#1569418835: *To Feed or Not to Feed Back*

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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		*To Feed or Not to Feed Back*
Abstract		"THIS PAPER IS ELIGIBLE FOR THE STUDENT PAPER AWARD" We prove capacity results for a communication system with Finite State Channels (FSCs), where the encoder and the decoder can control the availability or the quality of the noise-free feedback. The instantaneous feedback is a function of a cost constrained action taken by the encoder, a cost constrained action taken by the decoder, and the channel output. Achievability is through construction of a sequence of convergent achievable rates, using a simple scheme based on "codetree" generation, that generates channel input symbols along with encoder and decoder actions. For a given block length N and probability of error, ϵ_N, we give an upper bound on the maximum achievable rate. For stationary indecomposable channels without intersymbol interference (ISI), the capacity is given as the limit of normalized directed information between the input and output sequence, maximized over an appropriate set of causally conditioned distributions. As important special cases, we characterize (a) the framework of "to feed or not to feed back" where either the encoder or the decoder takes binary actions to determine whether current channel output will be fed back to the encoder, with a constraint on the fraction of channel outputs that are fed back, (b) the capacity of "coding on the backward link" in FSCs, i.e. when the decoder sends limited-rate instantaneous coded noise-free feedback on the backward link.
Keywords		Actions, Causal Conditioning, Channel with States, Cost Constraints, Directed Information, Feedback Sampling, Indecomposable Channel, Intersymbol Interference, Sampled Feedback, Time-invariant Deterministic Feedback, To Feed or Not to Feed Back.
Topics		Shannon theory
Session		The program is not yet visible (tpc)
DOI		
Status		accepted

Review manuscript	Document (show)	Pages	File size	Changed	MD5	Similarity score
	PDF	5	326,857	February 15, 2011 12:52:12 EST	9b91047be95253de57facfb35dff1b36	32

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

Personal notes

Reviews

You are a TPC member for this conference.

1 Review

Review 1 (Reviewer B)

Importance	Technical Level	Novelty	Presentation	Recommendation

Very Important (4) Good technical level (4) Very Novel (4) Good (4) Strongly Recommend (5)

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

Very nice paper. The statement of the converse should be made clearer. Is \eps_N in (12) an arbitrary sequence of positive numbers? or is it somehow related to the error probability P_e^N, as seems to be claimed a few lines after (12)?

Moreover, doesn't (12) imply R \leq \liminf \overline{C}_N(\Gamma) ?

1 Summary review by TPC member

Review 1 (Reviewer A)

TPC recommendation

Strong accept (5)

Discussion

Not a reviewer.
Apr 16, 2011 04:07

A TPC MEMBER SUBMITTED THE FOLLOWING NOMINATION OF THIS PAPER FOR THE STUDENT PAPER AWARD:
This paper # 1569418835 by Asnani, Permuter and Weissman focuses on feedback.
It addresses and conclusively answers such questions, which
lie at the intersection of information theory and control, in the
context of communication over Finite State Channels (FSCs), where the
instantaneous feedback is a function of an action taken by the
encoder, an action taken by the decoder, and the channel output,
possibly in the presence of cost constraints on the actions. Capacity
results are established by constructing a sequence of achievable
rates, using a scheme based on 'code tree' generation. This yields the
exact capacity when the probability of initial state is positive for
all states and for stationary indecomposable channels without
intersymbol interference (ISI).
'Coding on the backward link' in FSCs, which is a basic and important
problem to understand on its own right, is studied as a special case
of the framework considered, and a characterization of the capacity
for this setting is obtained.
The framework not only generalizes known channel coding results in
FSCs with noise free or deterministic function feedback, but gives new
understanding into other important types of feedback and into the
structure of schemes that approach the fundamental limits for such
scenarios. The capacity expression as a directed information over a
set of causally conditioned distributions is amenable to evaluation
through dynamic programming, and can yield explicit non-trivial bounds
on unknown capacities of channels with or without feedback.

I know that the student Himanshu Asnani was key to this contribution
from inception of the ideas to the concrete results and their
proofs, to the writeup. I am therefore pleased to nominate
this ISIT2011 Submission for the student paper award.