ML Assignment : Theory

2) a) Naive Bayes assumption is that the features are independent to each other.

(i) It helps in predicting the class from a test data.

(ii) When it the assumption is independent, then it peforms better when compare to other models like logistic regression.

(iii) It needs less training data, when features are independent.

Ex:- Consider a dataset based on the weather conditions person will play the game & not.

* features are :-

(i) Hot (Temperature).

(ii) Rainy (outlook).

If the temperature is 'hot', then no need of doing anything with humidity & outlook of 'Rainy'.

3) d)

(i) Given, $\sigma_{ij} = 0$, $\sigma_{ii} = \sigma_i^2$.

$$\Sigma = \mathrm{diag}(\sigma_1^2, \ldots \sigma_d^2)$$

$$= \begin{pmatrix} \sigma_1^2 & 0 - 0 & 0 \\ 0 & \sigma_2^2 & 0 & 0 \\ 0 & 0 & \sigma_3^2 & 0 \\ 0 & 0 & 0 & \sigma_d^2 \end{pmatrix}$$

$$|\Sigma| = \prod_{i=1}^{d} \sigma_i^2 .$$

$\Sigma^{-1} = \text{diag}(1/\sigma_1^2, \ldots 1/\sigma_d^2)$

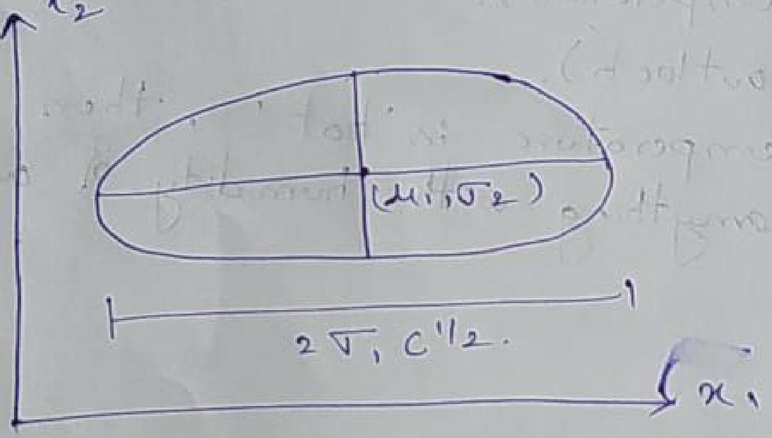
density as :-

$$p(x) = \frac{1}{(2\pi)^{d/2}|\Sigma|^{1/2}} \exp\left[-\frac{1}{2}(x-\mu)^t \left[\text{diag}(1/\sigma_1^2 - 1/\sigma_d^2)\right][x-\mu]\right]$$

$$= \frac{1}{\prod_{i=1}^{d} \sqrt{2\pi}\sigma_i} \exp\left[-\frac{1}{2}\sum_{i=1}^{d}\left(\frac{x_i - \mu_i}{\sigma_i}\right)^2\right]$$

ii) Contours of density are concentric ellipses in d dimensions whose centers are at $(\mu_1 \ldots \mu_d)^t = \mu$, axes in the ith direction are of length $2\sigma_i\sqrt{c}$ for the density $p(x)$.

$$\frac{e^{-c/2}}{\prod_{i=1}^{d}\sqrt{2\pi}\sigma_i}$$



b) The structural assumption the one that most affects the trade-off between overfitting & underfitting in :-

iii) Whether we assume full class covariance matrices ~~are~~ ~~equal~~ & diagonal class covariance matrices.

c) Given, $p(x|\omega_1) = N(0,1)$.

$p(x|\omega_2) = N(1,2)$.

$\mu_1 = 0$

$\sigma_1 = 1$

$\mu_2 = 1$

$\sigma_2 = 2$.

assume equal prior probabilities., means

$p(\omega_1) = p(\omega_2) = 0.5$.