CS/ECE/ME 532 Period 21

- Unit 5 Quiz is Thursday

- Today
  - video 6.1, intro to neural networks
  - video 6.2, backpropagation, SGD

Applications of artificial neural networks:

- natural language processing, translation, image processing, Alexa/Siri, self driving cars, …
- *predicting age/gender/income from browsing behavior*

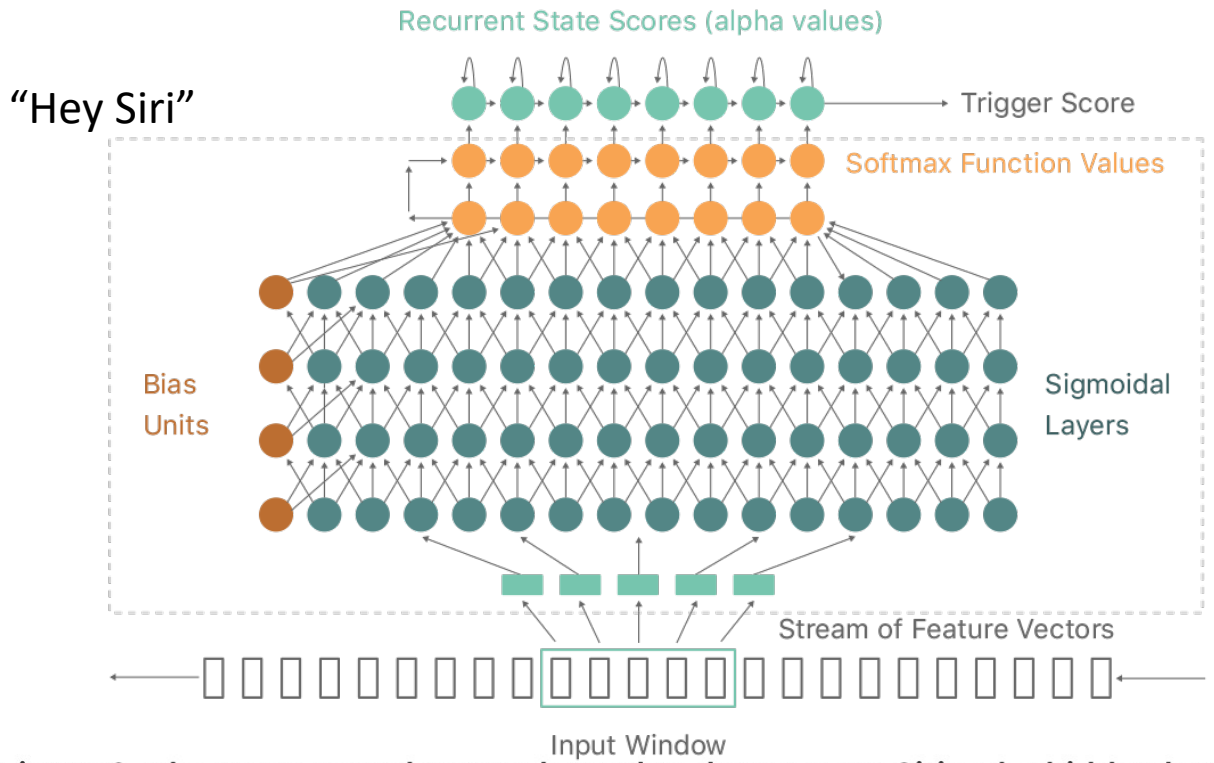


Figure 2. The Deep Neural Network used to detect "Hey Siri." The hidden layers are actually fully connected. The top layer performs temporal integration. The actual DNN is indicated by the dashed box.

https://machinelearning.apple.com/2017/10/01/hey-siri.html

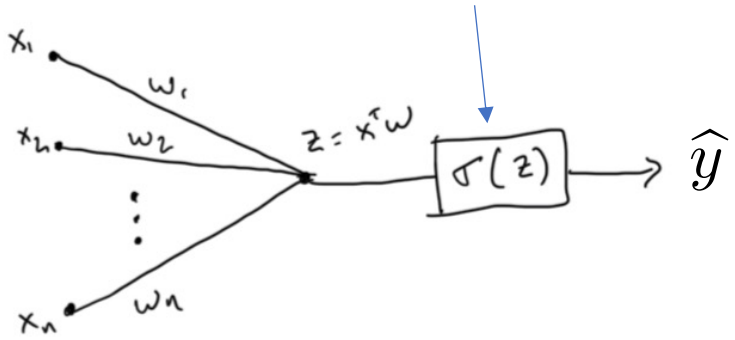
Introduction to Neural Networks

Linear regression: $\widehat{y} = \boldsymbol{x}^T \boldsymbol{w}$

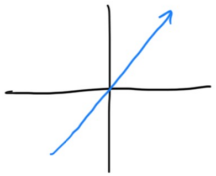
Binary classification: $\widehat{y} = \text{sign}(\boldsymbol{x}^T \boldsymbol{w})$

Single Neuron

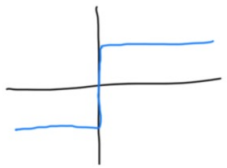
activation function



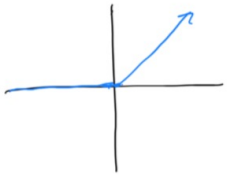
regression: $\sigma(z) = z$



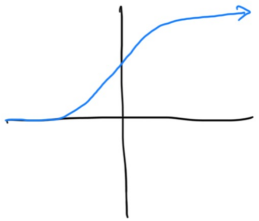
binary classification: $\sigma(z) = \text{sign}(z)$



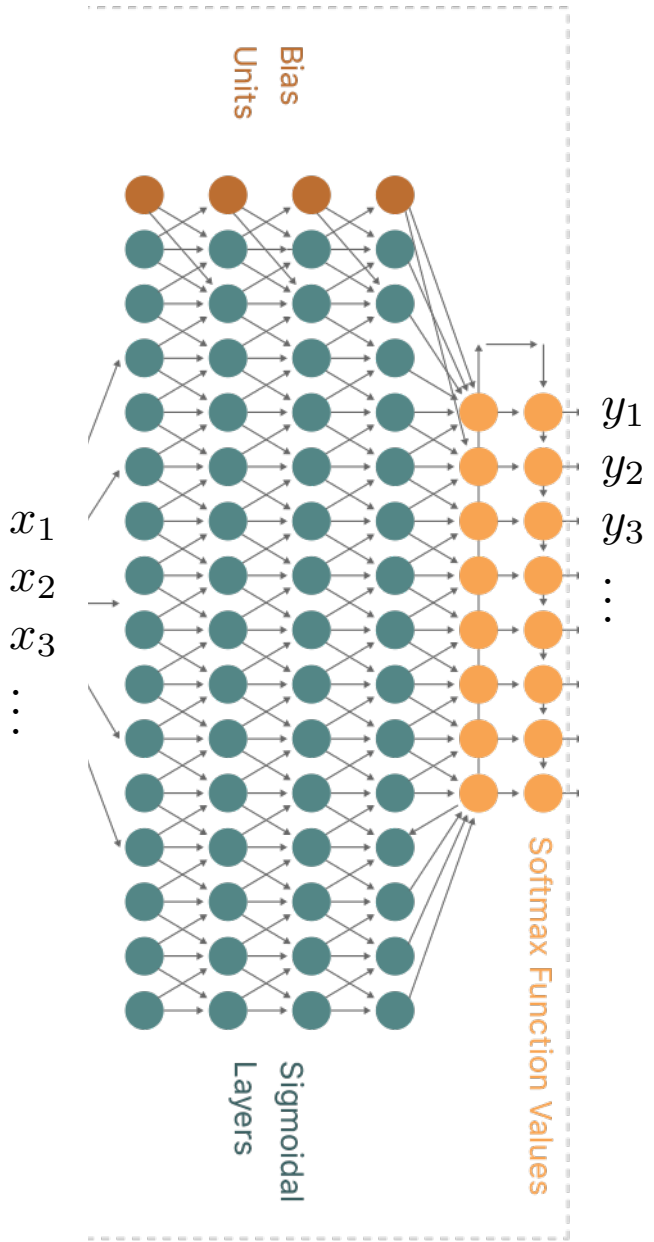
ReLU: $\sigma(z) = \max(0, z)$



sigmoid/logistic: $\sigma(z) = \frac{1}{1+e^{-z}}$



Neural Network – bunch of neurons connected together



'HEY SIRI!' input:

- DFT coefficients of audio

Network:

- 5 hidden layers
- 32-192 neurons per layer
- Logistic activation function

Outputs

- indicate probability of ~20 portions of word 'Siri'
- Declare 'SIRI' if sequence of detections align with 'Siri'