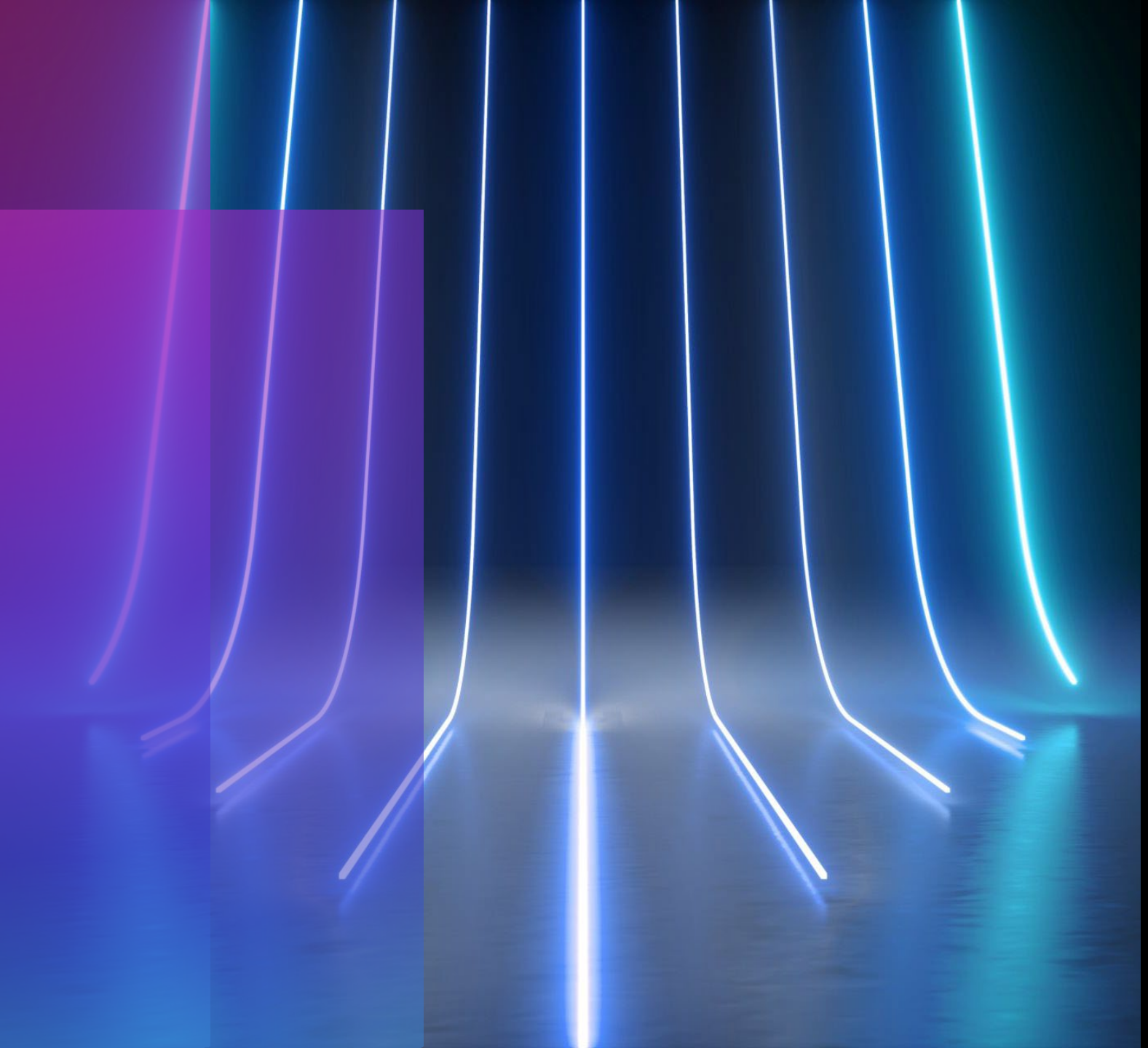


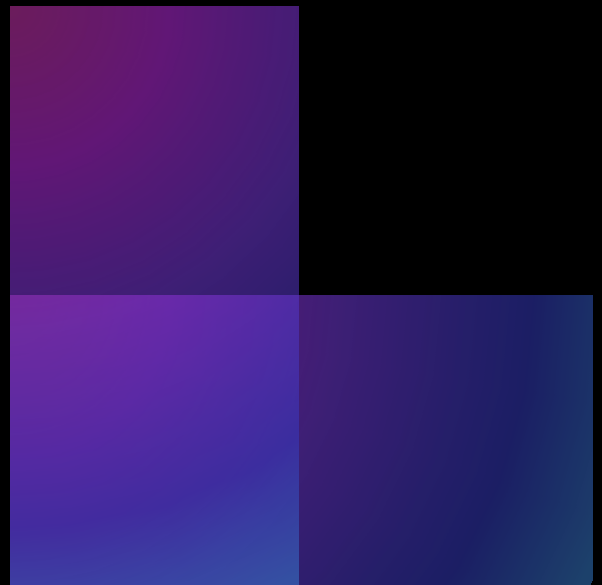
Expectation-Maximization (EM) Algorithm

Expectation-Maximization (EM) Algorithm

iterative way to find maximum-likelihood estimates for model parameters when the data is incomplete or has some missing data points or has some hidden variables

EM chooses some random values for the missing data points and estimates a new set of data

These new values are then recursively used to estimate a better first date, by filling up missing points, until the values get fixed.



Steps

Estimation Step

(E–Step)

Maximization step

(M – Step)

Estimation step

- Initialize mean (μk), covariance matrix (Σk) and mixing coefficient (πk)
- calculate the posterior probabilities of data points belonging to each centroid using the current parameter values.
- Estimate the values of the latent variables γ k based on the current parameter values

Maximization Step

- Update μk, Σk, πk using estimated latent variable γk.
- update the mean of the cluster point (μk) by taking the weighted average of data points using the corresponding latent variable probabilities
- update the covariance matrix (Σk) by taking the weighted average of the squared differences between the data points and the mean, using the corresponding latent variable probabilities.
- update the mixing coefficients (πk) by taking the average of the latent variable probabilities for each component

Repeat the E-step and M-step until convergence

iterate between the estimation step and maximization step

until the change in the log-likelihood or

the parameters falls below a predefined threshold or

until a maximum number of iterations is reached.

The Expectation-Maximization (EM) algorithm is a general framework and can be applied to various models, including Gaussian Mixture Models (GMMs).

estimation step, update the latent variables based on the current parameter values

maximization step, update the parameter values using the estimated latent variables