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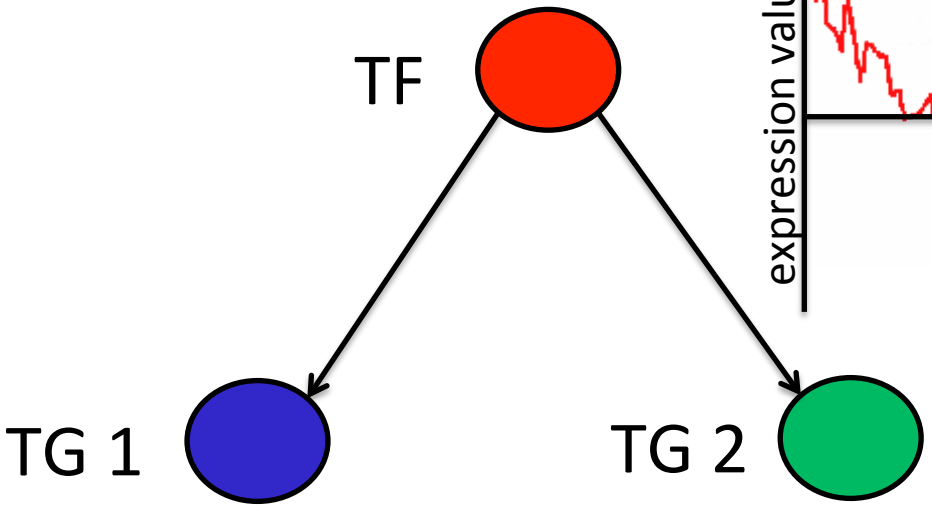
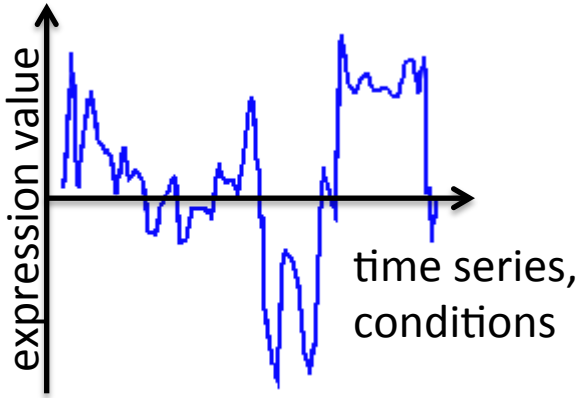
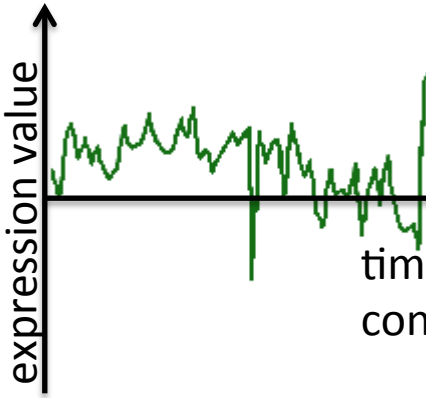
Extending partially known networks from SGS data

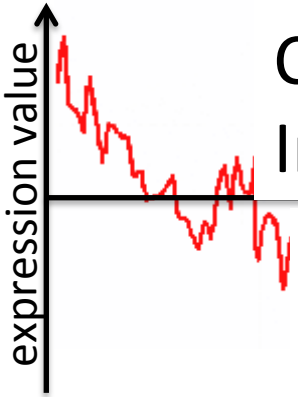
STATSEQ meeting on Gene Network Inference with Systems genetic data and beyond.
28-29th March 2013, Paris, France
AgroParisTech - ENGREF 19 avenue du Maine

Intro: Gene Regulatory Networks

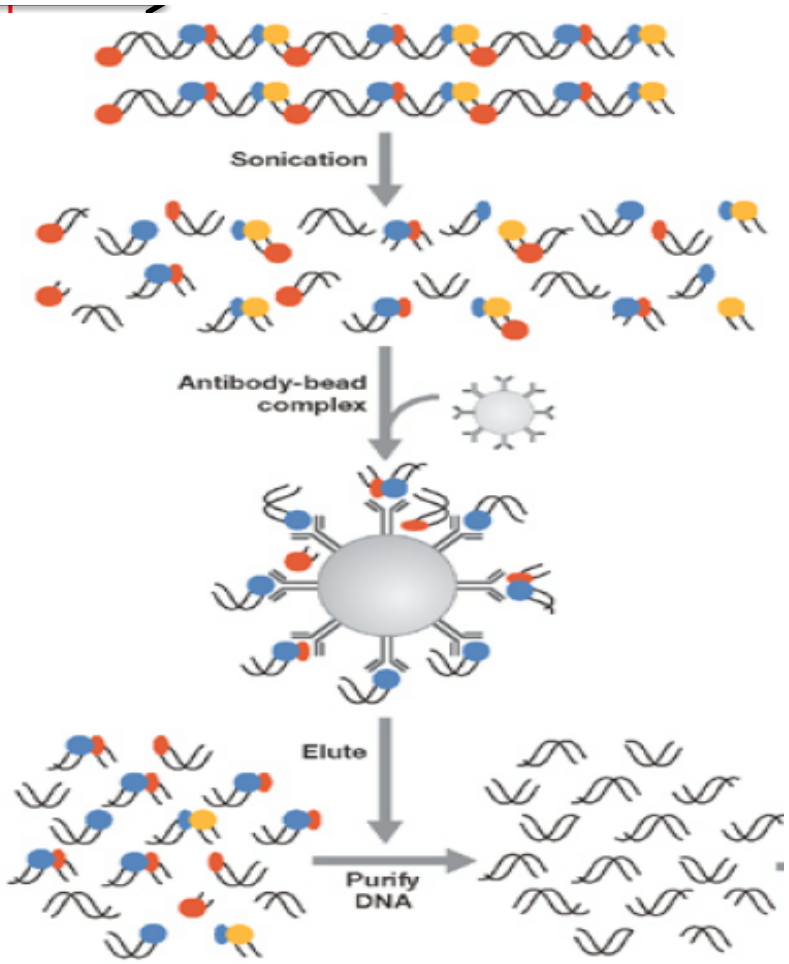








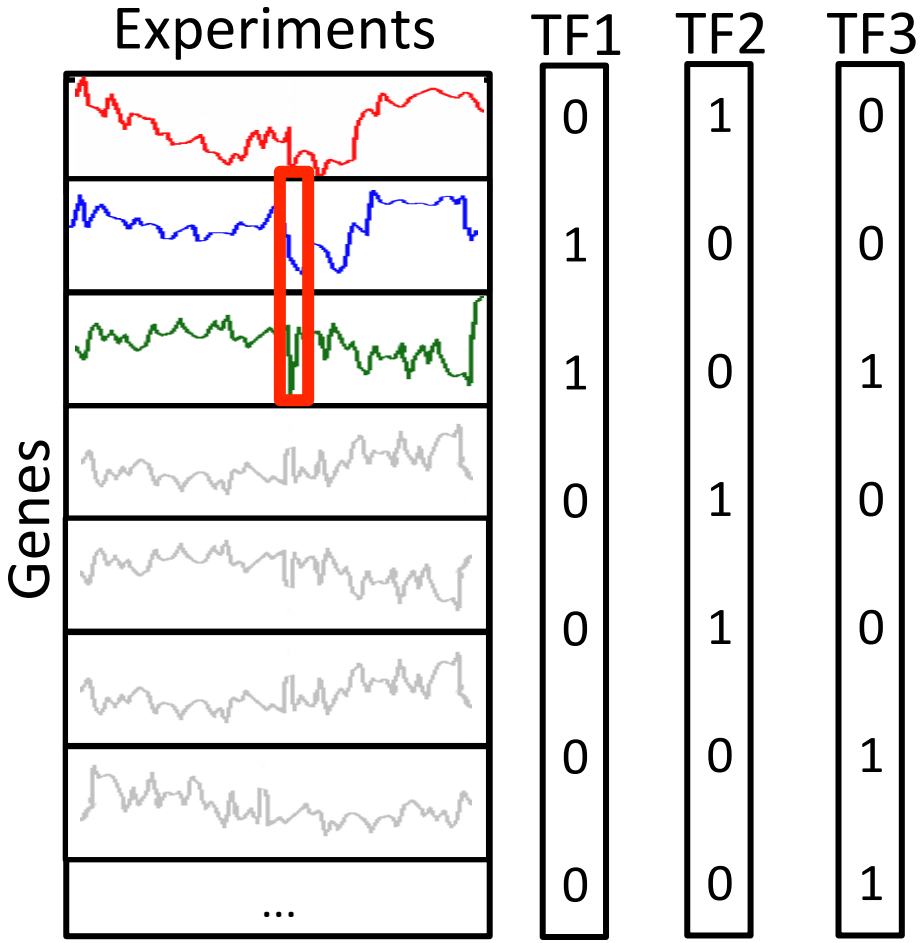
Chromatin Immunoprecipitation

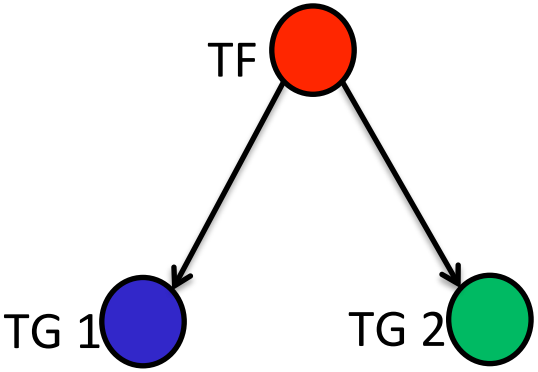


Methods: Unsupervised vs. Supervised

Unsupervised

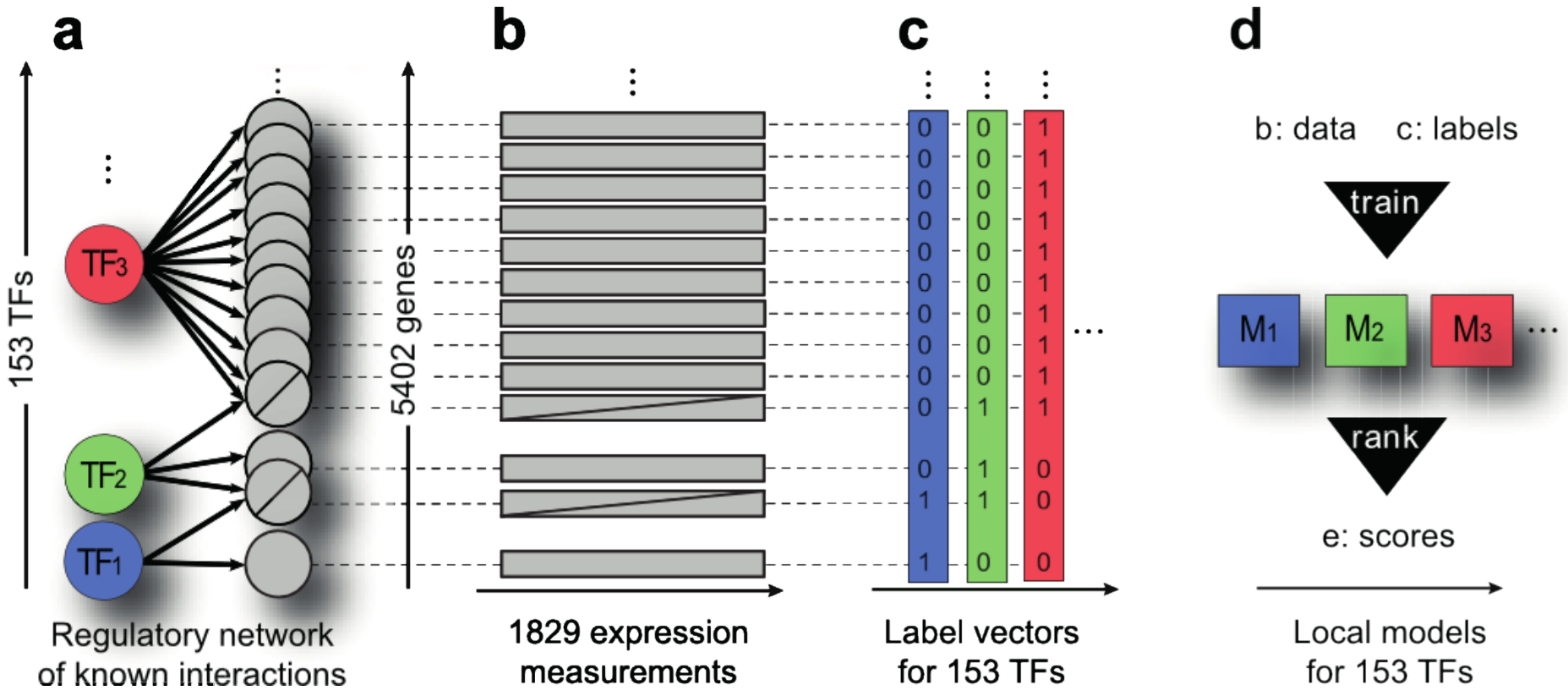
Supervised





Mordelet & Vert, 2008: Sirene

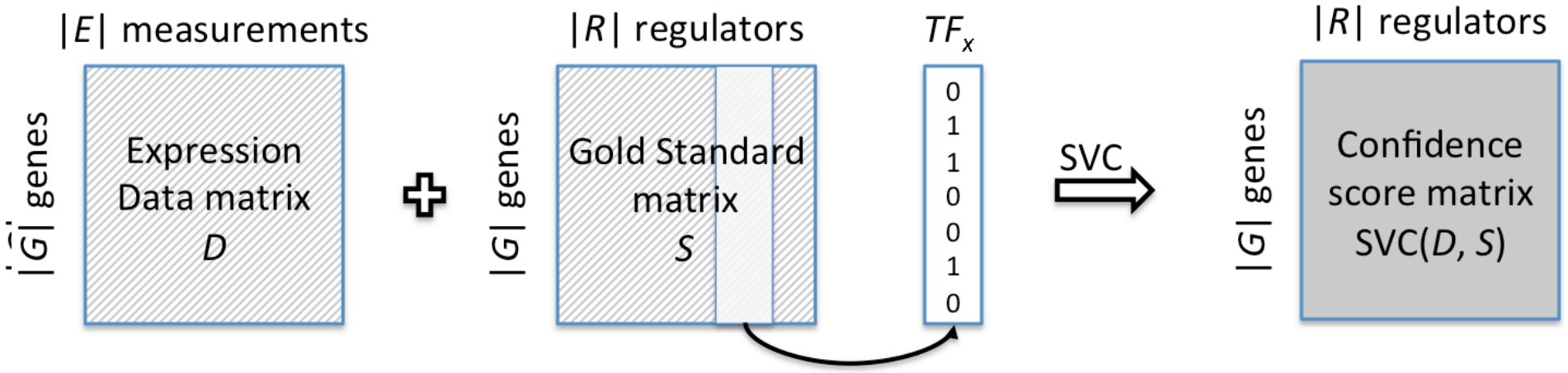
Methods: Supervised inference



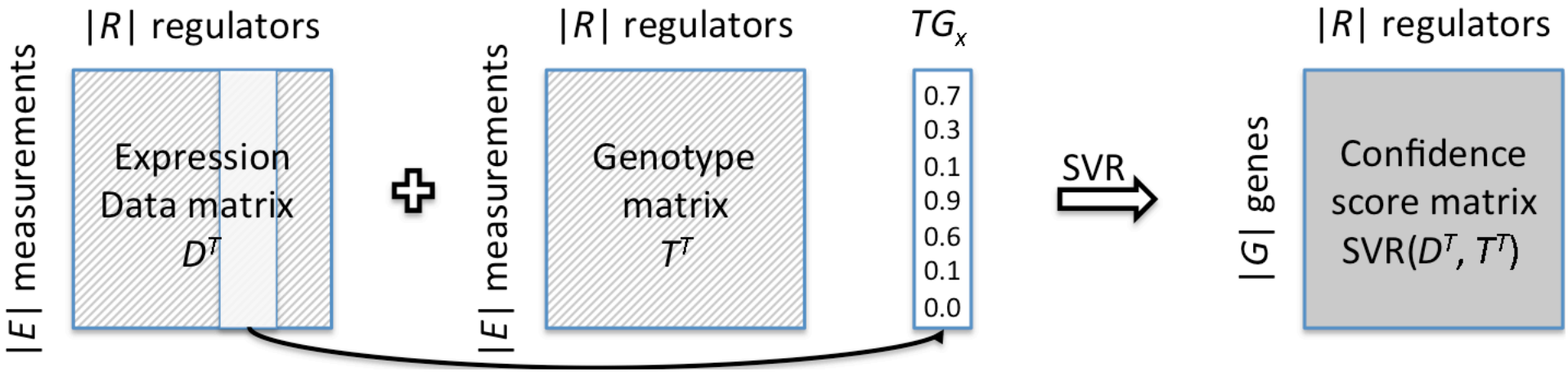
Mordelet & Vert, 2008: Sirene

Methods: Variant 1

supervised, add network

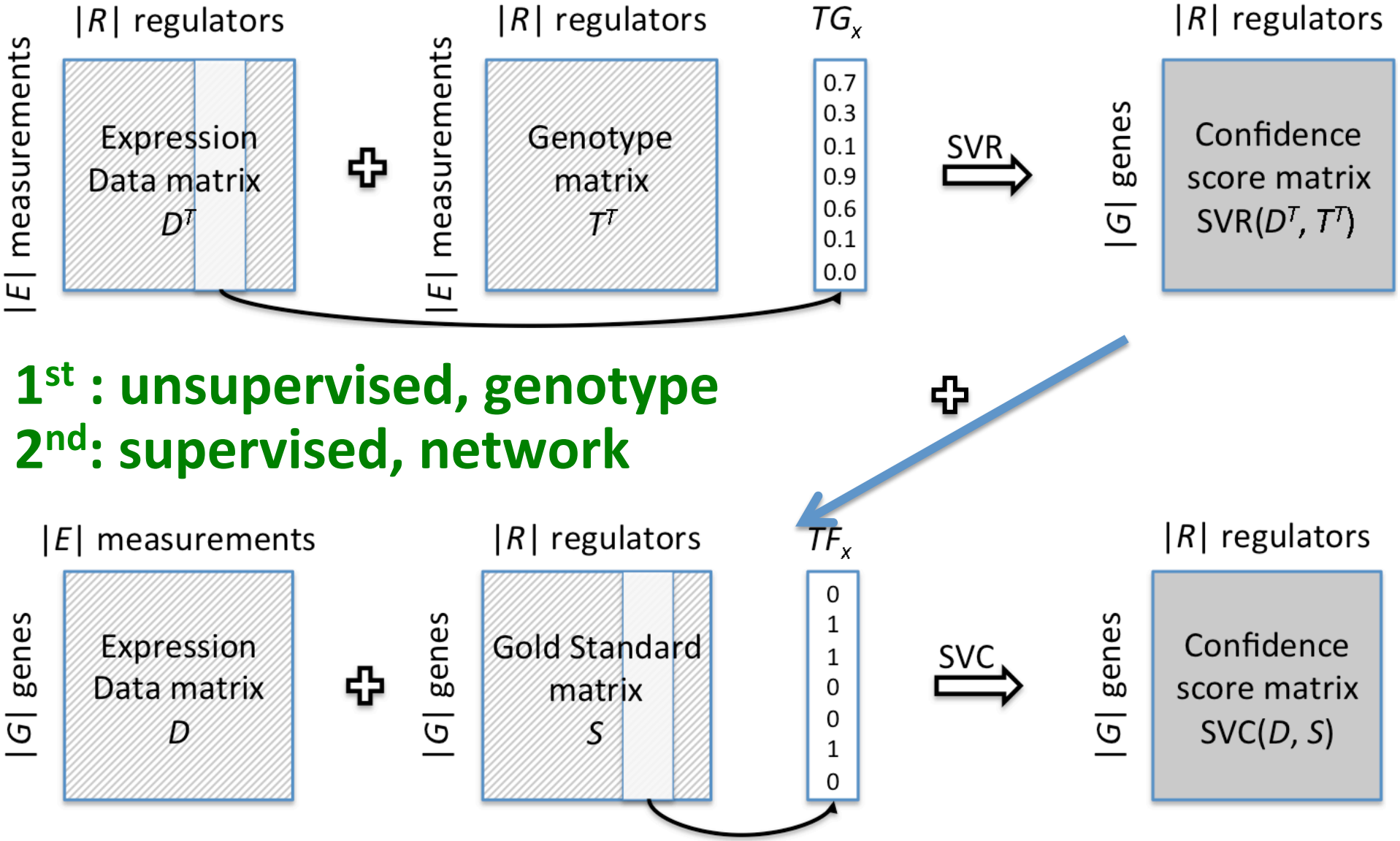


Methods: Variant 2

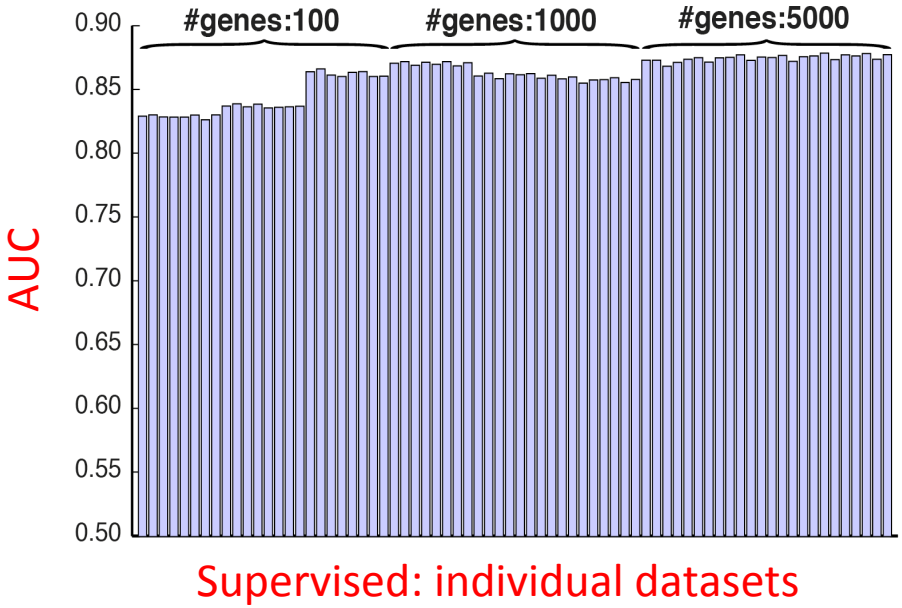


unsupervised, add genotype

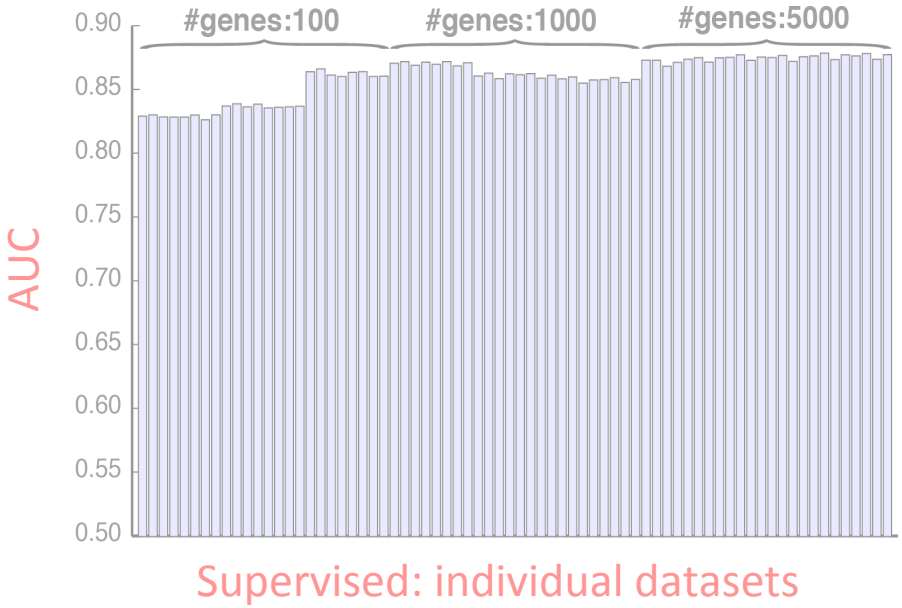
Methods: Both Genotype+Network

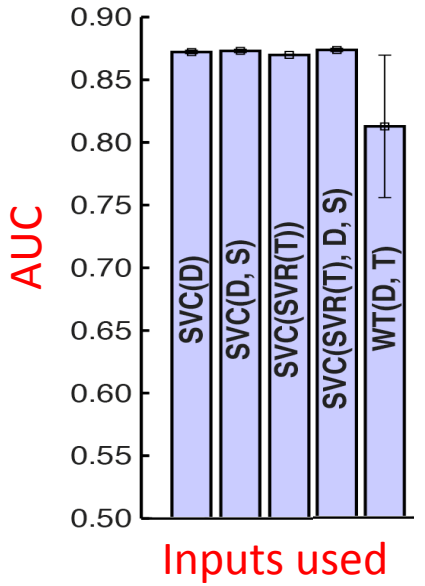


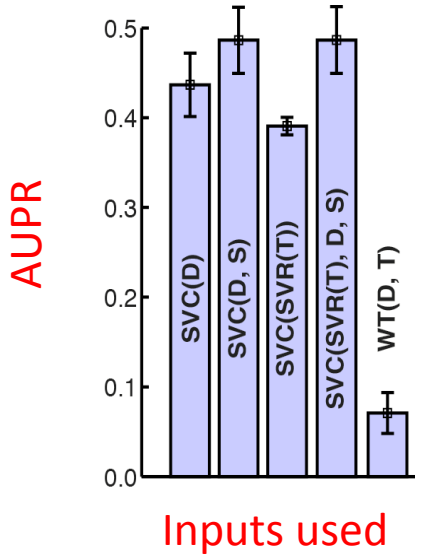
Results: Performance



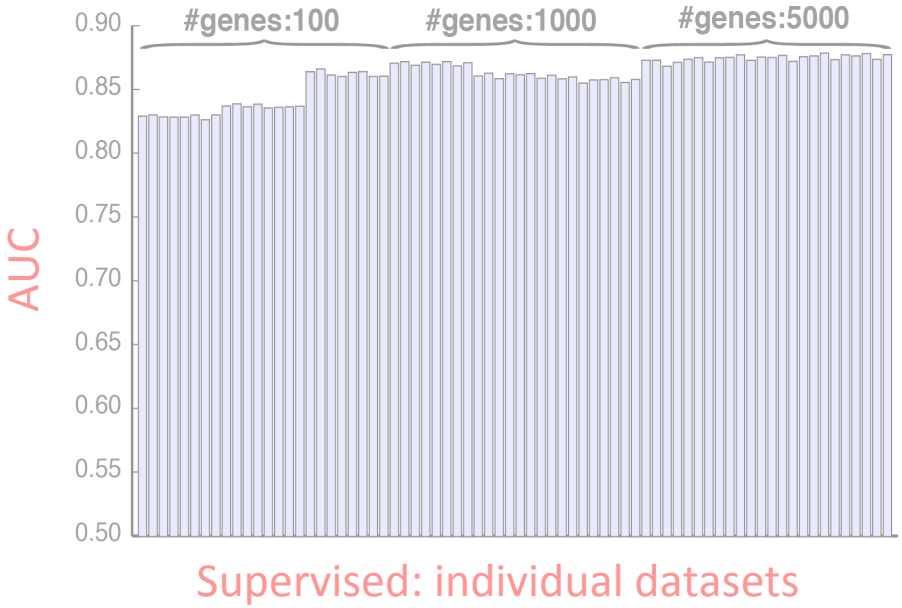
Results: Performance

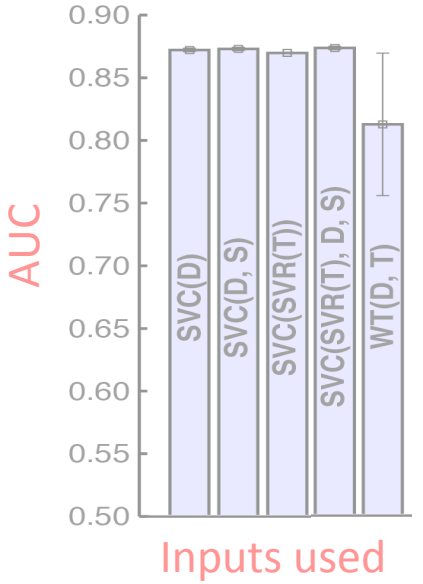


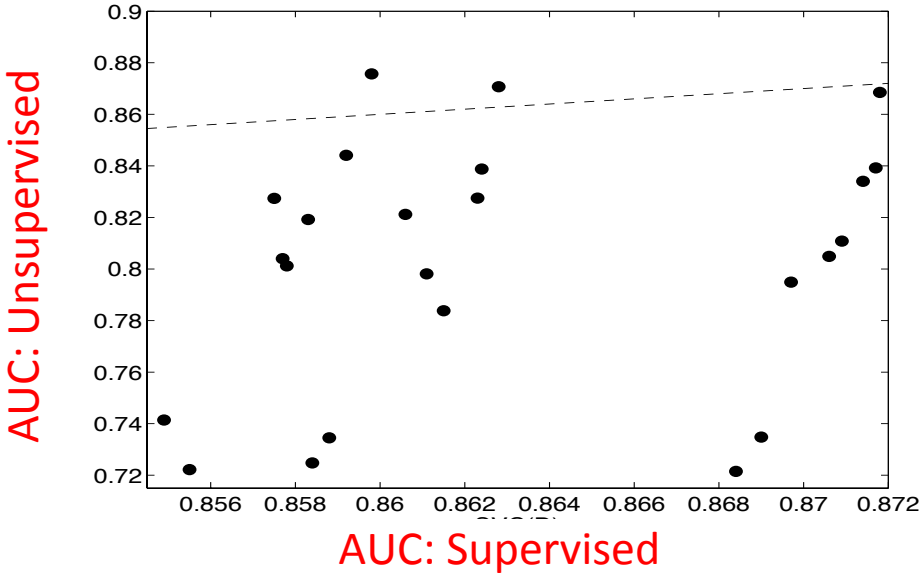


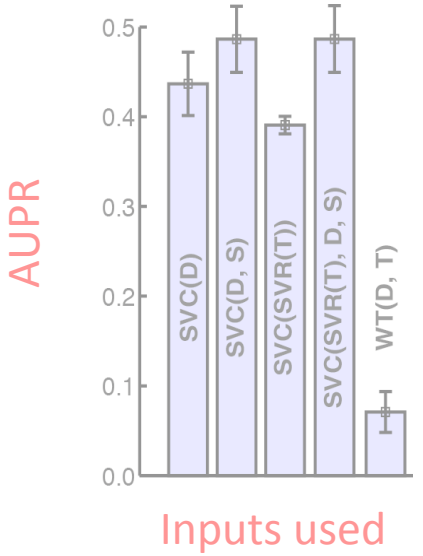


Results: Performance

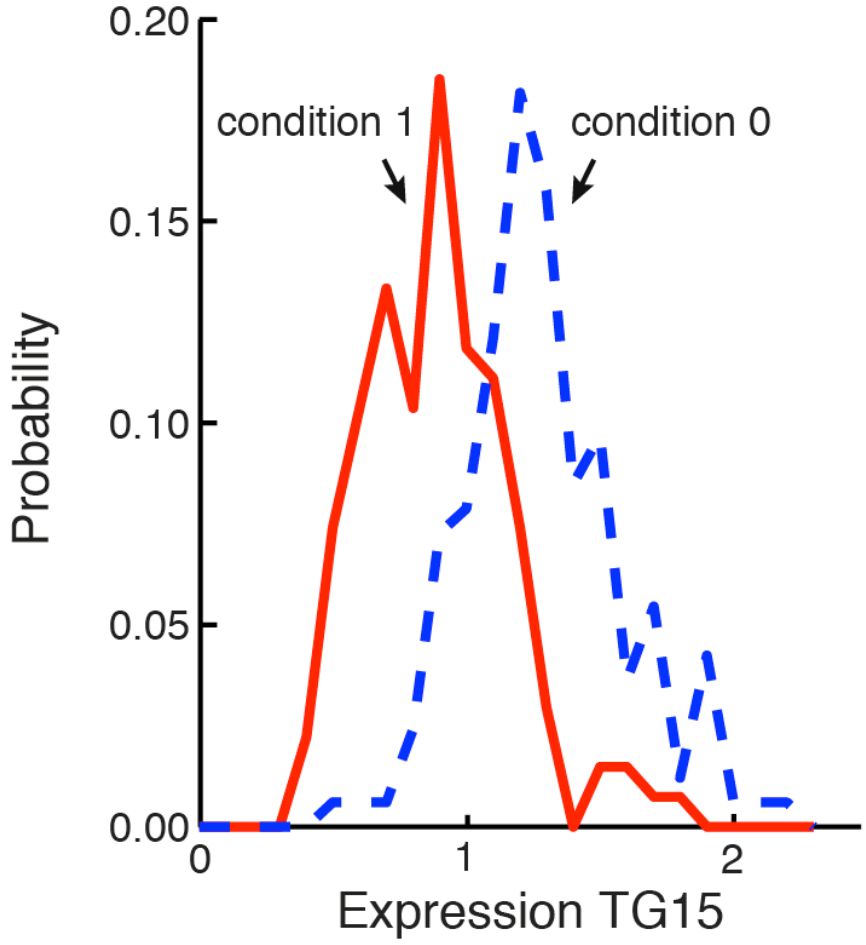


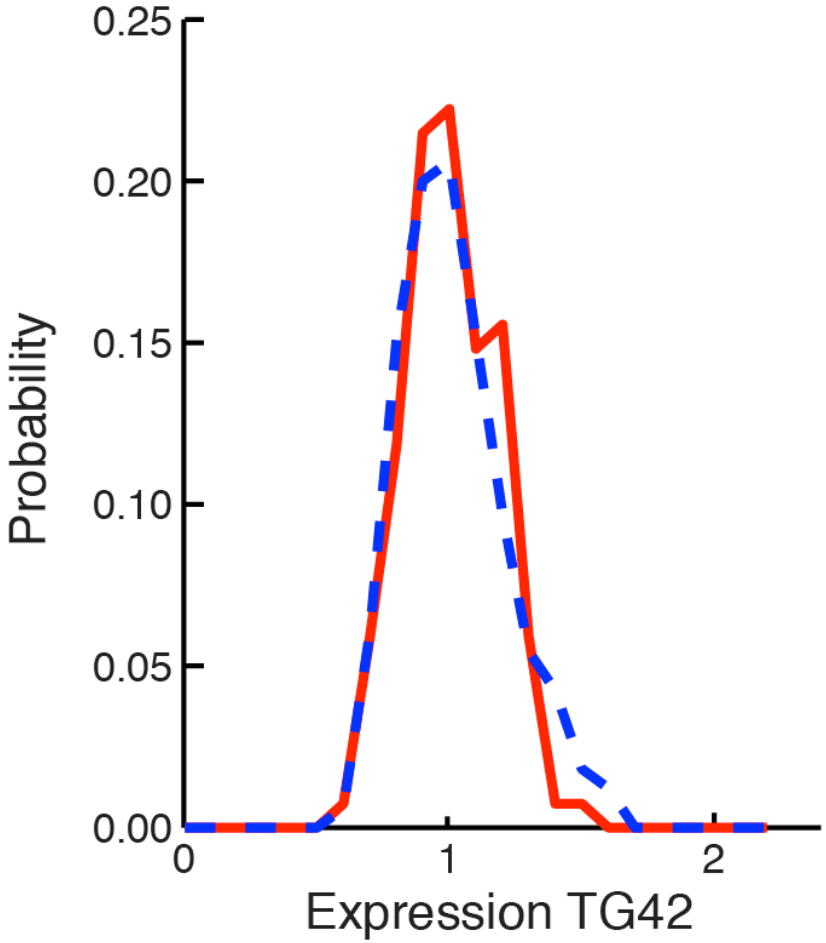




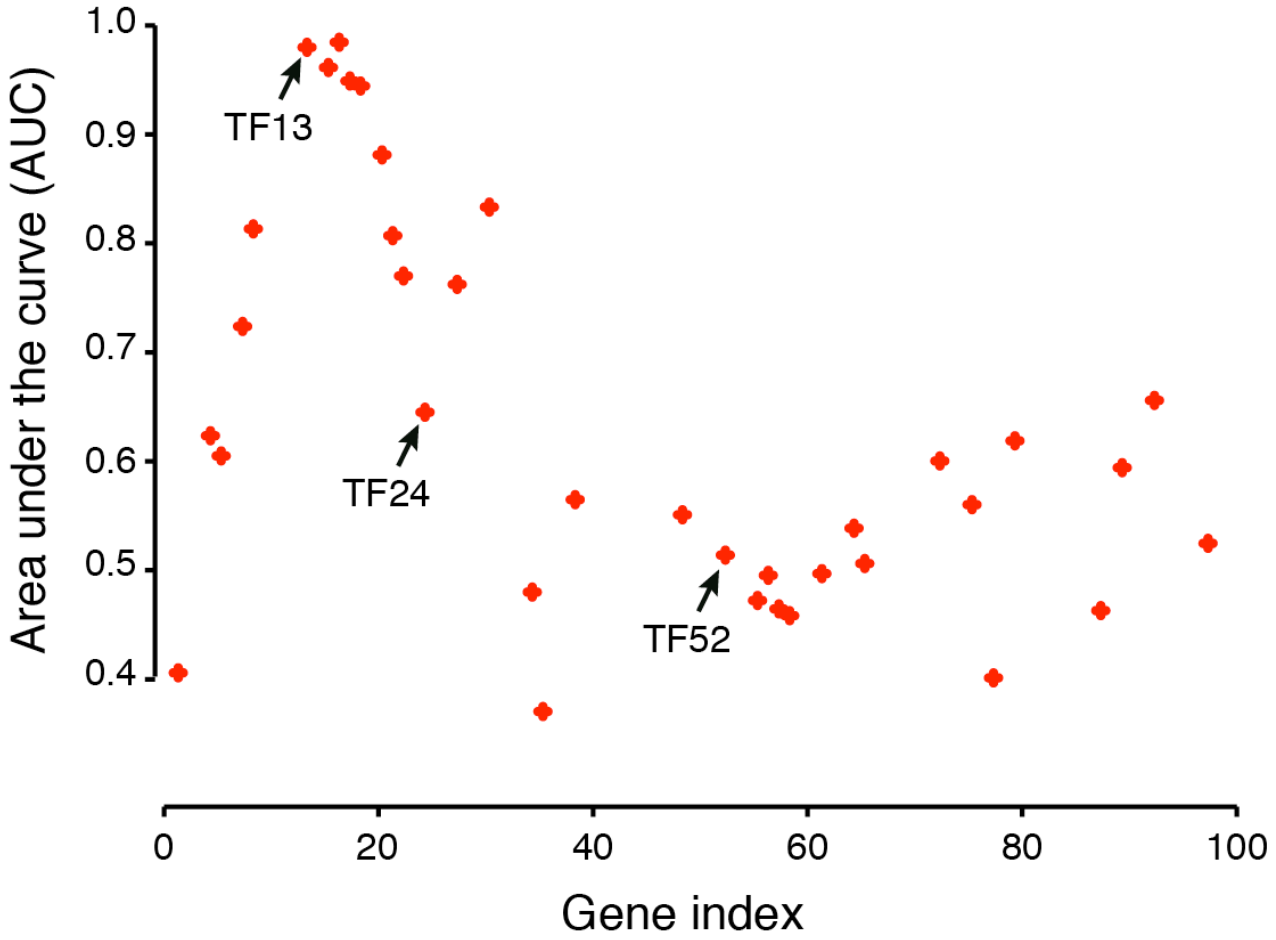


Results: Effect of Regulator Genotype

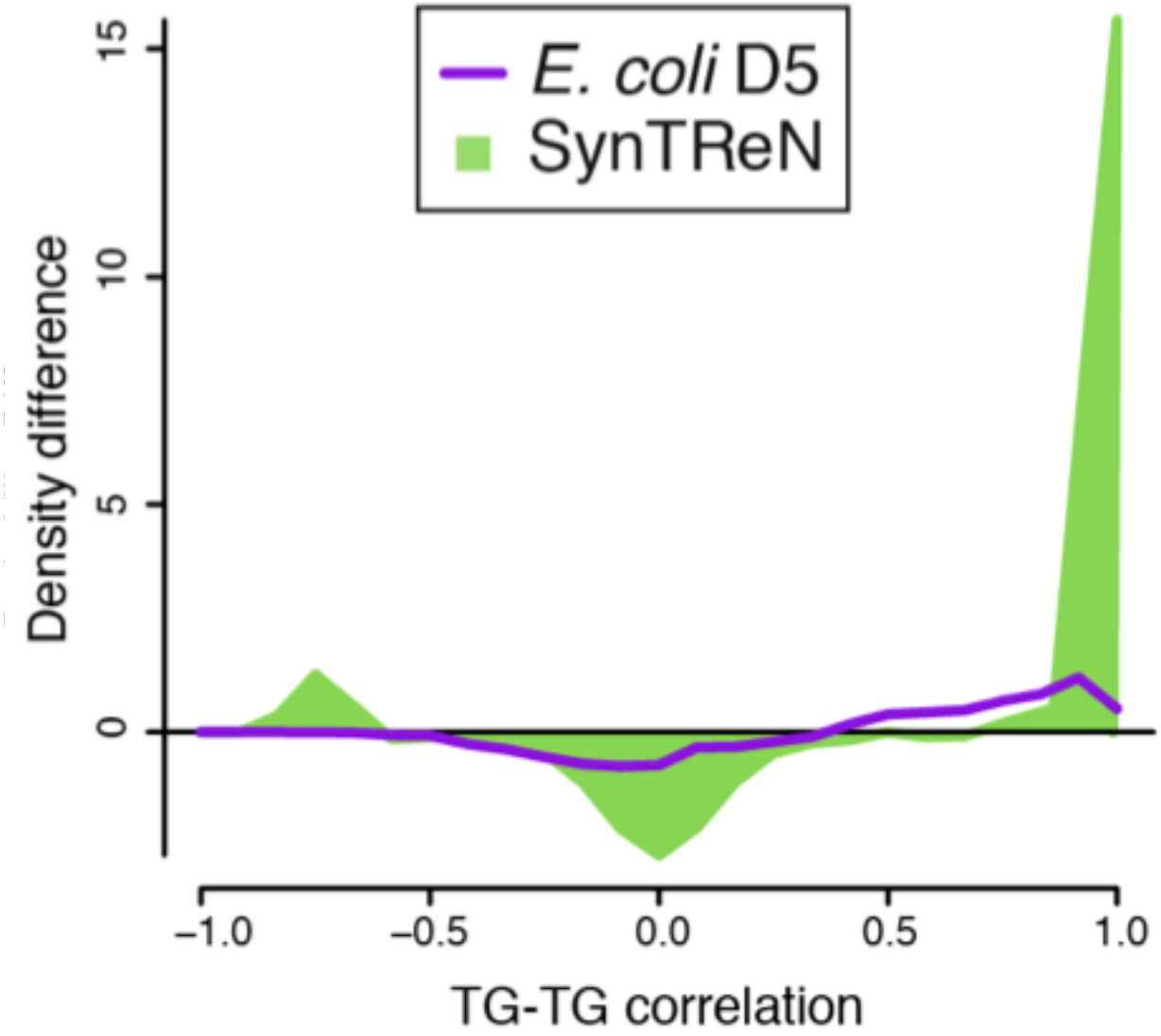




Results: Chromosomal Proximity



Results: Correlation vs Co-Regulation



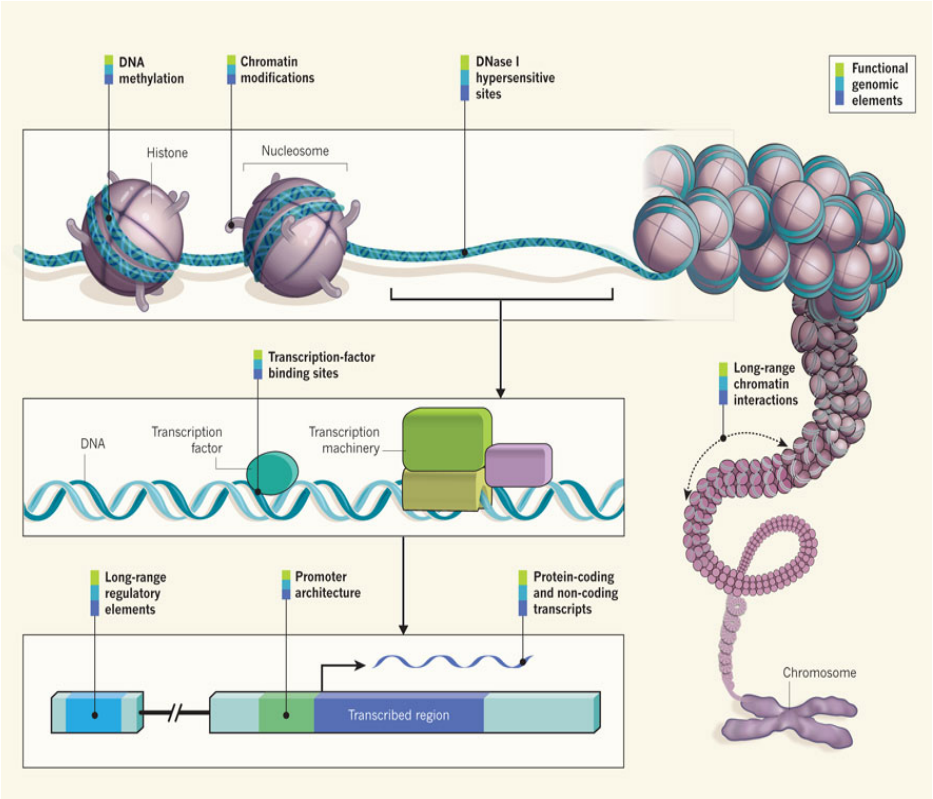
Discussion: Performance

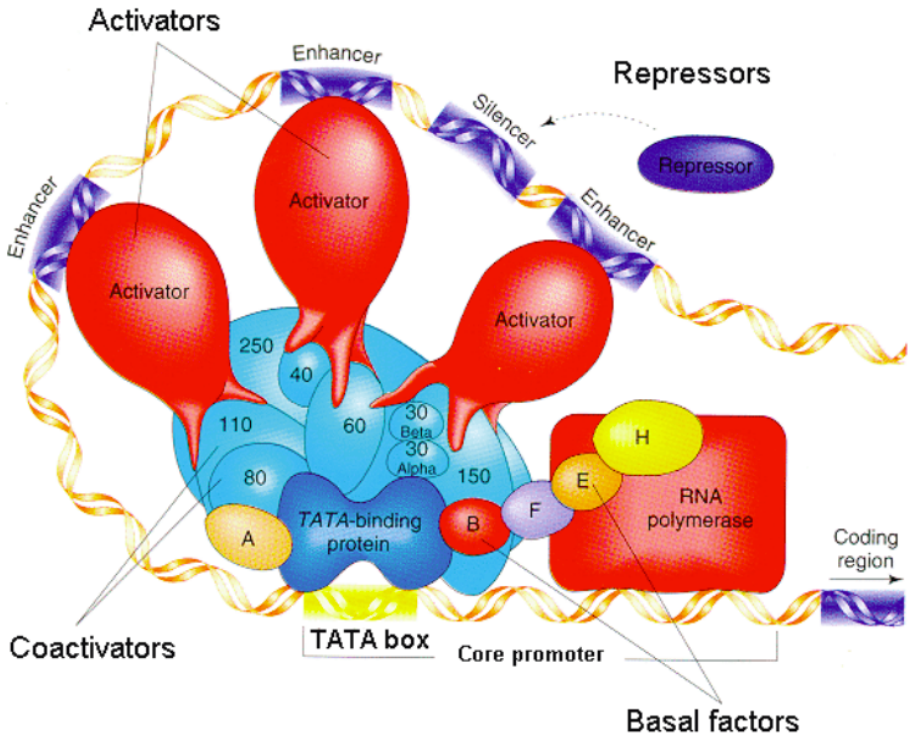
- Supervision increases performance on SGS
- Robust against preprocessing, parameters
- Expression data most informative
  - Genotype information did not help
  - Less information for close TFs?
  - Deducible from expression in supervised setup?
  - Network context hardly helps

Discussion: Real vs SGS

- Network context hardly helps
  - functionally related TGs regulated by same TFs
  - functionally related TFs regulate similar TGs
  - TG overlaps ⇔ correlated expression of TFs
- TGs regulated by same TF show extreme correlation in SGS
  - in comparison to bacteria
  - no correlation in eucaryotes!

Discussion: Complexity of Transcription





Discussion: Potential improvements

- Realistic network topologies?
- Careful parametrization of models?
- Complex genotypes & effects?
- Alternative splicing, protein networks?
- What else affects expression?
  - Methylation?
  - 3D DNA-DNA contacts
  - …

Acknowledgements

- Robert Küffner
- Pegah Tavakkolkhah
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