Universität Rostock Traditio et Innovatio

FAKULTÄT FÜR INFORMATIK UND ELEKTROTECHNIK

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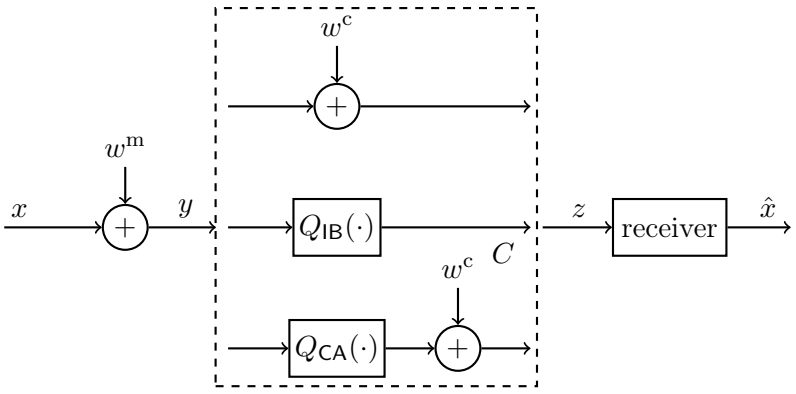
Title of Project / Master Thesis:

Comparison of Analog and Digital Sensing

Description:

Monitoring and control of technical systems rely heavily on sensing and communication. With the vision of the Internet of Things (IoT), billions of simple metering devices are expected to forward their measurement to control units leading to massive machine-to-machine communications. Regarding the efficiency of these systems, sensing, communication, and signal processing have to be jointly optimized to optimally infer the desired information.



In this thesis, the depicted system model below is considered. A sensor measures a noisy version y of the relevant signal x. Subsequently, the performances of three different kinds of processing shall be analyzed and compared to each other.

a) The sensor just scales and forwards the measurement over a noisy channel to the receiver, which is known as Amplify&Forward in relay systems. The system does not suffer from quantization effects but from noise amplification.

b) The sensor compresses the measured signal by quantizing it. The forward channel to the receiver is just characterized by its channel capacity C. The quantizer has to be optimized using the Information Bottleneck (IB) method for discrete as well as Gaussian x.

c) The sensor compresses the measured signal by quantizing it. The quantization indexes are mapped onto QAM symbols and forwarded over a discrete memoryless channel (DMC) with certain error probabilities. The optimization of the quantizer shall be performed with awareness of the forward channel statistics.

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All three strategies have to be compared to each other for different measurement Signal-to-Noise-Ratio (SNR)s and channel capacities. The forward channels have to chosen such that their capacities are identical. Conclusions have to be drawn how analog and digital sensing are related for different conditions.

In a second thesis, this concept can be extended to more than 1 sensor leading to a distributed optimization problem.

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