Concentration Inequalities, Oracles, and Applications

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Outline: Week 2

1) Statement of newer versions of Hoeffding inequality: Eaton, Prohorov, Pinsker, possibly others;

2) Proof that moment inequalities provide sharper bounds than Chernoff's method (proof has a gap); example;

3) Cramér-Chernoff theorem for convolutions on $\mathcal{R}$ in iid case; normal example;

4) Generalization to convolutions on $\mathcal{R}^d$; geometric interpretation of $\mathcal{R}^d$ result;

5) a) Introducing concentration inequalities for general functions of bounded Lipschitz norm in multivariate normal case; application to maximum of a Gaussian vector; potential application to false discovery;

b) Glivenko-Cantelli theorem and DKW inequality in $\mathcal{R}$; best constant;

c) generalization to higher dimensions via *shattering coefficients*;

d) application to testing for goodness of fit in $\mathcal{R}^d$; weak limits of test statistics; computing their critical values;

6) Introducing the methods of derivation of Gaussian concentration inequalities for bounded Lipschitz norm functions; the first methods, Borell and Sudakov.