Bayesian Inference for Gaussian Graphical Models

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Overview

Introduction

- Introduction and Data Familiarity
- Gibbs Sampling Technique and Prior Choice
- Graph and Inference
- Precision Matrix Inference

Literature Review

- Papers of Note for this Study
  - *Bayesian Inference for the Multivariate Normal* Penny, 2014
  - *Bayesian Variable Selection in Linear Regression* Mitchell and Beauchamp 1988
  - *Variable Selection Using Shrinkage Priors* Li and Pati 2017
  - *Sparsity Information and Regularization in the horseshoe and other shrinkage priors* Piironen and Vehtari 2017

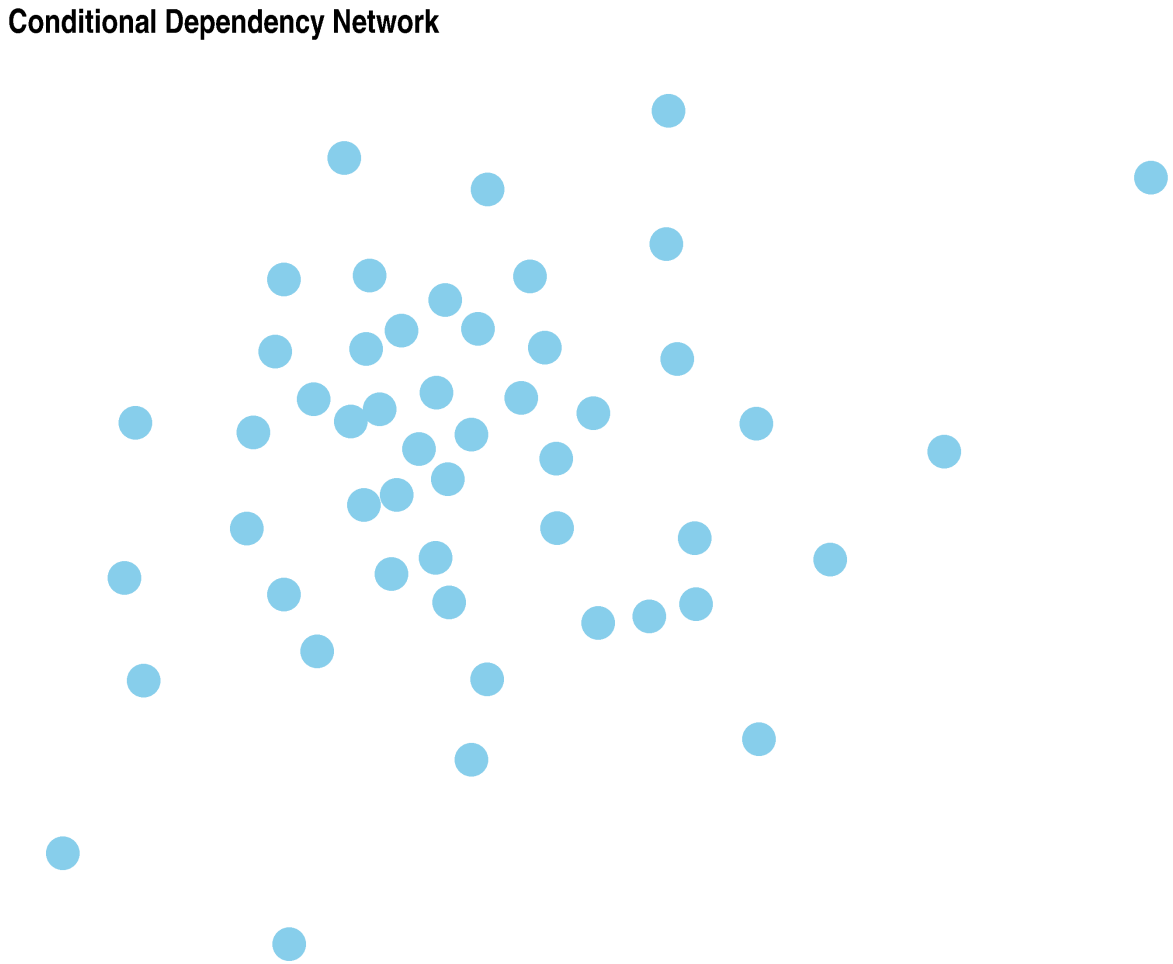
Data and Methodology

- Data Cleaning and Feature Engineering:
  - Provided dataset isolated to include only proteins for precision matrix inference
- Prior Specification and Full Conditionals:
  - Wishart Prior for Precision Matrix
  - Regularized Horseshoe Prior for Regression Coefficients used over Spike and Slab
- Gibbs Sampling:
  - Full Conditionals for Precision Matrix and Regression Coefficients
  - Gibbs Sampling done in the canonical parameterization

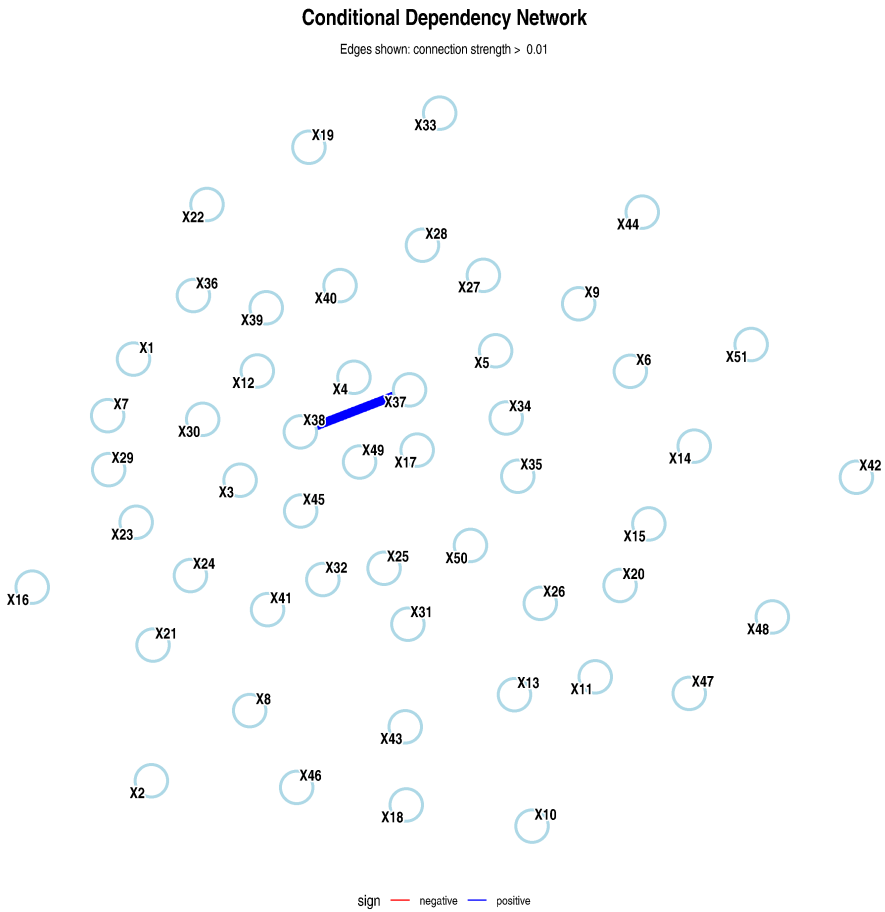
Results and Future Directions

- Results:
  - Posterior Inference for Precision Matrix
  - Posterior Inference for Regression Coefficients
- Future Directions:
  - Further exploration of the regularized horseshoe prior
  - Application to other datasets

Proposed Graphical Results - Phase 1



Proposed Graphical Results - Phase 2



Future Directions

- Evaluation of Prior Choice Over Alternative
- More analysis of Protein Network
- Further diagnosis of Gibbs sampler