Reading list and project guidelines for EE378C

1 Project guideline

In the final project, please choose one of the following papers (or several papers in the same topic, or propose your own upon the advisor’s approval), write an essay summarizing the given paper(s), and give a 20-minute presentation in class. In preparing the essay, please note the following:

• Clearly summarize the statistical/mathematical model, the technical assumptions and the main results. If the paper contains multiple key results, feel free to present the part you feel most interesting;

• Read the proof, sketch the main argument, and present the key ideas;

• If (part of) the paper is about lower bounds, discuss their technique with the tools you learned in class. If the technique was covered in class, comment on how it is applied in the paper; if not, discuss whether the tools covered in the class could provide an alternative proof; if your answer is no, summarize the innovative points in their arguments;

• Discuss in your opinion the most innovative/challenging part of the paper and why it is cool (if you think it is obvious, it is perfectly fine too as long as you can make a convincing case).

It is also encouraged to propose your own research project related to the course. In this case, in addition to the essay and presentation, you also need to submit a proposal at the end of the third week. Feel free to reach out to instructors any time for feedbacks and topic suggestions.

2 Reading list

2.1 Communication complexity

1. Public vs private coins:


2. Coupling arguments for communication complexity:


3. Statistical lower bounds via communication complexity:

2.2 Asymptotic equivalence and non-equivalence

1. Limits of experiments:

2. Asymptotic equivalence results:

3. Asymptotic non-equivalence results for small densities:

2.3 Statistical/computational tradeoff

1. The seminal paper on sparse PCA:

2. SOS lower bound for planted clique:

3. A statistical/computational tradeoff independent of planted clique:

4. Generalization of planted clique - secret leakage:

2.4 $f$-divergence and joint range

1. Joint range of $f$-divergences:

2. Sharp inequalities for $f$-divergences:
2.5 Two-point methods

1. Local minimax rate of convergence:

2. Posted-price auction:

3. Bandits with bounded regret:

4. Duality arguments in combinatorial bandits:

2.6 Testing simple against composite hypotheses

1. Sparse covariance estimation:

2. Instance-optimal identity testing:

3. Local goodness-of-fit tests:

2.7 Testing two composite hypotheses

1. Dualizing Le Cam’s method:

2. Nonparametric entropy estimation:

3. Multi-reference alignment:
2.8 Variants of Fano’s inequality

1. Distance-based Fano’s inequality:

2. Fano’s inequality based on $f$-informativity:

2.9 Aggregation and model selection

1. Theory of model selection:

2. Theory of aggregation:

3. Optimal competitive factor in proper and improper learning:

2.10 Covering and packing bounds

1. Metric entropy of classes of convex sets:
   Richard M. Dudley, Hiroshi Kunita, and Franois Ledrappier. Ecole d’Ete de Probabilites de Saint-Flour XII, 1982. (Section 7.3)

2. Metric entropy of $\ell_p$-balls in $\mathbb{R}^d$ with respect to $\ell_q$-norm:

3. Duality of metric entropy:

2.11 Statistical bounds based on global Fano

1. Hellinger covering:

2. KL covering:
3. Estimation and prediction in sparse linear regression:


4. Log-concave density estimation beyond Donsker regime:


### 2.12 Other geometric arguments

1. Redundancy and superefficiency:


2. Sample amplification:


### 2.13 Compression-based arguments

1. Linear convergence with first-order oracle in convex optimization:


2. Complexity of finding stationary points with \( p \)-th order oracle:


3. Compression-based upper bounds:


4. Lower bound of Johnson–Linderstrass:


### 2.14 Sequential experiments

1. Stochastic optimization with zeroth-order oracle:

2. Stochastic batch optimization:

3. Active learning:

4. Nonparametric bandit:

2.15 Ability of adaptation

1. A general constrained risk inequality:

2. Lepski’s adaptation trick:

3. Inability of adaptive tests:

4. Adaptation to loss functions:

2.16 Communication/privacy constrained estimation

1. Strong data-processing inequality:

2. Communication complexity:

3. Quantized Fisher information:
2.17 Memory constrained estimation

1. Memory-constrained parity learning:
   Or a clearer follow-up paper:

2. Memory-constrained learning with small noise:

3. Memory-constrained uniformity testing:

4. Memory constraints in belief propagation:

2.18 Max-min vs min-max formulation

1. Sequential Radamacher complexity:

2. Batched bandit with data-driven batch sizes:

3. Semi-min-max framework:

2.19 Network information theory

1. Reverse hypercontractivity:
2. Capacity of relay channel:

3. Strengthened cutset bound: