

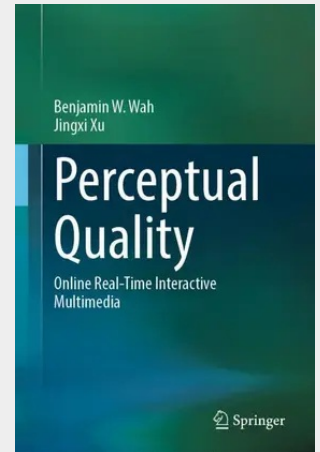
Perceptual Quality

Online Real-Time Interactive Multimedia

This monograph introduces a comprehensive framework for optimizing perceptual quality in online, real-time, interactive multimedia systems involving multiple users, performance metrics, and application controls. It outlines an integrated offline-online process that learns perceptual quality under controlled conditions and adapts it to dynamic, real-time environments. The optimization is modeled as a decomposable multi-metric, multi-control problem, solvable in polynomial time by integrating solutions from simpler subproblems. Each subproblem is evaluated using a novel, function-free method based on dominance and a binary-divide algorithm with guaranteed error tolerance.

The work is the first to show that the relationship between a stimulus and its variation in multimedia and psychophysical applications can be nonlinear yet monotonic and non-smooth. It also pioneers a method for optimizing perceptual quality in real-time communications without requiring original data at the receiver. This long-standing open problem is challenging due to the subjective nature of perceptual quality and the complexity of unknown tradeoffs among quality measures. The findings demonstrate the feasibility of solving these challenges through decomposition and dominance, offering practical solutions for improving perceptual quality in online real-time interactive multimedia applications.

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