Gaussian mixture models unit:

- Everything you need to know about probability (last week Friday)
- Lab activity: From histograms to Gaussians (Monday)
- Mixture models (**today**)
- Expectation-maximization (Friday)

Today:

- The density estimation task
- Gaussian mixture models
- The general idea of Expectation-Maximization
- The algorithm

Lessons of this unit

- Gaussian models as representative example of density estimation.
- Mixture models
- Unsupervised learning in data with latent variables
- Expectation-maximization as an iterative algorithm in the absence of a closed-form solution

Gaussian model family:

$$p(x) = \mathcal{N}(x \mid \mu, \sigma) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\frac{-(x-\mu)^2}{2\sigma^2}}$$

Multivariate Gaussian model family:

$$p(\boldsymbol{x}) = \mathcal{N}(\boldsymbol{x} \mid \boldsymbol{\mu}, \boldsymbol{\Sigma}) = \frac{1}{\sqrt{(2\pi)^D |\boldsymbol{\Sigma}|}} e^{\frac{-(\boldsymbol{x}-\boldsymbol{\mu})^T \Sigma^{-1} (\boldsymbol{x}-\boldsymbol{\mu})}{2}}$$

Gaussian mixture model family:

$$p(x) \text{ or } p(x, \boldsymbol{\mu}, \boldsymbol{\sigma}) = \sum_{i=0}^{K-1} \pi_i \mathcal{N}(x \mid \mu_i, \sigma_i)$$

Coming up:

Read textbook portions about Gaussian mixture models and EM (due end-of-day Tues, Feb 21)

Do logistic regression assignment (due end-of-day Wed, Feb 15)

Do reading and response assignment (due end-of-day Fri, Feb 17)

Project dataset confirmation *(due end-of-day Fri, Feb 17)*

(GMM assignment forthcoming . . .)