Title: ``On the Minimum Mean p-th Error in Gaussian Noise Channels and Its Applications.''

Time & Location: Friday October 7, 11am, FMH 414

Speaker: Alex Dytso

Abstract:

Selection of fidelity criteria or quantitative performance measure is an important first step, in engineering applications, for comparing different signal processing methods and optimizing signal processing algorithms. In this work, we study a large class of such fidelity criteria (cost functions) termed Minimum Mean p-th Errors (MMPE's) where the classical Minimum Mean Square Error (MMSE) is a special case of the MMPE. Specifically, we consider the problem of estimating an arbitrary random vector from its observation corrupted by additive white Gaussian noise (AWGN), where the cost function is taken to be the MMPE. In the first part of the talk, we derive and discuss several bounds and properties of the MMPE. We also focus on properties of the MMPE optimal estimators in terms of input distribution, such as linearity, stability, degradedness, average bias, etc.

In the second part of the talk, we focus on the application of the MMPE functional. As a first application, we study a problem of communication with the disturbance constraint where the goal is to maximize the communication rate at the intended/primary receiver subject to a disturbance constraint at the unintended/secondary receiver. The disturbance is measured in terms of the MMSE of the interference that the transmission to the primary receiver inflicts on the secondary receiver. The considered model is one of the simplest scenarios to study interference in wireless networks.

As a second application, the notion of the MMPE is applied to derive bounds on the conditional differential entropy as well as to generalize the Ozarow-Wyner mutual information lower bound for a discrete input on AWGN channel.

In the final example, we show that MMPE together with the famous I-MMSE relationship of Guo-Shamai-Verdu can be used to bound the MMSE of finite length codes improving on previous characterizations of the phase transition phenomenon for capacity-achieving codes of infinite length.

A short outlook of future applications concludes the presentation.

*This work is in collaboration with H. Vincent Poor, Ronit Bustin, Daniela Tuninetti, Natasha Devroye and Shlomo Shamai.

Bio:

Alex Dytso joined Department of Electrical Engineering at Princeton University as a postdoctoral researcher in the Fall of 2016 and under the supervision of H. Vincent Poor. He earned his Ph.D. in Electrical and Computer Engineering in 2016 from the University of Illinois at Chicago under the supervision of Daniela Tuninetti and Natasha Devroye. He received his B.Sc. degree in 2011 from the University of Illinois at Chicago where he received International Engineering Consortium's William L. Everitt Student Award of Excellence for outstanding seniors, who have demonstrated an interest in the communications field. His current research topic focuses on multi-user information and estimation theories and their applications to wireless networks.