ast cancer Detection using Deep learning

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Outline

- What’s Breast cancer
- Abstract and introduction
- Modules and architecture diagram
- Mammography
- Classes:benign nd malignant
- Neural network
- Identifying breast cancer
- Support vector machine

Objectives

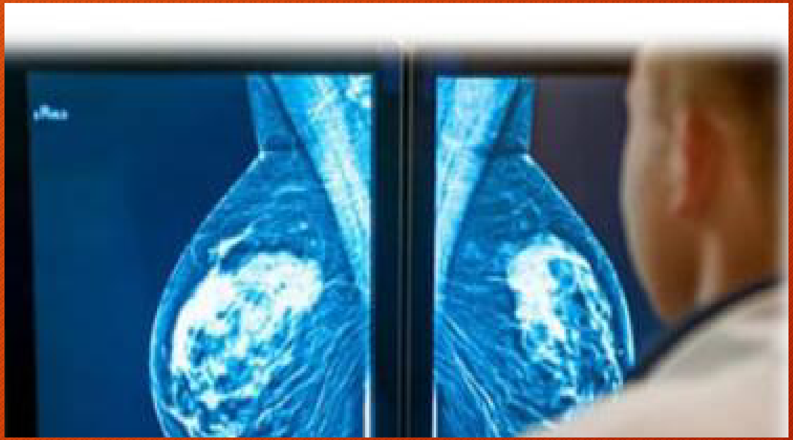
- In this presentation you obtain main information about breast cancer and how we analyse, detect breast types
- Explain all dataset types
- Explain classes in breast cancer
- Define main parts of CNN model for training data

Aim

- Classify features extracted from mammogram FNA images as malignant or benign based on
- extracted features using Support Vector Machines (SVMs).

Introduction to Breast cancer

- Breast cancer is the most common Cancer type diagnosed in women worldwide.while breast cancer can occur in both men and women,it is by far more prevalent in women.
- Breast cancer incidence in women in the United States is 1 in 8(about 13%)women have a 3% chance of breast cancer using their death.
- Feature extraction helps discriminate between benign and malignant tumors



Abstract

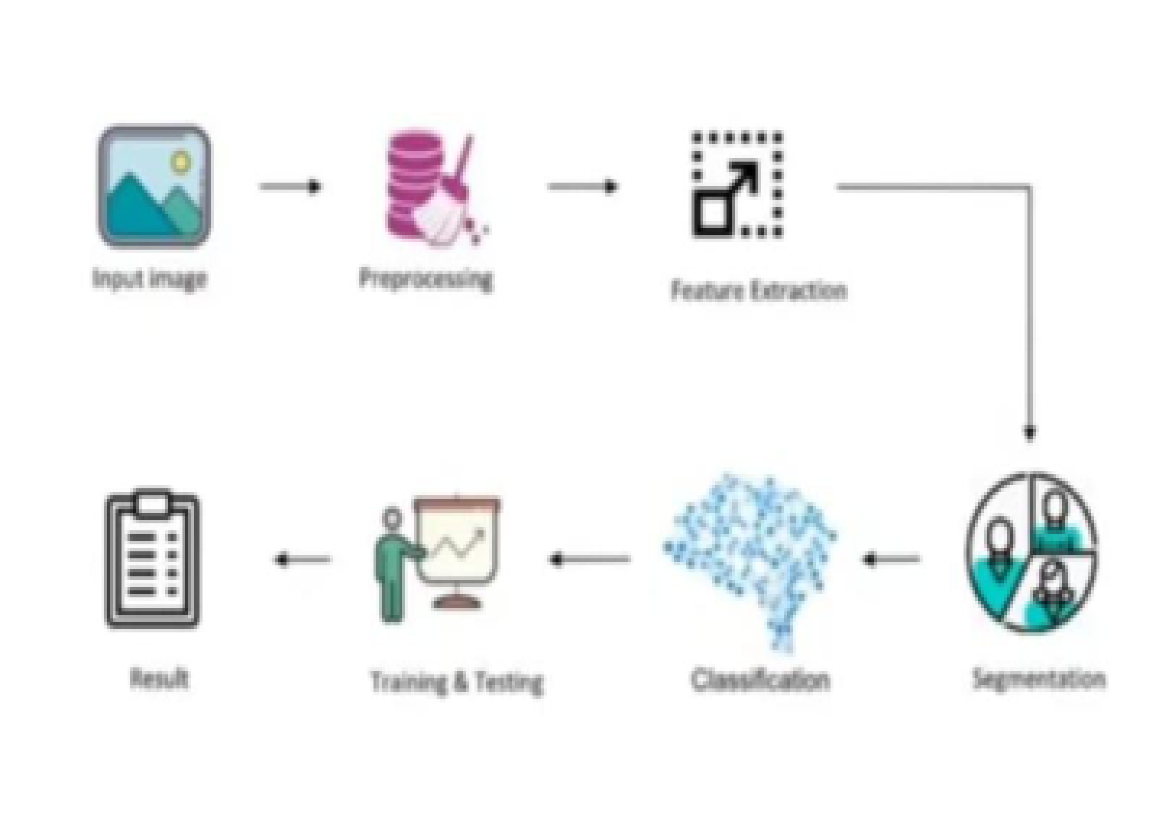
- Researchers have developed computer- aided systems for efficiency diagnosis of breast cancer from histopathological microscopic images.
- It detect the tumor cells automatically using advanced image processing techniques.
- It also recognise the tumor shape and position in MRI image using classification method.
- The results displayed whether it is benign or malignant.

MamMography

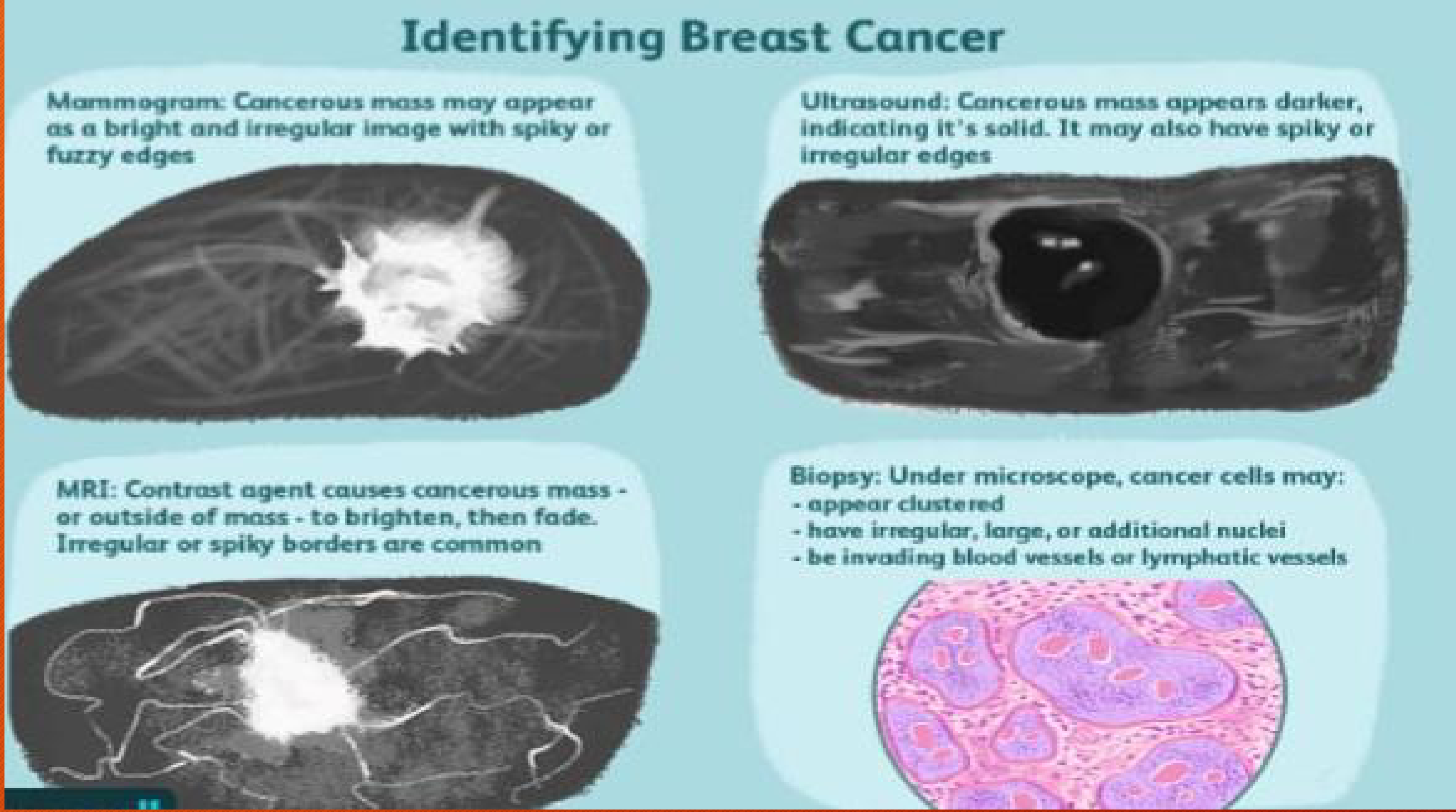
- Mammography is the recommended imaging modality for breast cancer screening
- It is more useful as an early detection tool before the appearance of the physical symptoms.

Modules and architecture diagram

- Preprocessing
- Segmentation
- Masked image
- Feature extraction
- Classification

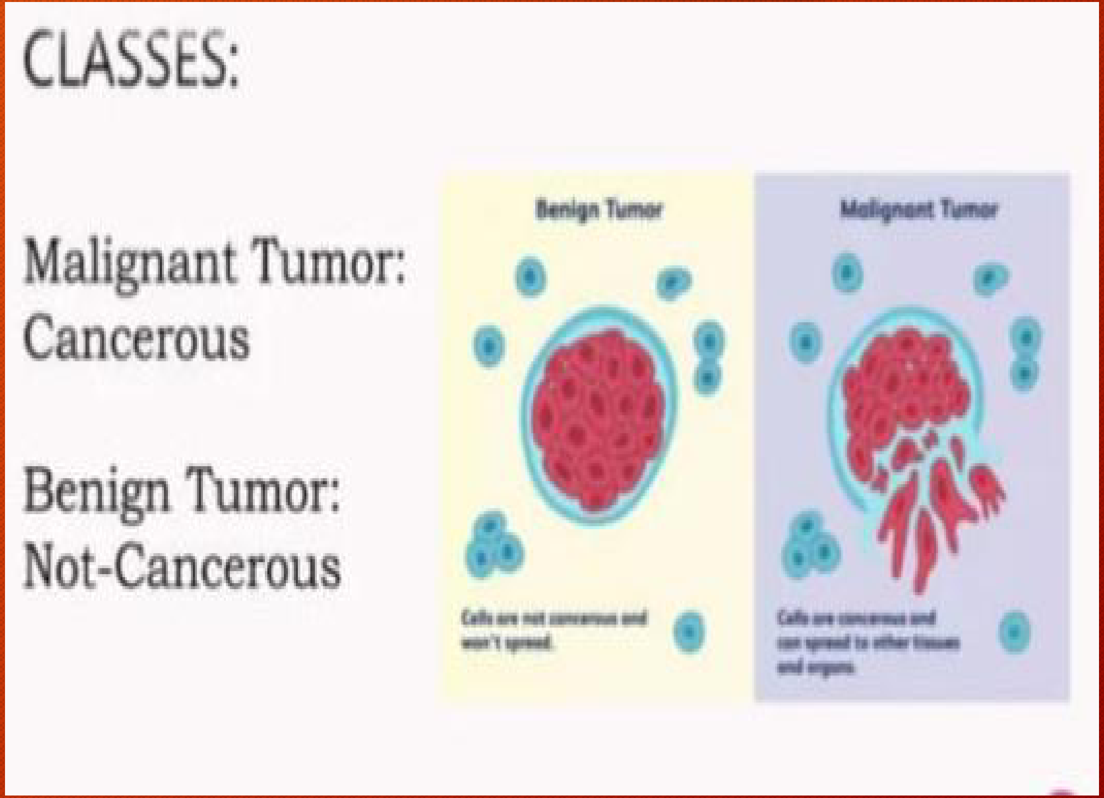


Identifying breast cancer

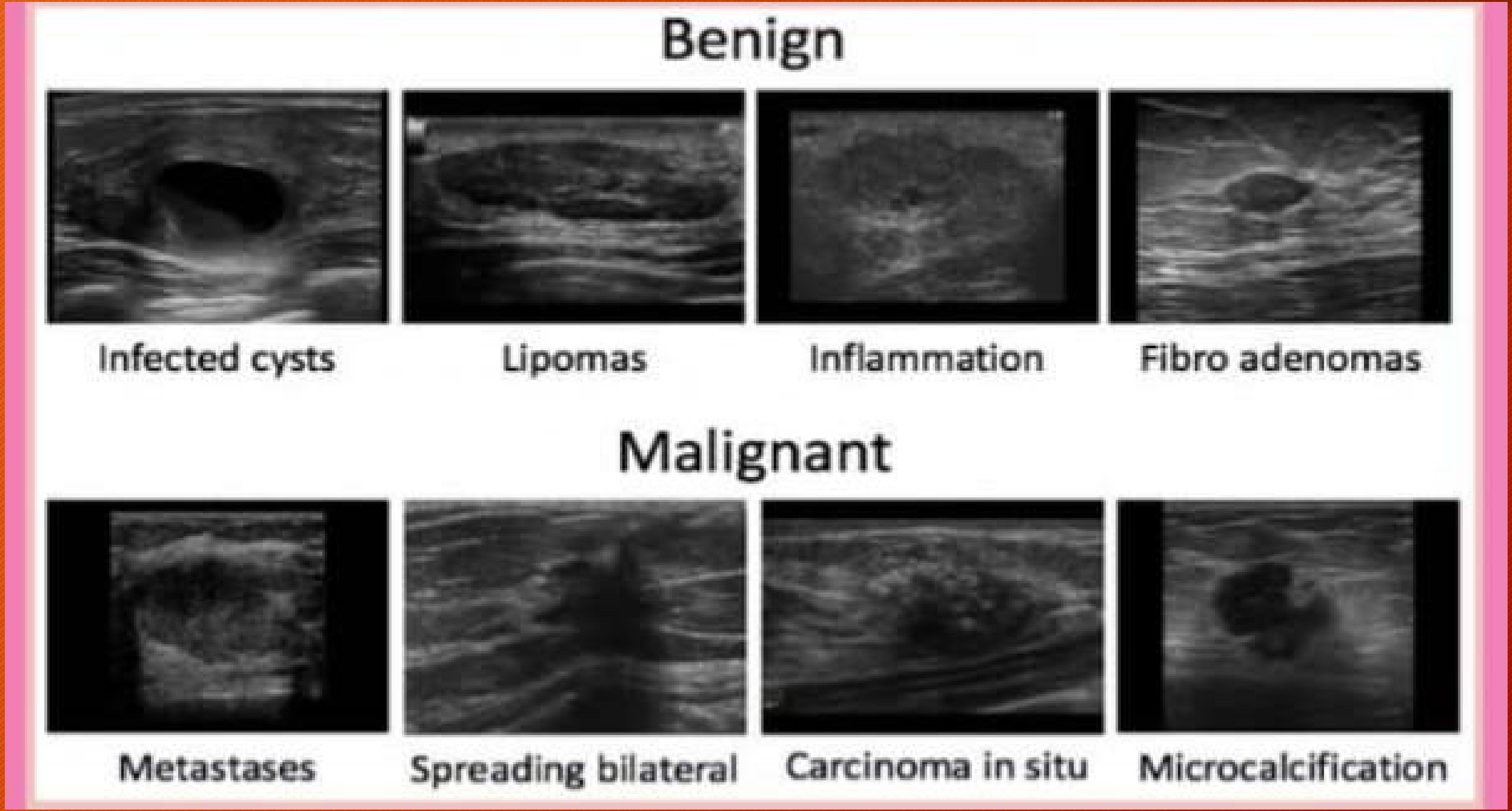


Classes:

- Benign tumor:it has distinct smooth, regular borders. A benign tumor can become larger, but will not invade nearby tissue or spread to other parts of your body.these are non cancerous tumors.
- Malignant tumor:It has irregular borders and grows faster than a benign tumor it can also spread to other parts of your body. These are cancerous tumors

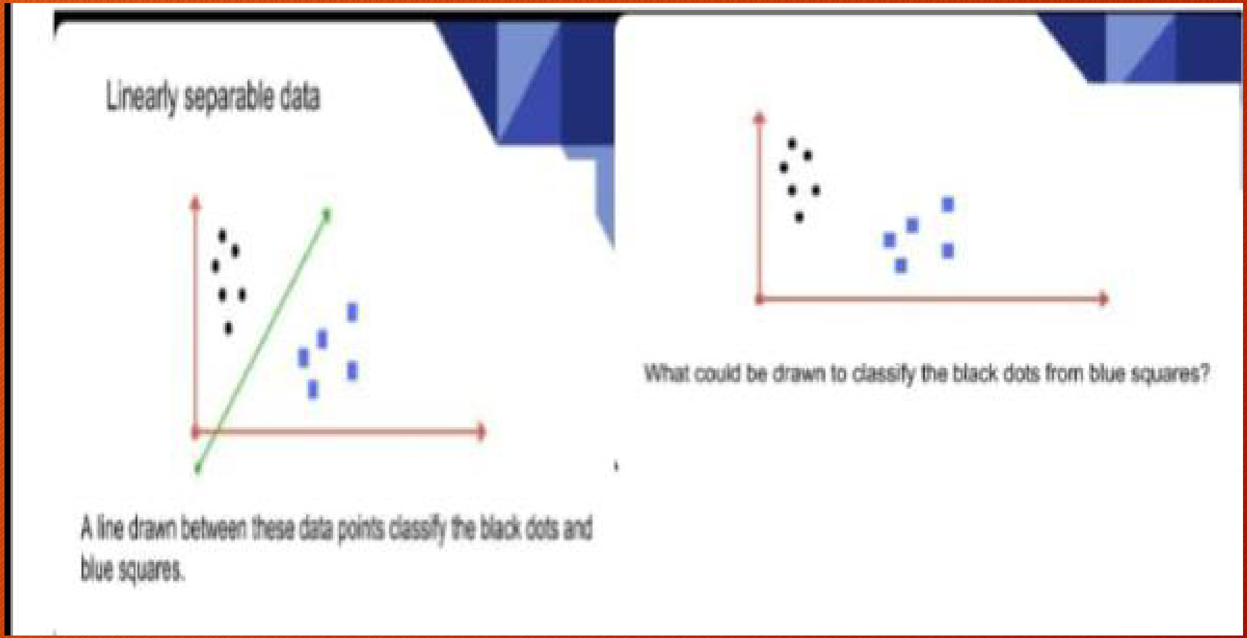


Benign and malignant tumors

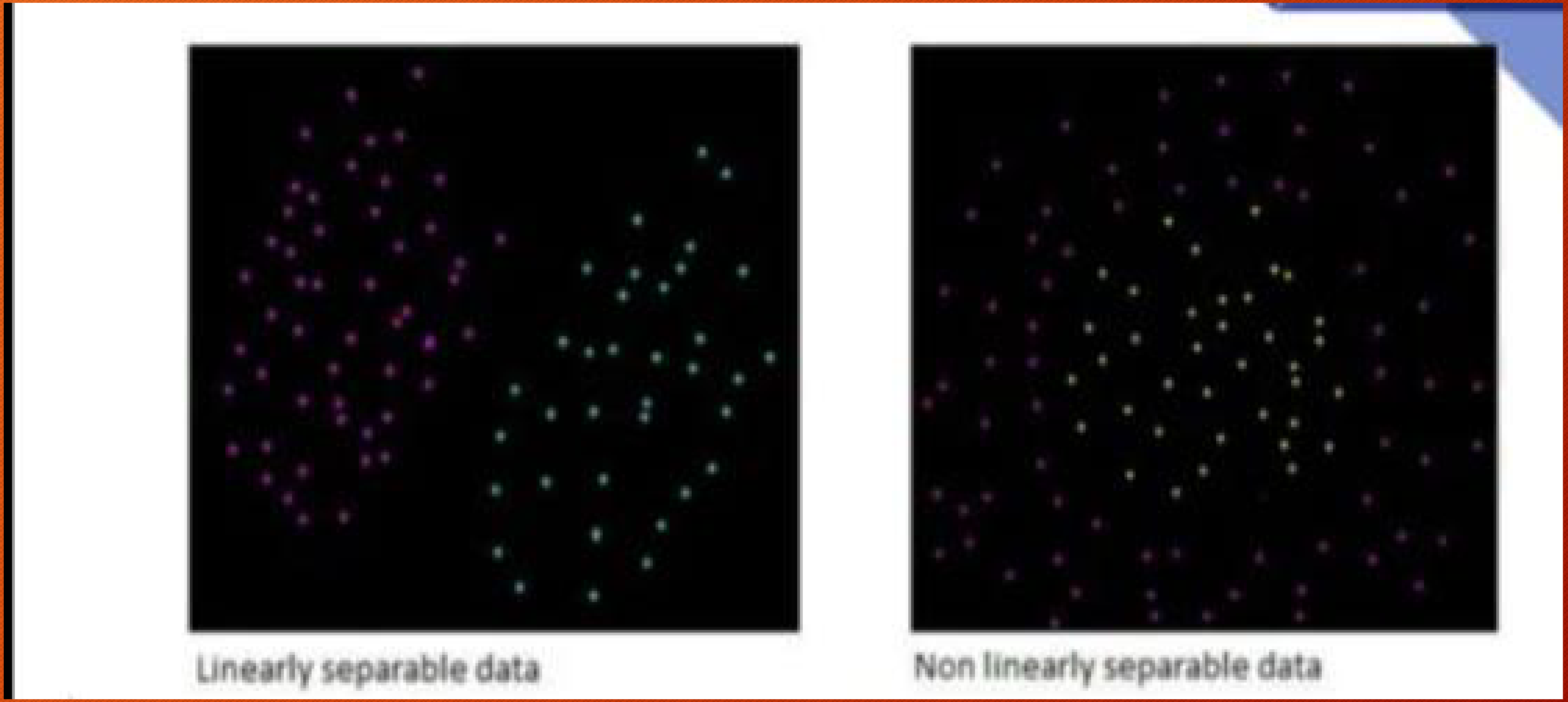


Support vector machine

- A svm is a discriminative classifier which intakes training data, the algorithm outputs an optimal hyperplane which categorizes new examples.,

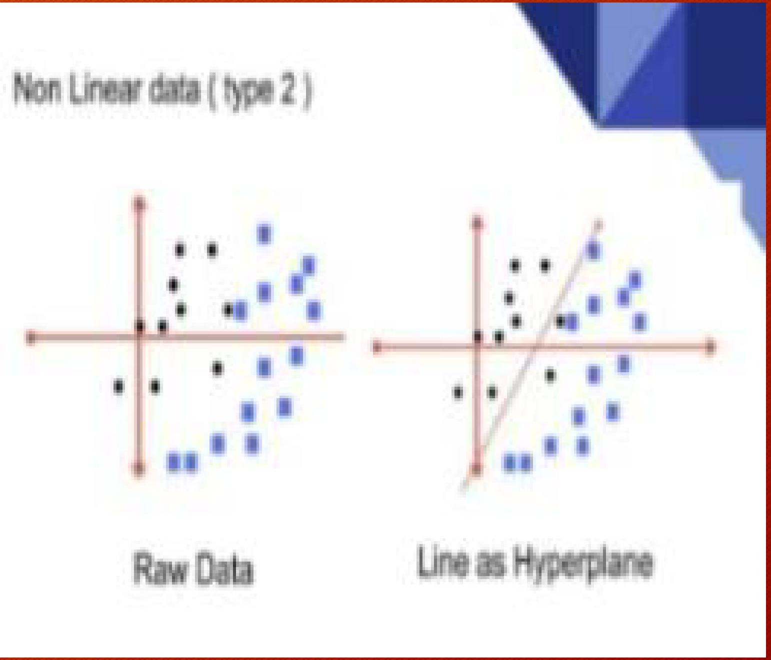


Linear vs nonlinear separable data



Non linear data

- For the previous data the line, if user as a hyperplane
- Two black dots also fall in category of blue squares
- Data separation is not perfect
- It tolerates some outliers in the classification



Various kernels available

1. Linear kernel
2. Non linear kernel
3. Radial basis function
4. Sigmoid
5. Polynomial
6. Exponential

Mathematical expression

$x = (x1, x2, x3);\ y = (y1, y2, y3)$

$f(x) = (x1x1, x1x2, x1x3, x2x1, x2x2, x2x3, x3x1, x3x2, x3x3)$

$f(y) = (y1y1, y1y2, y1y3, y2y1, y2y2, y2y3, y3y1, y3y2, y3y3)$

$K(x, y) = (\langle x, y\rangle)^2$

$x = (1, 2, 3)$

$y = (4, 5, 6)$

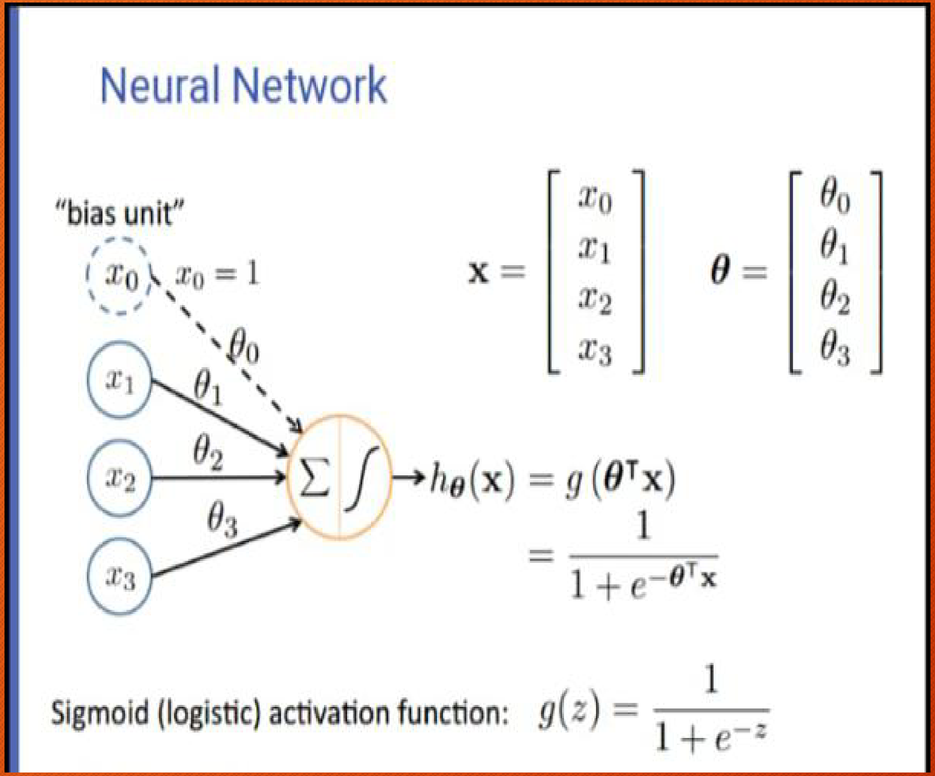
$f(x) = (1, 2, 3, 2, 4, 6, 3, 6, 9)$

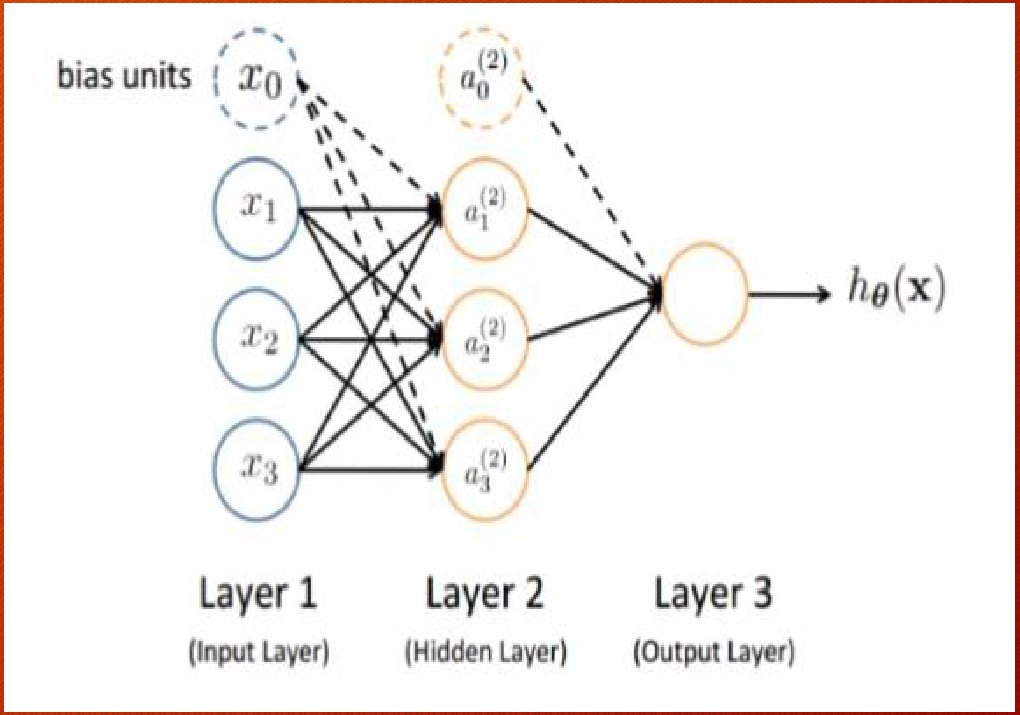
$f(y) = (16, 20, 24, 20, 25, 30, 24, 30, 36)$

$\langle f(x), f(y)\rangle = 16 + 40 + 72 + 40 + 100 + 180 + 72 + 180 + 324 = 1024$

$K(x, y) = (4 + 10 + 18)^2 = 1024$ ----> Kernel function

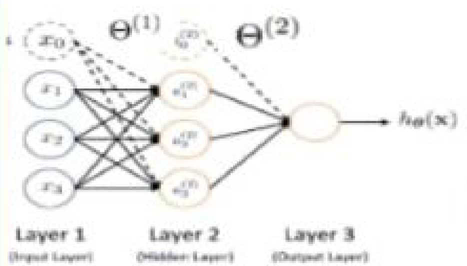
Neural network (feed forward)





Feed –forward process

- Input layer units are features (in NLP, e.g., words)
  - Usually, one-hot vector or word embedding
- Working forward through the network, the **input function** is applied to compute the input value
  - E.g., weighted sum of the input
- The **activation function** transforms this input function into a final value
  - Typically a **nonlinear** function (e.g, **sigmoid**)



$a_i^{(j)}$ = "activation" of unit i in layer j

$\Theta^{(j)}$ = weight matrix controlling function mapping from layer j to layer $j+1$

$$a_1^{(2)} = g(\Theta_{10}^{(1)}x_0 + \Theta_{11}^{(1)}x_1 + \Theta_{12}^{(1)}x_2 + \Theta_{13}^{(1)}x_3)$$
$$a_2^{(2)} = g(\Theta_{20}^{(1)}x_0 + \Theta_{21}^{(1)}x_1 + \Theta_{22}^{(1)}x_2 + \Theta_{23}^{(1)}x_3)$$
$$a_3^{(2)} = g(\Theta_{30}^{(1)}x_0 + \Theta_{31}^{(1)}x_1 + \Theta_{32}^{(1)}x_2 + \Theta_{33}^{(1)}x_3)$$
$$h_\Theta(x) = a_1^{(3)} = g(\Theta_{10}^{(2)}a_0^{(2)} + \Theta_{11}^{(2)}a_1^{(2)} + \Theta_{12}^{(2)}a_2^{(2)} + \Theta_{13}^{(2)}a_3^{(2)})$$

If network has s_j units in layer j *and* s_{j+1} units in layer $j+1$, then $\Theta^{(j)}$ has dimension $s_{j+1} \times (s_j+1)$.

$$\Theta^{(1)} \in \mathbb{R}^{3\times 4} \qquad \Theta^{(2)} \in \mathbb{R}^{1\times 4}$$

Vector representation

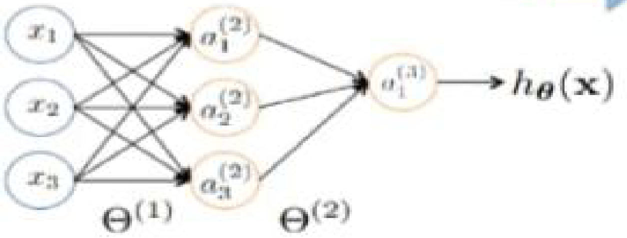
Vector Representation

$$a_1^{(2)} = g\left(\Theta_{10}^{(1)}x_0 + \Theta_{11}^{(1)}x_1 + \Theta_{12}^{(1)}x_2 + \Theta_{13}^{(1)}x_3\right) = g\left(z_1^{(2)}\right)$$

$$a_2^{(2)} = g\left(\Theta_{20}^{(1)}x_0 + \Theta_{21}^{(1)}x_1 + \Theta_{22}^{(1)}x_2 + \Theta_{23}^{(1)}x_3\right) = g\left(z_2^{(2)}\right)$$

$$a_3^{(2)} = g\left(\Theta_{30}^{(1)}x_0 + \Theta_{31}^{(1)}x_1 + \Theta_{32}^{(1)}x_2 + \Theta_{33}^{(1)}x_3\right) = g\left(z_3^{(2)}\right)$$

$$h_\Theta(\mathbf{x}) = g\left(\Theta_{10}^{(2)}a_0^{(2)} + \Theta_{11}^{(2)}a_1^{(2)} + \Theta_{12}^{(2)}a_2^{(2)} + \Theta_{13}^{(2)}a_3^{(2)}\right) = g\left(z_1^{(3)}\right)$$



Feed-Forward Steps:

$$\mathbf{z}^{(2)} = \Theta^{(1)}\mathbf{x}$$

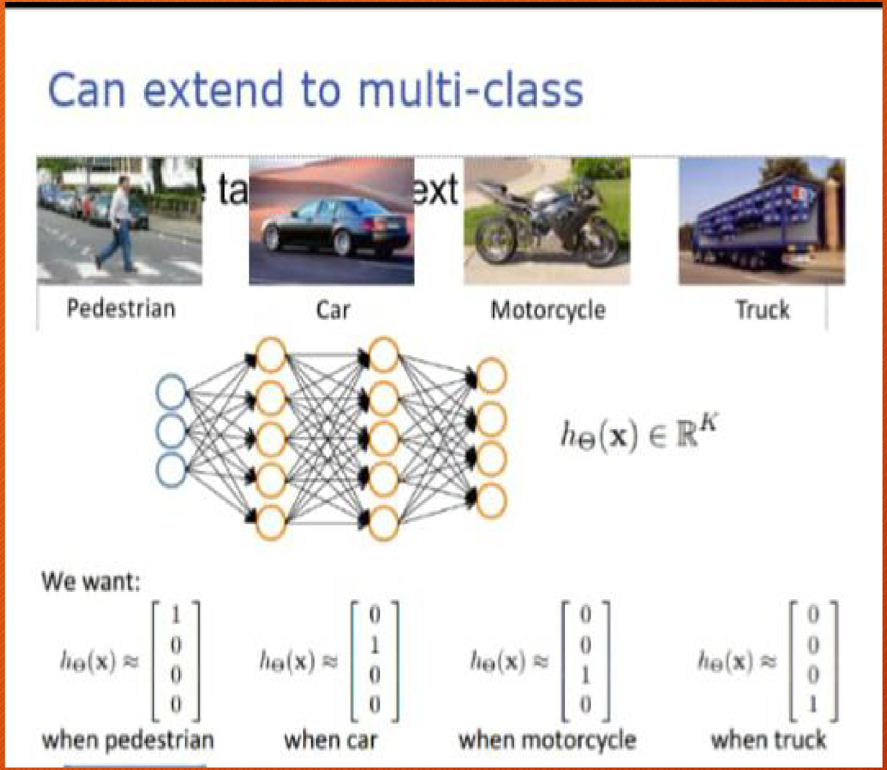
$$\mathbf{a}^{(2)} = g(\mathbf{z}^{(2)})$$

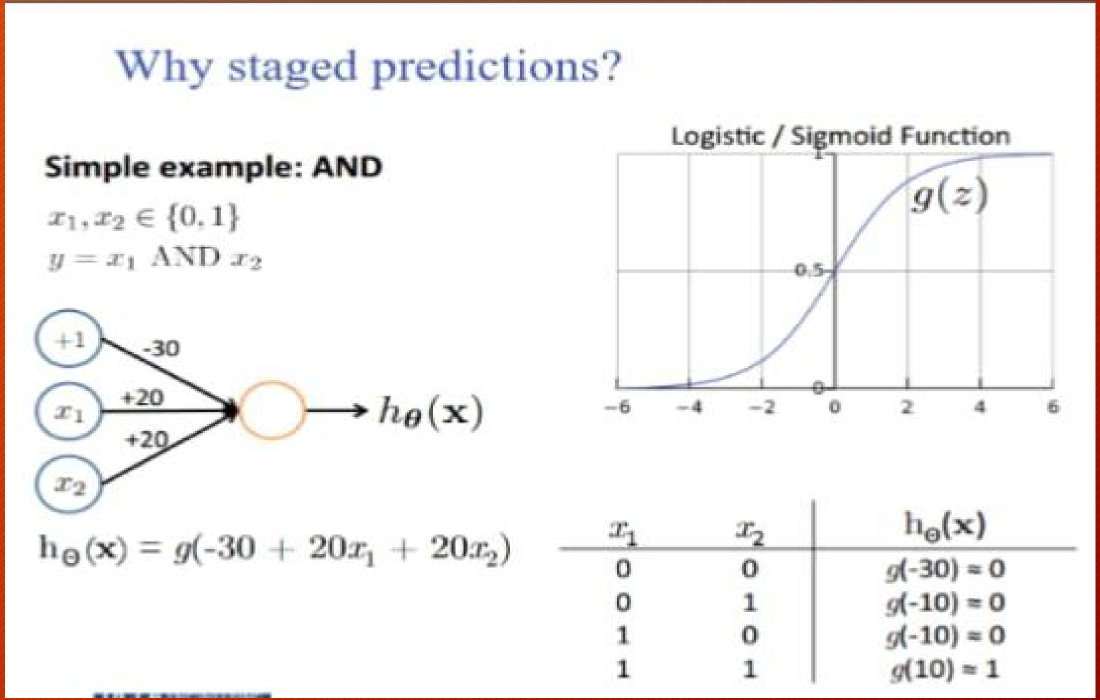
Add $a_0^{(2)} = 1$

$$\mathbf{z}^{(3)} = \Theta^{(2)}\mathbf{a}^{(2)}$$

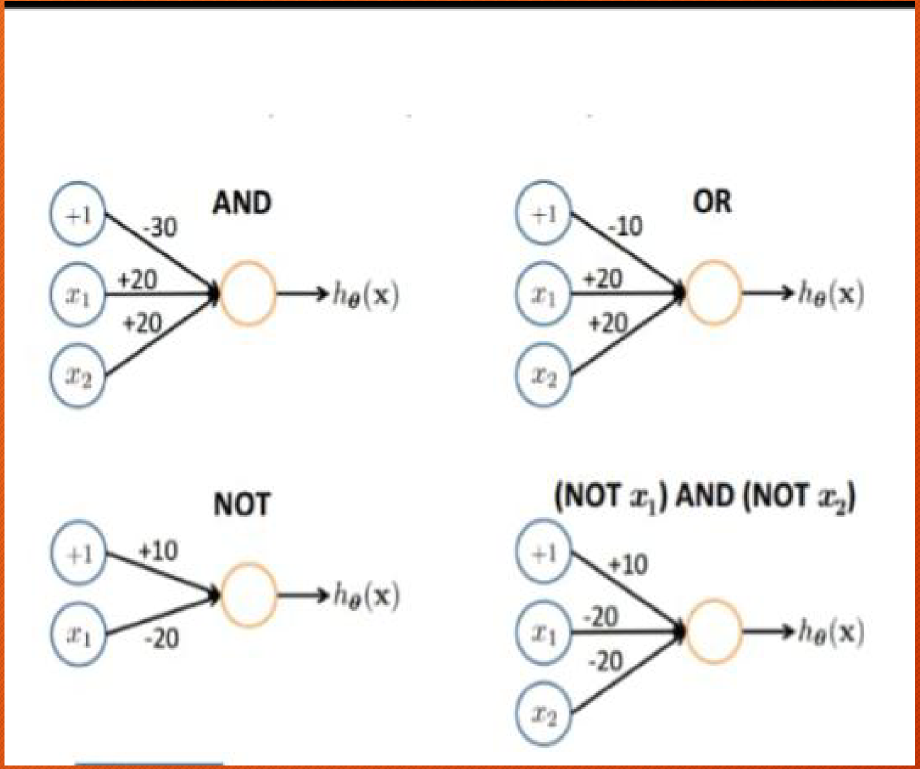
$$h_\Theta(\mathbf{x}) = \mathbf{a}^{(3)} = g(\mathbf{z}^{(3)})$$

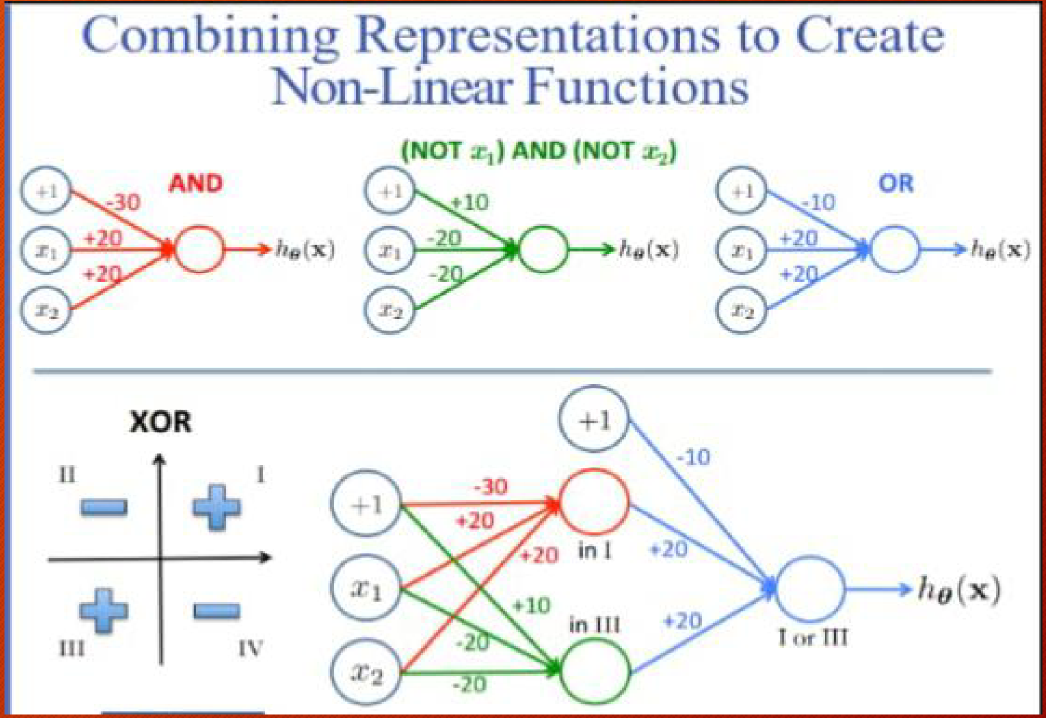
Extend to multi class



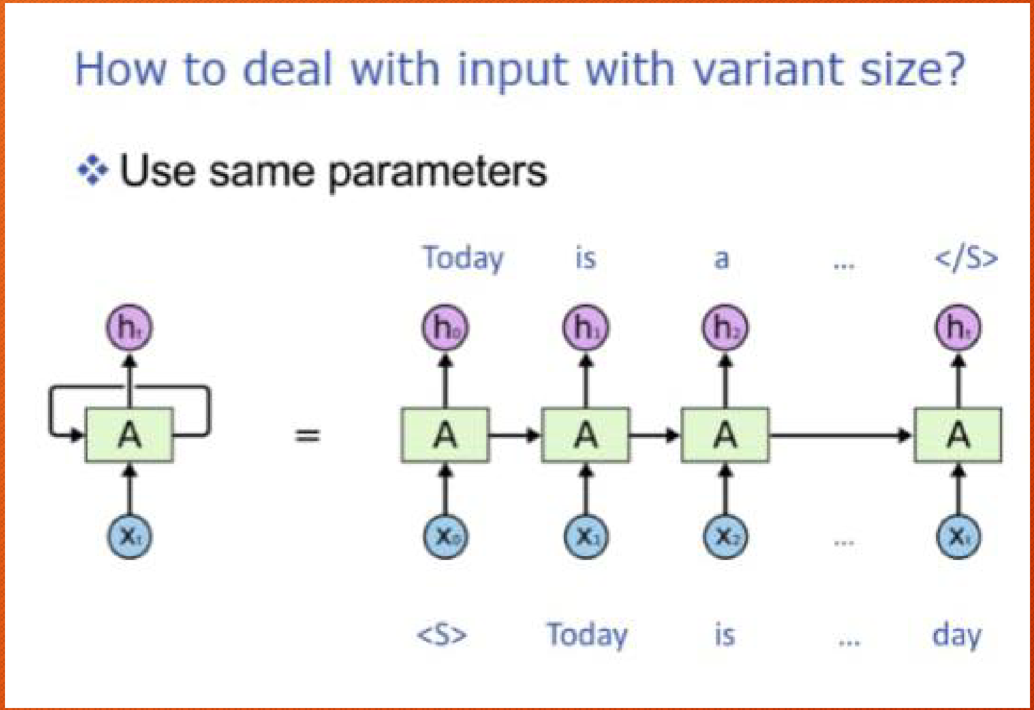


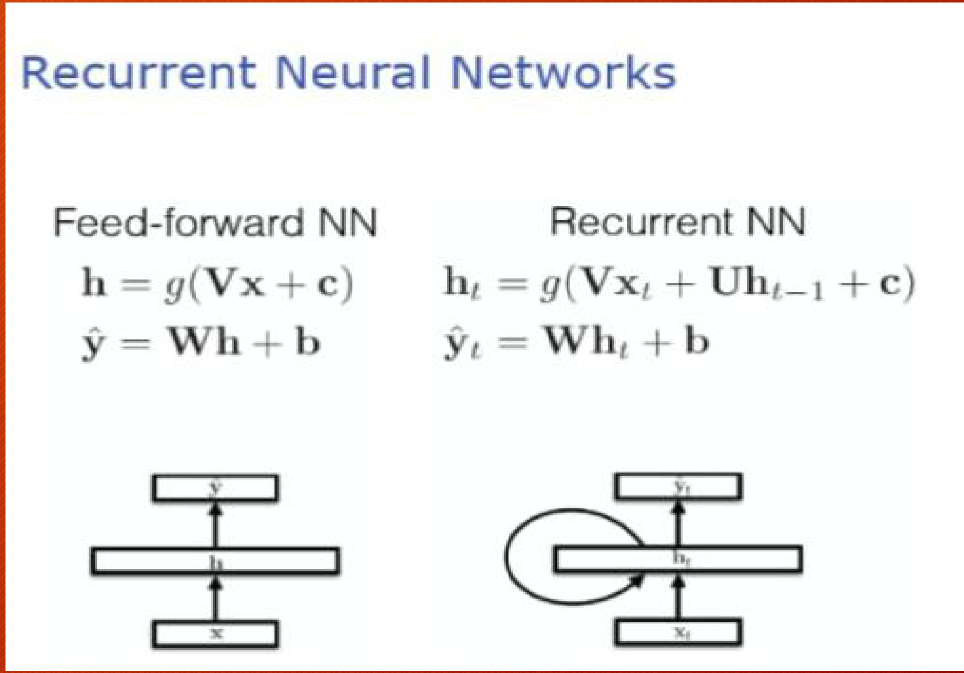
Combining representation to create nonlinear functions





Recurrent neural networks





Conclusion

CONCLUSION

- The most common cause of cancer related to death in women.
- Early detection and screening is vital.
- Breast self-examination is important but it should not substituted for screening tests.
- Maintain a healthy weight, add exercise into our routine.
- Limit alcohol intake and non-smoking.