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#1569419741: *Communicating Remote Gaussian Sources over Gaussian Multiple Access Channels*

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Conference and *track*		**2011 IEEE International Symposium on Information Theory** - *2011 IEEE International Symposium on Information Theory*

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Presenter		presenter not specified
Registration		
Category		Eligible for ISIT Student Paper Award
Title		*Communicating Remote Gaussian Sources over Gaussian Multiple Access Channels*
Abstract		THIS PAPER IS ELIGIBLE FOR THE STUDENT PAPER AWARD. We study a multiple-terminal joint source-channel coding problem, where two remote correlated Gaussian sources are transmitted over a Gaussian multiple-access channel with two transmitters. Each transmitter observes one of the sources contaminated in Gaussian noise. The receiver wishes to reconstruct both sources. We derive necessary conditions and sufficient conditions for the receiver to be able to reconstruct the sources with given expected squared-error distortions. These conditions establish the optimality of uncoded transmission below some signal-to-noise ratio (SNR) threshold, and they also establish the high-SNR asymptotics. To achieve the latter, a coding scheme is proposed that superimposes analog uncoded transmission and digital combined source-channel Gaussian vector quantization.
Topics		Source coding; Multiple terminal information theory
Session		The program is not yet visible (tpc)
DOI		
Status		accepted

	Document (show)	Pages	File size	Changed	MD5	Similarity score
Review manuscript		5	1,203,003	February 15, 2011 22:15:00 EST	1ef907db2d6a7cbacfd647e69758f020	9

Final manuscript		Can upload 5 pages until May 31, 2011 00:00:00 EDT.

Personal notes

Reviews

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2 Reviews

Review 1 (Reviewer C)

Importance	Technical Level	Novelty	Presentation	Recommendation
Average Importance (3)	Good technical level (4)	Average Novelty (3)	Excellent (5)	Recommend (4)

Strengths (What are the key strengths of this paper?)

The authors consider the joint source-channel coding problem of transmitting two correlated Gaussian sources over a Gaussian multiple-access channel. The two Gaussian sources are observed in Gaussian noise and the receiver wishes to reconstruct the sources (in a squared error

sense). Necessary and sufficient conditions are provided for the receiver to be able to perform this reconstruction to a given distortion level.

Of interest is not only the necessary and sufficient conditions, but also the fact that the authors are able to establish optimality in the low and high SNR regimes.

Weaknesses (What are the major weaknesses of this paper?)

There are no big weaknesses.

Comments and Recommendation (Please give the reasoning for your overall recommendation and any additional comments you wish to add.)

Given the paper's in-depth look at a joint-source channel coding problem, the quality of the results available (characterization of the optimal achievable distortion below a certain SNR and at high SNR), and the well-presented nature of this work, the reviewer recommends this for publication.

Review 2 (Reviewer B)

Importance	Technical Level	Novelty	Presentation	Recommendation
Very Important (4)	Good technical level (4)	Average Novelty (3)	Excellent (5)	Recommend (4)

Comments and Recommendation (Please give the reasoning for your overall recommendation and any additional comments you wish to add.)

As the title accurately indicates, this paper addresses the problem of sending two Gaussian sources, encoded by two separate encoders, over a Gaussian MAC, when the sources are observed in the presence of Gaussian noise. The paper is thus an extension of [4] to the "remote source case." The authors show that uncoded transmission is optimal below a certain channel SNR, and in the high SNR case they show that superposition coding, with the proper mix of digital quantization and uncoded transmission, achieves the optimal order of distortion decay and the optimal pre-constant.

This problem is important and fundamental. The paper is well written and a pleasure to read (with the possible exception of the complicated formulas, which are probably inevitable). Although the neither the coding schemes nor the converse approach are novel, their application to this setup is nontrivial and the findings are quite a bit different from those of similar problems.

Some suggestions for the authors to consider:
- The paper gets off to kind of a slow start with its emphasis on the suboptimality of estimate-and-compress. As the authors point out, this suboptimality is not surprising. The fact that in the high SNR regime the optimal scheme is different from both that in [4] and [8] is more interesting, and I would emphasize that more in the intro.
- Hidden in the first paragraph of section III is the assumption that alpha and beta are both positive. This implies that rho must be positive, so later formulas that appear to depend on the sign of rho (e.g., in Corollary 1) actually do not. I would recommend pointing out that rho > 0 is implicitly being assumed, and that the general case can be reduced to this one.
- Since the remote source problem can be reduced to the direct problem with distortion constraints on linear combinations, why not view the latter problem as the more fundamental one and try to solve it in general?

1 Summary review by TPC member

Review 1 (Reviewer A)

TPC recommendation

Strong accept (5)

TPC Recommendation Justification (Please give a justification for your recommendation, especially if the review scores vary widely or your recommendation differs significantly from those of the reviewers.)

Both reviewers agree that this is a very well-written paper, addresses an interesting multiterminal coding problem, and presents a thorough solution. While the approach seems to be relatively standard, it is applied to a nontrivial set-up. The fact that the authors show optimality of uncoded transmission in the low-SNR regime and of a variant of superposition coding (a hybrid scheme involving quantization and uncoded transmission) in the high-SNR regime, and in both cases establish optimality not only in terms of rates of distortion decay but also of the constants, is quite impressive.

Reviewer B brings up some minor issues which should be addressed in the final version.

Discussion