

STANFORD UNIVERSITY
DEPARTMENT OF STATISTICS
DEPARTMENTAL SEMINAR

4:15 p.m., Tuesday, July 25, 2000
Sequoia Hall Rm. 200
(Cookies at 3:45 p.m. in 1st Floor Lounge)

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From emission tomography to fMRI

In emission tomography a radiopharmaceutical moves under metabolic action to lodge in tissues active during a task; the emitted radioactivity then can be traced and the metabolism studied for clinical use.

In principle we could use this technique to learn which parts of the brain are active during a higher cognition task such as image recognition. One problem with emission CT is that it has inherently poor temporal resolution. Since image recognition involves several subtasks which should be separated, emission CT is not adequate to this higher cognition study.

Functional magnetic resonance imaging is a more recent technique which can also be used to study the same problem. In fMRI oxy-hemoglobin and deoxy-hemoglobin have a slightly different magnetic resonance signature. Mathematically a measurement is made of the Fourier transform at various points k of the difference f between pre and post task level of oxy-hemoglobin. Each measurement of the Fourier transform of f at a point takes about 1 ms. If we use a dense grid of points k we can reconstruct the difference via Fourier inversion but it takes too long to measure the transform at a dense grid. Instead we propose to measure the transform only at a relatively few points and then to use these measurements to compute only a low spatial resolution image of f . That is we are trading off spatial for temporal resolution. We use wavelets or more precisely prolate spheroidal wave functions to realize the trade-off. This is joint work with CH Zhang of Rutgers and Qing Yang at Hershey Medical Center.

Martin Lindquist may present part of his thesis at Rutgers which is based on his new L1 formulation of the problem at the end of my talk and may describe his on-going work at Stanford and Hershey Medical Centers.