**Lecture 11.3 (03:55-04:10)**

**Asymptotic Behaviors of Multiple Testing Procedures under Dependence**

**Monitirtha Dey (ISI)**

Large-scale multiple testing problems in various disciplines routinely involve dependent observations. Tackling this dependence among observations has been one of the pertinent problems in simultaneous inference. However, very little literature exists that elucidates the effect of correlation on different testing procedures. This talk considers the multiple testing problem under the correlated Gaussian sequence model framework. Here we focus on the family-wise error rate (FWER) and the false discovery rate (FDR), two of the most widely considered frequentist approaches to multiple testing. We prove that under the equicorrelated normality assumption, the FWER of Bonferroni's procedure asymptotically goes to zero when the number of hypotheses approaches infinity. We extend this result to general positively dependent normal setups and generalized family-wise error rates. We also discuss the asymptotic power of Bonferroni's procedure. We then extend this to the class of step-down procedures under quite general correlated normal setups. Specifically, we show that the probability of rejecting at least one hypothesis approaches zero asymptotically for any step-down procedure. Consequently, the FWER and the Power of the step-down procedures also tend to be asymptotically zero. We also establish similar limiting zero results on FWER of other popular multiple testing rules, e.g., Hochberg's and Hommel's procedures. It turns out that, within our chosen asymptotic framework, the Benjamini-Hochberg method can hold the FWER at a strictly positive level asymptotically under equicorrelated normality.