On Feb 6, 2011, at 6:44 AM, Guang Gong wrote:

Hi Muriel,

I would like to nominate the following paper, which I handled during my AE tenure, for IEEE-IT Award 2010.

S. Gurevich, R. Hadani, and N. Sochen. The finite harmonic oscillator and its applications to sequences, communication and radar, IEEE Trans. Inform. Theory, Vol. 54, No. 9, September 2008, pp. 4239-4253.

Using the representation theory to construct complex valued sequences with period p have good correlation is another approach in the sequence design for communication. Using the Weil representation, Gurevich, Hadani and Sochen presents a family of complex valued sequences of period p with low correlation, low ambiguity function, and low magnitude of the Fourier transform spectrum. This is the first class of the sequences which satisfy those three properties simultaneously.

This opens another direction for the problem of constructing sequences with good correlation using more sophistic mathematical tools. Several researchers have tried to investigate this problem using the Heisenberg representation in this decade, including Robert Caderbank with his co-authors. However, the sequences constructed by Heisenberg representation were turned out that they are the same sequences constructed by Frank, Zadoff, and Chu in 1970's.

The work has stimulated tremendous effort to find some simple and elementary construction for those sequences and to construct more sequences in an elementary way (without involving representation theory) for easy implementation, which is rooted in this paper. I strongly recommend this paper for an Information Theory Society Paper Award.

Best regards,

--Guang

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Hi Muriel,

In case no one else has done so already, I would like to nominate the paper:
Young-Han Kim, "Feedback capacity of stationary Gaussian channels", IEEE Trans. Inform. Theory, 56(1), Jan. 2010, 57—85.

Below is a summary and commentary on the paper. The bottom line is that
the paper solves a 30-40 year old open problem that attracted the attention of
many top information theorists over the years.

Best,

Erik

The paper tackles the problem of determining the capacity of
an average power constrained discrete time non-white stationary

additive Gaussian noise channel with feedback. As noted in the introduction, numerous researchers have chipped away at this problem
over the course of 30 to 40 years. The present work makes the following contributions. For stationary noise, the feedback capacity in general is shown to be the maximum entropy rate of stationary processes obtainable by monic and causal filtering of the noise process,
subject to a certain power constraint on the causal filter. Sufficient conditions
for the optimality of a causal filter are derived using convex duality motivated techniques. The infinite dimensional optimization problem is solved in closed form for the special case of
first order auto regressive moving average (ARMA) noise processes, thus
completely settling a problem first studied by Butman in the 70's. Butman's scheme, a generalization of Schwalwijk-Kailath, turns out to be optimal. The more general case of k-th order ARMA noise processes is also
treated, and the capacity in this case is reduced to the solution of a finite dimensional optimization problem over k dimensional vectors satisfying a complicated constraint involving a discrete algebraic Riccati equation (DARE). A similar expression was conjectured recently by
Yang, Kavcic, and Tatikonda to be the capacity and the present paper proves this
rigorously.

The paper is a huge contribution to the study of this problem.
A big stumbling block for previous works,
including Butman and the recent Yang et. al., has been demonstrating that a ``stationary'' feedback coding scheme is asymptotically optimal. Overcoming this barrier I would say is one of the main contributions of this work. This permits the expression of the feedback capacity as a single infinite dimensional optimization

problem rather than as the limit of an infinite sequence of finite dimensional optimization problems, as obtained by Cover and Pombra.

While the remaining steps in the ARMA solution are not trivial by any means, they are within reach after this initial reformulation of the problem.

1st of March 2011

Nomination for the IEEE ITsoc Best Paper Award, for the paper : ``Channel Coding Rate in the Finite Block Length Regime'' by Yury Polyanskiy, H. Vincent Poor, Sergio Verdú, IEEE Transactions on Information Theory, 56 (5) 2307-2359, May 2010

The paper ``Channel Coding Rate in the Finite Block Length Regime'' by Yury Polyanskiy, H. Vincent Poor and Sergio Verdú considers the maximal channel coding rate achievable at a given blocklength and error probability. The case under study has become extremely relevant for the design of the next generation wireless networks, where bursty transmissions and quality-of-service (QoS) concerns require short blocklengths.

The fundamental limits on channel transmission for fixed blocklength are a longstanding open problem of great practical relevance (e.g, in multimedia transmission and ARQ systems). Until now, no guidance was offered to answer that question. Usual techniques rely on the strong version of the coding theorem, or use the reliability function, which gives the asymptotic exponential decay of error probability when transmitting at any given fraction of capacity, which are barely sufficient.

This paper is very innovative and important as it gives very general and tighter achievability bounds than those of Shannon, Feinstein, and Gallager. A new converse approach, called the "meta-converse" approach leads to new lower bounds on error probability as well as the recovery of classical converses of Fano, Wolfowitz, and Shannon, Gallager and Berlekamp. Interestingly, the resulting bounds are tight for blocklengths as short as 100.

In order to do so, a new parameter is introduced, called channel dispersion, which together with (Shannon) capacity is shown to give an excellent approximation to the finite-blocklength maximal achievable rate. As the authors

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point out, it turns out that dispersion is much easier to find than the error exponent and gives greater insight into the behavior in the regime of interest.

In conclusion, this paper is timely and provides new insights on the channel coding rate for finite blocklength. The analysis is based on elegant information theoretic bounding techniques and will have without any doubt important practical designs. It should be noted that many follow-ups to the approach of this paper are expected to analyze the effects on maximal transmission rate of fading, memory, feedback, etc., which, so far, have been investigated only in the asymptotic blocklength regime.

Sincerely,

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Dear Prof. Muriel Medard,

I would like to nominate the paper 'Optimal, systematic, q-ary codes correcting all asymmetric and symmetric errors of limited magnitude," by Noha Elarief and Bella Bose published in IEEE Transactions on Information Theory, V. 56, No. 3, March 2010.

The major reasons why this paper deserves this honor are as follows:

1. The code can correct all limited magnitude errors. No code published in the last 60-70 years has this concept of correcting all errors.

2. The codes are systematic.

3. The code design methods are very simple. Not much background in coding theory
is required to understand the paper.

4. The codes are optimal.

5. The code find immediate applications in recently developed multilevel Flash memories, which has a market value of more than $100M. (To increase the capacity of flash, each cell is designed to store q-levels of voltage. At present q = 2, 4, 8 and 16 are possible. The error nature in these memory is of limited magnitude and so the proposed codes achieve 100% reliability).

Thus, these codes are not only of theoretically interesting but also of practically useful. Thus, I strongly recommend this paper for the best paper award.

Sincerely Yours,

Luca Tallini
--
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I am sending this email to nominate the following paper to be considered for IEEE Information Theory Society Award 2011:

Navid Abedini, Sunil P. Khatri, Serap A. Savari, "A SAT-Based Scheme to Determine Optimal Fix-Free Codes," Data Compression Conference, pp. 169-178, 2010 Data Compression Conference, 2010.

This paper attracted many interests from Data Compression Conference committee last year and got the Capocelli award 2010 (for the best student authored and presented paper).
(http://pages.cs.brandeis.edu/~dcc/CapocelliPrize.html)

Contributions: An efficient scheme to study the fix-free codes was proposed based on a formulation to the Boolean Satisfiability (SAT) problem.
By means of this scheme, we can determine the existence of a fix-free code (with any additional constraint like minimum distance) for any given length sequence and generate the code words in case of the feasibility.
Based on our SAT-based scheme, we proposed an algorithm to find ALL dominant length sequences (LS's corresponding to optimal codes) for fix-free codes (symmetric and asymmetric variations). The results for n (number of symbols to be coded) up to 33 (symmetric case) and 18 (asymmetric case) were presented in the paper.

Please let me know if more information is needed.

Thanks,
Navid Abedini.

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To the Information Theory Society Paper Award Committee:

Dear Committee Members,

I would like to nominate the paper "Noncoherent capacity of underspread fading channels" by Giuseppe Durisi, Ulrich Schuster, Helmut Bölcskei, and Shlomo Shamai for the 2011 IT Paper award. The paper appeared in the IT Transactions in December 2010. I handled this paper as AE for the Information Theory Transactions, and am nominating it for the 2011 IT Paper Award based on my own assessment of its excellence, as well as the very favorable reviews that it received. This is one of two papers that I am recommending, and I am not ranking them against each other since I believe they are both deserving of a paper award. However, if the committee wishes for me to provide such a ranking I would be happy to.

The paper is the first to derive upper and lower bounds on the noncoherent capacity of wide-sense stationary uncorrelated scattering (WSSUS) time and frequency selective fading channels. While there has been much work in the literature and in industry studying the channel model given its accuracy in modeling current cellular systems, this is the first paper to my knowledge that characterizes its capacity via upper and lower bounds. Underspread channels are considered, where the product of the channel's delay spread and Doppler spread is small. Upper and lower bounds for capacity are obtained for peak-constrained inputs in time and frequency that also identify optimal bandwidth occupancy. Asymptotic upper and lower bounds on capacity in the limit of infinite bandwidth are also obtained, with ties between the lower bound and very early work by Viterbi obtained. The upper and lower bounds are also shown to meet in some cases. The analysis in this paper is based on a discrete-time discrete-frequency approximation to the channel which explicitly takes the underspread properties of the channel.

The paper captures the uncertainty of the noncoherence channel through the approximate eigenfunctions of the underspread channel, which is how channel uncertainty is captured. This powerful and novel idea enables the capacity bounds to be obtained. All three reviewers were enthusiastic about the paper, recommending it for publication with only minor revisions. I shard their enthusiasm due to the novelty of the results, importance of the channel model under consideration, depth of the mathematics used to obtain the results, and the overall quality of the exposition. For these reasons I find the paper deserving of the 2011 IT paper award.

Sincerely,

Andrea Goldsmith

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To the Information Theory Society Paper Award Committee:

Dear Committee Members,

I would like to nominate the paper "Wideband fading channels with feedback" by Shashi Borade and Lizhong Zheng for the 2011 IT Paper award. The paper appeared in the IT Transactions in November 2010. I handled this paper as AE for the Information Theory Transactions, and am nominating it for the 2011 IT Paper Award based on my own assessment of its excellence, as well as the very favorable reviews that it received and the recommendation by one of the reviewers that it be considered for an award. This is one of two papers that I am recommending, and I am not ranking them against each other since I believe they are both deserving of a paper award. However, if the committee wishes for me to provide such a ranking I would be happy to.

In this work the capacity of Rayleigh flat fading channels at low SNR is derived under different CSI conditions at the transmitter and receiver. With full channel state information (CSI) at the transmitter and receiver, capacity is shown to be SNR log(1/SNR), as SNR goes to zero. Moreover, it is shown that this rate can be achieved with a just one bit of CSI at the transmitter per fading realization and with no receiver CSI. The capacity under noisy transmitter CSI, as is typical in practice, is also obtained. For Rayleigh block fading channels with coherence time $T \leq 1/\text{SNR}$ an achievable rate of SNR log T is obtained under causal feedback and no a priori CSI. This capacity thus matches that of full CSI when the coherence time T is on the order of 1/SNR.

The strengths of the paper lie in its remarkably simple and intuitive results, as well as the novel and clever coding, power allocation, and feedback schemes that are proved to be capacity achieving. The mathematics behind these results is deep as well as elegant. The reviewers were quite enthusiastic about the paper; accepting it for publication in the 1st review round with only minor revisions. The reviewer that recommended this paper for an award indicated that the paper presents "very interesting capacity results along with rich engineering insights of how coding, training and feedback should be done in a fading environment when SNR is low." A similarly-enthusiastic reviewer stated "the paper is written well and has remarkable results." My own assessment was that both the capacity results as well as the capacity-achieving strategies were novel, deep, and provided significant engineering insight and design ideas. It is on this basis that I find the paper is worthy of the 2011 IT paper award.

Sincerely,

Andrea Goldsmith