Universität Rostock Traditio et Innovatio

FAKULTÄT FÜR INFORMATIK UND ELEKTROTECHNIK

Institut für Nachrichtentechnik, Lehrstuhl für Nachrichtentechnik, Prof. Dr.-Ing. Volker Kühn

Master Thesis

Distributed Lossy Compression and Turbo Reconstruction

Description:

Distributed control systems become more and more important because communication systems allow for reliable and real-time exchange of measurements and control commands. They consist of a set of sensors transmitting their measurements to a common control unit. The controller processes the received measurements and determines commands for the actors to control the process. Since the links used for data exchange are capacity limited, a compression of the measured data might be necessary at the sensor nodes. Originally, the measured signals are analog, i.e. continuous in time and amplitude. Before transmitting them to the control unit, they are generally PCM (pulse coded modulation) encoded, i.e. they have to be sampled and quantized. The resulting stream of bits is delivered to the control unit via a wireless link by applying appropriate coding and modulation techniques.

In this thesis, two sensors are assumed sensing the same process X. They measure noisy observations y_i which are quantized by ~~a~~ stochastic device[s] optimized using the information bottleneck approach. The quantizer mappings are denoted by $p_i(z_i|y_i)$, $i = 1, 2$. For the stochastic mapping, a lossy compression is required reducing the rate to $I(Y_i; Z_i) < H(Z_i)$. This compression shall be implemented by puncturing FEC codes to code rates $R_{c,i} \leq C_i$. As a consequence, a separate decoding of the resulting codewords is impossible due to the loss of information. However, a joint decoding of codewords from both sensors might be possible if extrinsic information is exchanged in a turbo-like iterative decoding process.

First, the literature has to be scanned to find related work. Second, an existing simulation environment in Matlab has to be extended to match the considered scenario. Appropriate codes, e.g. convolutional codes or repeat accumulate codes, have to be chosen and puncturing schemes have to be optimized using the EXIT chart analysis. Third, the turbo decoding process at the fusion center has to be implemented and simulations have to be performed to investigate the performance of the proposed approach.

Chair: Prof. Dr.-Ing. habil. Volker Kühn
Supervisor: Dipl.-Ing. Clemens-Konrad Müller **Email:** cm575@uni-rostock.de