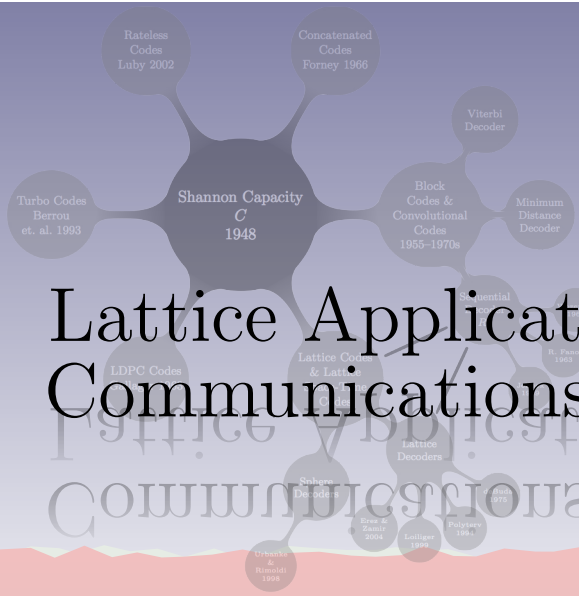
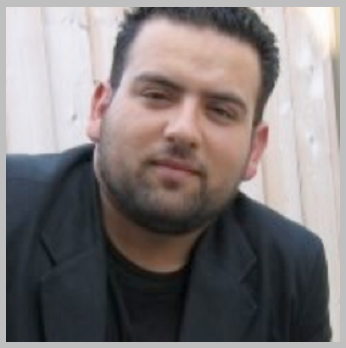


Lattice Applications for Digital & Wireless Communications: From Theory to Practice

The road to channel capacity is a long ride. It all started in 1949, by Claude-Shannon in his remarkable paper *A Mathematical Theory of Communication*. Shannon showed that there exists a parameter C, the channel capacity, such that, the error decoding probability, can be made arbitrary small for any transmission rate R less than C. In his mathematical proof, Shannon assumed that the input codewords are drawn from the ensemble of Gaussian codes — a code that has no structure. He also, assumed that the received signal is detected using the optimal maximum-likelihood (ML) receiver — a receiver that is considered practically to be infeasible. Ever since Shannons original paper, information theorists have attempted to construct structured codes and low complexity decoders that achieve the channel capacity.

In this talk we will address these questions elegantly using the theory of lattices. Lattices — a mathematical approach for representing infinite discrete points in Euclidean space, has become a powerful tool in several areas of mathematics, science, and engineering such as number theory, cryptography, coding theory, analog-to-digital conversion and data compression, and crystallographic. Our talk will be more focused on application of lattices to digital and wireless communication systems. Particularly, we will show how lattice can provide extremely useful tools for the communication engineer to achieve reliable communication and high data rates over several communication channels.



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