

# Biophysics 298: Journal Club - Statistical Activations in fMRI

## Spring Semester 2004

Daniel B. Rowe, Ph.D.

Course based on lectures. Recommended text.

Rowe, D.B. Multivariate Bayesian Statistics, CRC Press 2003. ~ \$80. (No Photocopies!)

I will lecture for the first few classes and occasionally thereafter.

Every student must select a paper to present in class and make copies.

Papers must be selected by the second week of class and submitted to me.

I will arrange student presentations in a logical order.

Topics may include statistical experimental design, fMRI time course modeling, fMRI activation level computing, and fMRI activation thresholding.

January	07	Rowe: Statistics Lecture
	14	Rowe: Statistics Lecture
	21	Rowe: Statistics Lecture
	28	Rowe: Statistics Lecture
February	04	Rowe: Statistics Lecture
	11	Rowe: Statistics Lecture
	18	Peter Kufahl: Razavi et al.: Model Assessment and Model Building in fMRI. Hum Brain Mapp 20:227238(2003)
	25	Xiaoguang Xu: Kruggel et al.: Estimating the effective degrees of freedom in univariate multiple regression analysis. Medical Image Analysis 6:6375 (2002).
March	03	Doug Prah: Clare et al.: Detecting Activations in Event-Related fMRI Using Analysis of Variance. Magn Reson Med 42:11171122 (1999).
	11	Eric Paulson: McNamee1 and Eddy: Visual Analysis of Variance: A Tool for Quantitative Assessment of fMRI Data Processing and Analysis. Magn Reson Med 46:12021208 (2001).
	18	Yan: Bandettini and Cox: Event-Related fMRI Contrast When Using Constant Interstimulus Interval: Theory and Experiment. Magn Reson Med 43:540548 (2000).
	24	Amrisha Chatterjee: Mechelli et al.: Estimating efficiency a priori: a comparison of blocked and randomized designs. NeuroImage 18:798805 (2003).
	31	Ritabrata Datta: Friston et al.: Multisubject fMRI Studies and Conjunction Analyses. NeuroImage 10:385396 (1999).
April	07	Rowe: Bayesian Statistics Lecture

	14	Rowe: Bayesian Statistics Lecture
	21	Goufan Xu: Liu et al.: Detection Power, Estimation Efficiency, and Predictability in Event-Related fMRI. <i>NeuroImage</i> 13, 759773 (2001).
	28	Rowe: Rowe: Bayesian Source Separation. <i>Magn Reson Med</i> 46:374378 (2001).
May	05	Kufahl: Statistics Discussion
	12	Bennett: Statistics Discussion
	19	No Class-ISMRM

**Grading System:** Attendance and Participation.

## FMRI Statistical Analysis

### 1. Statistical distributions

- Normal
- Scalar Wishart or Gamma
- Student-t
- Multivariate Normal
- Wishart
- Multivariate Student-t

### 2. Univariate Normal Samples

- Estimating the Mean
- Estimating the Variance
- Distribution of Est. Mean
- Distribution of Est. Variance
- Confidence intervals
- Hypothesis tests
- Vector/Matrix Formulation

### 3. Univariate Regression: Simple

- Estimating Coefficients
- Estimating the Variance
- Distribution of Est. Coefficients
- Distribution of Est. Variance
- Confidence intervals
- Hypothesis tests
- Vector/Matrix Formulation

### 4. Univariate Regression: Multiple

- Vector/Matrix formulation
- Estimating Coefficients
- Estimating the Variance
- Distribution of Est. Coefficients
- Distribution of Est. Variance
- Confidence intervals
- Hypothesis tests

## 5. Multivariate Regression: Multiple

- Vector/Matrix formulation
- Estimating Coefficients
- Estimating the Variance
- Distribution of Est. Coefficients
- Distribution of Est. CoVariance Matrix
- Confidence intervals
- Hypothesis tests