

nlp4kor

<https://github.com/bage79/nlp4kor>

<https://facebook.com/nlp4kor>

왕초보를 위한 RNN



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<https://youtu.be/UNmqTiOnRfg>



Fei-Fei Li

http://cs231n.stanford.edu/slides/2017/cs231n_2017_lecture10.pdf

Vectors



$$\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$



$$\begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$



$$\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

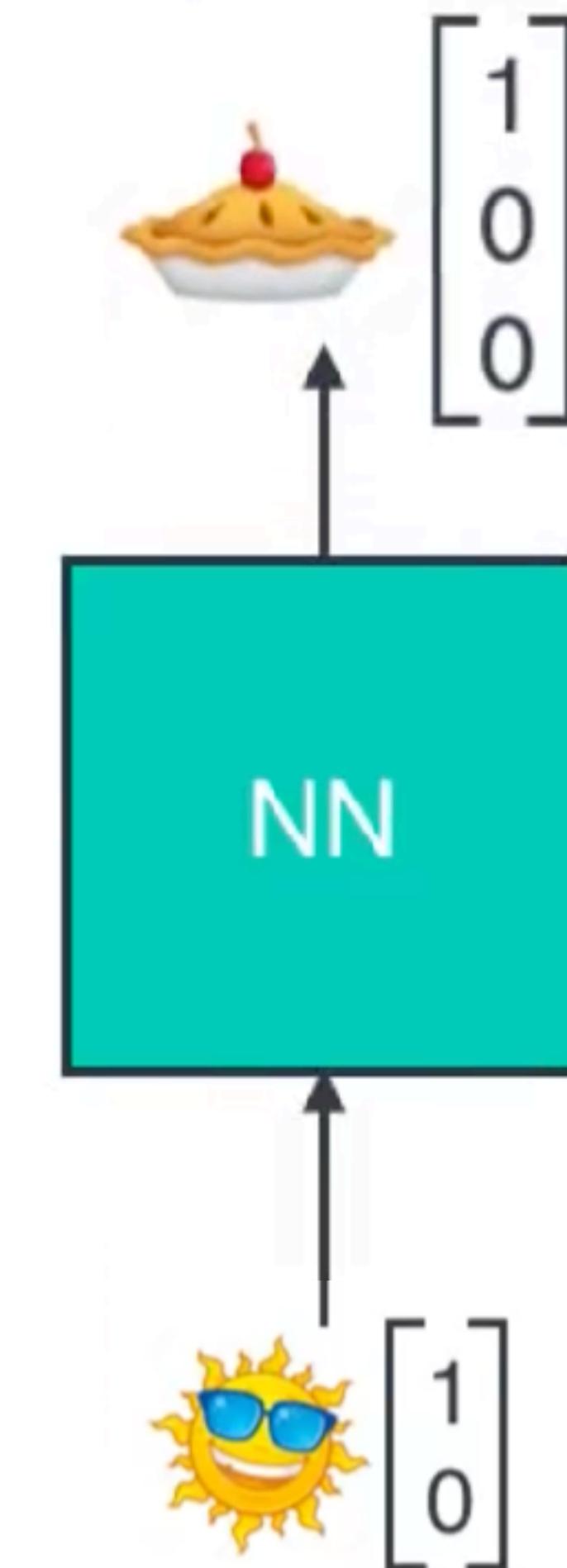


$$\begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

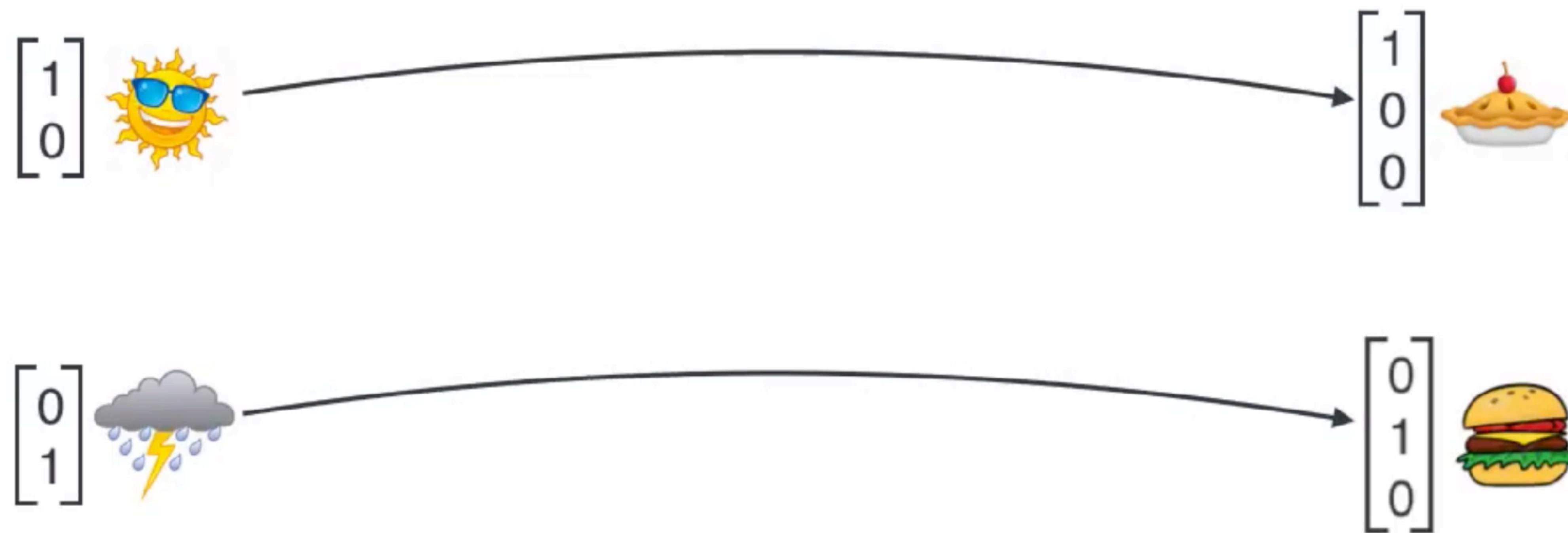


$$\begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

Neural Network



Neural Network



Neural Network

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} \text{☀️} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \text{🥧}$$

Neural Network

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} \text{☀️} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \text{🥧}$$

Neural Network

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} \text{rainy emoji} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \text{hamburger emoji}$$

Neural Network

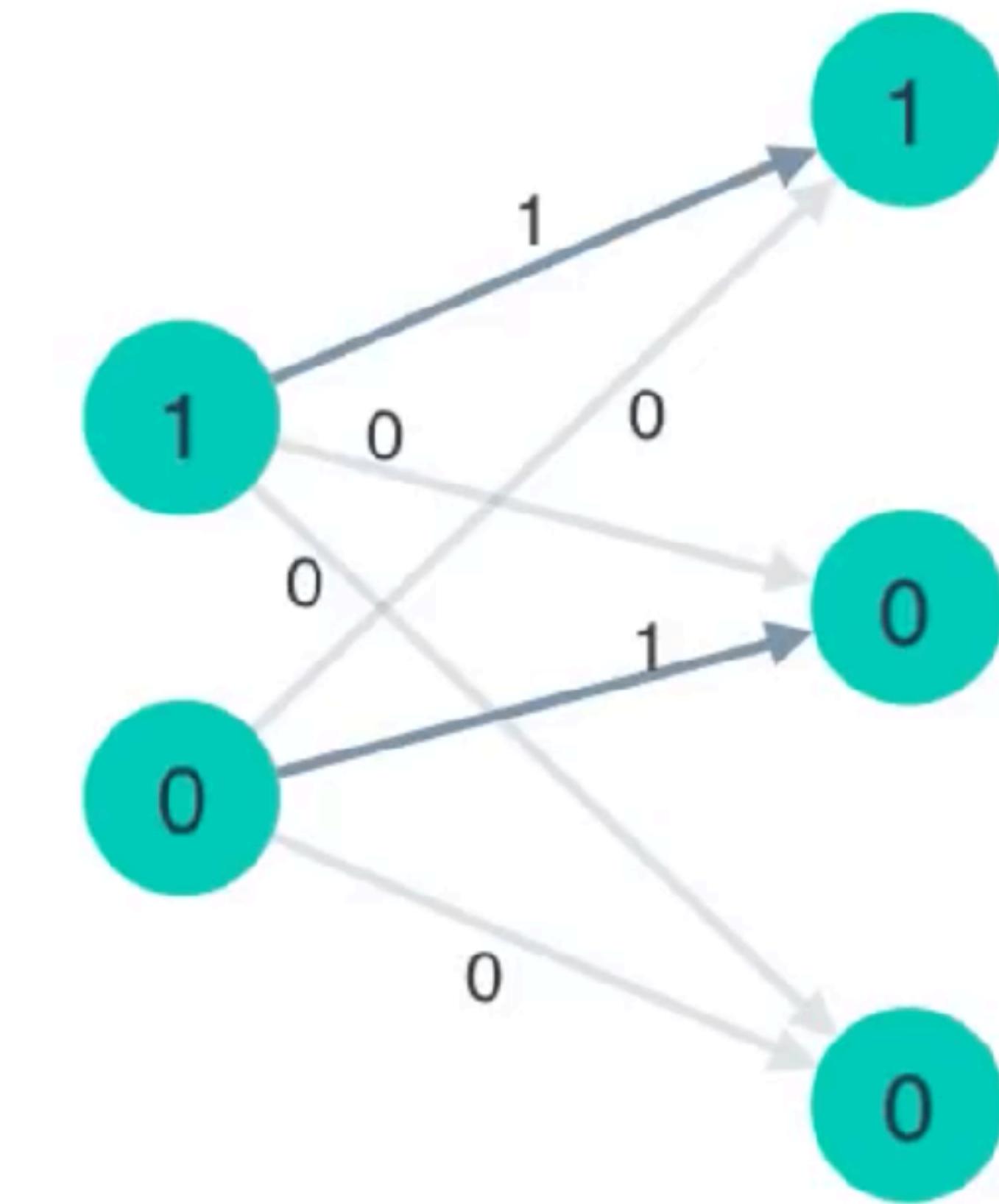
$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} \text{rainy weather icon} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \text{hamburger icon}$$

Neural Network

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}$$



$$\begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

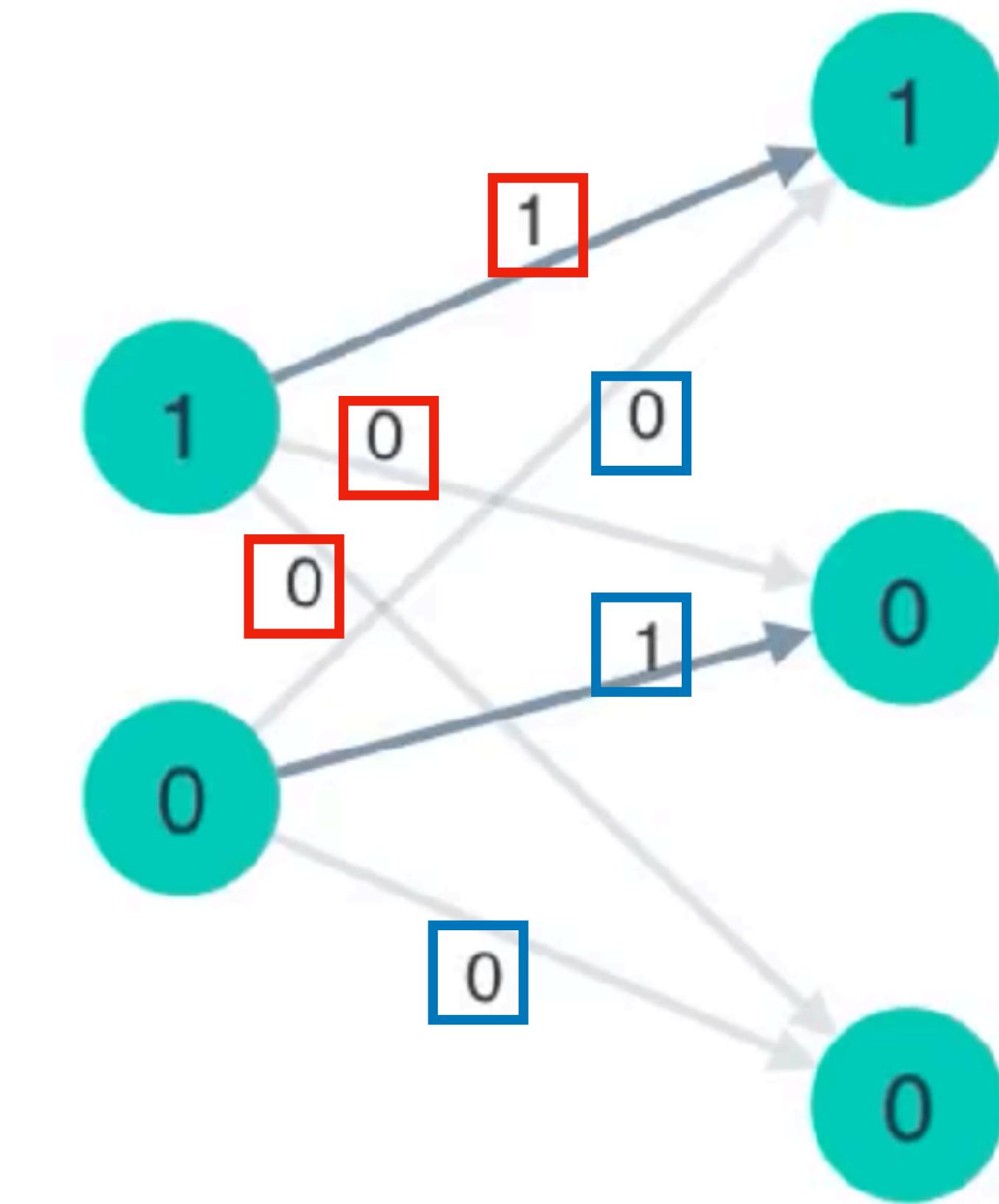


Neural Network

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}$$



$$\begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

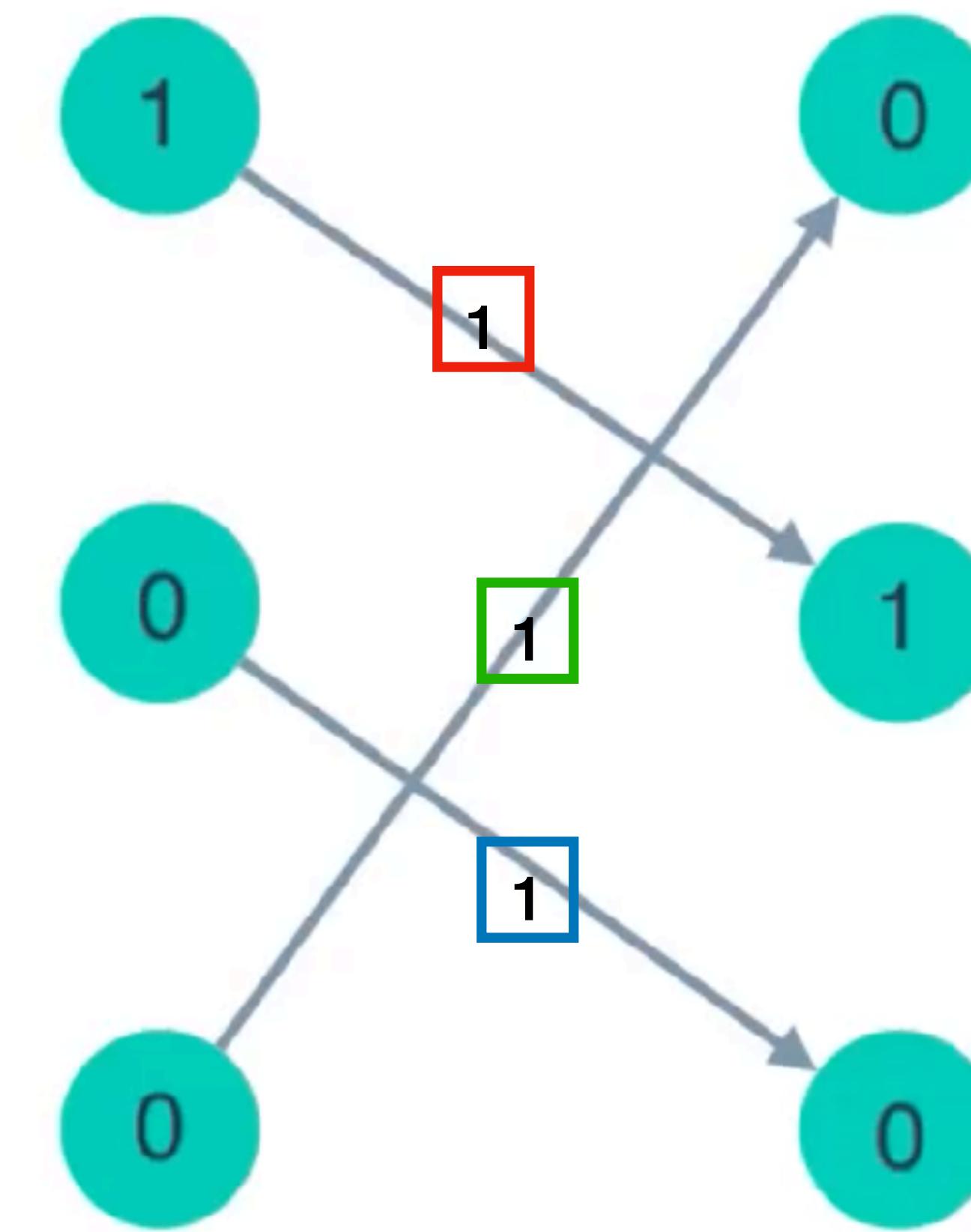


Simple (Recurrent) Neural Network

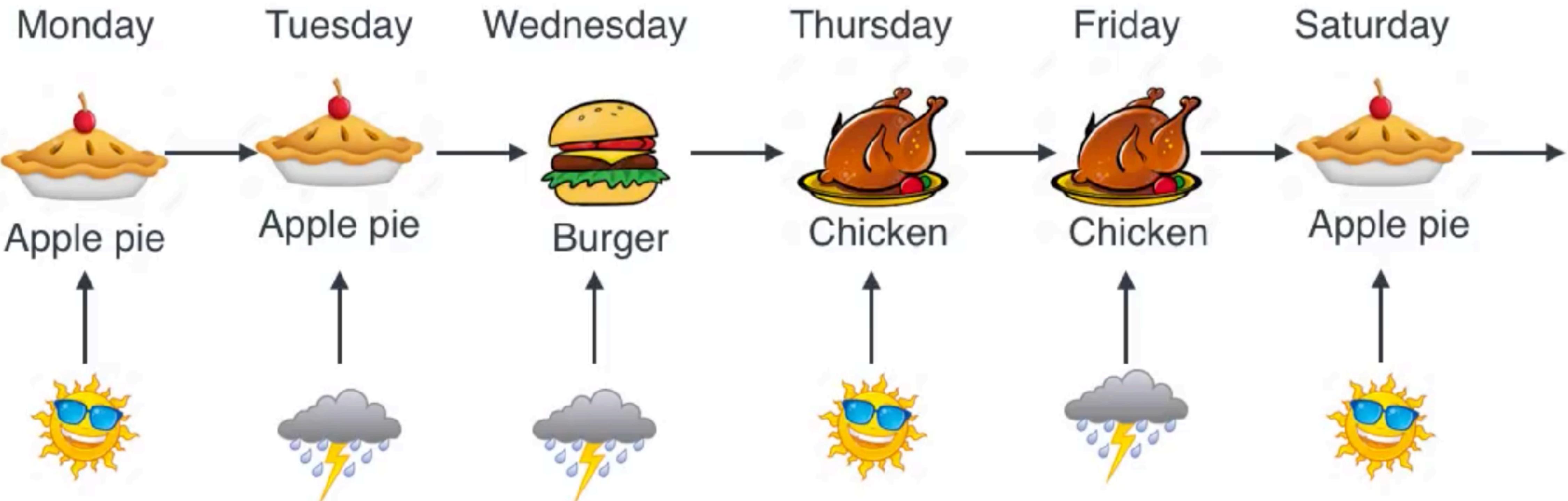
$$\begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$



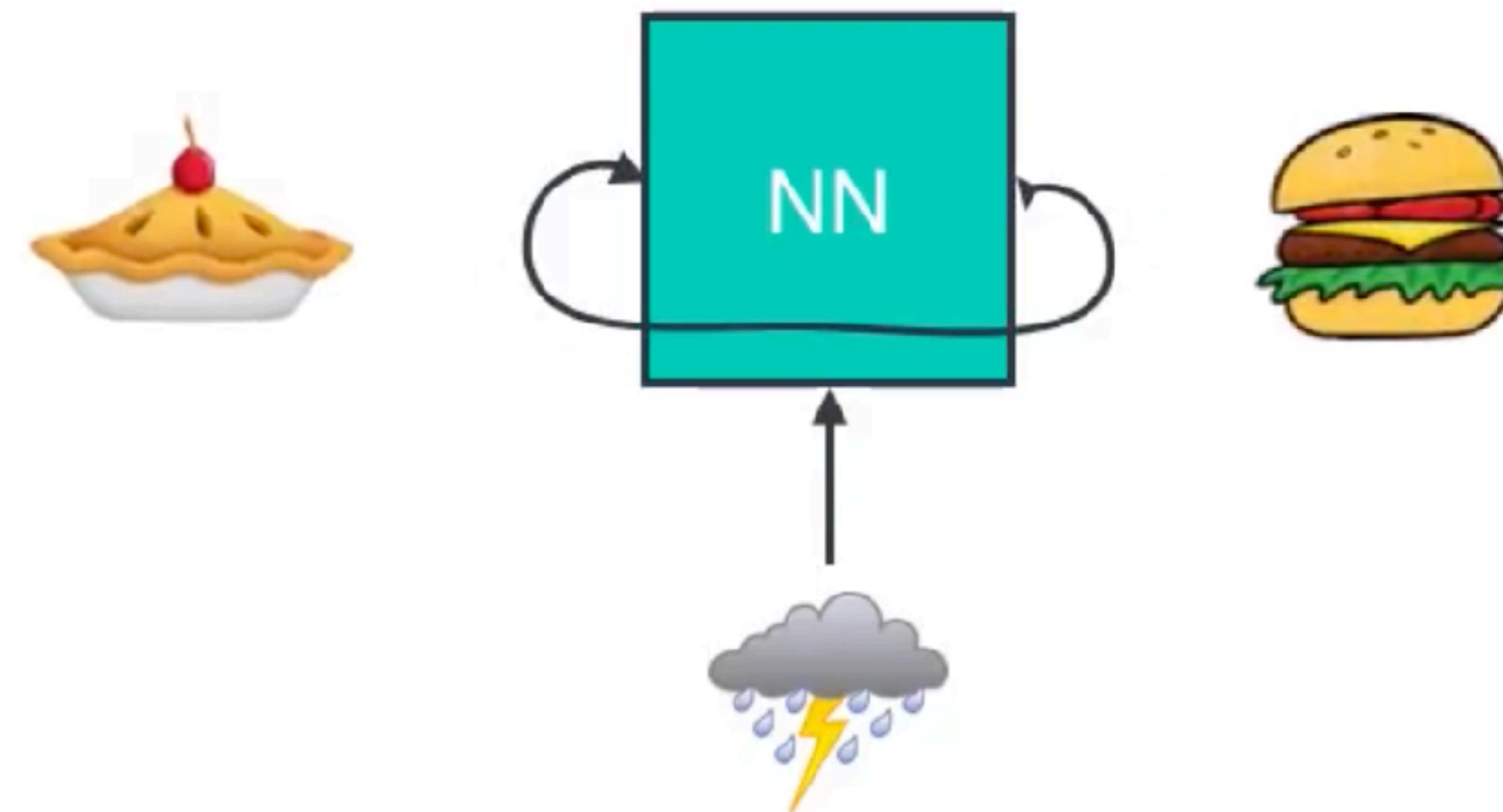
$$\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$



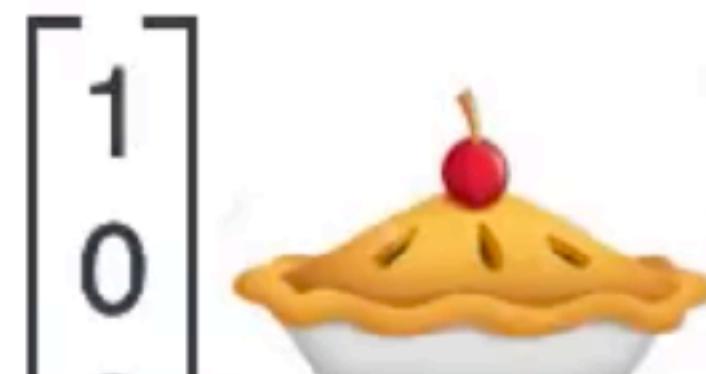
Cooking Schedule



Recurrent Neural Network



Food



$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ \hline 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} =$$

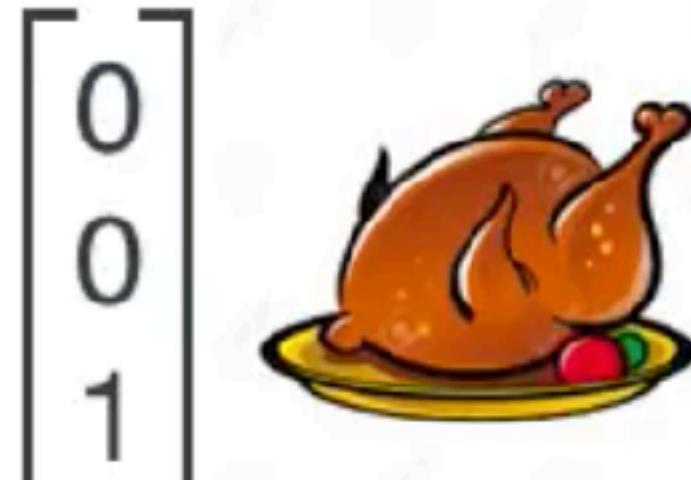
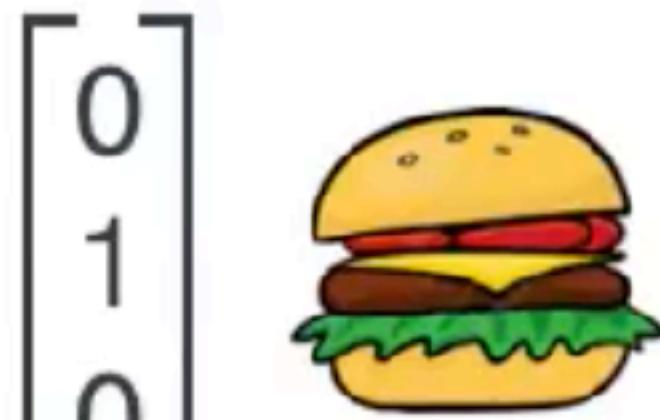
Food



$$\begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

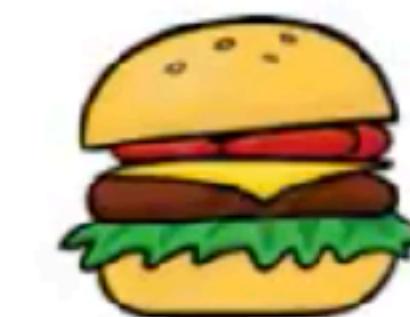


Food


$$\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$
$$\begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$
$$\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ \hline 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} =$$

Food



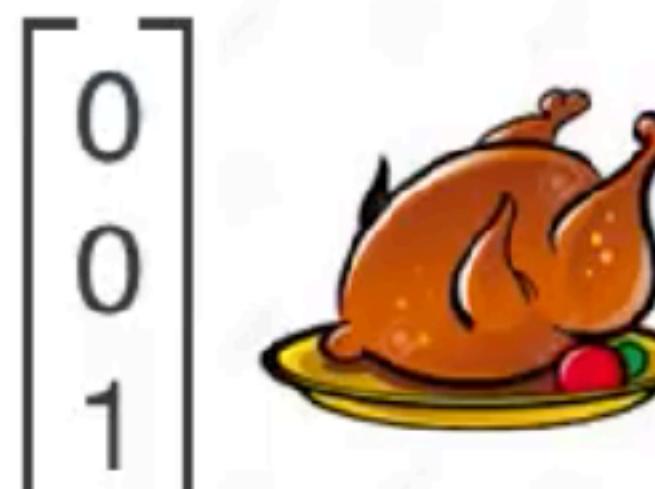
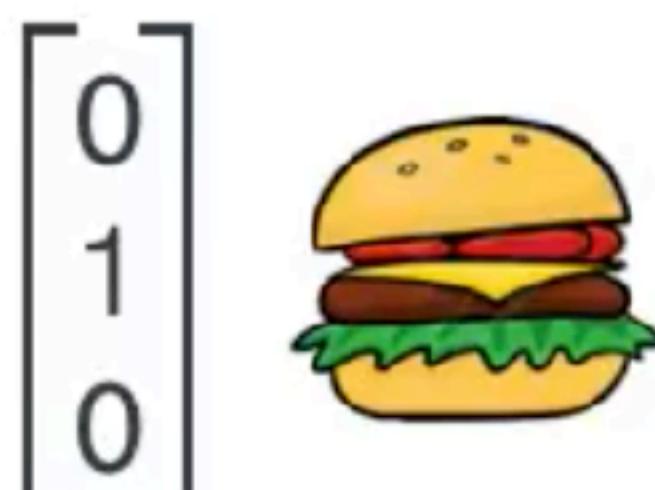
$$\begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$



Same

Next day

Food



$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ \hline 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

Food

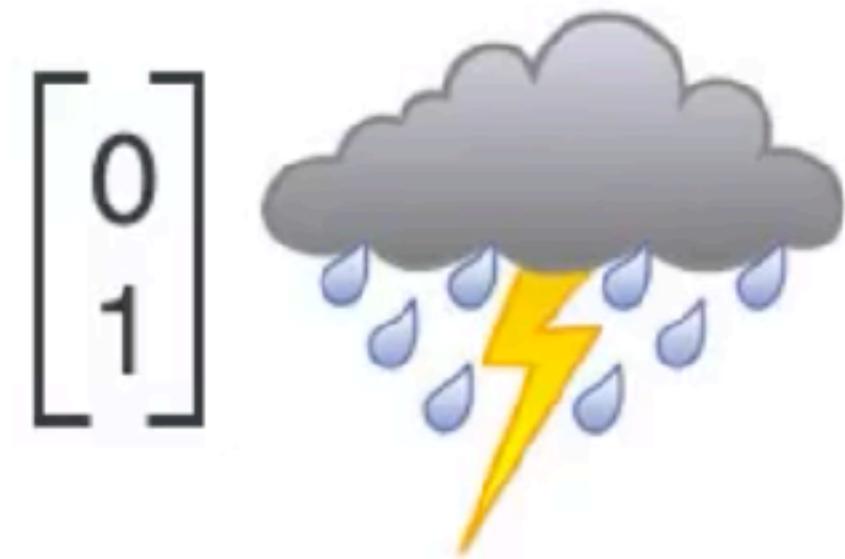
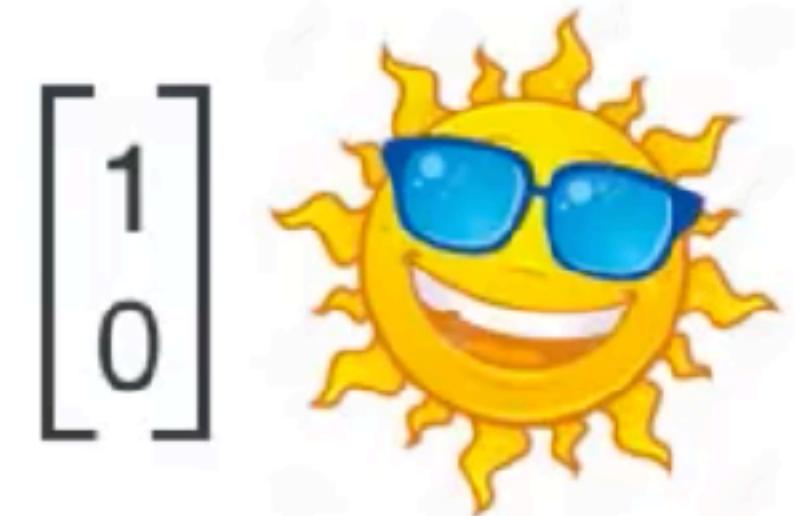


Same



Next day

Weather



$$\begin{bmatrix} 1 & 0 \\ 1 & 0 \\ \hline 1 & 0 \\ 0 & 1 \\ 0 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

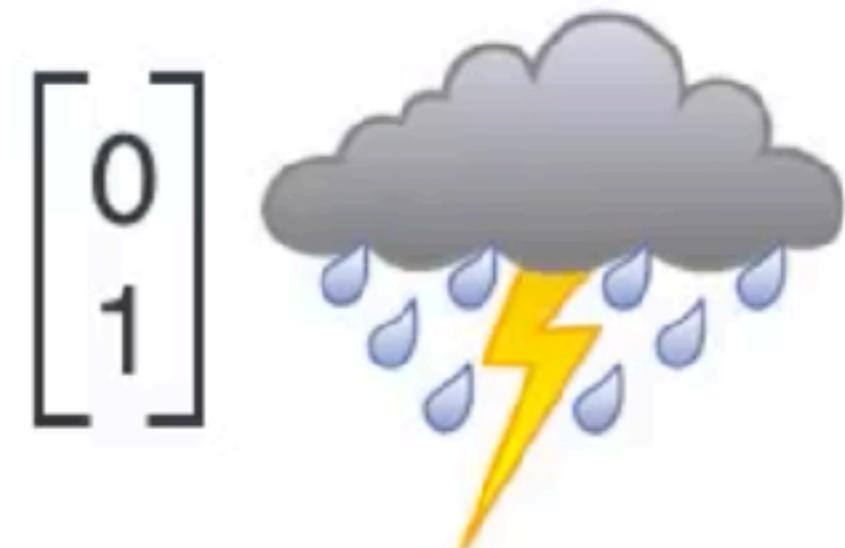

Weather

$$\begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$


Same

Next day

Weather



$$\begin{bmatrix} 1 & 0 \\ 1 & 0 \\ 1 & 0 \\ \hline 0 & 1 \\ 0 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ \hline 1 \\ 1 \\ 1 \end{bmatrix}$$


Weather

$$\begin{bmatrix} 0 \\ 0 \\ 0 \\ \hline 1 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} \text{Sun with sunglasses emoji} \\ \text{Cloud with rain and lightning emoji} \end{bmatrix}$$

Same

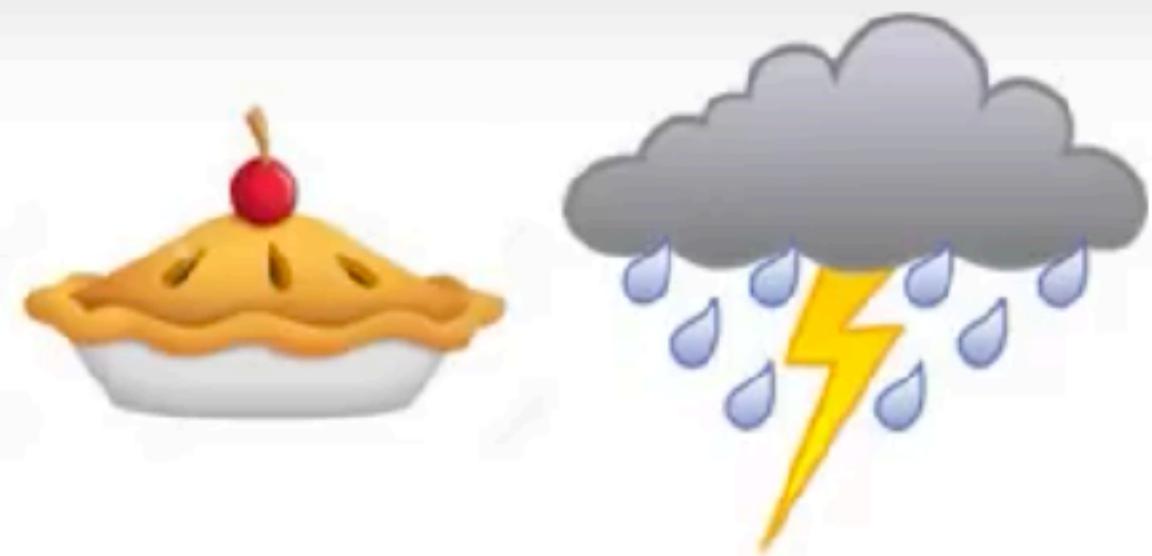
Next day

Add

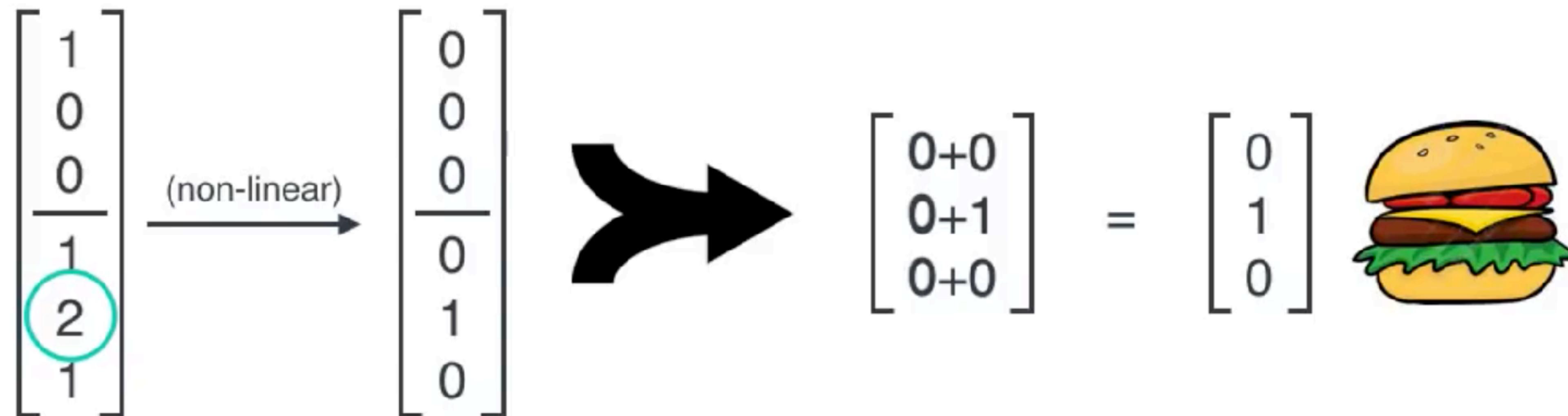


$$\begin{bmatrix} 1 \\ 0 \\ 0 \\ \hline 0 \\ 1 \\ 0 \end{bmatrix} \text{ Same } \begin{bmatrix} 0 \\ 0 \\ 0 \\ \hline 1 \\ 1 \\ 1 \end{bmatrix} \text{ Next day} + \begin{bmatrix} 0 \\ 0 \\ 0 \\ \hline 1 \\ 1 \\ 1 \end{bmatrix} \text{ Same } \begin{bmatrix} 1 \\ 0 \\ 0 \\ \hline 1 \\ 2 \\ 1 \end{bmatrix} \text{ Next day} = \begin{bmatrix} 1 \\ 0 \\ 0 \\ \hline 1 \\ 2 \\ 1 \end{bmatrix}$$

The diagram illustrates a recurrent neural network addition operation. It shows two hidden states, each represented by a 6-dimensional vector (row vector for the first, column vector for the second). The first hidden state corresponds to the emoji sequence "Pie, Rain", and the second corresponds to "Sun, Rain". The addition is performed element-wise, resulting in a third hidden state corresponding to the emoji sequence "Pie, Sun". The resulting vector is highlighted with a green circle around the value 2 in the fourth position.



Merge



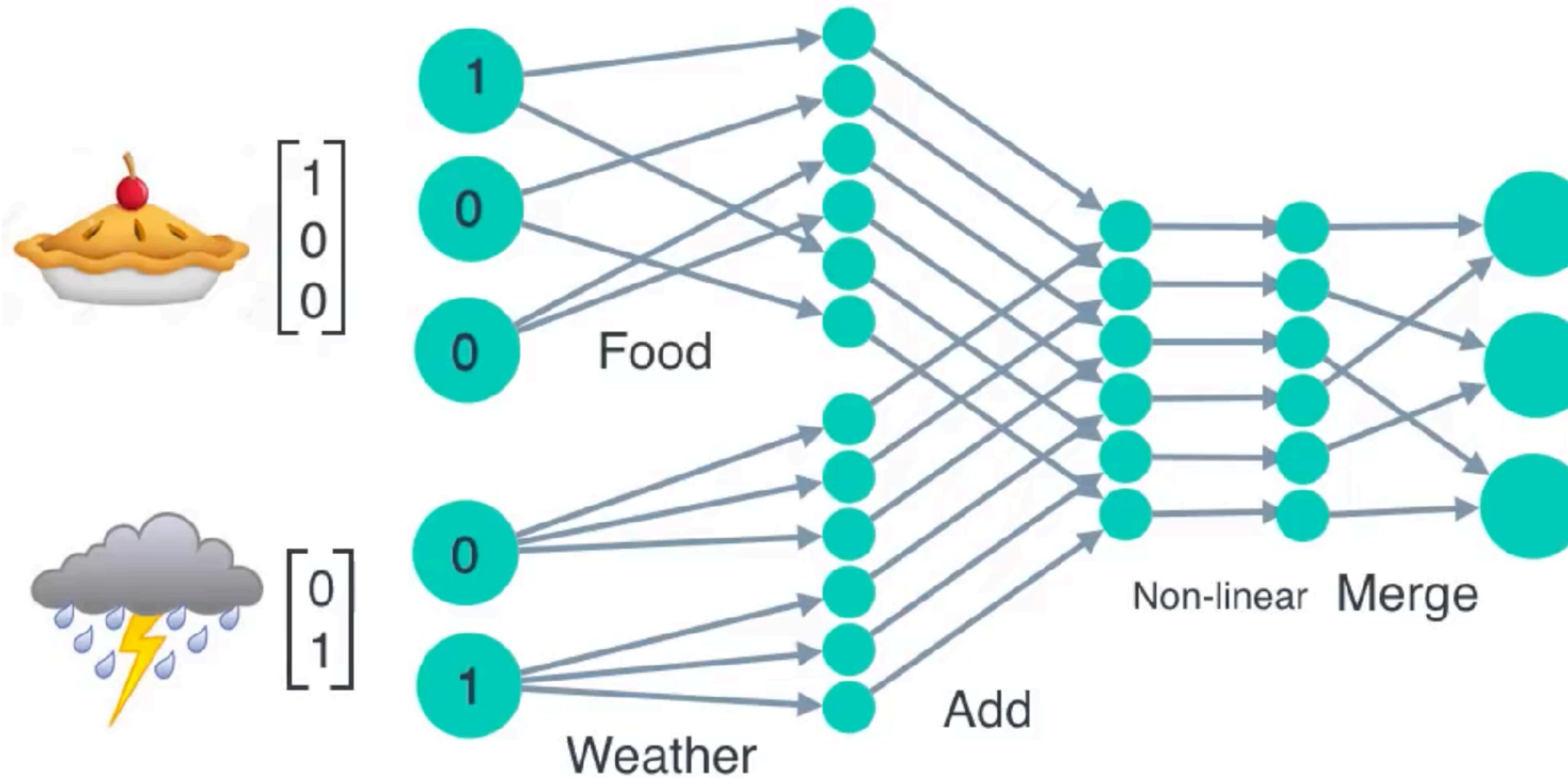


Merge

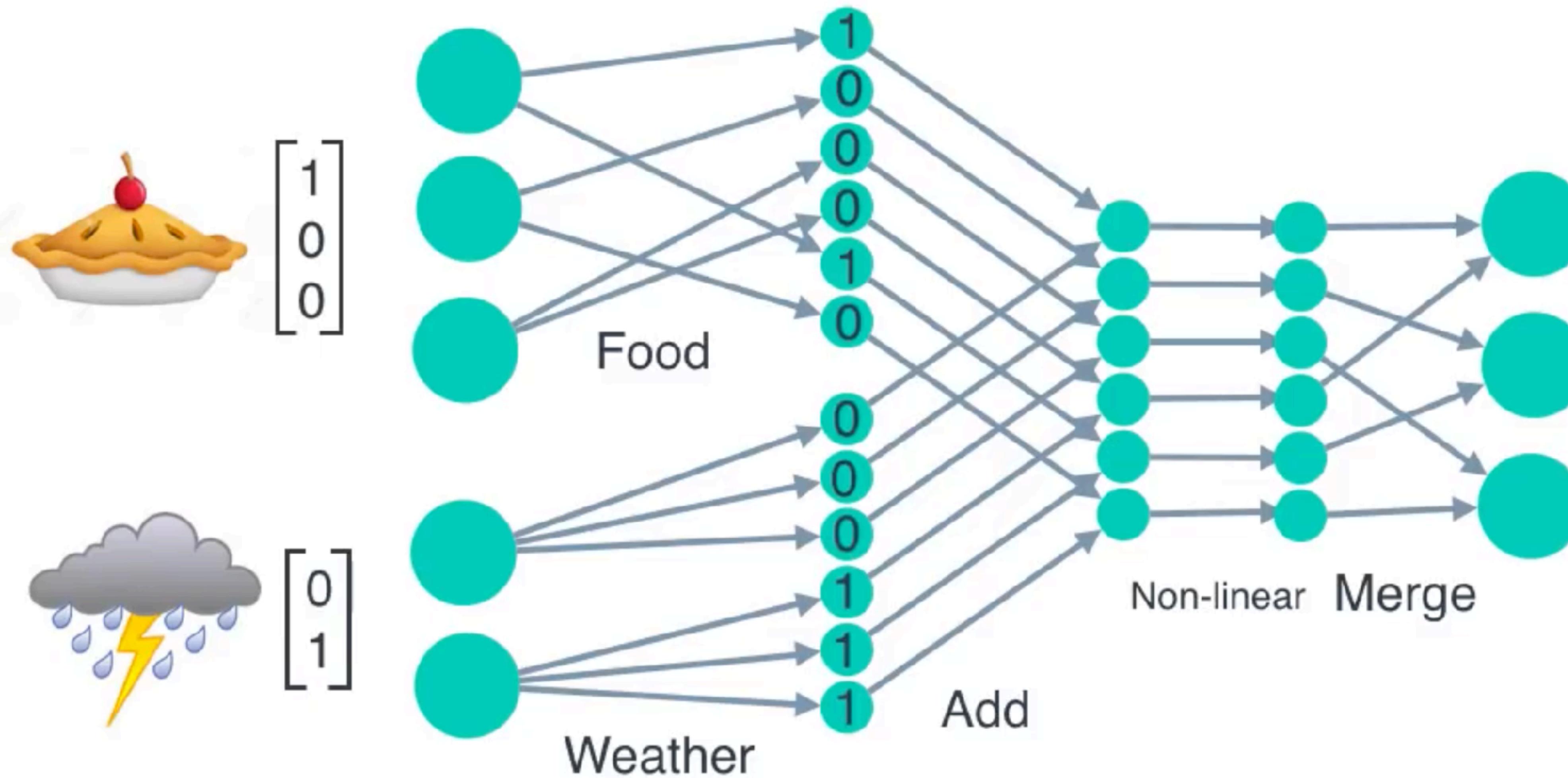
$$\left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{array} \right] \left[\begin{array}{c} 0 \\ 0 \\ 0 \\ \hline 0 \\ 1 \\ 0 \end{array} \right] = \left[\begin{array}{c} 0+0 \\ 0+1 \\ 0+0 \end{array} \right] = \left[\begin{array}{c} 0 \\ 1 \\ 0 \end{array} \right] \quad \text{Hamburger emoji}$$

Merge

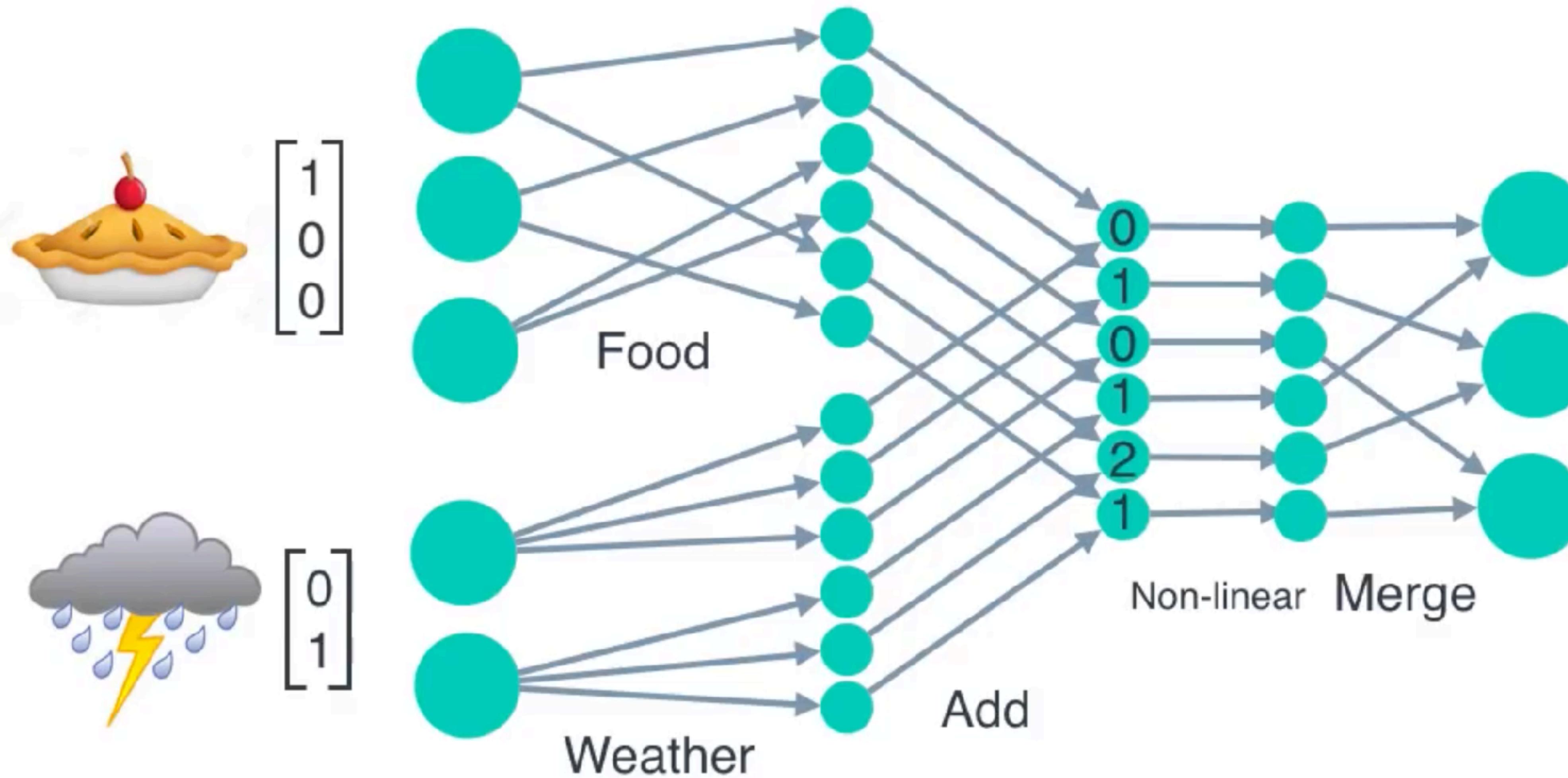
Recurrent Neural Network



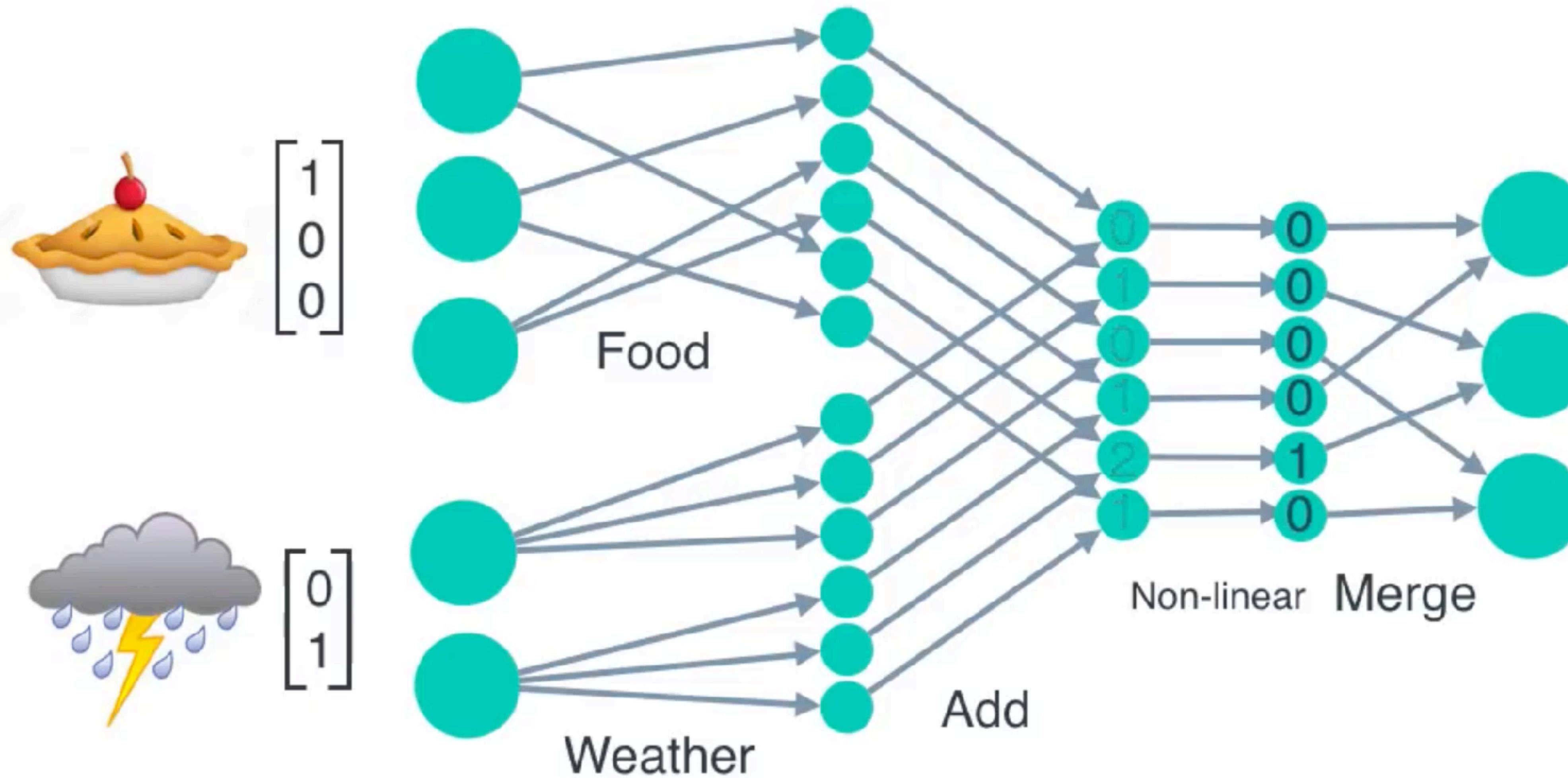
Recurrent Neural Network



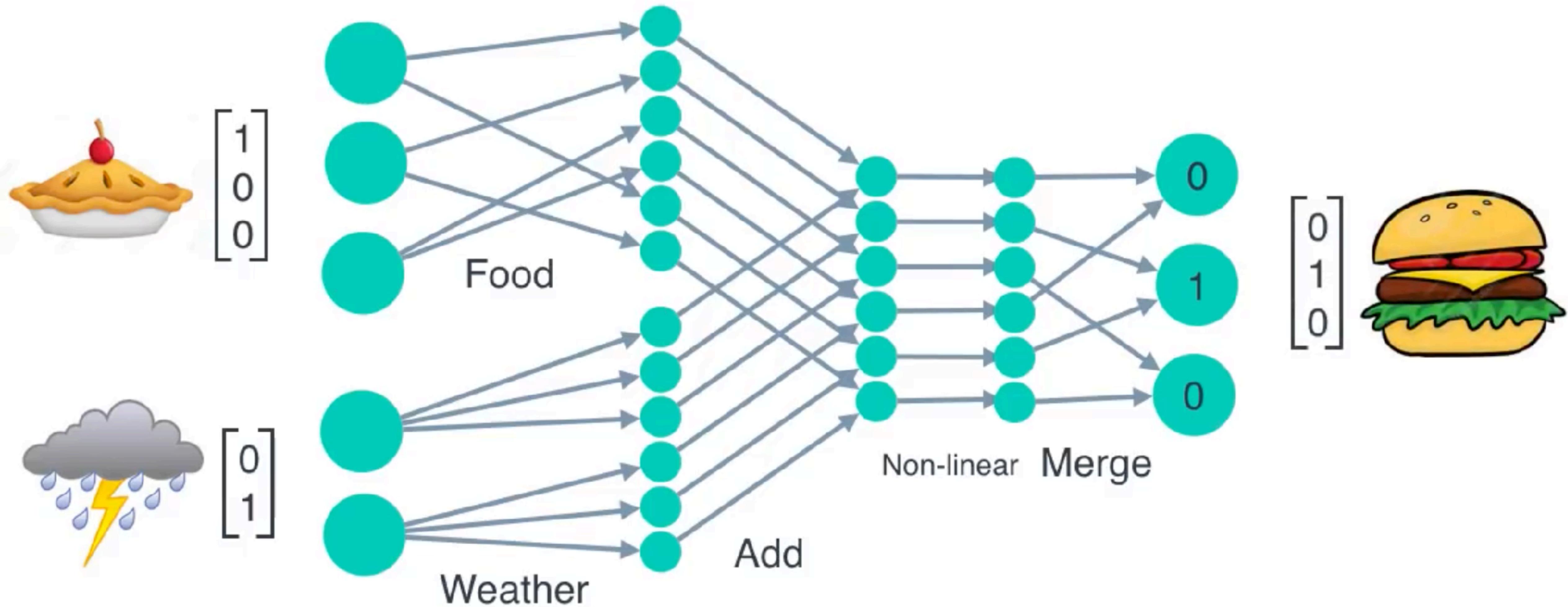
Recurrent Neural Network

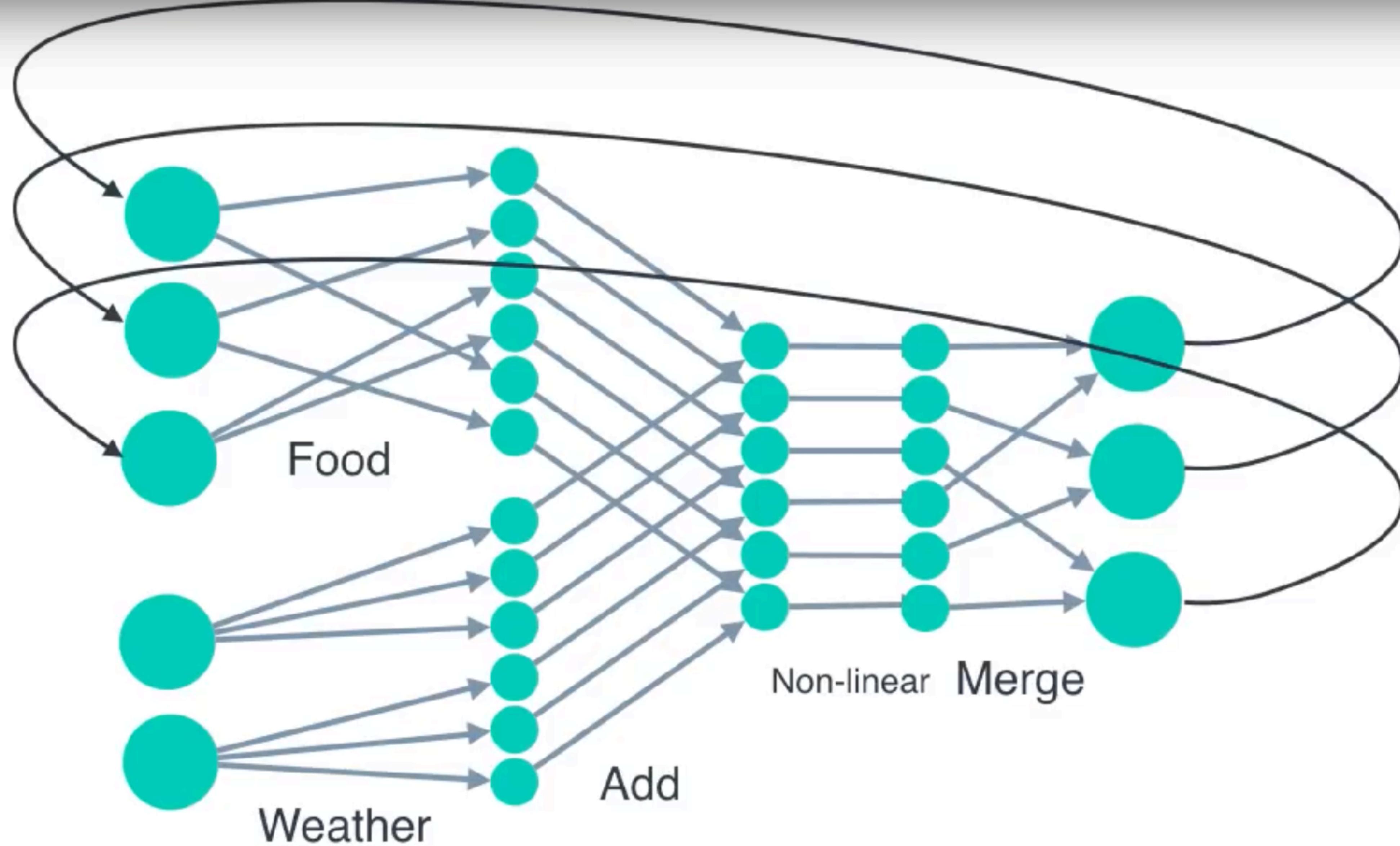


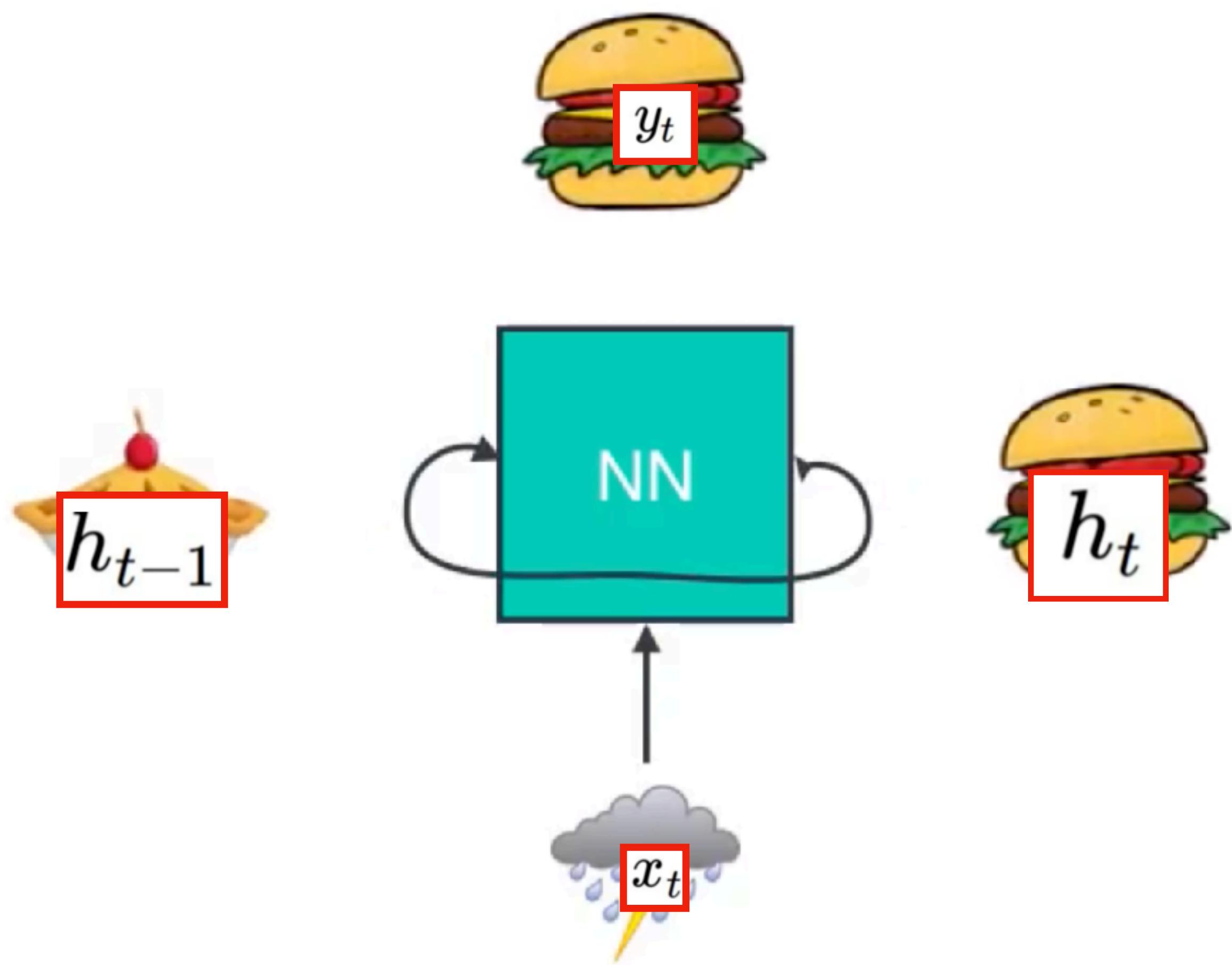
Recurrent Neural Network



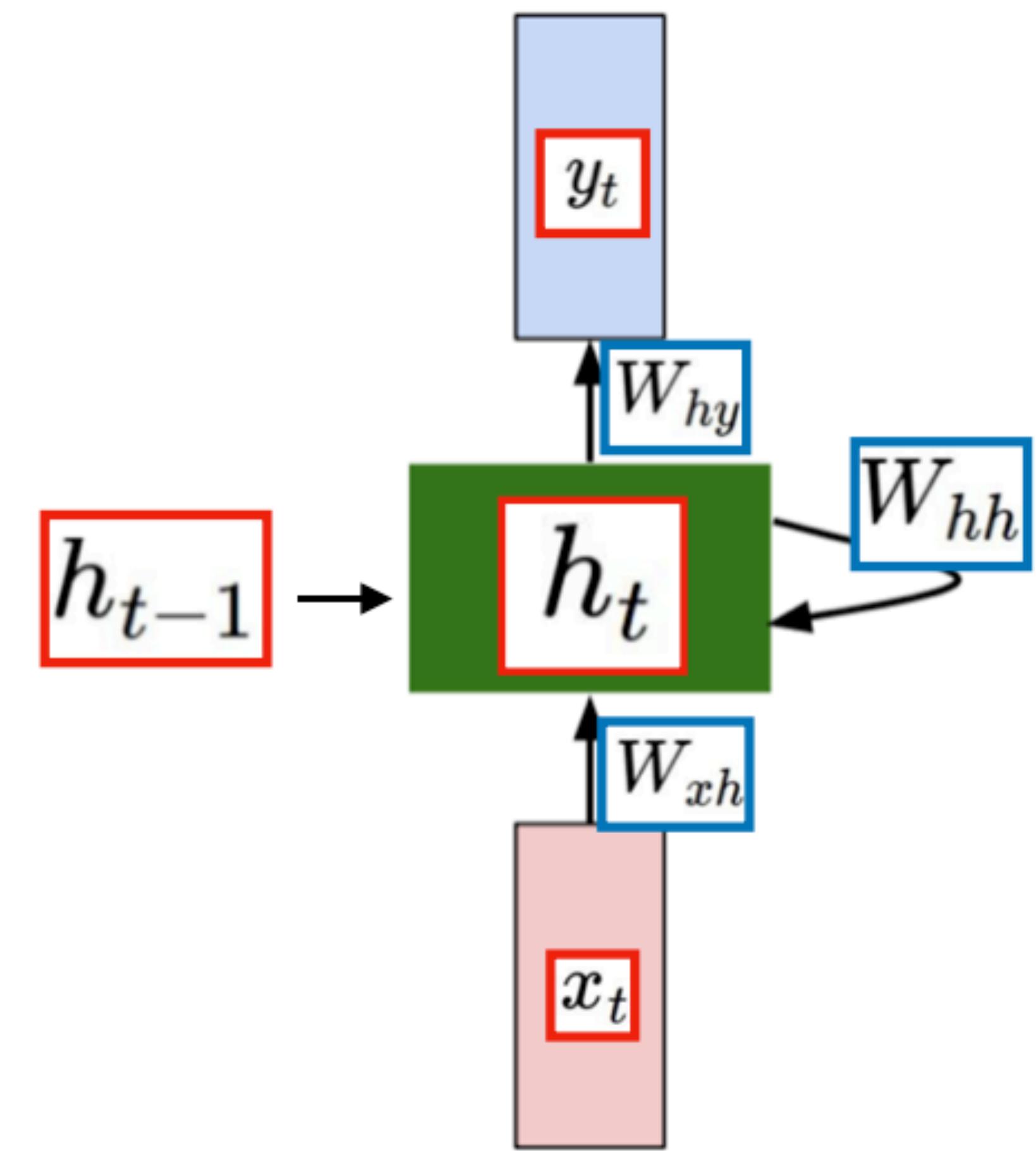
Recurrent Neural Network







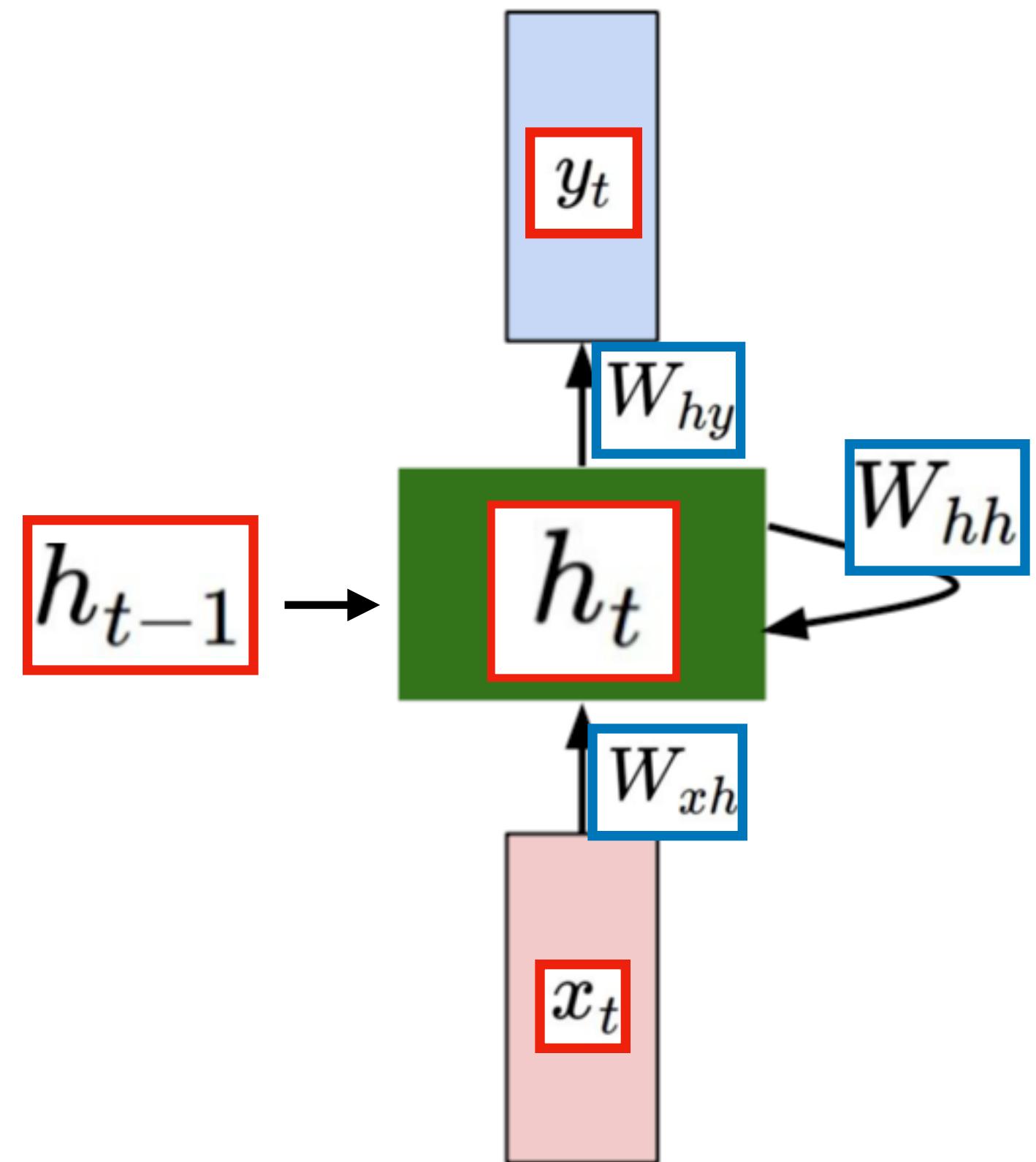
$$y_t = h_t$$



$$y_t \neq h_t$$

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http://cs231n.stanford.edu/slides/2017/cs231n_2017_lecture10.pdf



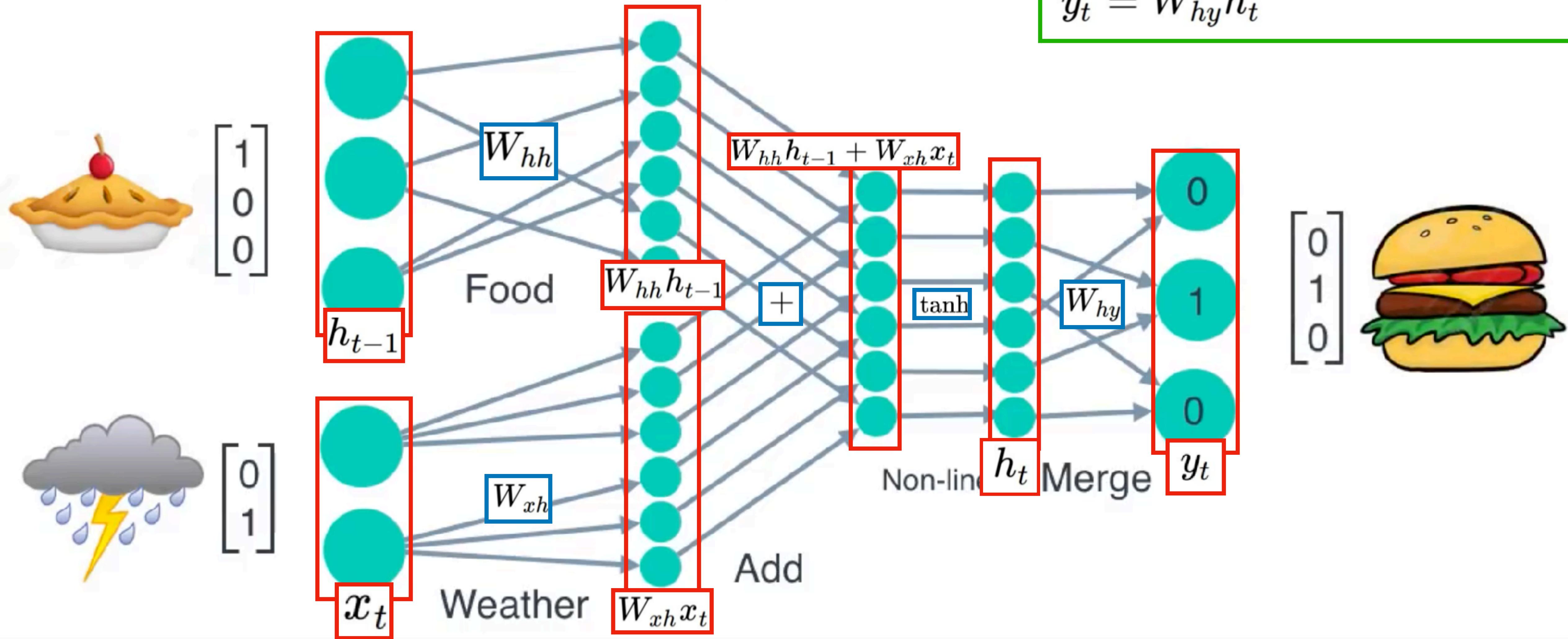
$$h_t = \tanh(W_{hh}h_{t-1} + W_{xh}x_t)$$

$$y_t = W_{hy}h_t$$

Recurrent Neural Networks

$$h_t = \tanh(W_{hh}h_{t-1} + W_{xh}x_t)$$

$$y_t = W_{hy}h_t$$



<https://youtu.be/UNmqTiOnRfg>

http://cs231n.stanford.edu/slides/2017/cs231n_2017_lecture10.pdf