

Seminar Talk

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3:00 p.m. KH 224

Title: Some results from a joint project on Information Theory and Genetics

Abstract:

A wider perspective looking a bit outside the own area leads to surprising results and collaborations especially between life scientists and information or communication theorists have proven to be fruitful. This talk will provide four exemplary results of a joint project with a genetics group. The first will describe the effect of mutations by a channel model, determining mutual information and in the end defining what it means, when a species will be replaced by another or ceases to exist, argued from an information-theoretic perspective. As a second example, we will look into the genetic code mapping between triplets of base pairs, so-called codons, to amino acids. Describing probabilities of mutations as mutational distances and drawing "chemical distances" in parallel will show that mostly high probabilities for mutations go in line with small effects in the modifications of proteins when amino acids are replaced by others. Very high mutation probabilities are mapped to synonymous codons leading to the same amino acid. The third example will show a surprising links between Shannon entropy, chemical stability, and frequency of certain protein classes along the genome of *E. coli*. Finally, we tried to learn from the encoding in the genome using overlapping genes on opposite DNA strands and the adaptive splicing in vertebrates. The latter reminded us of source coding in the Lempel-Ziv 77 algorithm. The overlapping genes in both directions made us modify all Lempel Ziv-(Welch) source coding algorithms to include also backward reading of the dictionary.

Bio:

Werner Henkel received his Diploma and Dr.-Ing. (Ph.D.) degree from Darmstadt University of Technology (TUD) in May 1984 and June 1989, respectively. From 1989 to 1999 he was with Deutsche Telekom's R&D Labs in Darmstadt. In 1993/94 he was on sabbatical leave at AT&T Bell Laboratories (currently Alcatel Lucent), Advanced Data Communications Group. From 1999 to 2002 he was with a newly founded Telecommunications Research Center Vienna representing the signal processing department and heading a basic research group. In August 2002, Dr. Henkel became a professor for telecommunications at the University of Applied Sciences in Bremen. Since September 2003 he is a professor for electrical engineering at the Jacobs

University Bremen. He was elected to become Dean for Engineering and Mathematical Sciences in April 2012, a duty that was ending in June 2014. During the Spring semester, he is on sabbatical leave visiting Old Dominion University where he is teaching a probability course and continuing an earlier research collaboration. His research topics are LDPC and Turbo coding, joint source-channel coding, impulse-noise modeling and suppression, multicarrier modulation, MIMO, multi-user communication, physical-layer security, compressive sensing, neural networks, and DNA analysis.