



**Aalto University**  
School of Science

# Multiresolution Mixture Modeling using Merging of Mixture Components

Prem Raj Adhikari<sup>1,2</sup>, Jaakko Hollmén<sup>1,2</sup>

Parsimonious Modelling Research Group in

<sup>1</sup>Department of Information and Computer Science  
Aalto University School of Science, Finland

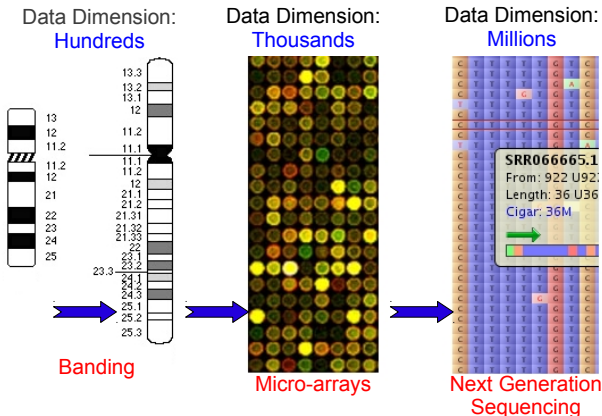
<sup>2</sup>Helsinki Institute for Information Technology (HIIT)  
{prem.adhikari,jaakko.hollmen}@aalto.fi

# Management Summary

- ▶ The multiresolution data
- ▶ Mixture Models of multiresolution data
- ▶ Experiments on two chromosomal aberrations datasets
- ▶ Summary and Conclusions

# Multiple Resolutions of Data

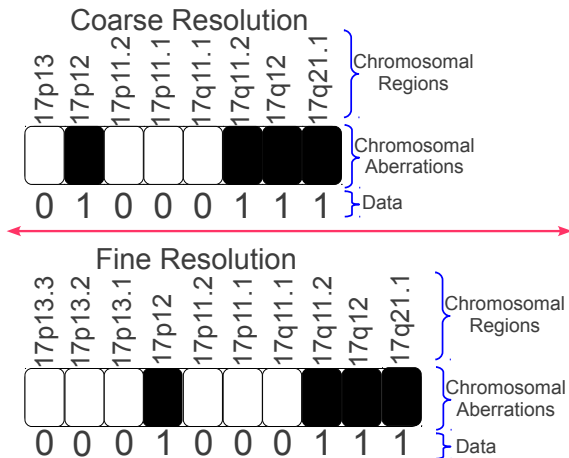
- ▶ Older Generation Technology  $\Rightarrow$  Data in Coarse Resolution
- ▶ New Generation Technology  $\Rightarrow$  Data in Fine Resolution



Different resolutions of data produced over the years.

- ▶ How to analyze data in multiple resolutions i.e. different dimensions?

# Multiresolution Data in Cancer Genomics

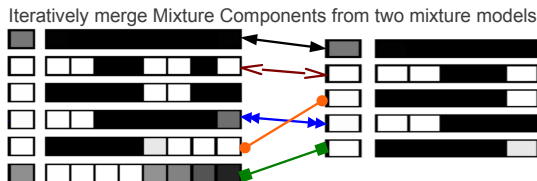


# Multiresolution Mixture Modelling Algorithm

- ▶ Finite Mixture Models of the Multivariate Bernoulli Distributions for 0-1 Data

$$P(x) = \sum_{j=1}^J \pi_j P(x|\theta_j) = \sum_{j=1}^J \pi_j \prod_{i=1}^d \theta_{ji}^{x_i} (1 - \theta_{ji})^{1-x_i}$$

- ▶ What is done?



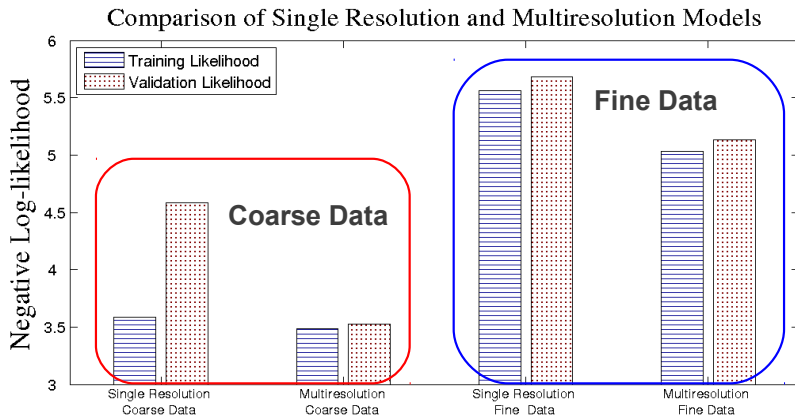
Until the change in KL divergence is very small

- ▶ How is it done?
- ▶ Fast approximation of KL divergence (P. R. Adhikari, J. Hollmén, DS 2012)

$$KL = \sum_{i \in X^*} \pi_{\alpha} \prod_{m=1}^d \left( \alpha_m^{X_{im}^*} (1 - \alpha_m)^{(1-X_{im}^*)} \right) - \sum_{i \in Y^*} \pi_{\beta} \prod_{n=1}^{d'} \left( \beta_n^{Y_{in}^*} (1 - \beta_n)^{(1-Y_{in}^*)} \right)$$

- ▶ Retrain the mixture models in different resolutions

# Performance of Multiresolution Mixture Model



Better generalization through multiresolution mixture models

# Summary and Conclusions

- ▶ The sources of multiresolution data
- ▶ Multiresolution mixture modelling using merging of mixture components
- ▶ Fast approximation of KL divergence as the criterion to merge the components
- ▶ Better generalization over single resolution mixture models

# Thanks, Questions, Comments and Feedback

