Tutorial – Normal Distribution – Bayes classifier – Various cases

Code available at -
https://github.com/bhavi289/Plotting-Multivariate-Normal-Distribution

- Find the discriminant (show it geometrically) for a two class two dimensional problem, when

(1) $\mu_1 = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mu_2 = \begin{pmatrix} 4 \\ 10 \end{pmatrix}, \Sigma_1 = \Sigma_2 = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$ with equal priors.

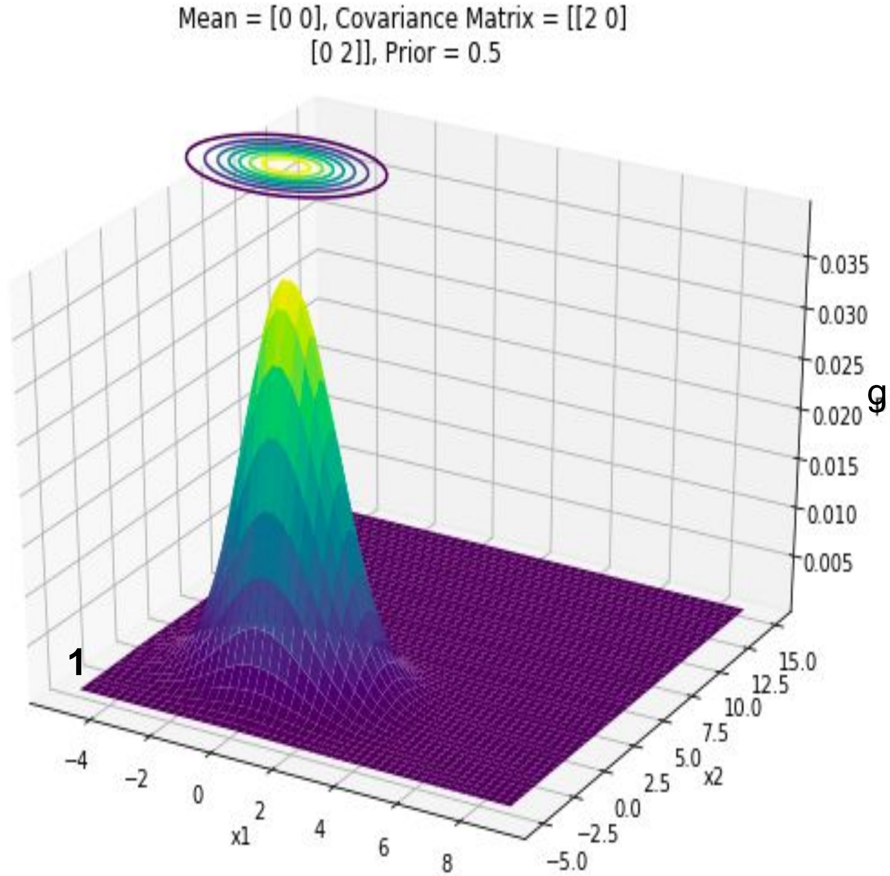
(2) Do the problem 1 when $P(\omega_1) = 0.75, and\ P(\omega_2) = 0.25.$

- (3) Take means to be same along with same Σ_1, but, let $\Sigma_2 = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$ with equal priors.

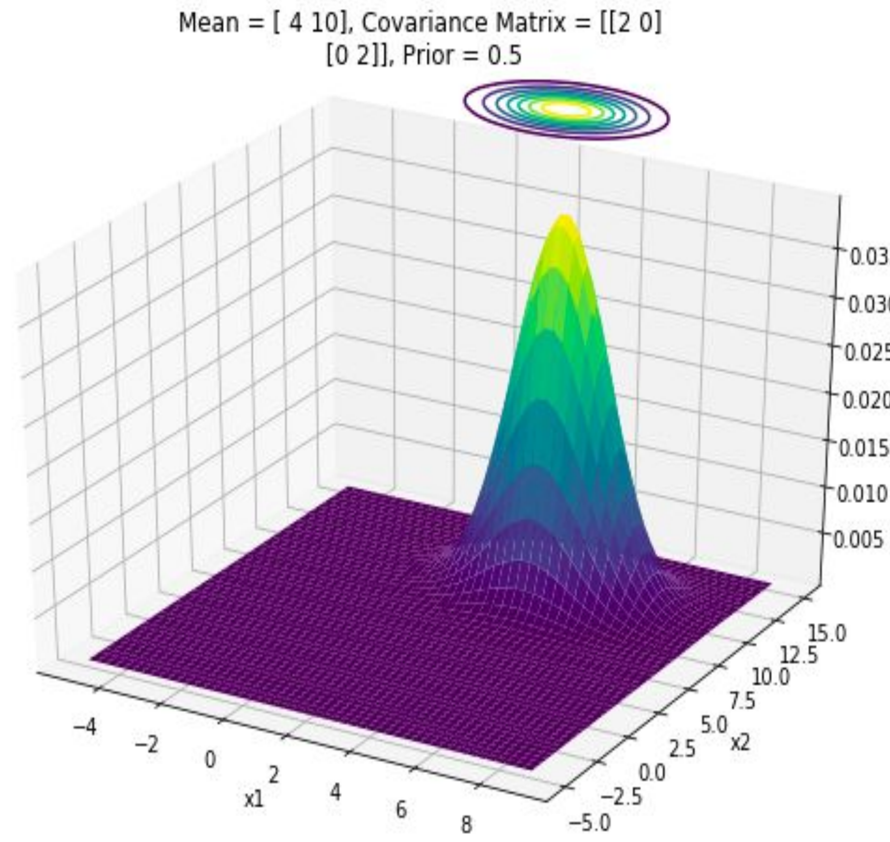
  (4) Take $\Sigma_1 = \Sigma_2 = \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$ with equal priors.

  (5) Take same means, but let $\Sigma_1 = I\ and \Sigma_2 = \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$ with equal priors.

(1) $\mu_1 = \begin{pmatrix}0\\0\end{pmatrix}, \mu_2 = \begin{pmatrix}4\\10\end{pmatrix}, \Sigma_1 = \Sigma_2 = \begin{bmatrix}2 & 0\\0 & 2\end{bmatrix}$ with equal priors.

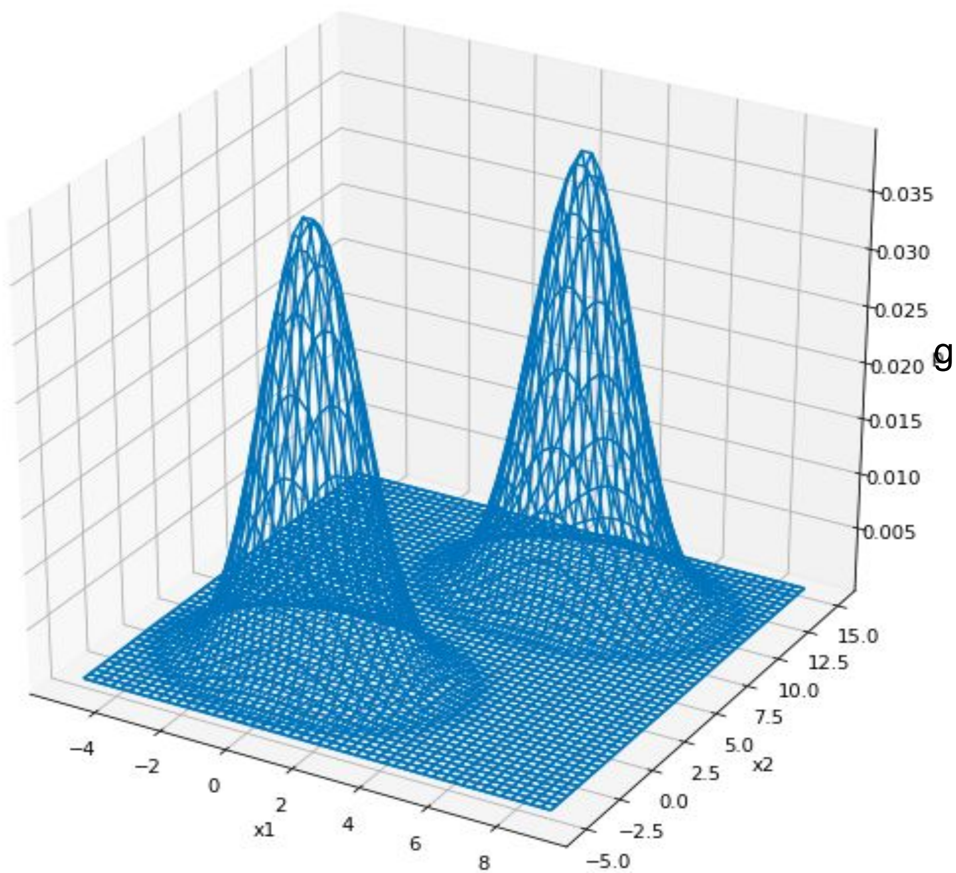


g1(x)

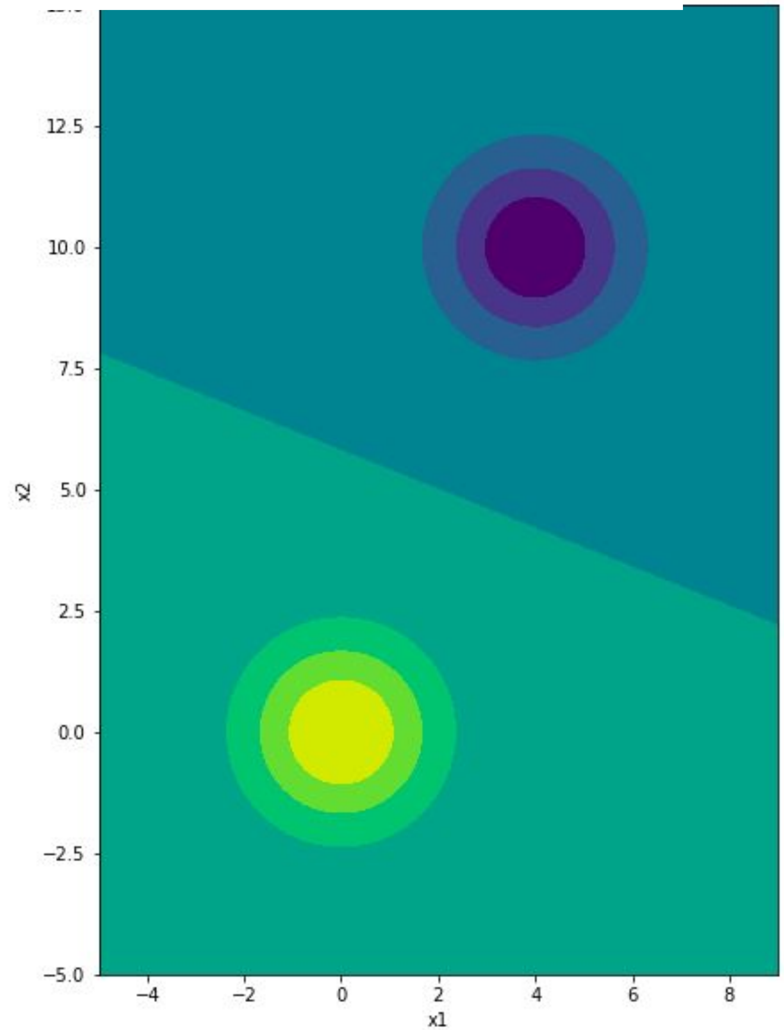


g2(x)

(1) $\mu_1 = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mu_2 = \begin{pmatrix} 4 \\ 10 \end{pmatrix}, \Sigma_1 = \Sigma_2 = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$ with equal priors.



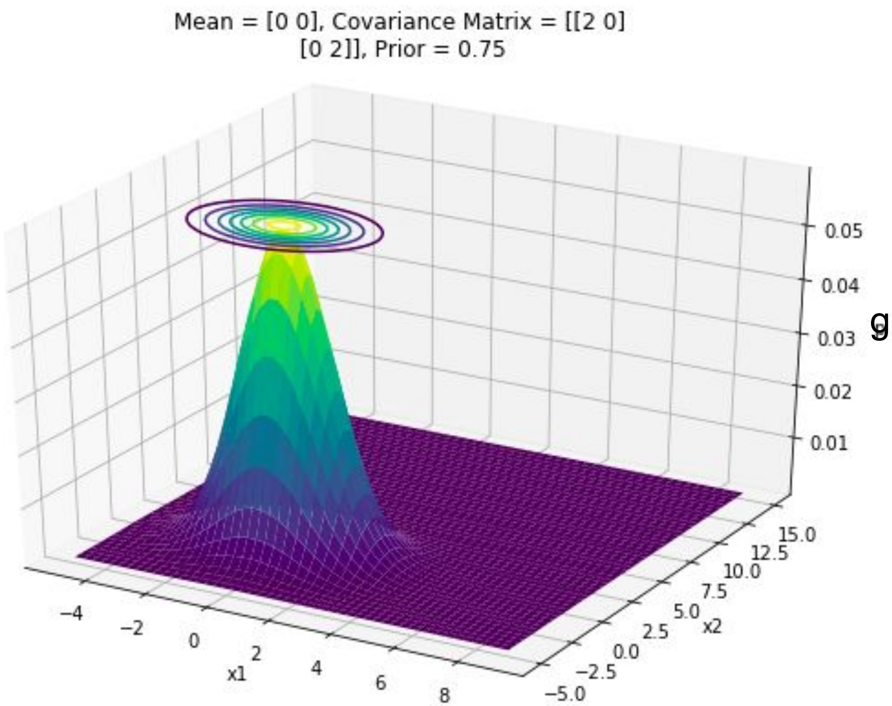
g1(x) and g2(x)



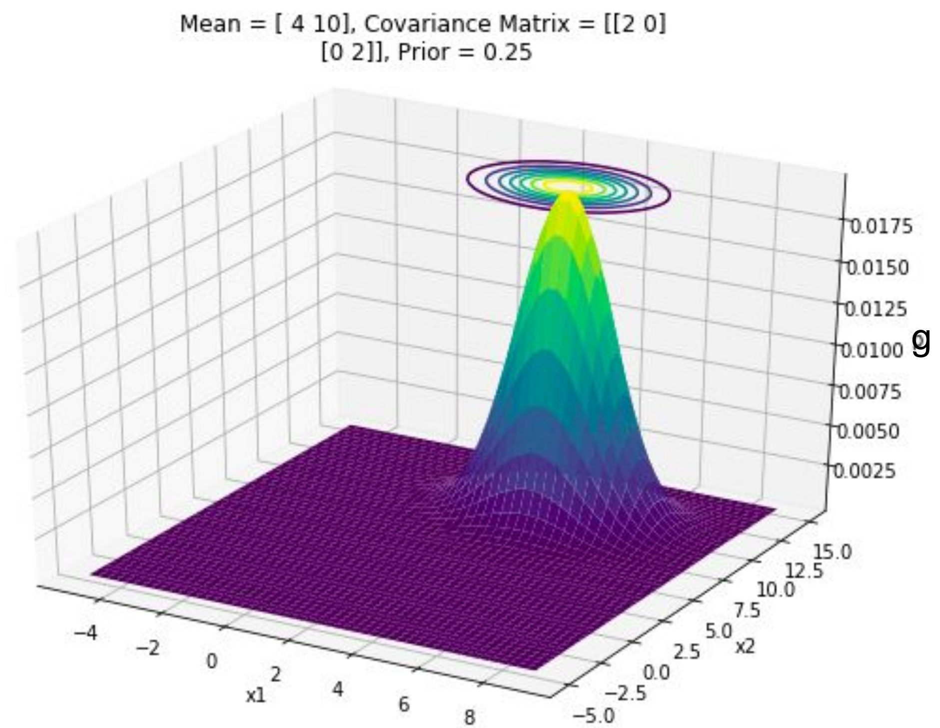
Decision boundary

(2) Do the problem 1 when

$$P(\omega_1) = 0.75, and\ P(\omega_2) = 0.25.$$



g1(x)



g2(x)

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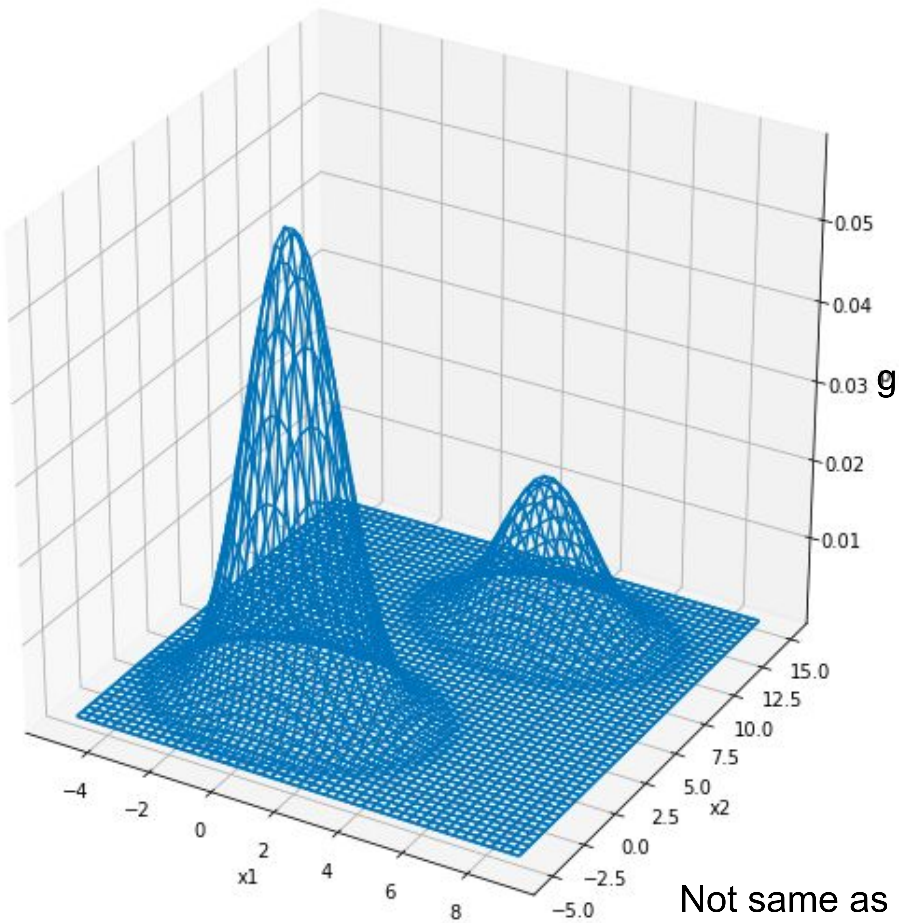
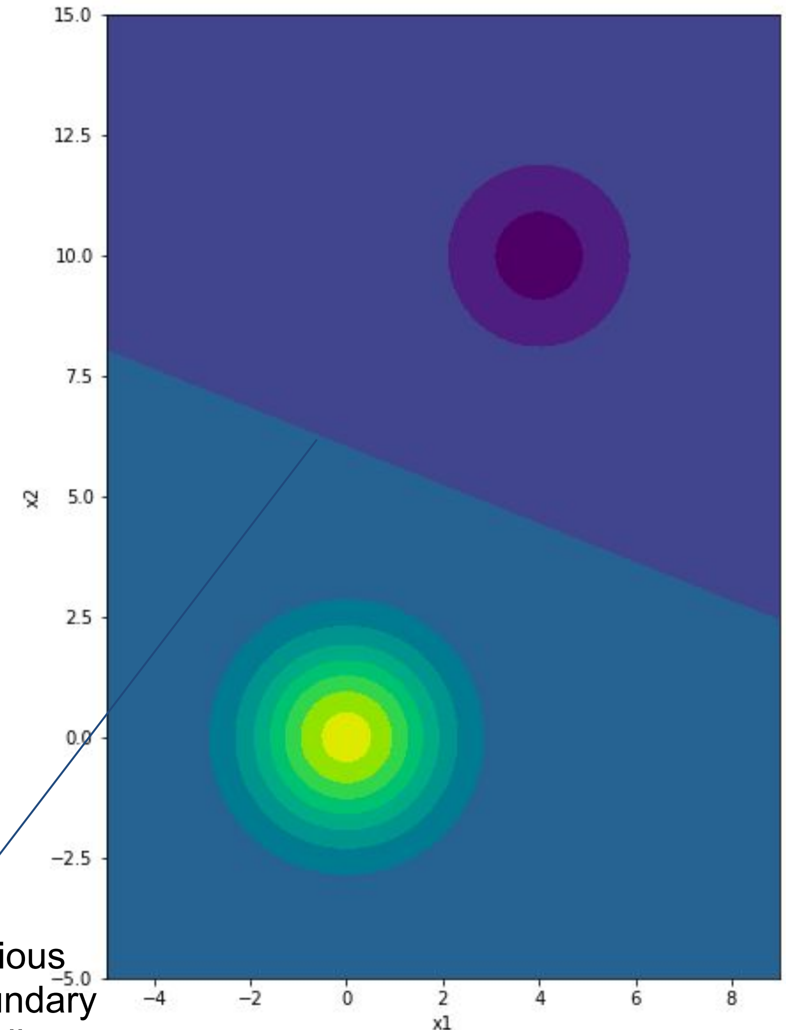


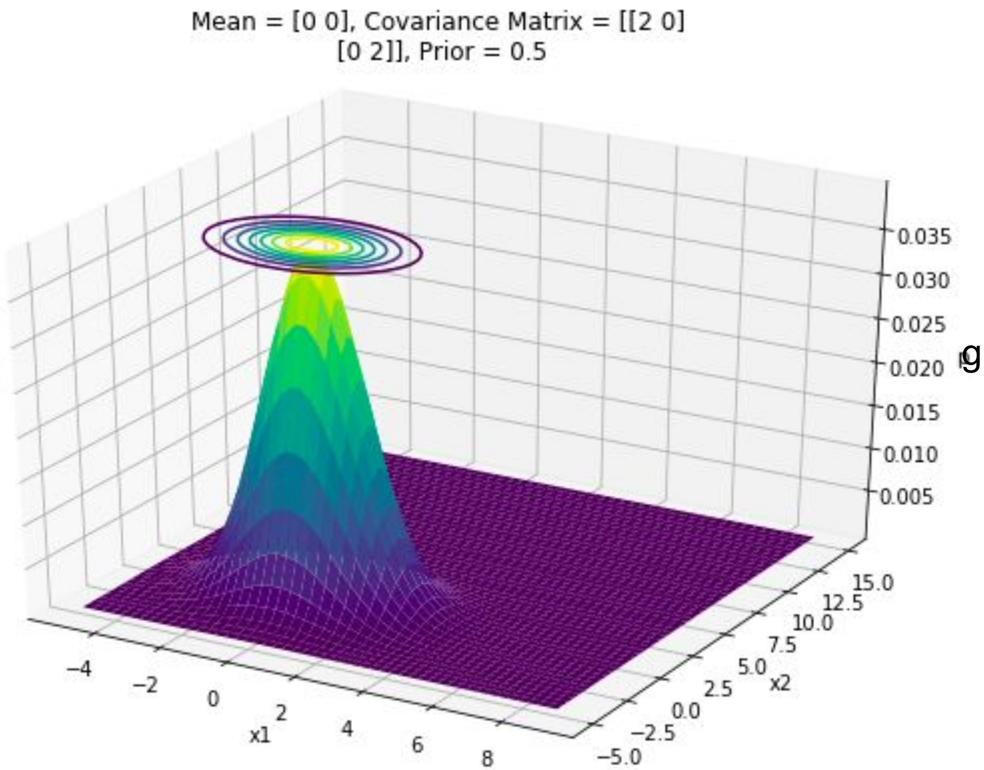
g1(x) and g2(x)

Not same as previous one. Decision boundary shifts up(very small shift)

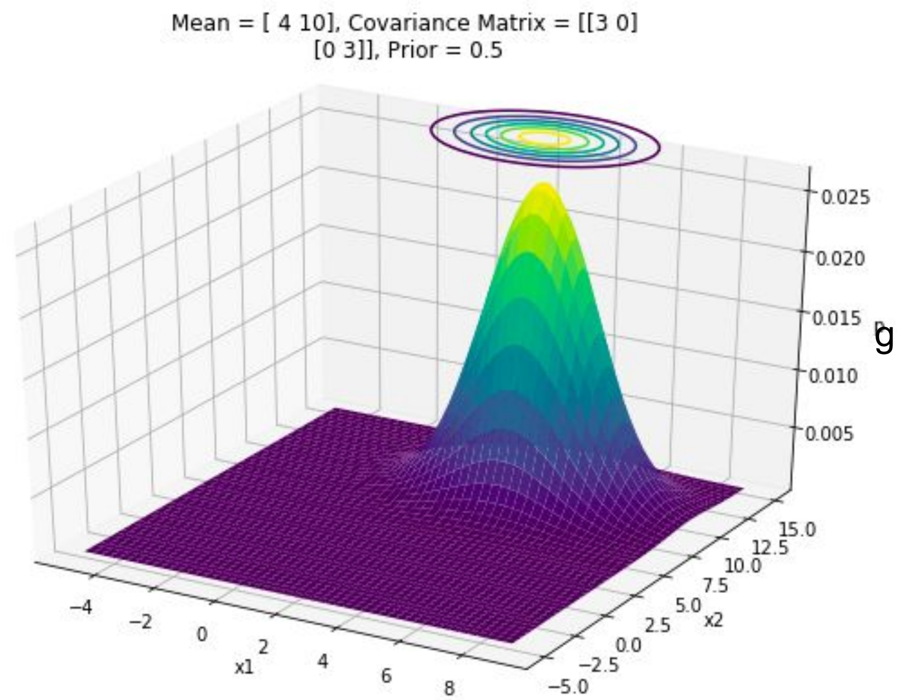


Decision boundary

(3) Take means to be same along with same Σ_1, but, let $\Sigma_2 = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$ with equal priors.



g1(x)



g2(x)

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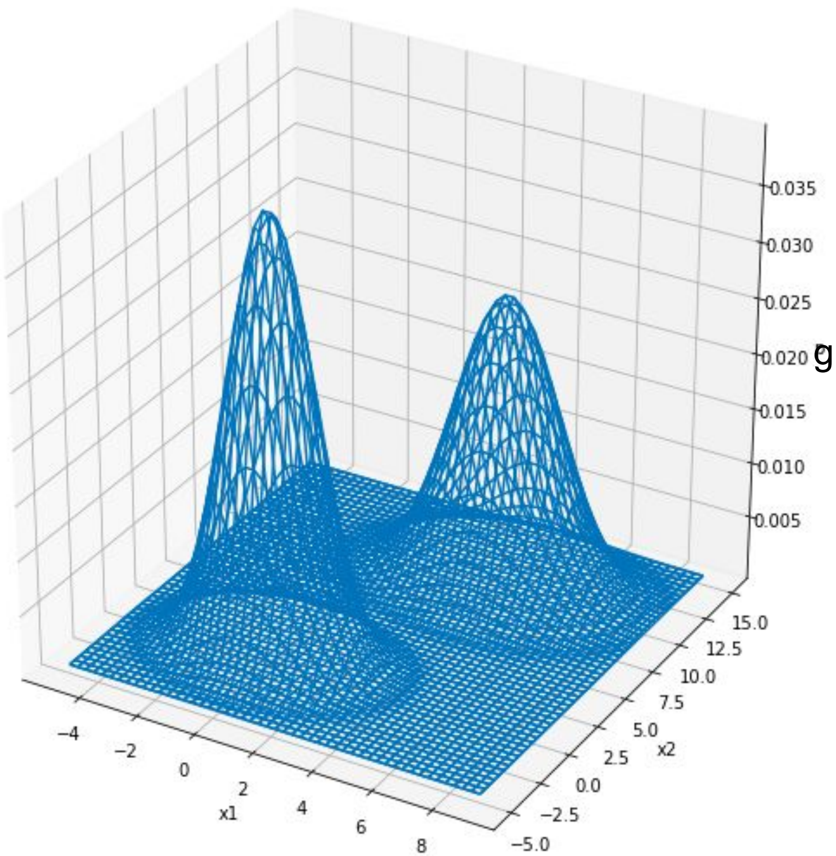
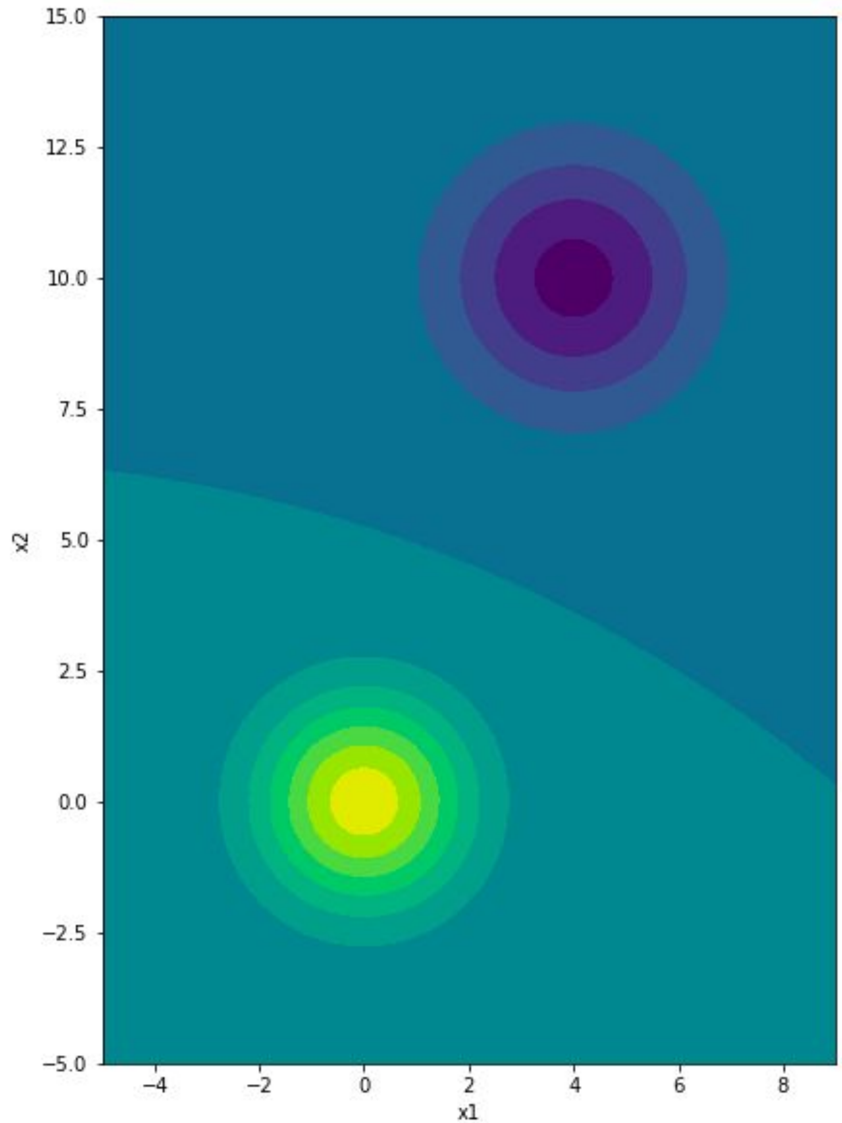


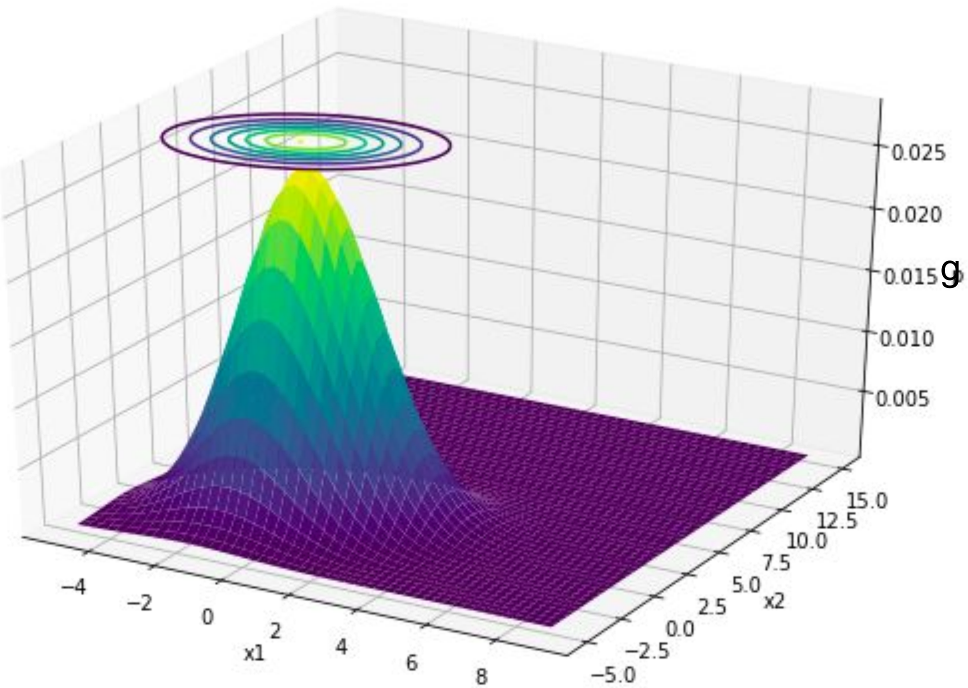
g1(x) and g2(x)



Decision boundary

(4) Take $\Sigma_1 = \Sigma_2 = \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$ with equal priors.

Mean = [0 0], Covariance Matrix = [[3 1]
[1 3]], Prior = 0.5



g1(x)

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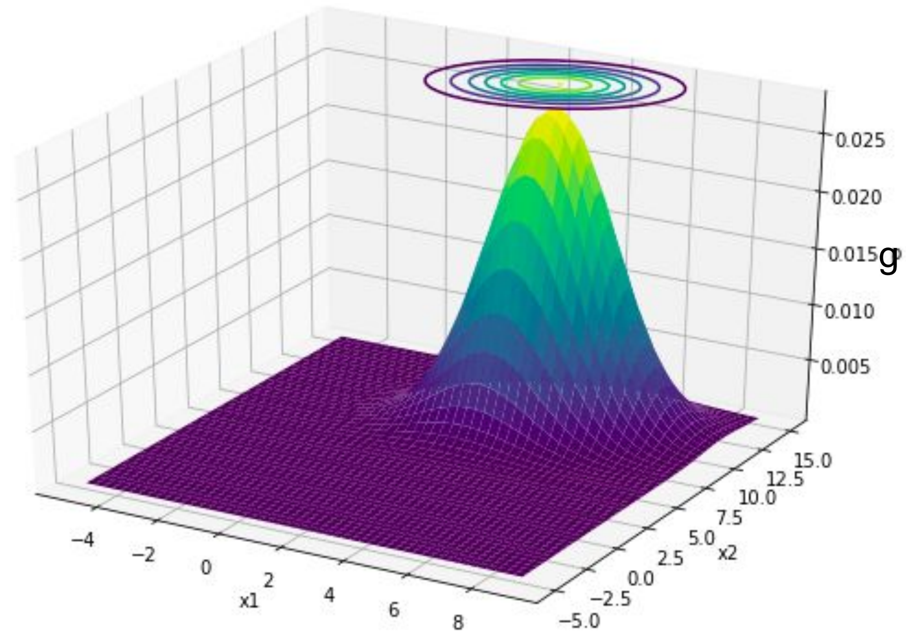
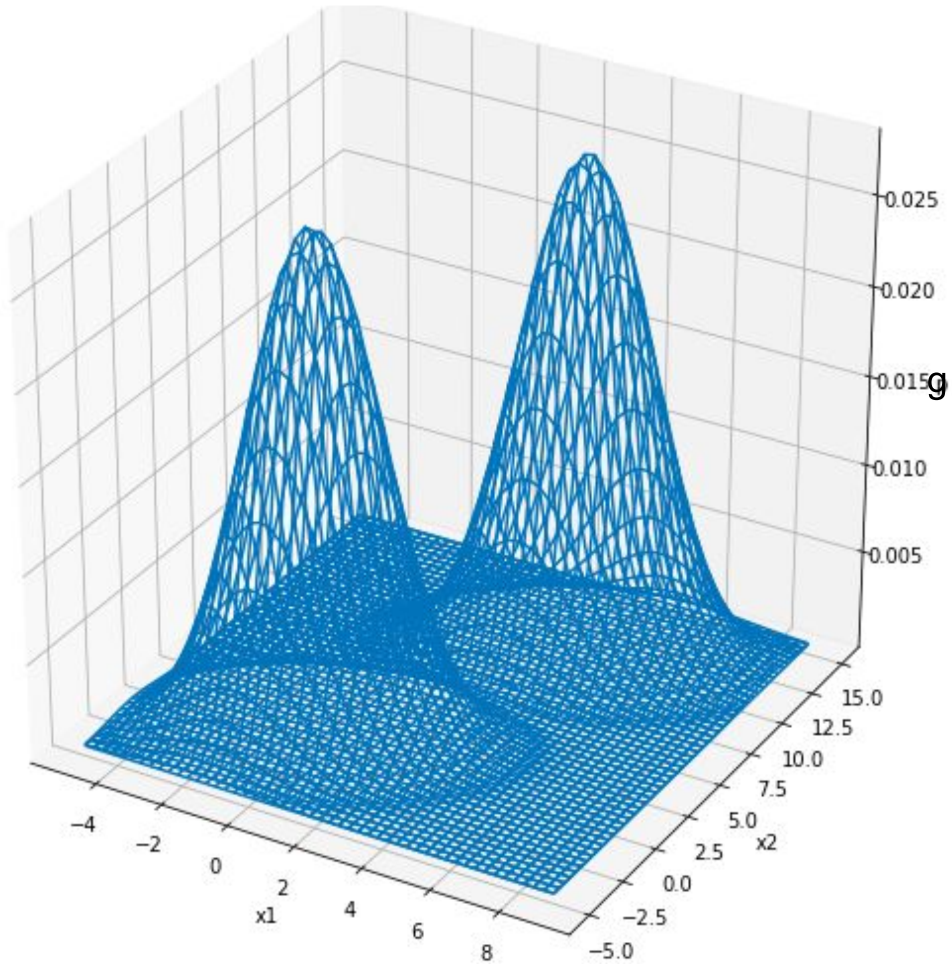
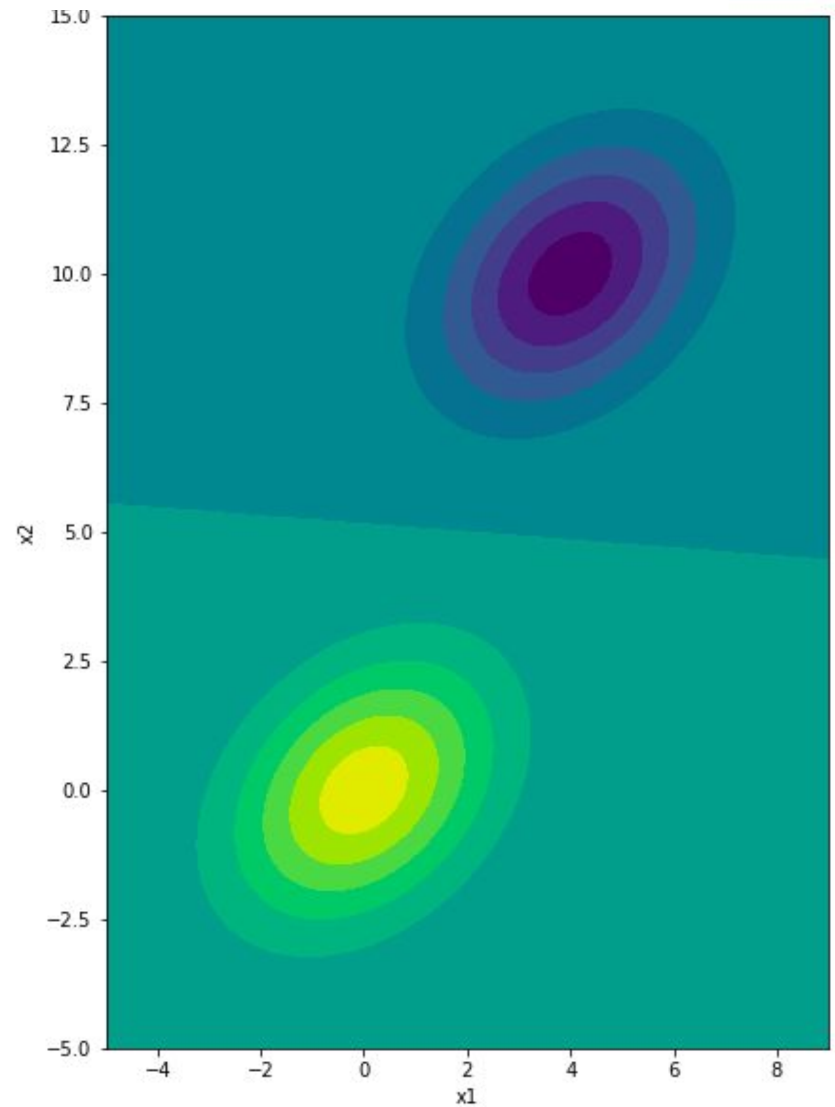


g2(x)

(4) Take $\Sigma_1 = \Sigma_2 = \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$ with equal priors.

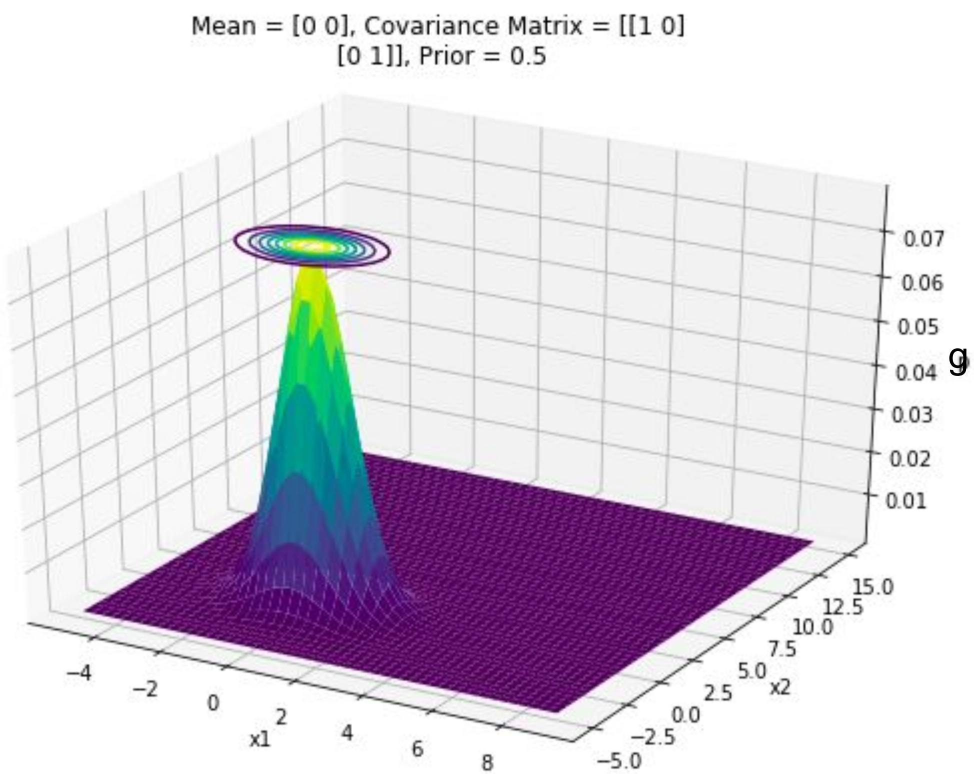


g1(x) and g2(x)

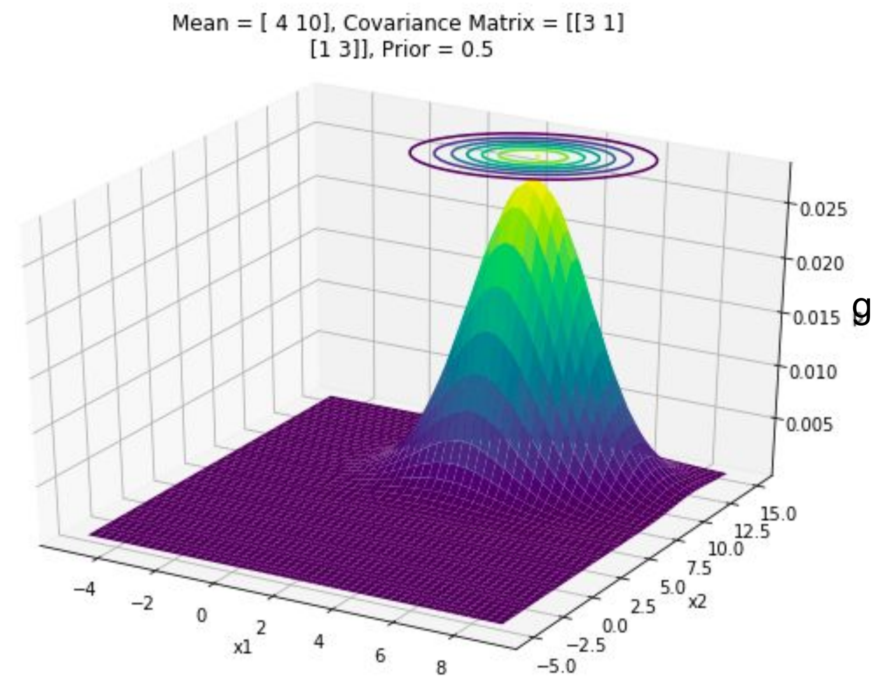


Decision boundary

(5) Take same means, but let $\Sigma_1 = I \; and \Sigma_2 = \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$ with equal priors.



g1(x)



g2(x)

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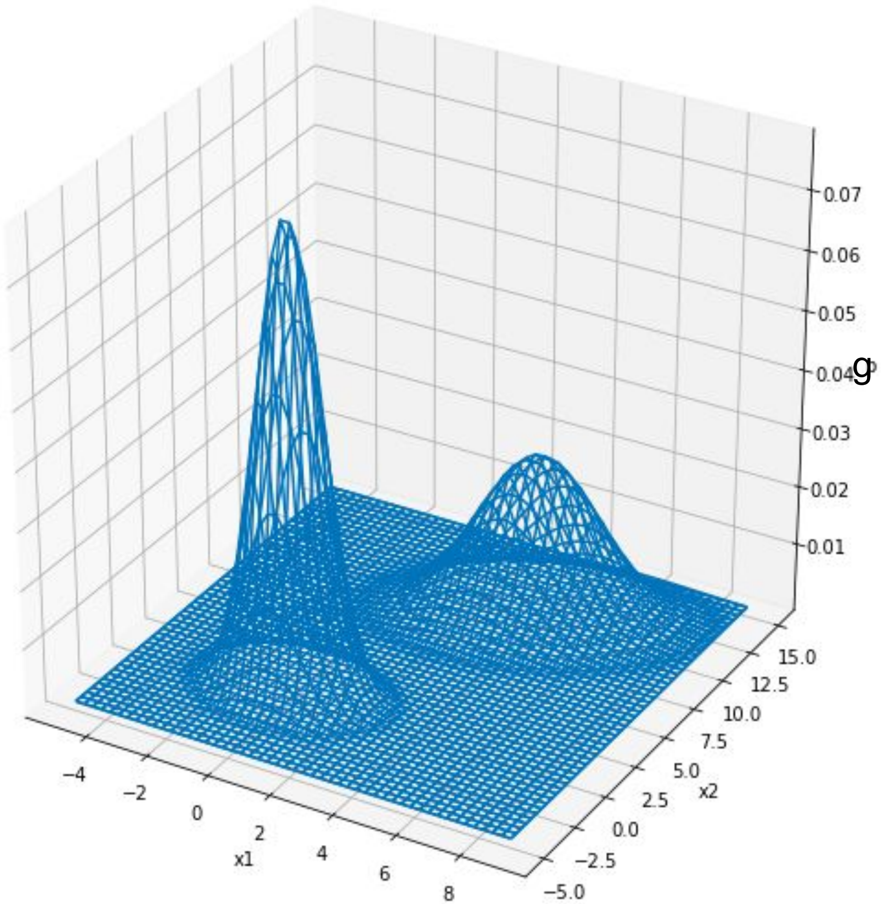
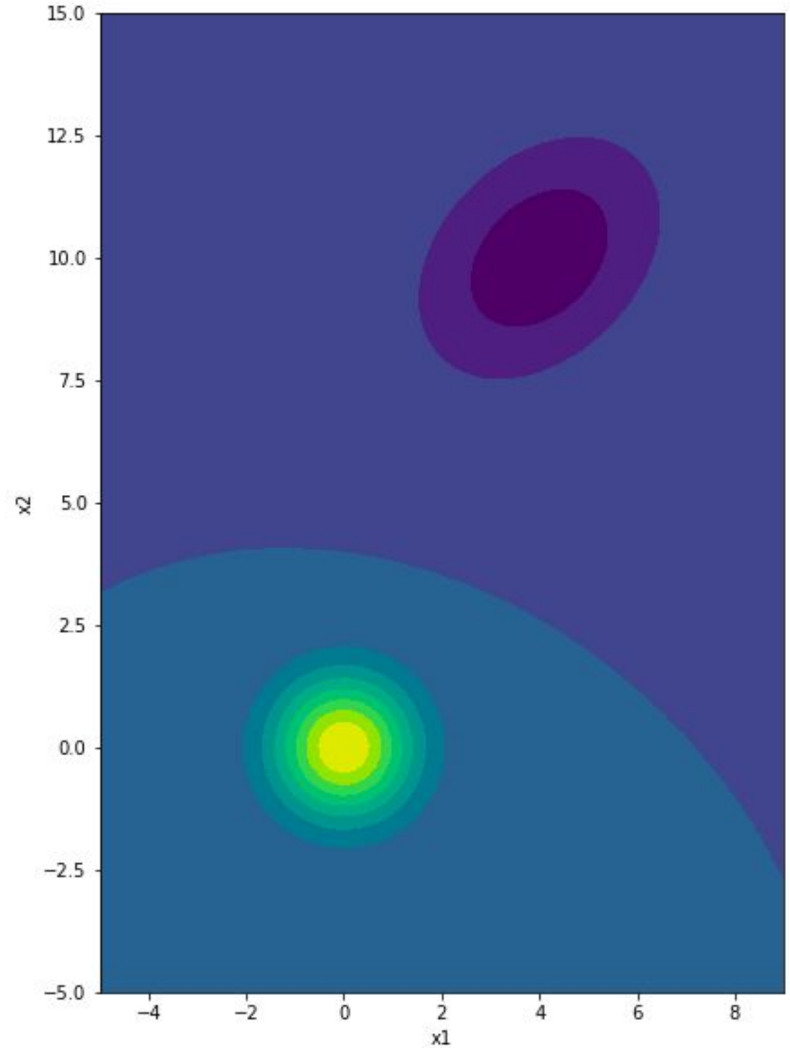


g1(x) and g2(x)



Decision boundary