



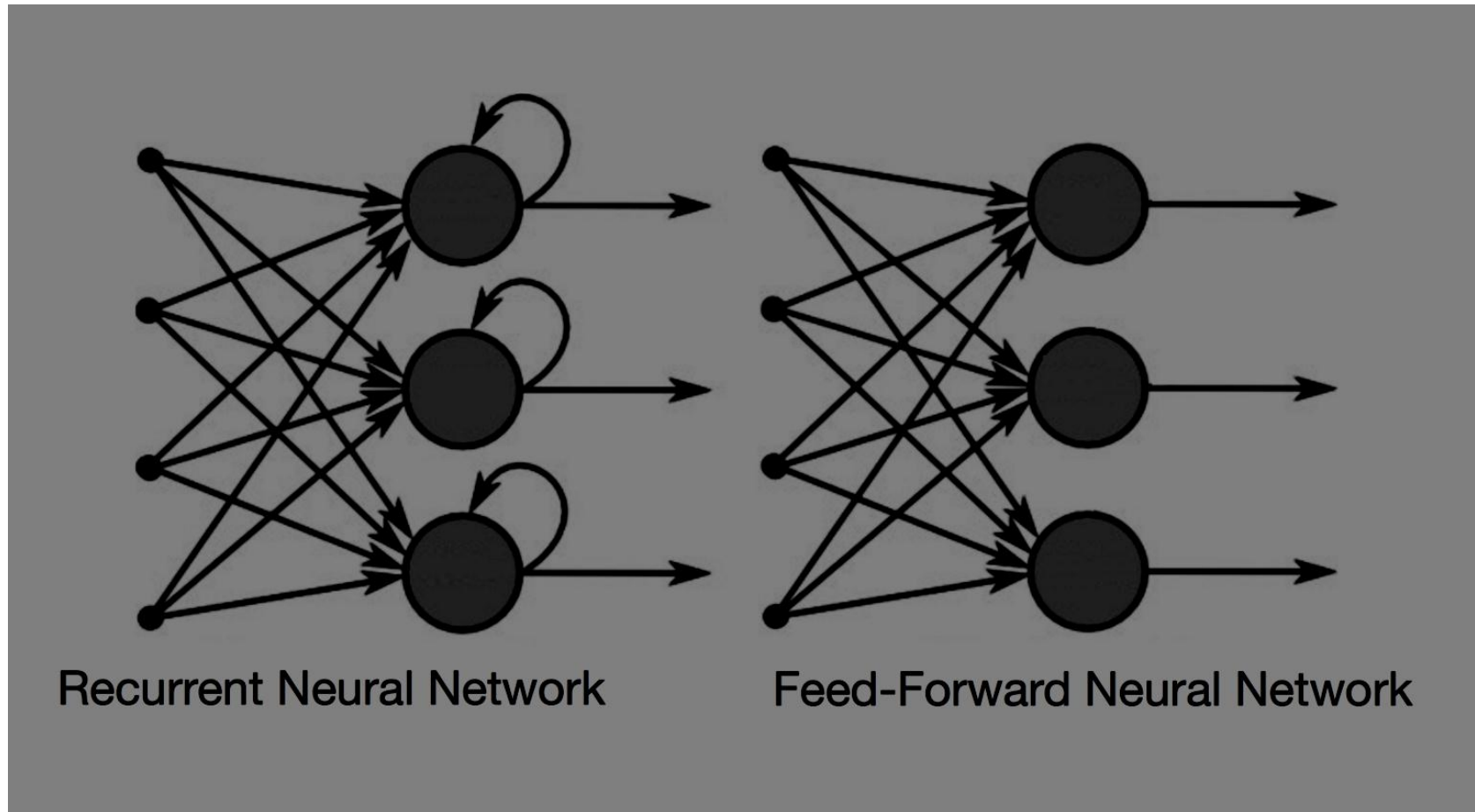
# Sequence Prediction Problems

- Output depends on previous inputs also
- The length of the input is not fixed

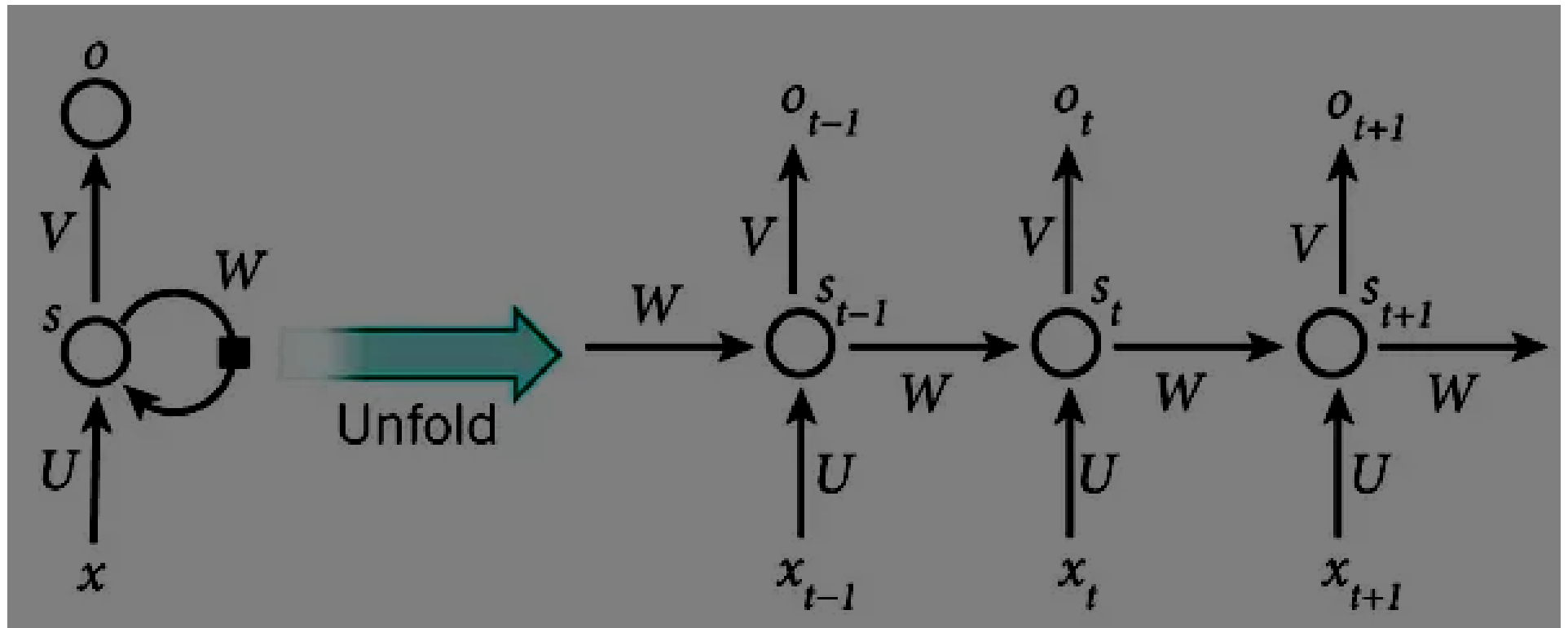
# Recurrent Neural Network

- RNN is a powerful type of neural network designed to handle sequence predictions.
- The Long Short-Term Memory network(LSTM) network is a type of RNN used in deep learning.
- The LSTM network, is trained using Back propagation through Time

# RNN Feedback path



# RNN Model



# RNN Model

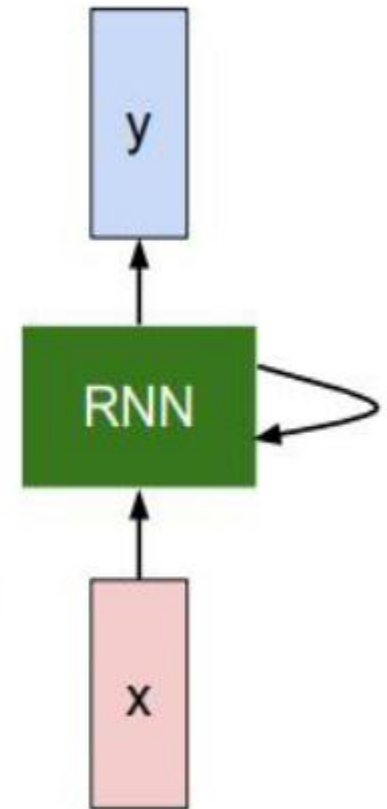
We can process a sequence of vectors  $\mathbf{x}$  by applying a **recurrence formula** at every time step:

$$\boxed{h_t} = \boxed{f_W}(\boxed{h_{t-1}}, \boxed{x_t})$$

new state / some function with parameters  $W$

old state

input vector at some time step



Notice: the same function and the same set of parameters are used at every time step

# Sequential Patterns

Text

Speech

Audio

Video

Physical processes

Anything embedded in time (almost everything)