① visualization results

② K-means cross validation → related reading

③ mfcc revisited

3.1 normal distribution

univariate: $\underset{\sim}{x} = (x_1, \cdots, x_n)^T$

data

$\bar{x}_n = \frac{1}{n}\sum_{i=1}^{n} x_i$

$s_n^2 = \frac{1}{n-1}\sum_{i=1}^{n} (x_i - \bar{x})^2$

univariate normal:

$X \sim N(\mu, \sigma^2)$

dist'n "song 1"

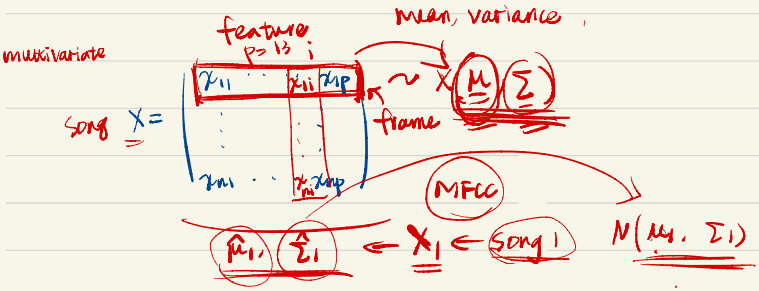
X_1

frame 1

frame M

x_1 ⋮ x_M

song 1 $\in X \sim N(\mu, \sigma^2)$



$\hat{\mu}_{1000}, \hat{\Sigma}_{1000} \leftarrow X_{1000} \leftarrow$ song 1000 $\quad N(\mu_{1000}, \Sigma_{1000})$

$\mu = (\mu_1, \cdots, \mu_p)^T$

$\mu_j = \frac{1}{n}\sum_{j=1}^{n} x_{ji}$

$D_{KL}(N_0 \| N_1) + D_{KL}(N_1 \| N_0)$