



# The Advanced Network Colloquium Series

*Presented by the Maryland Hybrid Networks Center, the Electrical and Computer Engineering Department and the Institute for Systems Research*

## Rudolf Ahlswede

### “Identification Entropy”

**Date:** Tuesday, November 14, 2006      **Time:** 5:00 p.m.  
**Location:** 2460 AVWilliams Building  
**Host:** Prakash Narayan

**Abstract:** Shannon (1948) has shown that a source  $(U, P, U)$  with output satisfying  $\text{Prob}(U = u) = P_u$ , can be encoded in a prefix code  $C = \{c_u : u \in U\} \subset \{0, 1\}^*$  such that for the entropy  $H(P) = \sum_{u \in U} -p_u \log p_u \leq \sum p_u \text{length}(c_u) \leq H(P) + 1$ .

We use a prefix code  $C$  for another purpose, namely noiseless identification, that is every user, who wants to know whether a  $u(u \in U)$  of his interest is the actual source output or not, can consider the RV  $C$  with  $C = c_u = (c_{u1}, \dots, c_{un(p)})$  and check whether  $C = (C_1, C_2, \dots)$  coincides with  $C = c_u$ . Let  $L_c(P, u)$  be the expected number of checkings, if code  $C$  is used.

Our discovery is an identification entropy, the function  $H_I(P) = 2(1 - \sum_{u \in U} P_u^2)$ , which plays a similar role for estimating  $L_c(P, u)$  in noiseless identification source coding as Shannon's entropy does in noiseless data compression.

**Bio:** Rudolf Ahlswede studied mathematics, physics, and philosophy in Göttingen, where he received his Dr. rer. Nat. degree in mathematics in 1966. In 1967 he joined the faculty of the Department of Mathematics, Ohio State University, Columbus, where he was promoted to Associate Professor in 1969 and served as Full-Professor from 1972 to 1976. Since then he has been in Bielefeld, till 2003 as Ordinarius and then as Emeritus. He has been guest of most of the leading research centers in the world. Honors and prizes include an Honorary Doctor of the Russian Academy of Sciences 2001, membership of the European Academy of Sciences 2004, and the 2006 Shannon Award.

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