#1569414061: *Prediction of Priors for Communication over Arbitrarily Varying Channels*

Property	Change Add	Value
Conference and *track*		**2011 IEEE International Symposium on Information Theory** - *2011 IEEE International Symposium on Information Theory*

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Property		Value
Presenter		presenter not specified
Registration		➕
Category		Eligible for ISIT Student Paper Award
Title		*Prediction of Priors for Communication over Arbitrarily Varying Channels*
Abstract		We consider the problem of communicating over an unknown and arbitrarily varying channel, using feedback. This paper focuses on the problem of determining the input behavior, or more specifically, a prior which is used to randomly generate a codebook. We pose the problem of setting the prior as a universal sequential prediction problem using information theoretic abstractions of the communication channel. For the case where the channel is block-wise constant, we show it is possible to asymptotically approach the best rate that can be attained by any system using a fixed prior. For the case where the channel may change on each symbol, we combine a rateless coding scheme with a prior predictor and asymptotically approach the capacity of the average channel universally for every sequence of channels.
Keywords		Communication, Universal Prediction, Arbitrary Varying Channels, AVC, Feedback
Topics		Communication theory
Session		The program is not yet visible (tpc)
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	Document (show)	Pages	File size	Changed	MD5	Similarity score
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Personal notes

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Reviews

You are a TPC member for this conference.

2 Reviews

Review 1 (Reviewer B)

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

Strengths (What are the key strengths of this paper?)
- novel approach via competitive optimality

Weaknesses (What are the major weaknesses of this paper?)
- basically a paper that reports results rather than gives proofs, so it's hard to verify that all the details are sorted out

Comments and Recommendation (Please give the reasoning for your overall recommendation and any additional comments you wish to add.)
- The question on the first page seems already answered (as it is posed) -- if the channel is arbitrarily changing, then surely adaptation is not beneficial. However, this does not seem to be what the authors are asking. It seems more that "given that the channel is varying in an unknown manner..."
- III.C : is this like using the Hedge algorithm of Freund?
- it seems that this paper is related in approach and subject (but not content per se) to the work of Buchbinder et al (INFOCOM 2009 / 2010). They look at power allocation using a similar approach. The authors seem unaware of this work.

typos:
- before (1) "fed back"
- (4) should it be $I(Q, W_i)$? See also (5)
- before II.C : perhaps call it $C_j(W_1^n)$ for j = 1, 2, 3, 4, rather than C?
- II.D : "Section 2.1"

Review 2 (Reviewer C)

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

Strengths (What are the key strengths of this paper?)
In the last years, several papers addressed communication over unknown and arbitrarily varying channels where the rate of transmission may depend on information about previous states made available to the sender via feedback. In previous related papers, random codes with a fixed distribution were employed, the main novelty here is that an adaptive choice of this distribution is addressed. A predictor is given that admits to achieve as large rate as the capacity of the (apriori unknown) averaged channel, typically a larger rate than achievable by classical block coding.

Weaknesses (What are the major weaknesses of this paper?)
The paper strongly depends on works of the authors available only in Arxive; even after consulting those, the reviewer has found some points less than clear. For example, on P.1, two assumptions are made and said to be approximately true. Is it not the case that assumption 1 is actually proved in the paper, employing rateless codes?
One undesirable feature is the need for common randomness. It would be good to discuss (as in at least one of the references) what amount of common randomness is needed, or whether it could dispensed with.

Errors: P.2, eq. (2): script Q is not defined (only in the full paper)
    P.2, eqs. (4), (5): correct P to Q
    P.3, line 4 below Theorem 1: logmax should be logmin

Comments and Recommendation (Please give the reasoning for your overall recommendation and any additional comments you wish to add.)
This is a valuable contribution to a subject repeatedly addressed recently. The results appear correct, although I did not check the rather complex details. Hence I am recommending acceptance.
The paper addresses two kinds of models, likely both unfamiliar to most participants of ISIT2011. In a short talk it is much harder to make the audience understand two models than one. I strongly recommend to concentrate in the talk on the second model which (as the authors themselves say) is the one of real interest.

Student Paper Award (This paper is eligible for the student paper award. Do you think it would rank among the top ten papers out of the 500 submitted papers in that category? If so, explain why.)
This paper may well rank among the top ten in that category. It adds substantial new contribution to a subject repeatedly addressed recently. The technical level is good, and although the presentation could be improved, I do not consider that a major shortcoming.

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.)
The authors consider the problem of transmitting over an arbitrarily varying channel (AVC) when the transmitter gleans information about past state symbols from receiver feedback. An adaptive choice of the distribution of a random code leads to the achievability of the capacity of the averaged channel, which can exceed the AVC random code capacity (i.e., capacity of the worst averaged channel). A nice result.

The authors are urged to heed the referees' suggestions for improving the presentation of their results.

For TPC eyes only (Write here if you have comments you don't wish the author to see.)

An easy accept. I also recommend that this paper be considered for a Student Paper Award, for which I shall submit a separate nomination.

Discussion

Not a reviewer.
Apr 16, 2011 04:14

A TPC MEMBER SUBMITTED THE FOLLOWING NOMINATION OF THIS PAPER FOR THE STUDENT PAPER AWARD:
The authors consider the problem of communicating over an arbitrarily varying channel (AVC) when the sender has access to past channel state information obtained through receiver feedback. The authors argue that the classical AVC model, which entails reliable communication over a worst-case sequence of channel conditions, is often too pessimistic. Rather, a better model of channel uncertainty is one in which the sender uses receiver feedback concerning past channel conditions to adjust its encoding rate as well as the input distribution of a random code. Such an adaptive choice of the distribution of a random code leads to the achievability of the capacity of the averaged channel, which can exceed the AVC random code capacity (i.e., capacity of the worst averaged channel).

This paper is a strong contribution to the topic of reliable communication over uncertain channels. It has four commendable attributes. First, it represents a new and optimistic way of viewing an AVC in which the sender uses gainfully its available channel state information. Second, it shows a nice use of adaptive prediction of the channel input distribution using a (known) weighted average predictor with exponential weighting. Third, this prediction scheme is used in conjunction with a rate adaptation method which has the feature of competitive optimality. Fourth, the authors take pains to justify their approach at every step. All in all, an imaginative piece of work.