Scalable Error-resilient Coding of Meshes

The dissertation mainly focuses on two topics in the field of scalable coding of meshes. The first topic introduces the novel concept of local error control in mesh geometry encoding. In contrast to traditional mesh coding systems that use the mean-square error as target distortion metric, this dissertation proposes a new L-infinite mesh coding approach, for which the target distortion metric is the L-infinite distortion. In this context, a novel wavelet-based L-infinite-constrained coding approach for meshes is proposed, which ensures that the maximum error between the original and decoded meshes is lower than a given upper bound. Two distortion estimation approaches are presented, expressing the L-infinite distortion in the spatial domain as a function of quantization errors produced in the wavelet domain. Additionally, a fast algorithm for solving the rate-distortion optimization problem is conceived, enabling a real-time implementation of the rate-allocation.

The second topic presents a new approach for Joint Source and Channel Coding of meshes, simultaneously providing scalability and optimized resilience against transmission errors. An unequal error protection approach is followed, to cope with the different error-sensitivity levels characterizing the various resolution and quality layers produced by the input scalable source codec. The number of layers and the protection levels to be employed for each layer are determined by solving a joint source and channel coding problem. In this context, a novel fast algorithm for solving the optimization problem is conceived, enabling a real-time implementation of the JSCC rate-allocation.

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