

COMPSCI590.7

Sample Projects

Project

- Groups of ≈ 3 people
- Week of Oct 26 – 30, project starts.
- Week of Nov 16 – 20, checkpoint.
- Dec 7, project report due.

Format

- Read 1 (or 2 related) paper carefully
- Search for related literature
- Write a survey
 - Highlight the important proof ideas in the paper
 - Briefly describe some related works
- (Optional) Find a related open problem that you are interested in and research

Examples

- Nonnegative Matrix Factorization, beyond separability
- Paper
Intersecting Faces: Non-negative Matrix Factorization With New Guarantees [Ge, Zou 2015]
- Related papers: subspace clustering
- Possible open problems
 - Faster Algorithm? Working heuristic? Better subspace clustering models?

Examples

- Spectral algorithms for “Predictive State Representation”
- A Spectral Algorithm for Learning Hidden Markov Models [Hsu, Kakade, Zhang 2012]
Closing the Learning-Planning Loop with Predictive State Representations [Boots, Siddiqi, Gordon 2010]
- Possible open problems:
 - Tensor methods for learning the parameters of POMDP instead of “Predictive State Representation”?

Examples

- Tensor algorithms for Latent Parse Trees
- Identifiability and Unmixing of Latent Parse Trees [Hsu Kakade Liang 2012]
Spectral Learning of Latent-Variable PCFGs: Algorithms and Sample Complexity [Cohen Stratos Collins Foster Ungar 2014]
- Possible Open Problems:
 - Understand the limitations of these works and see what can be improved.

Examples

- “Homotopy” Method in optimization
- On the Link between Gaussian Homotopy Continuation and Convex Envelopes [Mobani, Fisher III]
- Related papers: May require prior knowledge about some PDEs
- Possible open problems:
 - A concrete setting where we can say something about computational/sample complexity?

Examples

- Landscape for “non-convex” optimization
- Complete Dictionary Recovery over the Sphere [Sun Qu Wright 2015]
- Possible open problems:
 - What other non-convex functions may have a nice landscape?
 - Example: Maximum likelihood objective for mixture of spherical Gaussians?