Statistical Engineering Division Seminar

Wednesday September 13, 1995 2:00 - 3:00pm

CAML Conference Room, Technology Bldg, Room B111

NIST

Gaithersburg, MD

A Comovement Coefficient for Time Sequences

Stefan Leigh
Statistical Engineering Division, NIST
Andrew L. Rukhin
University of Maryland Baltimore County
S. Perlman
National Security Agency

In the applied literature, for example in geophysics and economics, the ordinary correlation coefficient has often been used inappropriately to test comovement of time or space sequences. With the exception of an article on a nonparametric index of comovement, relatively little attention has been paid to the problem in the theoretical or the applied statistical literature.

We propose a suitably normalized inner product of first differences (derivatives), in sample form for nontrivial time sequences u and v

$$cm(u,v) \;=\; \frac{\sum \Delta u \cdot \Delta v}{(\sum(\Delta u)^2 \cdot \sum(\Delta v)^2)^{\frac{1}{2}}}$$

or in integral form for nontrivial curves f, g

$$cm(f,g) \;=\; \frac{\int f'(t)g'(t)dt}{(\int(f'(t))^2dt\int(g'(t))^2dt)^{\frac{1}{2}}}$$

as a geometrically natural comovement coefficient in that it tests for proportional slopes at matched pairs of points across the sequences.

Properties of this statistic, its asymptotic sampling distribution for simple ARMA processes, and bootstrapped estimates of its standard error are investigated.

Application of the statistic is illustrated for NIST surface conformity measurements, photoacoustic IR spectral profiles, and a geophysical example involving sunspot and atmospheric Carbon-14 cycles.

[NIST contact: Stefan Leigh, 301-975-2856]