

ECS289A – Modeling Gene Regulation
Vladimir Filkov, Winter 2003

Preliminary Course Project List

1. Microarray Data

- Data Clustering
 - Clustering based on perturbation data and sequence data
 - Comparison and validation of popular clustering methods
 - Biclustering (Church et al, Kasif et al)
 - Triclustering (as above but additional data types)
 - Clustering promoter regions with HMMs (Jiang et al, Noble et al)
 - Clustering protein interaction data
 - Clustering annotation data (from references and literature)
- Curve smoothing of microarray data - local features identification
- Better regulation inference from microarray data (with respect to latest work)

2. Sequence Data

- Sequence queering for Modules using sequence searches and finding non-activators and non-inhibitors as parts of modules
- Promoter Region Commonalities in differentially expressed homologous genes

3. Protein Data

- Investigate the binding specificities of a protein individually and when it is bound to a complex
- Clusters of microarray data and triplets of protein-protein interactions (Ge et al., Nature Genetics, v. 29, 2001)

4. Networks

- Implement Simulators for Boolean Networks
- Implement Alvis Brazmas linear finite model
- Inferring networks from gene perturbation and time-course microarray data
- Over represented sub-networks in yeast
- Simulate evolutionary changes in scale-free networks. Assume random mutations, and threshold protein specificity

5. Visualization

- Visualizing differentially expressed genes in multiple genotypes
- Visualizing Gene Networks (Graph Drawing + Dynamics)

6. Data Integration (Fusion)

- Sequence + Microarray Data (sequence similarity, database searches, microarray data similarity)
 - similar sequences, link in microarray data
 - clusters of microarray data, link in sequences
- Integrating clustered data (trees)

7. Survey Papers (8-12 page)

- Microarray analysis methods and software
- Sequence motifs methods and software
- Statistics of Gene Regulation
- Uses of Microarrays in Medicine