



# Expectation Maximization

## 1 Why

I am doing a homework on this.

## 2 Definition

Let  $Z$  and  $X$  be non-empty finite sets. We want to model a distribution  $p^\theta : Z \times X \rightarrow \mathbf{R}$ . We parameterize a family of distributions by a parameter  $\theta$ . We have a dataset  $(x^1, \dots, x^n)$ . Given a parameter  $\theta^0$ , we want to solve

$$\begin{array}{ll} \text{find} & \theta \\ \text{to maximize} & \sum_{k=1}^n \mathbf{E}_{p_{z|x}^{\theta^0}(z, x^k)} [\log p^\theta(z, x)] \end{array}$$

### 2.1 Binary Gaussian Mixture Example

The