership from them. It was decided that the officers will have further discussion about this issue and, after consultation with the online committee, make a proposal to the BoG about website registration.

   The question was raised whether to allow commercial announcements on the IT Society website, for instance Elsevier Special Issue, Cambridge Publishers, etc. This led to a question about charging for the ads. Response: this should be possible, for example this was done in ISIT 2007. Concern was raised whether this is an issue that needs IEEE approval.

   Several related issues were raised regarding tutorial/survey articles in the newsletter and overlap between the website and the newsletter. The BoG indicated its support of obtaining a more general type of content and of jointly publishing on the website and the newsletter. The BoG requests that the Online Committee and the newsletter editor put together a more concrete proposal for the BoG.

9. The Membership/Chapter Committee report was presented by Giuseppe Caire. The distinguished lecturer program is on track. The committee nominated Amin Shokrollahi, Alon Orlitsky, Michael Gastpar and Sergio Verdu for distinguished lecturers, and is looking for a fifth person. The lecturer information will be available on the web, and the committee will contact chapter chairs to encourage them make use of the distinguished lecturer program. There is a plan to have about 10 active distinguished lecturers, with a tenure of 2 years, with 5 distinguished lecturers stepping into the program every year. Given the success of posting the content of the schools on the web, we can consider placing the distinguished lecture materials on the web.

The Padovani lecture by Abbas El Gamal at the North American IT School was very successful. The 2010 Annual North American School of Information Theory will be held at USC. In 2011, it will be held in the Houston area.

Taipei won the Chapter of the year. The chapter lunch at ISIT was successful and the contact list from all the chapters has been updated.

This year a 1/2-year membership was included with registration at ISIT. It is recommended that a process will be put in place so that the ISIT organizers and Membership Committee will interact for a smooth implementation of the 1/2-year membership incentive.

10. The Fellows Committee Report was presented by Dan Costello. The size of the committee has been increased from 5 to 6. Two new members will be needed. The IEEE introduced an all-electronic nomination system this year. The system allows any Fellow in the Society to be an evaluator for a nominee. The evaluation was done internally, but there is the possibility to send out the reviews to a larger field of people. We have 5 more nominations this year compared with the past years.

11. The Student Committee report was presented by Gerhard Kramer. The second annual School of IT was held in August at Northwestern University with 140 students, a 40% increase in student attendance over the last year. Videos of the lectures are available on the IT Society website. Local organizers were Dongning Guo and Randall Berry, applications and program was handled by Daniela Tuninetti and Natasha Devroye, and the website by Matthieu Bloch. Many thanks to the local volunteers.

    Lectures by Dan Costello on Coding Theory, Bruce Hajek on Networks, Abbas El Gamal (Padovani lecture), and Bob Gallager (keynote lecture).

    Financial support was provided by the IT society, DARPA, NSF, Northwestern University, USC, Notre Dame and Padovani Lecture.

    Students had poster sessions in the afternoons. The school provided breakfast, coffee breaks, snacks, lunch, wireless LAN, and dorm rooms fully paid for all students. (students initially paid $100 that was later reimbursed thanks to the generosity of the sponsors). The dorm rooms comprised approximately $29K of a total budget of $58K. Modest travel supplements was provided to 31 students, totaling $3K. A survey of the attendees showed overwhelmingly positive results.

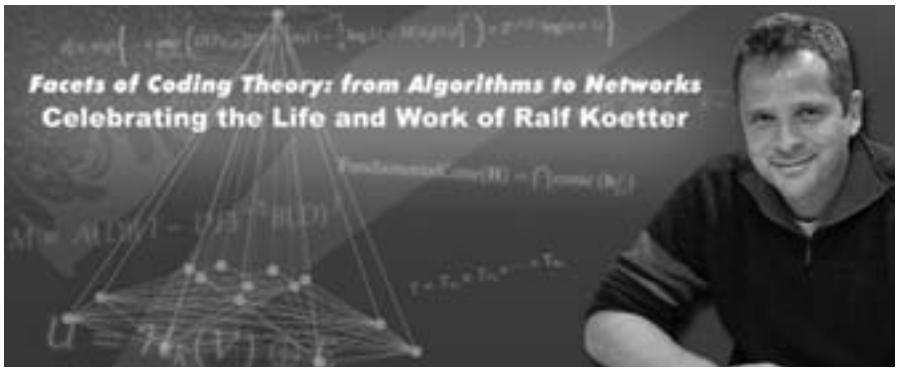
    For 2010, the school switched to USC from Caltech, since there are more resources and space in the dorms at USC. The IT school requests funds in order to sign the contract for USC dorms, which require a deposit. The BoG approved $10K for deposits, subject to approval of the North American IT School by the Membership/Chapters Committee.

12. The Outreach Committee report was presented by Muriel Médard. There was a panel at ISIT 2009 with the purpose of highlighting the issues in the industry. It was noted that it was difficult to find IT Society women in industry. There was local participation from Samsung employees.

    A successful mentor/mentee breakfast was held, and it is recommended to make this a regular event at ISIT, with a suggestion to hold the event early at the Symposium to help encourage interaction. Todd Coleman agreed to take over the mentor/mentee events. The BoG expresses its appreciation for the care he has devoted to his work on behalf of the Society during his five years as officer.

13. The meeting was adjourned

Call for Papers: Special Issue of the IEEE Transactions on Information Theory



A special issue of the IEEE Transactions on Information Theory, envisioned as a tribute to the scientific legacy of Ralf Koetter, will be published in early 2011. The scope of the special issue encompasses all aspects of coding theory (both algebraic and probabilistic), network coding, turbo equalization, as well as other topics in networks and signal processing. Ralf Koetter worked in all these areas and forged numerous ground-breaking connections among them. Further exploring these exciting connections is one of the goals of this special issue. Another goal is to highlight the many new facets of coding theory that emerged during the past decade, largely owing to the contributions of Ralf Koetter.

Original research papers, as well as expository and survey papers, are sought, both invited and contributed. Papers submitted to this special issue should relate in some way to the work of Ralf Koetter. Sample topics include, but are not limited to, the following:

- Algebraic theory of network coding and its applications
- Analysis of iterative algorithms in graphical models
- Codes on graphs: realization complexity and constructions
- Efficient decoding (especially list-decoding) of algebraic codes
- Error-correction in networks, both coherent and non-coherent
- Turbo equalization and related topics in signal processing

The deadline for submission of manuscripts is April 15, 2010, and early submission is encouraged. All submissions will undergo a rigorous peer review, handled by one of the Guest Editors.

A special Workshop titled "Facets of Coding Theory: from Algorithms to Networks" and dedicated to Ralf Koetter will take place at the Allerton House, Monticello, Illinois, from Sunday, September 26, until Tuesday, September 28, 2010, immediately prior to the Forty-Eighth Annual Allerton Conference. Authors of papers accepted for the special issue will be expected to present their work at this Workshop. However, presentation at the Workshop will not be a prerequisite for publication in the special issue. Conversely, inclusion of a paper in the Workshop program will not guarantee inclusion in the special issue.

Questions regarding the special issue should be directed to Alexander Vardy at <avardy@ucsd.edu>. Questions regarding the Workshop should be directed to Andrew Singer at <acsinger@illinois.edu>.

SUBMISSION PROCEDURE:
Prospective authors should submit their papers electronically at http://pareja.itsoc.org/initial_submission, and adhere to the regular guidelines of the IEEE Transactions on Information Theory, with the following exceptions. In the field labeled "Editorial Area or Special Issue," please select this special issue. All the papers will be deemed submitted BOTH for publication in the special issue AND for presentation at the Workshop, unless clearly indicated otherwise in the field labeled "Message to Editor-in-Chief." Authors may also indicate in the same field their preference for a Guest Editor to handle the submission.

SCHEDULE:

Manuscript submission deadline:	**April 15, 2010**
Notification of acceptance:	**August 31, 2010**
Final manuscripts due:	**September 28, 2010**
Tentative publication date:	**February 2011**

GUEST EDITORS:
Michelle Effros, California Institute of Technology
G. David Forney, Jr., Massachusetts Institute of Technology
Frank R. Kschischang, University of Toronto
Muriel Médard, Massachusetts Institute of Technology
Andrew C. Singer, University of Illinois at Urbana-Champaign
Alexander Vardy, University of California San Diego

Call for Papers

ITW 2010 Dublin - IEEE Information Theory Workshop

Organizing Committee

Marcus Greferath (chair)
Joachim Rosenthal (chair)
Eimear Byrne
Jens Zumbrägel

Technical Program Committee

Alexander Barg (chair)
Gilles Zemor (chair)
Alexei Ashikhmin
Joseph Boutros
Jun Chen
Suhas Diggavi
Ilya Dumer
Iwan Duursma
Tuvi Etzion
Mark Flanagan
Marc Fossorier
Philippe Gaborit
Albert Guillen i Fabregas
Tom Hoeholdt
Ashish Khristi
Michael Langberg
Yingbin Liang
San Ling
Gary McGuire
Gabriele Nebe
Haim Permuter
Ron Roth
Prasad Santhanam
Igal Sason
Vitaly Skachek
Roxana Smarandache
Yossef Steinberg
Alexander Vardy
Pascal Vontobel
Aaron Wagner
Judy Walker
Chaoping Xing

Focus on Algebraic Methods in Information Theory

Topics of interest include:

- **Information and coding theory in networks**
- **Graph-based codes and iterative decoding**
- **Information- and coding-theoretic aspects of secure communications**
- **Algebraic codes and sequences**

Keynote Speakers

Erdal Arikan	Bilkent University
Christine Bachoc	University of Bordeaux
Ian Blake	University of Toronto
Ueli Maurer	ETH Zurich

Invited Sessions

	Organizers
• **Algebraic codes and sequences**	Patrick Sole
• **LDPC codes**	Simon Litsyn, David Burshtein
• **Quantum information processing**	Jean-Pierre Tillich
• **Channel uncertainty** **- Point-to-point communication** **- Network communication**	Navin Kashyap, Michael Langberg
• **Polar codes**	Emre Telatar
• **Coding and information-theoretic methods in cryptography**	Gerard Cohen

Call for Papers

We invite participants to submit an extended abstract of at most 5 pages for consideration of presentation and publication. All papers must be original, not published elsewhere, and report on recent significant achievements, challenges or work in progress. All submissions are subject to a peer-review process to ensure that the high standard of the conference be maintained.

Deadline for submissions: 1 April, 2010
Notification of decision: 4 June, 2010

The conference proceedings will be published by IEEE Xplore.

For more information: **www.ITW2010Dublin.org**

Claude Shannon Institute
Discrete Mathematics, Coding, Cryptography and Information Security

IEEE Information Theory Society

Call for Papers

FORTY-EIGHTH ANNUAL ALLERTON CONFERENCE

ON COMMUNICATION, CONTROL, AND COMPUTING

September 29 – October 1, 2010

Preliminary Call for Papers

The Forty-Eighth Annual Allerton Conference on Communication, Control, and Computing will be held from Wednesday, September 29 through Friday, October 1, 2010, at Allerton House, the conference center of the University of Illinois. Allerton House is located twenty-six miles southwest of the Urbana-Champaign campus of the University in a wooded area on the Sangamon River. It is part of the fifteen-hundred acre Robert Allerton Park, a complex of natural and man-made beauty designated as a National natural landmark. Allerton Park has twenty miles of well-maintained trails and a living gallery of formal gardens, studded with sculptures collected from around the world.

Papers presenting original research are solicited in the areas of communication systems, communication and computer networks, detection and estimation theory, information theory, error control coding, source coding and data compression, queueing networks, control systems, robust and nonlinear control, adaptive control, optimization, dynamic games, large-scale systems, robotics and automation, manufacturing systems, discrete event systems, intelligent control, multivariable control, computer vision-based control, learning theory, neural networks, VLSI architectures for communications and signal processing, and automated highway systems.

Information for authors: Regular papers suitable for presentation in twenty minutes are solicited. Regular papers will be published in full (subject to a maximum length of eight 8.5" x 11" pages, in two column format) in the Conference Proceedings.

For reviewing purposes of papers, a title and a five to ten page extended abstract, including references and sufficient detail to permit careful reviewing, are required.

Manuscripts must be submitted by **Wednesday, June 16, 2010**, following the instructions at the Conference website: http://www.csl.uiuc.edu/allerton/**.**

Authors will be notified of acceptance via e-mail by July 28, 2010, at which time they will also be sent detailed instructions for the preparation of their papers for the Proceedings.

NOTICE: Deadlines are earlier than in previous years. Final versions of papers to be presented at the conference must be submitted electronically by August 25, 2010.

Conference Co-Chairs: Pramod Viswanath and Sean Meyn

Email: *allerton@csl.uiuc.edu* URL: http://www.comm.csl.uiuc.edu/allerton

COORDINATED SCIENCE LABORATORY AND THE
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

University of Illinois at Urbana-Champaign

Call for Papers

Fourth International Symposium on Broadband Communications (ISBC 2010)
11th – 14th July 2010, Hotel Equatorial, Melaka, Malaysia
www.dcs.lancs.ac.uk/isbc10
www.utem.edu.my/isbc2010

Hotel Information

The symposium venue is Hotel Equatorial, Melaka, a 5-star international business class hotel where all the presentations, most meals and social events will take place. The hotel is conveniently located 1½ hours South of Kuala Lumpur and a 2 hour drive from Singapore. There will be an opportunity for various social activities and exciting excursions during the event. Special hotel rates are available for delegates of the symposium. For further information please visit the following website: http://www.equatorial.com/mel

About Melaka

Melaka, popularly believed to be have been named from the "pokok Melaka" was founded in 1396. This historical city is divided into the new and old sections. The older part of the city is fairly compact and has many historical attractions tucked into the nooks and crannies of its narrow streets. Malaysia has an equatorial climate with uniform temperatures throughout the year. Temperatures range from 32°C during the day to 22°C at night. The climate in the highland areas is cooler. For further information please visit the following website:
http://www.utem.edu.my/isbc2010

Registration

To register for the symposium please download and complete the registration form from the following websites and return to Professor Markarian at the University of Lancaster, **no later than Friday 11th June 2010**.

http://www.consellium.com
http://www.dcs.lancs.ac.uk/isbc10

2ND CALL FOR PAPERS

Symposium Information

A major objective of the Symposium will be to pursue the development of broadband communications research through to the implementation, performance analysis and commercial evaluation of practical broadband communication systems and their components of various types. You are invited to submit original papers in the following and related areas:

- Broadband Communication System Architectures and Performance
- LTE-Advanced vs WiMAX
- 3G and Beyond 3G Wireless Broadband Communication Systems
- Enhancements in Physical and MAC Layers of Broadband Communication Systems
- Smart antennas and MIMO systems
- Performance of OFDM and OFDMA Based Wireless Broadband Access Systems
- Error Control, including Turbo, LDPC and Space-Time Coding
- Modulation, Detection, and Synchronisation
- Channel Characteristics and Modelling for Wireless Broadband Communication Systems
- Multimedia Networking and Protocols
- Privacy, Secrecy and Security in Broadband Communications
- Novel Applications over Broadband Communication Systems

Paper Submission

The deadline for the submission of papers for consideration is **Friday 26th March 2010**.

Papers should not exceed 3 pages in length, including figures, and should be submitted electronically to: Julia Brooks or Donna Fletcher at Consellium Ltd via email at info@consellium.com as an MS Word attachment. Further guidelines on paper submisison can be found at: http://www.dcs.lancs.ac.uk/isbc10 or http://www.utem.edu.my/isbc2010.

You will be notified of acceptance by Monday 26th April 2010. Proceedings of papers will be published prior to the Symposium and will be available to all participants at the Symposium. Negotiations are underway with a leading publishing house to publish a book of selected papers after the Symposium. There will then be an opportunity to revise your paper, taking into account any comments by the referees and Symposium delegates.

Call for Papers

SETA 2010
SEquences and Their Applications Conference

The sixth conference on **Sequences and their applications (SETA 2010)** will be held at Telecom ParisTech, Paris, France from **September 12 to 17, 2010**.

Contact
Patrick Solé
Département COMELEC
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seta2010@telecom-paristech.fr

Technical Program Committee

Claude Carlet
Alexander Pott
Thierry P. Berger
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Wilfried Meidl
Sihem Mesnager
Gary McGuire
Udaya Parampalli
Matthew Parker
Bernhard Schmidt
Kai-Uwe Schmidt
Hong-Yeop Song
Kyeongcheol Yang
Nam Yul Yu

Invited Speakers
- Robert Calderbank, Princeton University, USA
- James Massey, ETH Zurich, Switzerland (retired)
- Arne Winterhof, Österreichische Akademie der Wissenschaften (Austrian Academy of Sciences)

General Chair
- Patrick Solé, Telecom ParisTech

Local Arrangments
- Jean-Claude Belfiore, Telecom ParisTech

Proceedings
- Springer Lecture Notes in Computer Science

Important Dates
- April 1: Submission deadline
- Mid of May: Notification of acceptance
- Beginning of June: Final paper submission

TOPICS
Previously unpublished papers on all technical aspects of sequences and their applications in communications, cryptography, and combinatorics are solicited for submission to SETA'10. Topics include:
- Randomness of sequences
- Correlation (periodic and aperiodic types) and combinatorial aspects of sequences (difference sets)
- Sequences with applications in coding theory and cryptography
- Sequences over finite fields/rings/function fields
- Linear and nonlinear feedback shift register sequences
- Sequences for radar distance ranging, synchronization, identification, and hardware testing
- Sequences for wireless communication
- Pseudorandom sequence generators
- Boolean and vectorial functions for sequences, coding and/or cryptography
- Multidimensional sequences and their correlation properties
- Linear and nonlinear complexity of sequences

Contact seta2010@telecom-paristech.fr
http://www.telecom-paristech.fr, rubrique Agenda

Conference Calendar

DATE	CONFERENCE	LOCATION	WEB PAGE	DUE DATE
March 15–19, 2010	**2010 IEEE Conference on Computer Communications (INFOCOM 2010)**	San Diego, California, USA	http://www.ieee-infocom.org/2010	Passed
March 17–19, 2010	**44th Annual Conference on Information Sciences and Systems (CISS 2010)**	Princeton University, NJ	http://conf.ee.princeton.edu/ciss/	Passed
March 29–31, 2010	**International Conference on Cryptography, Coding and Information Security (ICCCIS 2010)**	Rio de Janeiro, Brazil	http://www.waset.org/conferences/2010/riodejaneiro/icccis/index.php	Passed
April 13–15, 2010	**2010 The Fifth Conference on Theory of Quantum Computation, Communication and Cryptography (TQC 2010)**	University of Leeds, United Kingdom	http://tqc2010.leeds.ac.uk	Passed
May 10–12, 2010	**2010 IEEE Communication Theory Workshop (CTW 2010)**	Cancun, Mexico	http://www.ieee-ctw.org/	March 1, 2010
May 23–27, 2010	**2009 IEEE International Conference on Communications (ICC 2010)**	Cape Town, South Africa	http://www.ieee-icc.org/2010	Passed
June 12–18, 2010	**2010 IEEE International Symposium on Information Theory (ISIT 2010)**	Austin, Texas, USA	http://www.isit2010.info	Passed
July 11–14, 2010	**4th International Symposium on Broadband Communications (ISBC 2010)**	Melaka, Malaysia	http://www.dcs.lancs.ac.uk/isbc10	26th March 2010
August 30–September 3, 2010	**2010 IEEE Information Theory Workshop (ITW 2010)**	Dublin, Ireland itw2010/	http://www.shannoninstitute.ie/	April 1, 2010
September 6–10, 2010	**6th International Symposium on Turbo Codes & Iterative Information Processing**	Brest, France	http://conferences.telecom-bretagne.eu/turbocodes/	March 15, 2010
September 12–17, 2010	**Sequences and Their Applications (SETA 2010)**	Paris, France	http://www.telecom-paristech.fr	April 1, 2010
September 29–October 1, 2010	**48th Annual Allerton Conference on Communications, Control, and Computing**	Monticello, Illinois, USA	http://cslgreenhouse.csl.illinois.edu/allerton/	August 25, 2010
October 17–20, 2010	**2010 International Symposium on Information Theory and Its Applications and 2010 International Symposium on Spread Spectrum Techniques and Applications**	Taichung, Taiwan	http://www.sita.gr.jp/ISITA2010	March 7, 2010

Major COMSOC conferences: http://www.comsoc.org/confs/index.html