New Course – FALL 2014: EE 150

Nonasymptotic information theory

(3-0-6) Prerequisite: EE/MA 126

This course will expose you to the tools and ideas of nonasymptotic information theory and prepare you for research in this very exciting field. We will dissect each basic communication problem: channel coding, source coding, joint source-channel coding - by looking at the best error rate - coding rate tradeoff achievable in a single transmission. By using this 'single shot' approach, we separate information-theoretic ideas from limit theorems in probability, and we will simultaneously treat sources and channels that are nonstationary/ nonergodic/ have memory/ live in an abstract probability space. Once we have understood each of the basic communication problems from a (single-shot) information-theoretic point of view, we will invoke tools from probability theory to study both the large deviations (error exponent) asymptotics and the Gaussian approximation (dispersion) asymptotics to gain insight into how these systems behave as the blocklength increases. We will uncover many curious cases where the classical asymptotics-based intuition fails us, such as variable-length coding, channel coding with feedback and joint source-channel coding.

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