

Sequence Data

Neural Networks Design And Application

Convolutional neural networks

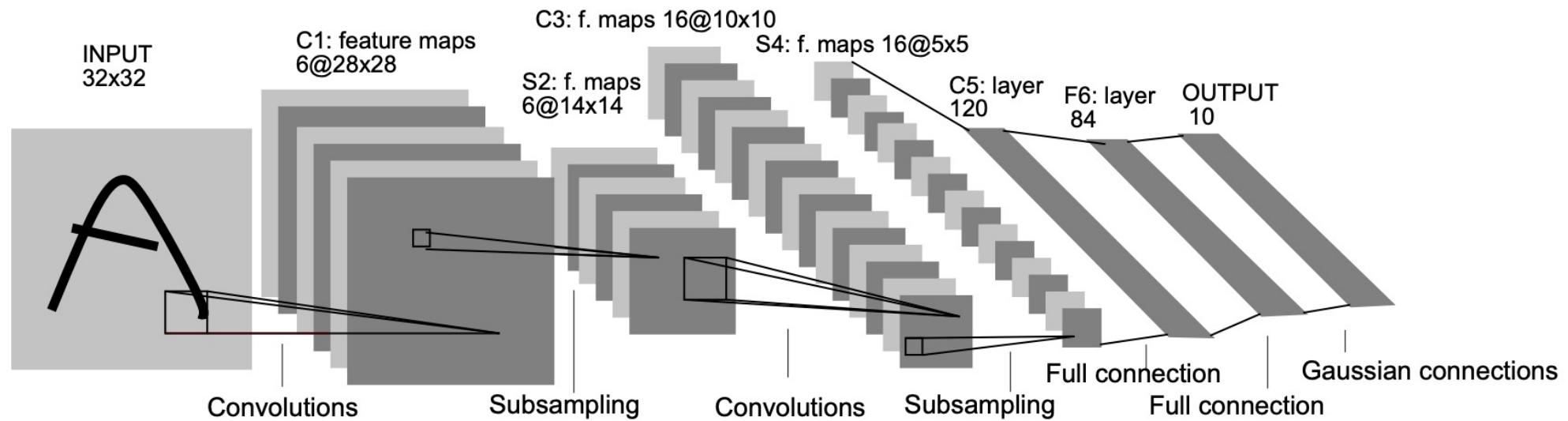


Fig. 1. Architecture of LeNet-5, a Convolutional Neural Network, here for digits recognition. Each plane is a feature map, i.e. a set of units whose weights are constrained to be identical.

Convolutional neural networks

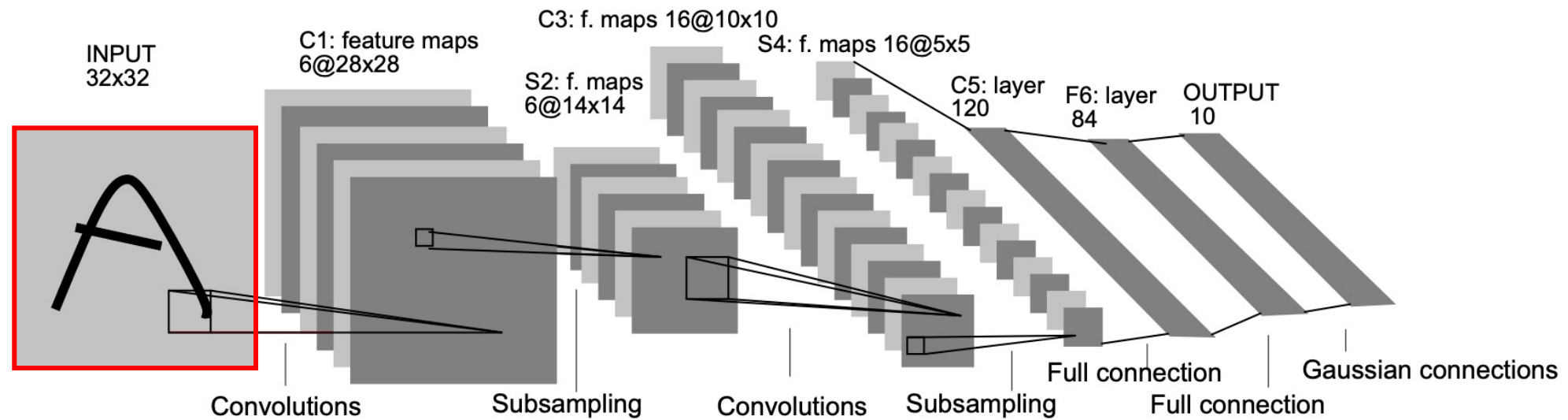


Fig. 1. Architecture of LeNet-5, a Convolutional Neural Network, here for digits recognition. Each plane is a feature map, i.e. a set of units whose weights are constrained to be identical.

Convolutional neural networks



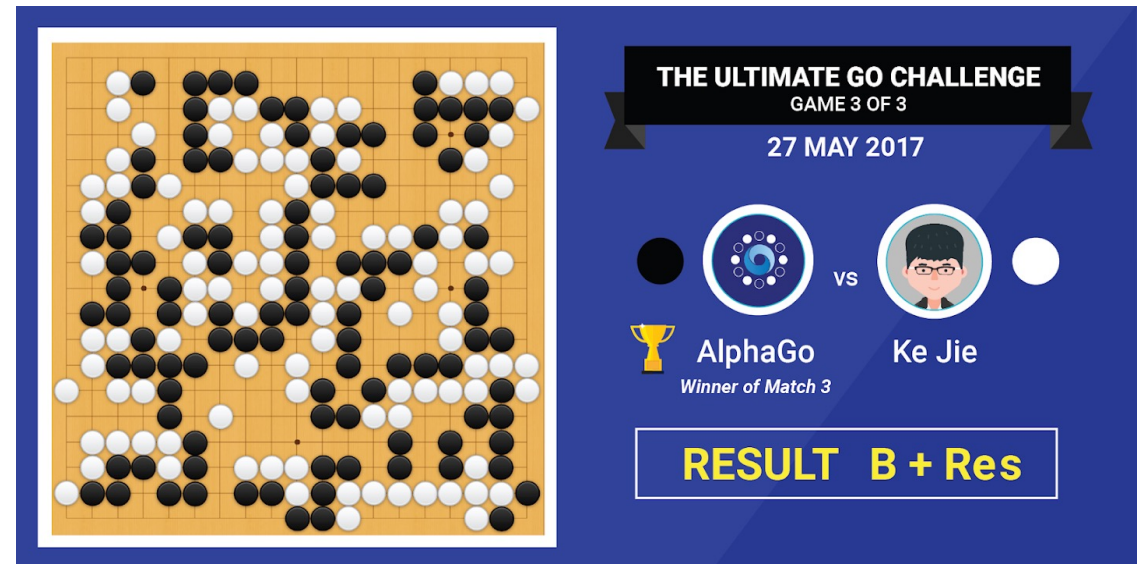
Fig. 1. Architecture for digits recognition. Each plane is constrained to be identical.

Convolutional neural networks

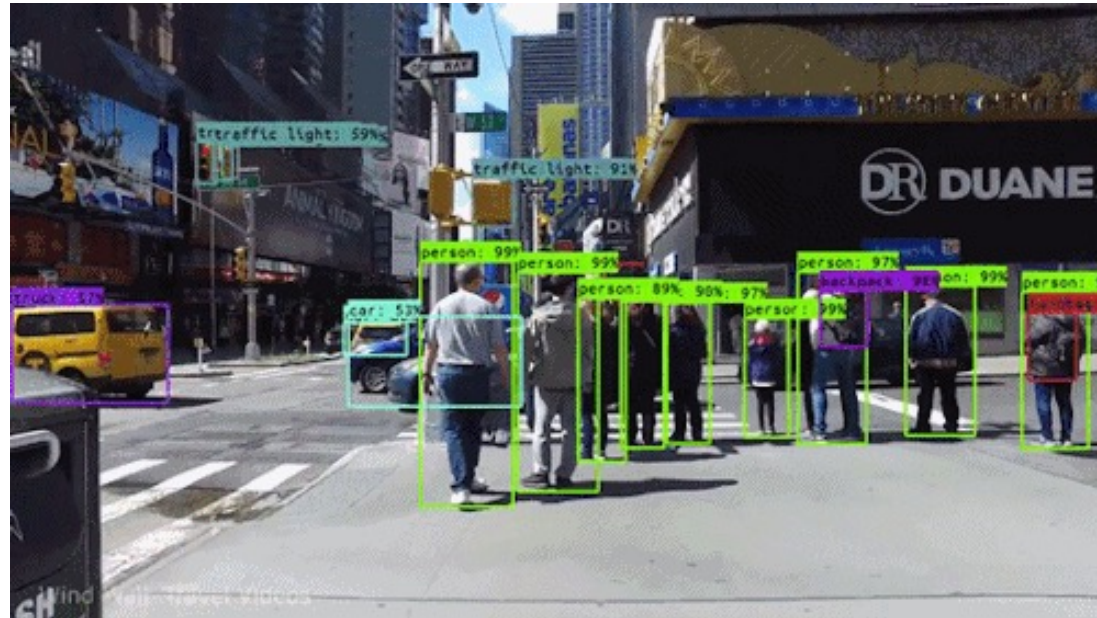


Fig. 1. Architecture of the CNN for digit recognition. Each plane in the network is constrained to be identical.

Some data may not be independent



Some data may not be independent



Some data may not be independent

[A demo video](https://pjreddie.com/darknet/yolo/) of **YOLOv3** from <https://pjreddie.com/darknet/yolo/>

Limitations of FC nets and CNNs

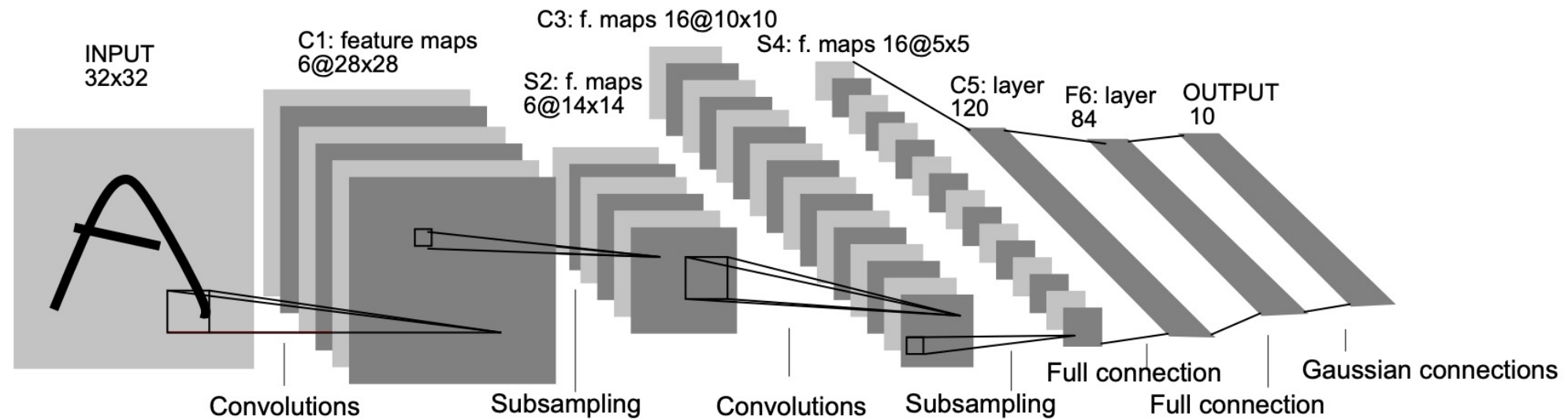


Fig. 1. Architecture of LeNet-5, a Convolutional Neural Network, here for digits recognition. Each plane is a feature map, i.e. a set of units whose weights are constrained to be identical.

Limitations of FC nets and CNNs

one to one

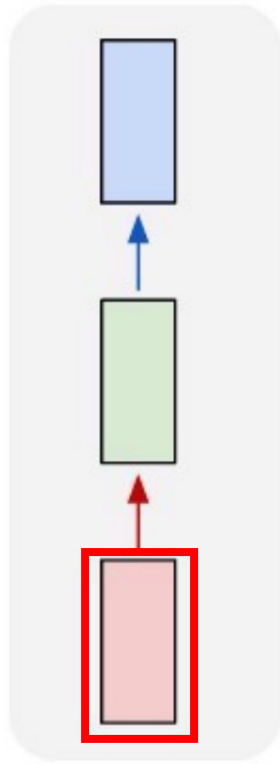


Image data: a single sample

Limitations of FC nets and CNNs

one to one

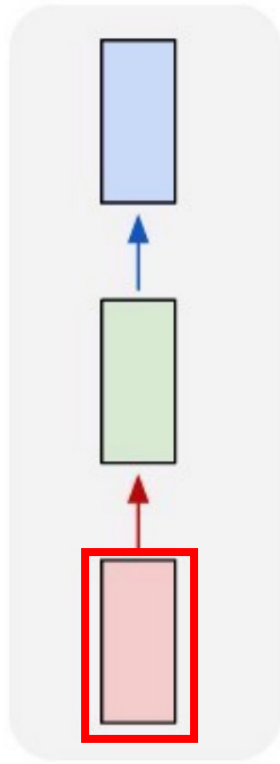


Image data: a single sample

Q: what if video data (e.g.,
60 frame per second)?

Limitations of FC nets and CNNs

one to one

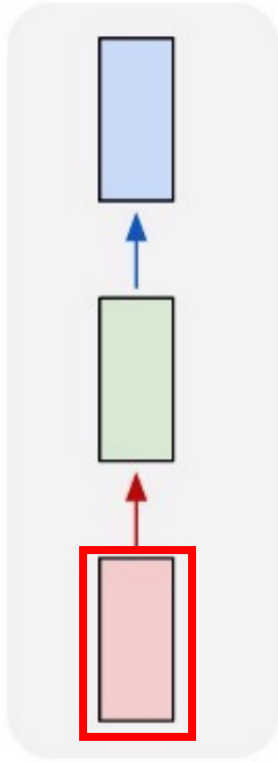
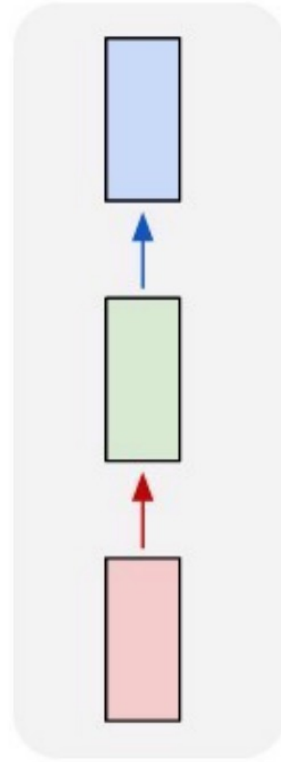


Image data: a single sample

Q: what if video data (e.g., 60 frame per second)?

one to one



Video data: multiple frames per second

Limitations of FC nets and CNNs

one to one

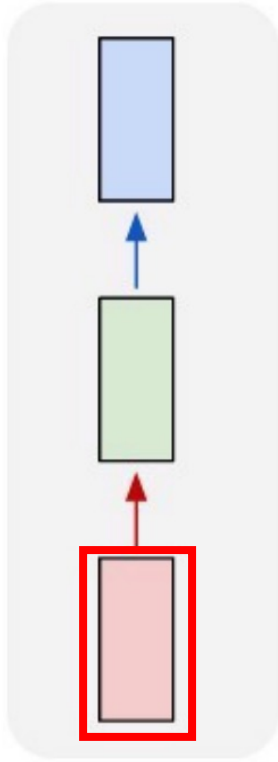
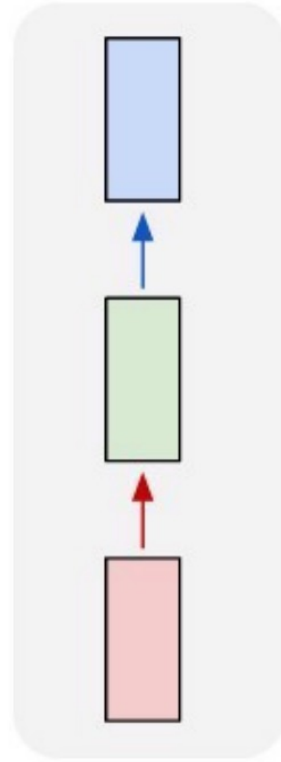


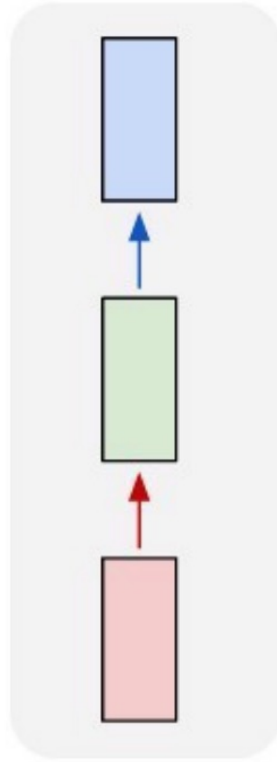
Image data: a single sample

Q: what if video data (e.g., 60 frame per second)?

one to one



one to one



Video data: multiple frames per second

Limitations of FC nets and CNNs

one to one

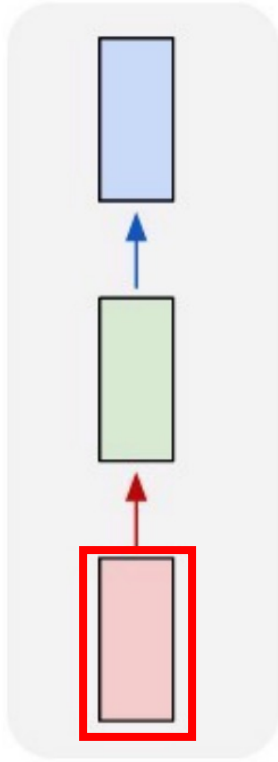
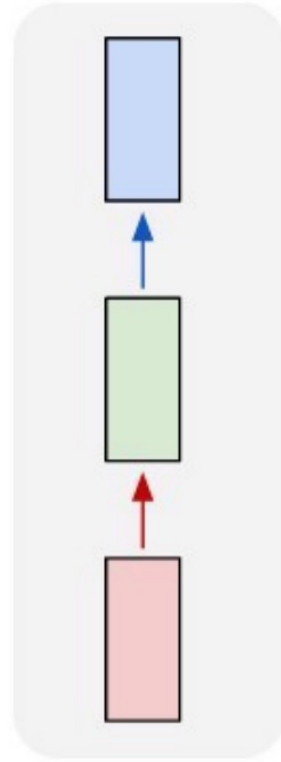


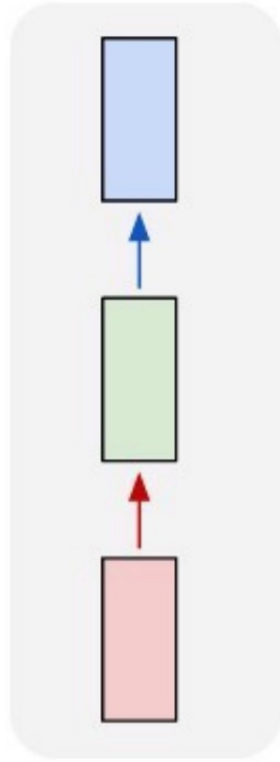
Image data: a single sample

Q: what if video data (e.g., 60 frame per second)?

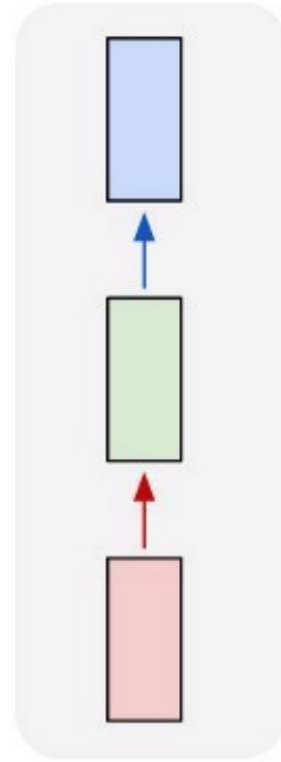
one to one



one to one



one to one



Video data: multiple frames per second

Limitations of FC nets and CNNs

one to one

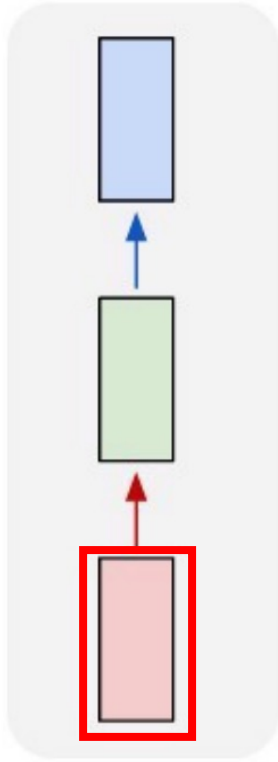


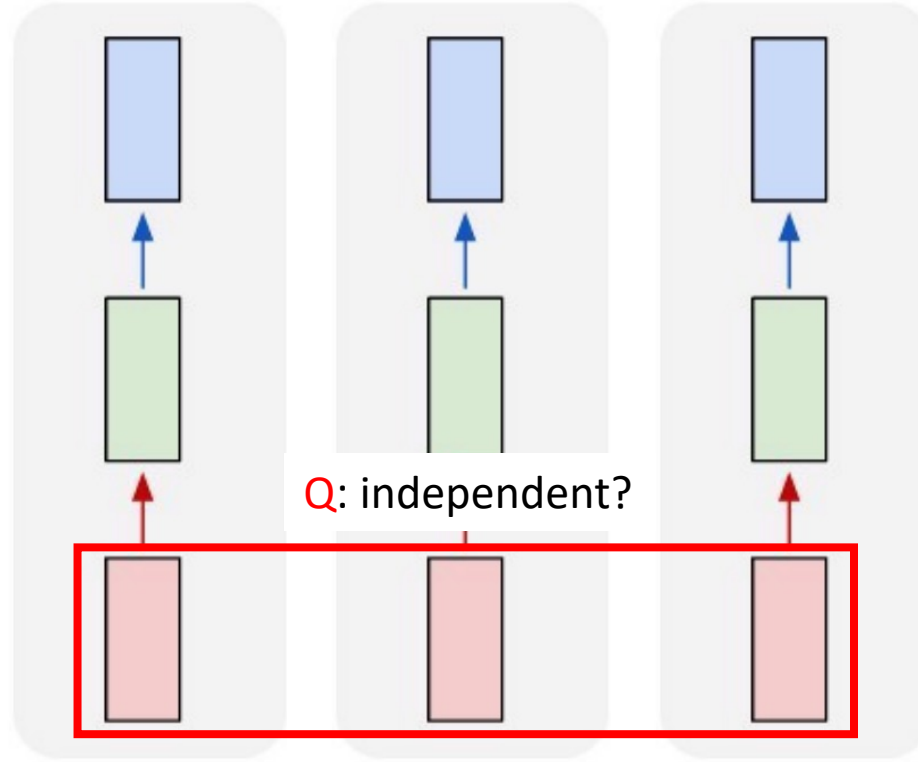
Image data: a single sample

Q: what if video data (e.g., 60 frame per second)?

one to one

one to one

one to one



Video data: multiple frames per second

Limitations of FC nets and CNNs

one to one

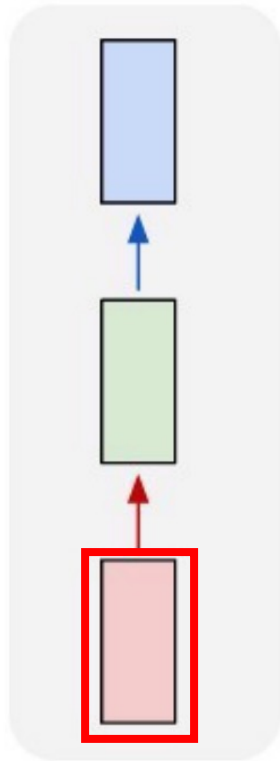


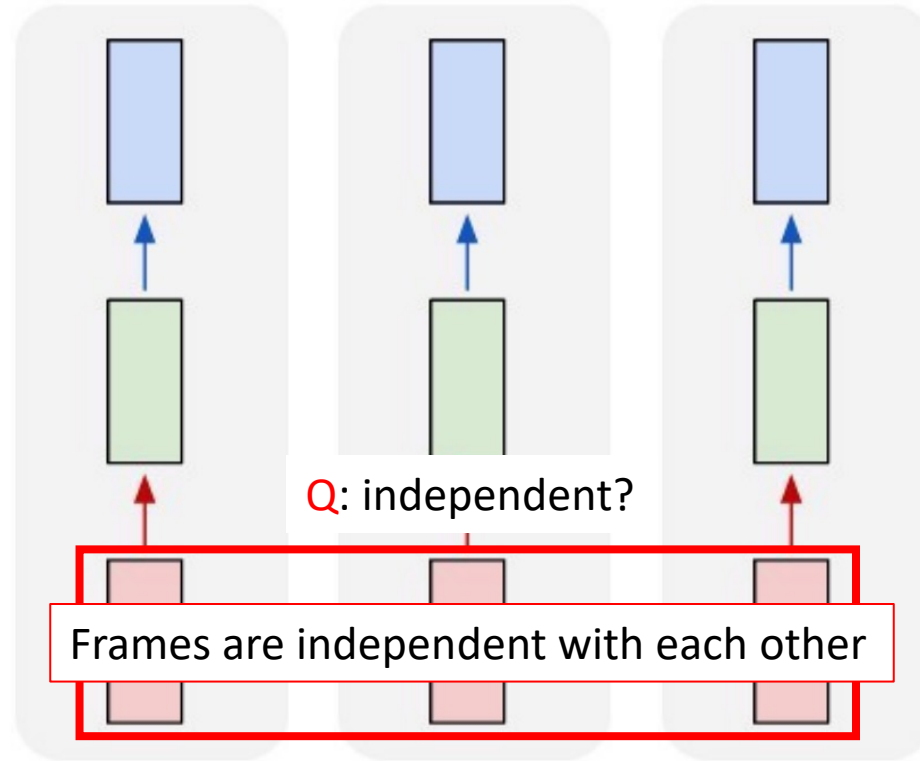
Image data: a single sample

Q: what if video data (e.g., 60 frame per second)?

one to one

one to one

one to one



Video data: multiple frames per second

Limitations of FC nets and CNNs

one to one

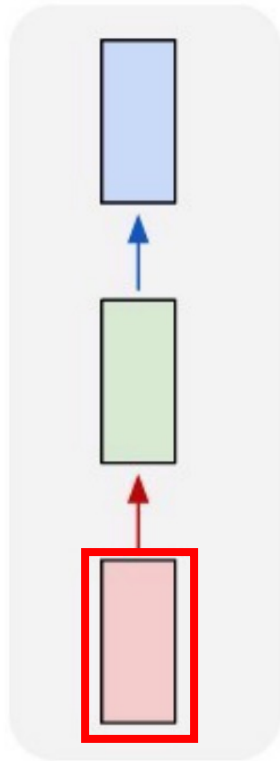
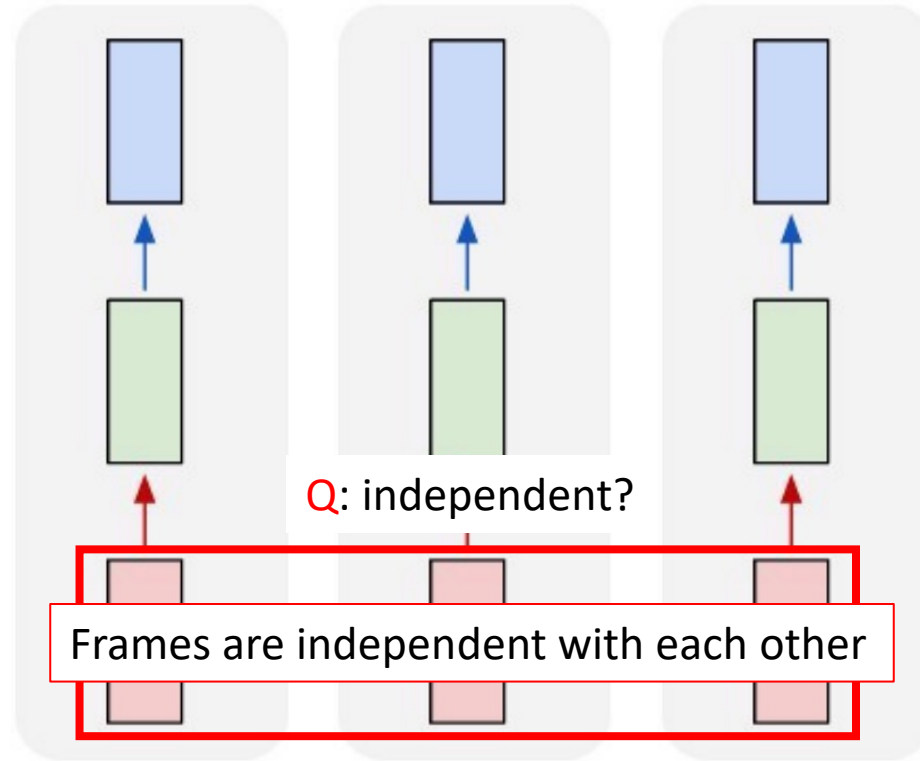


Image data: a single sample

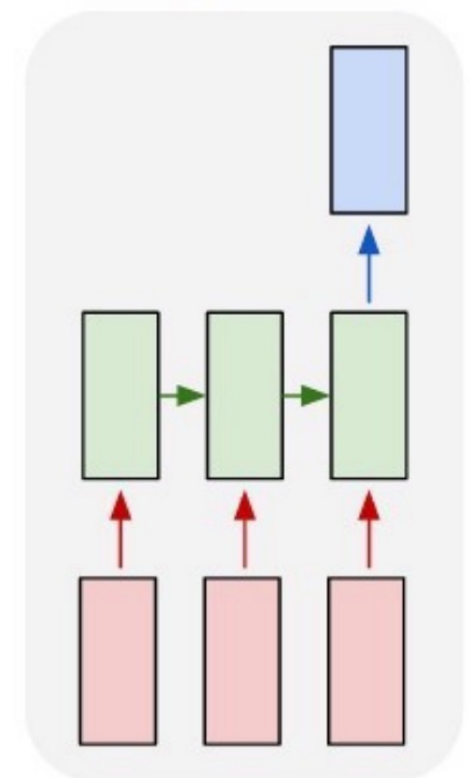
Q: what if video data (e.g., 60 frame per second)?

one to one one to one one to one



Video data: multiple frames per second

many to one



Video data: multiple frames per second

Limitations of FC nets and CNNs

one to one

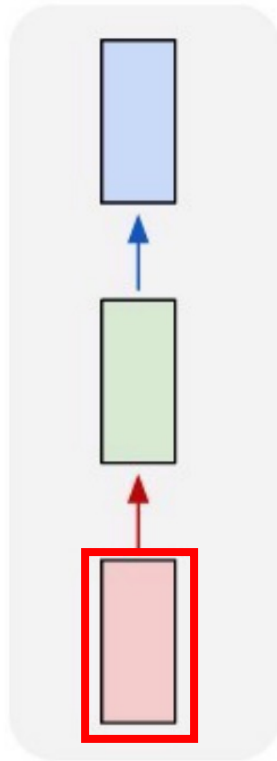
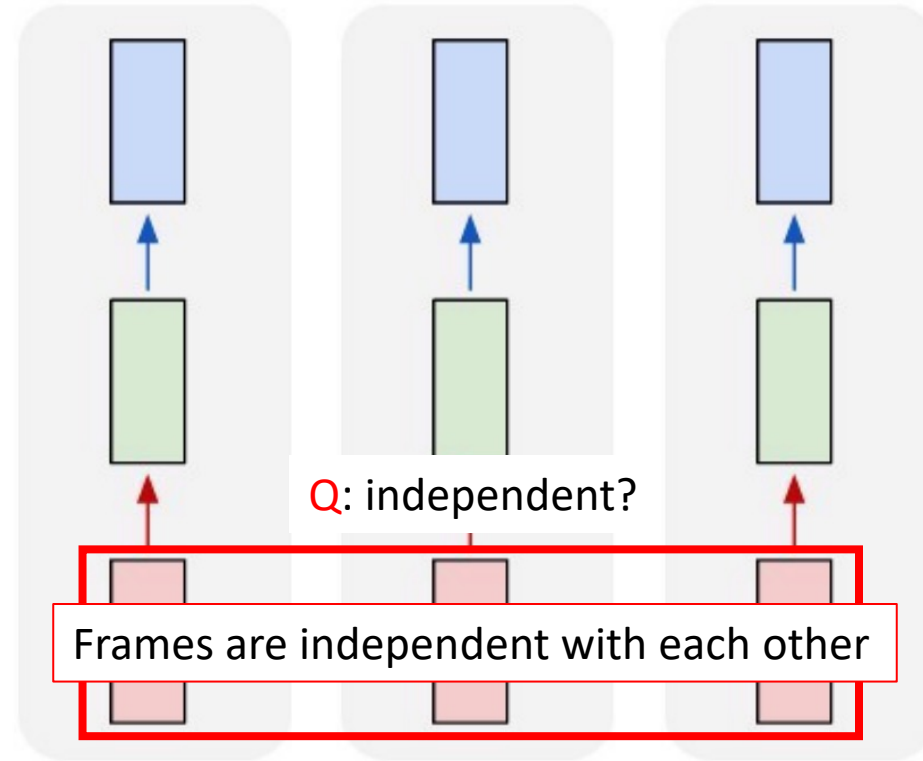


Image data: a single sample

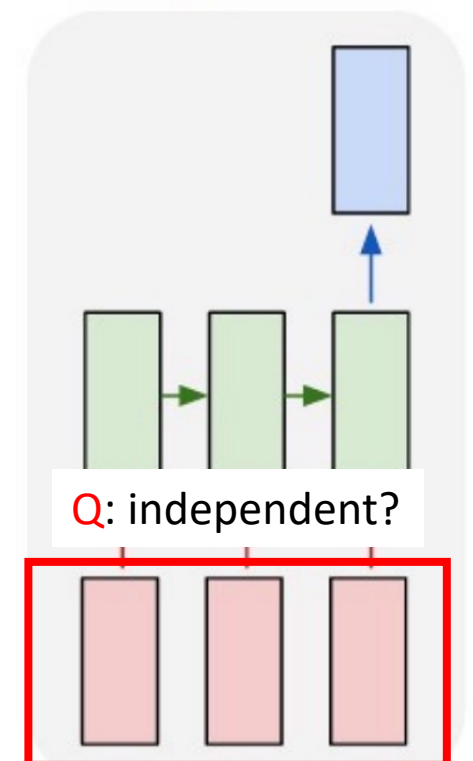
Q: what if video data (e.g., 60 frame per second)?

one to one one to one one to one



Video data: multiple frames per second

many to one



Video data: multiple frames per second

Limitations of FC nets and CNNs

one to one

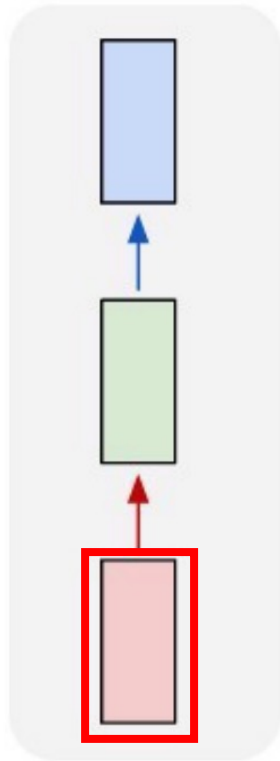
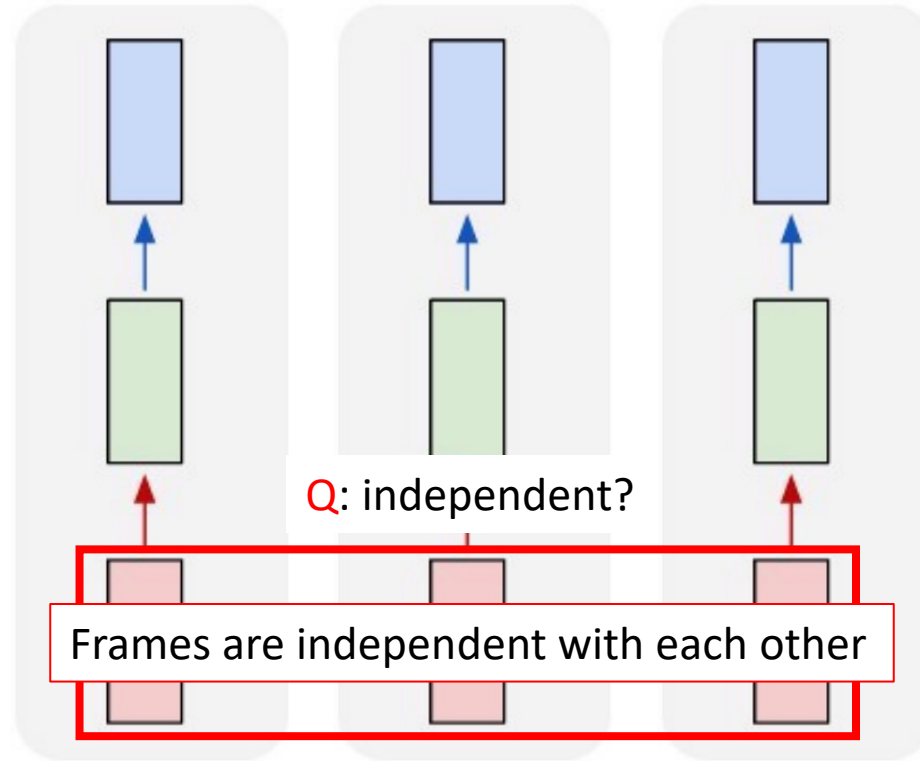


Image data: a single sample

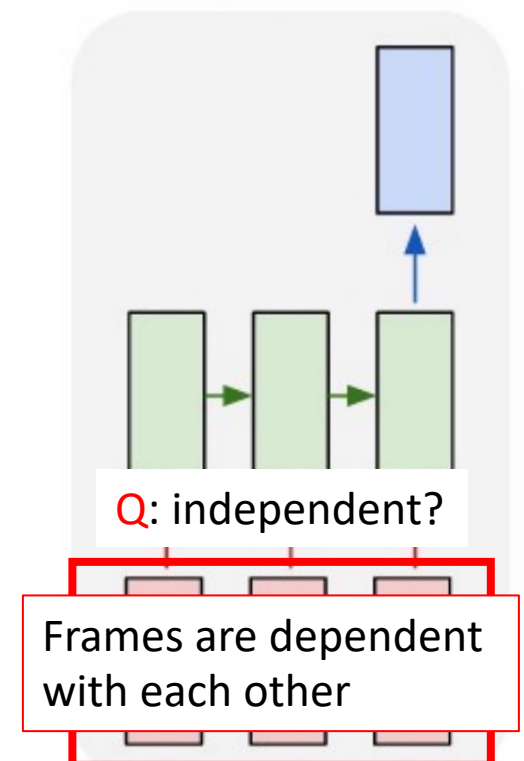
Q: what if video data (e.g., 60 frame per second)?

one to one one to one one to one



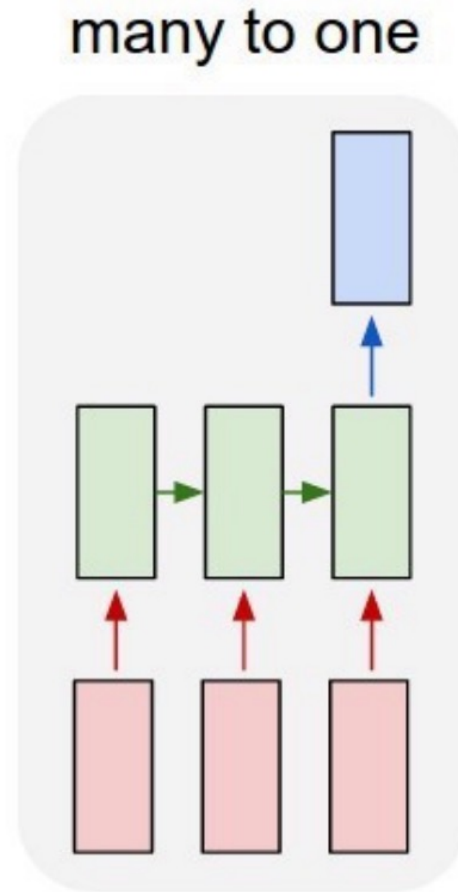
Video data: multiple frames per second

many to one

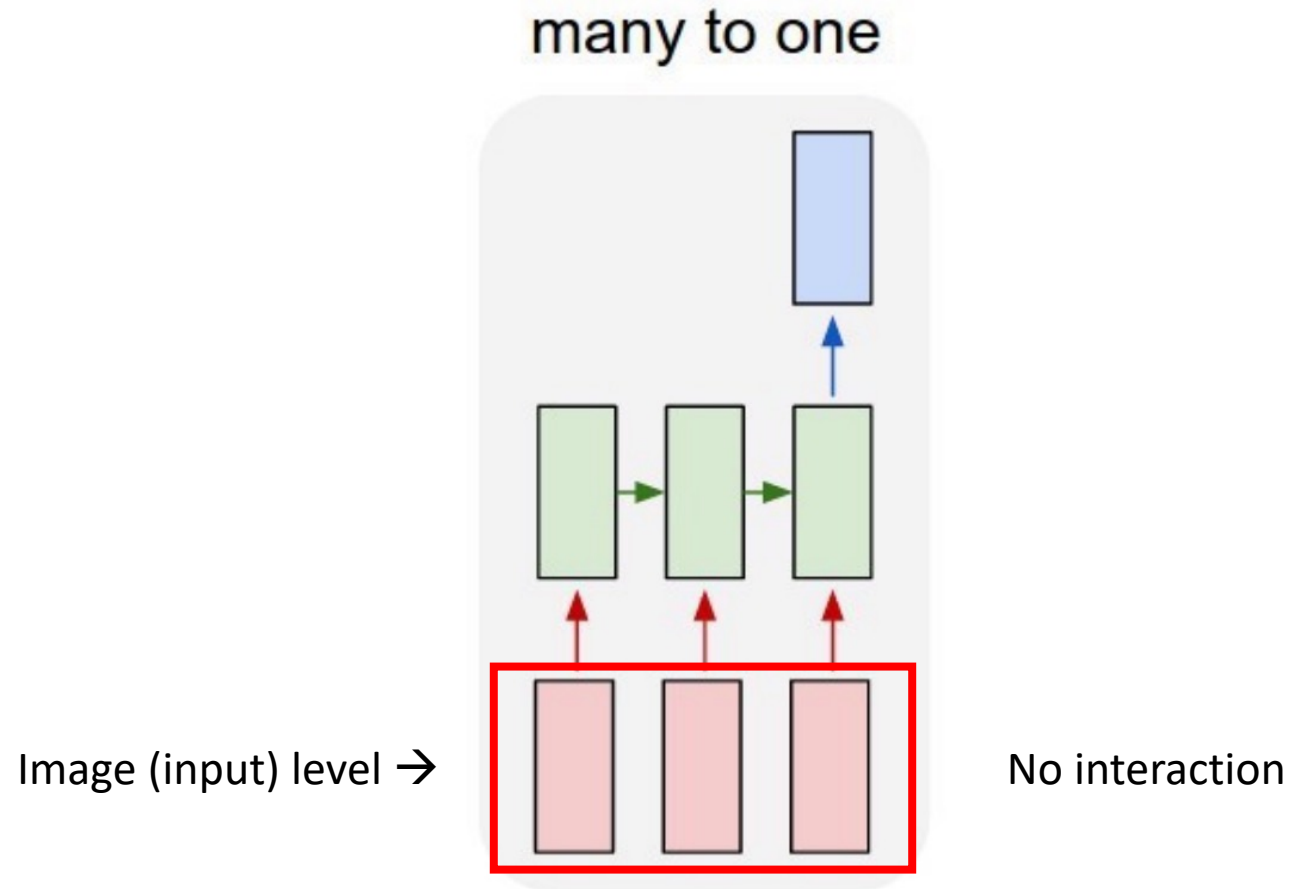


Video data: multiple frames per second

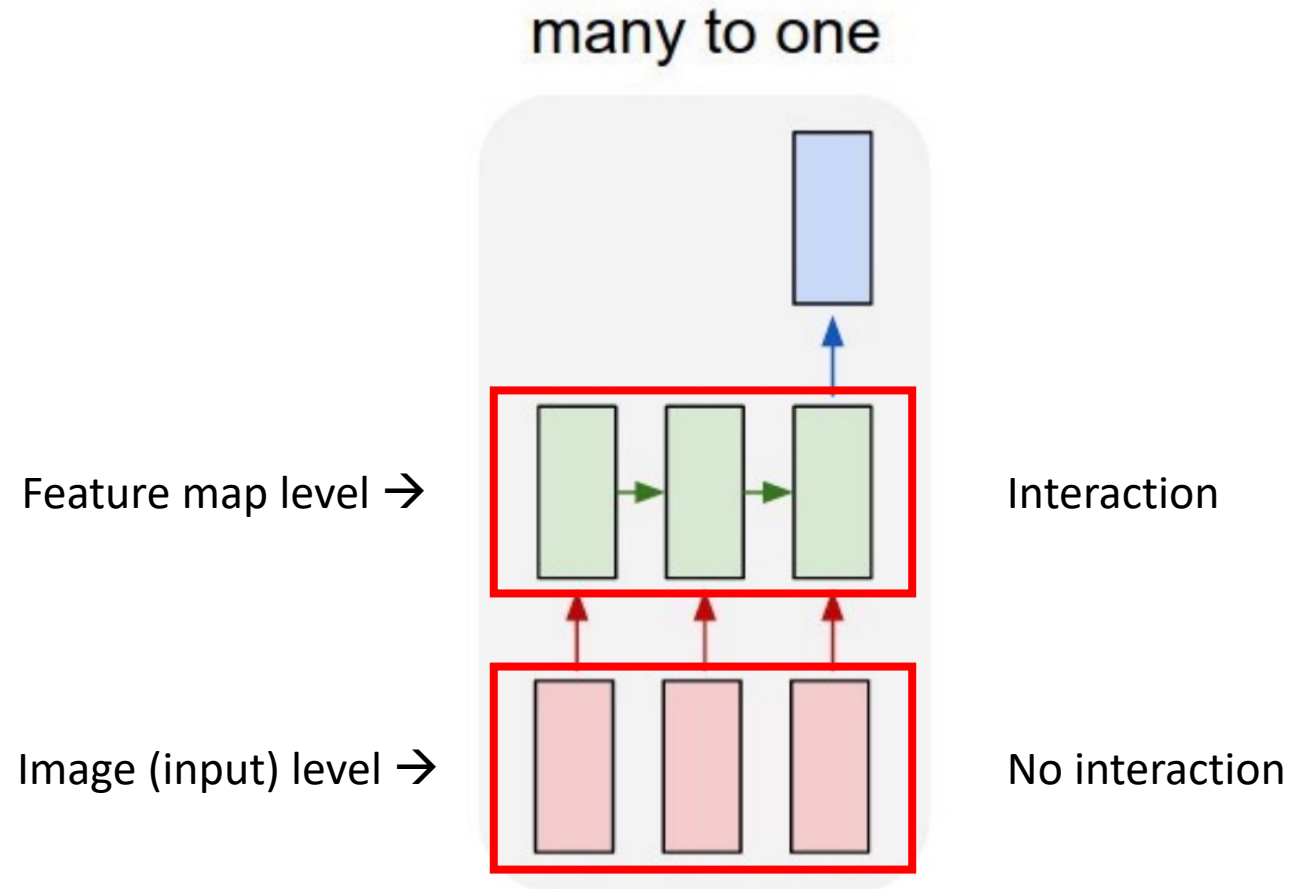
Limitations of FC nets and CNNs



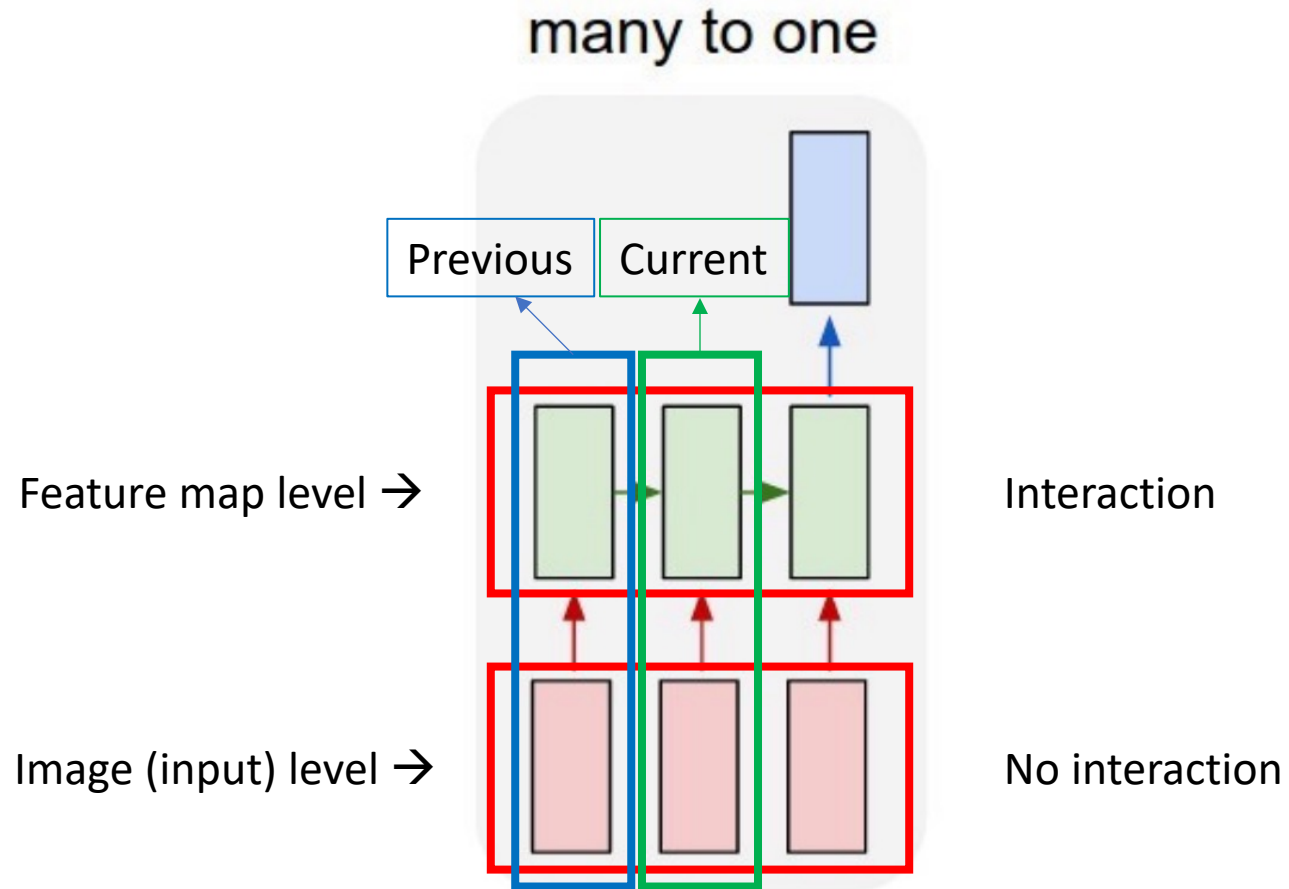
Limitations of FC nets and CNNs



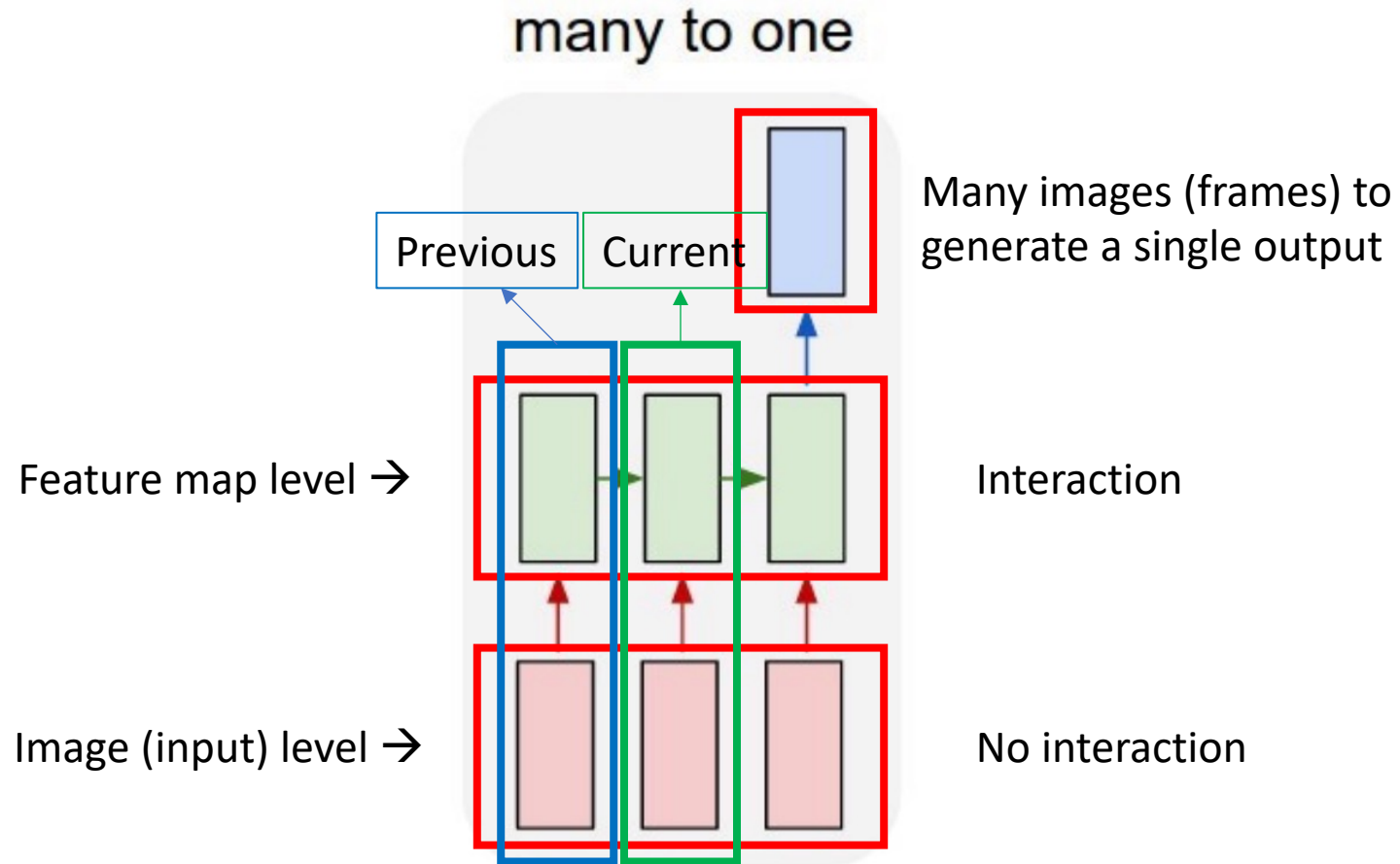
Limitations of FC nets and CNNs



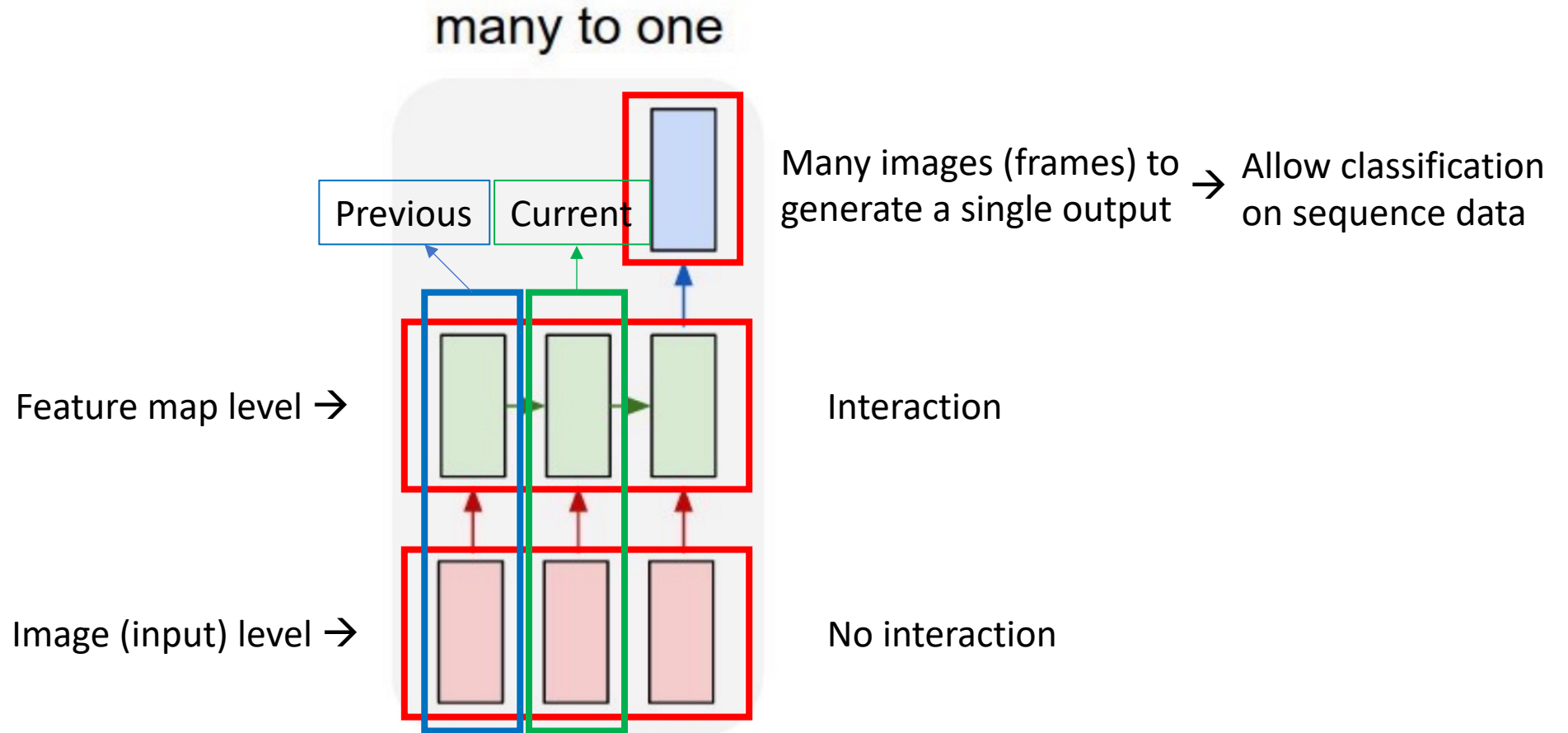
Limitations of FC nets and CNNs



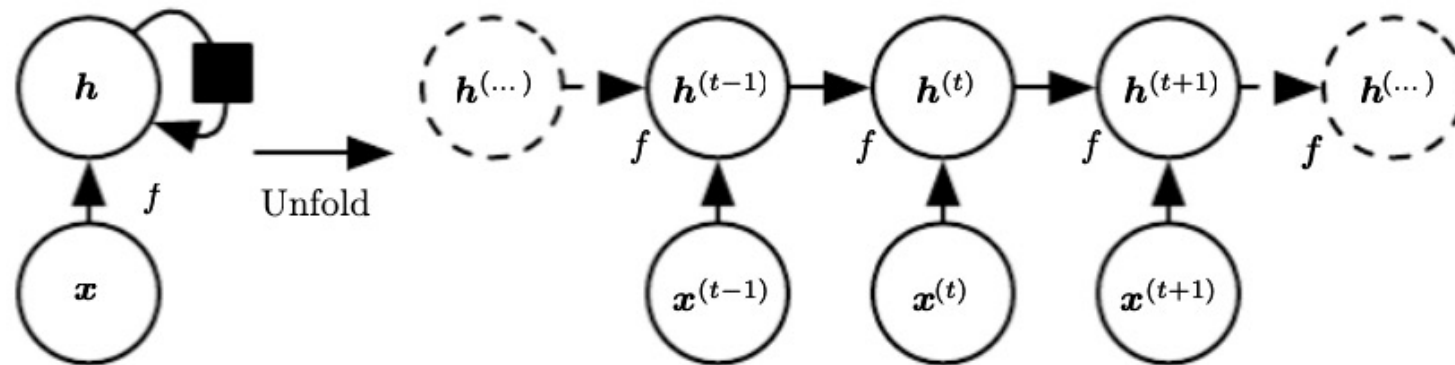
Limitations of FC nets and CNNs



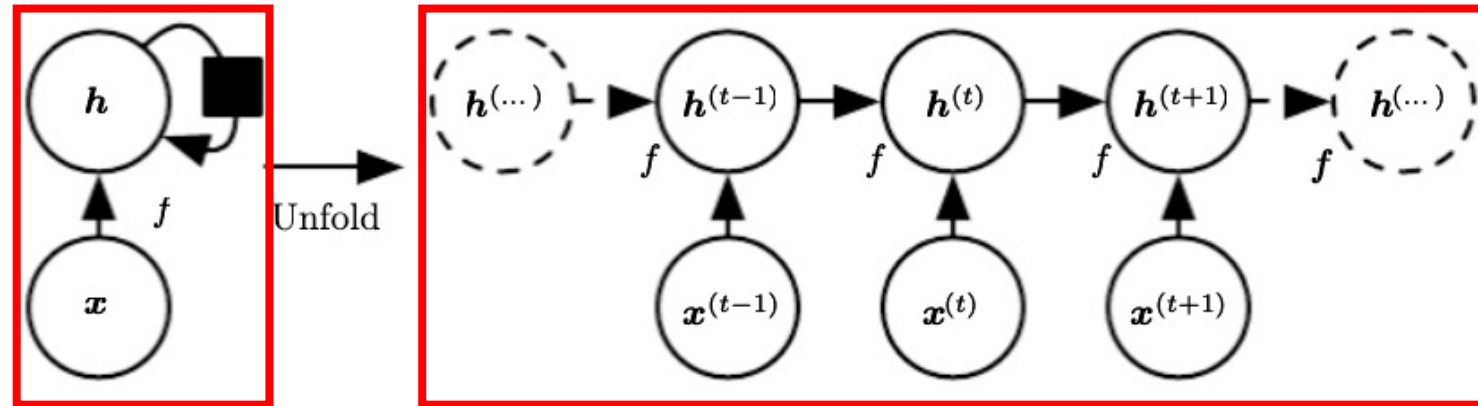
Limitations of FC nets and CNNs



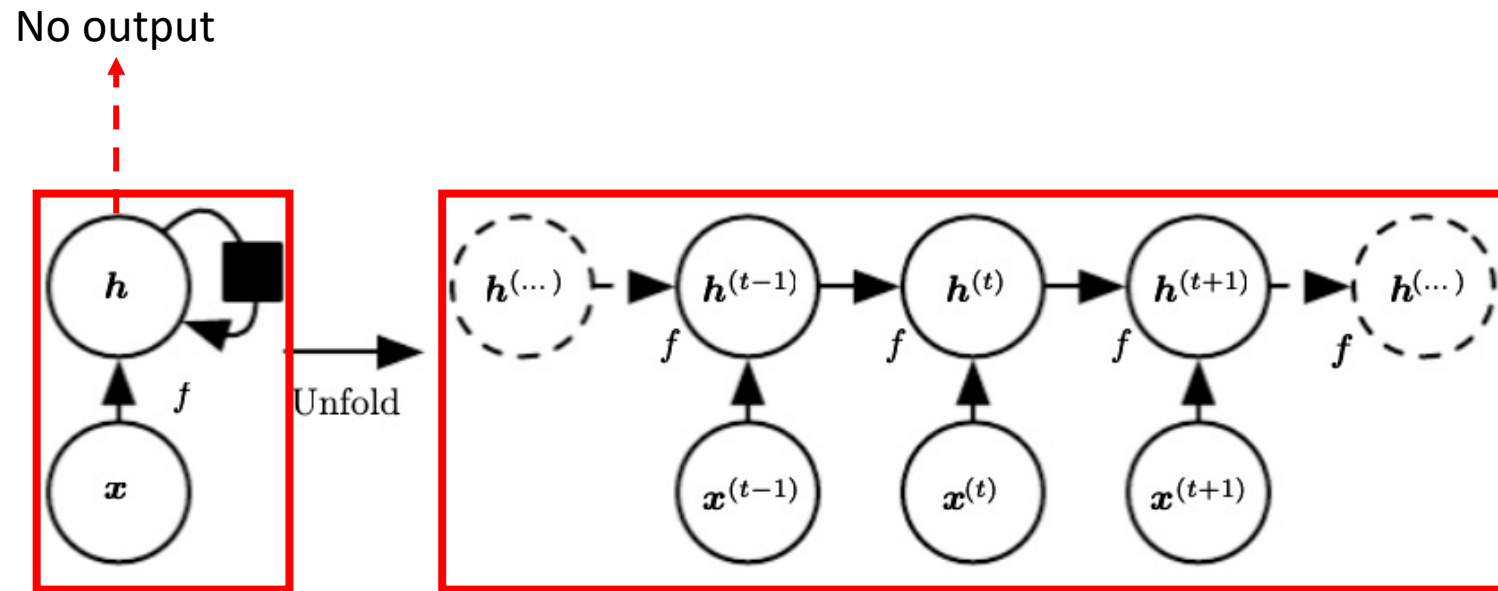
Recurrent networks



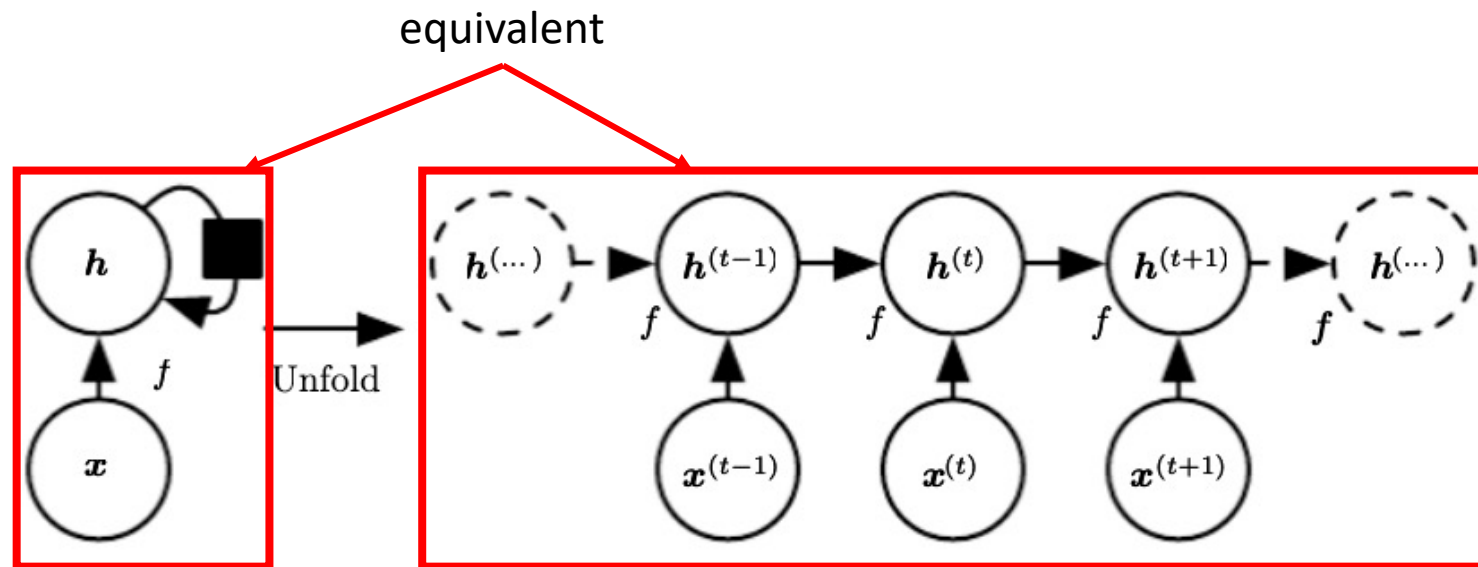
Recurrent networks



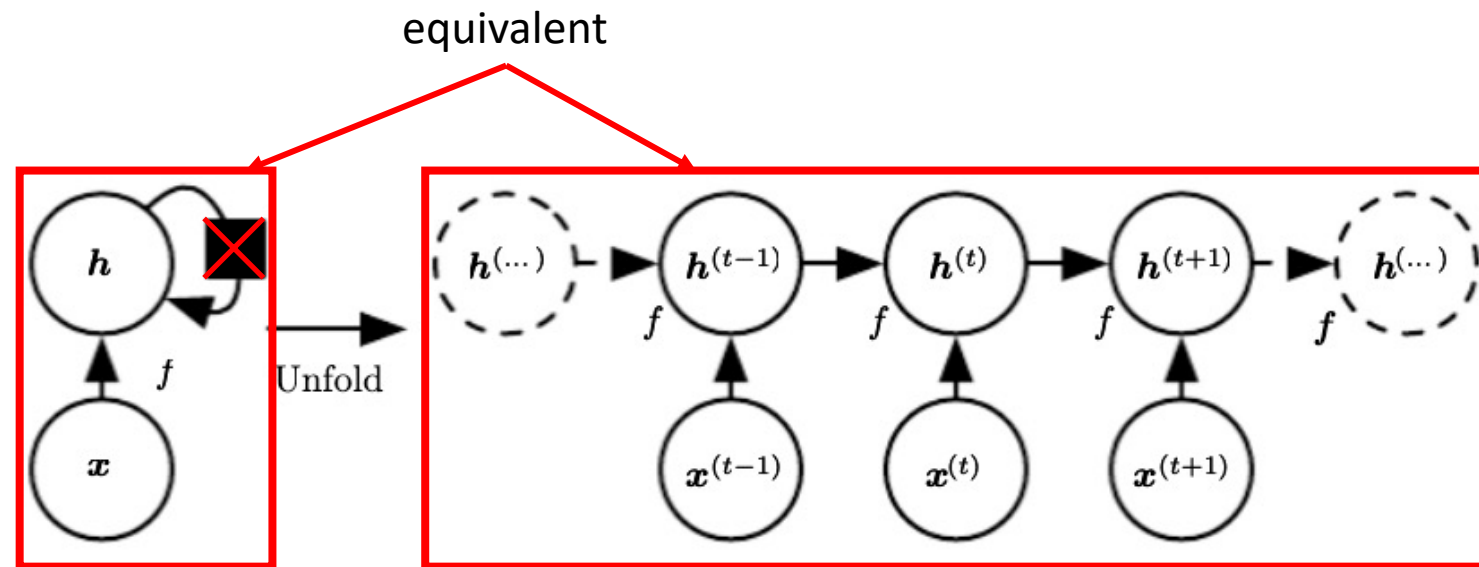
Recurrent networks



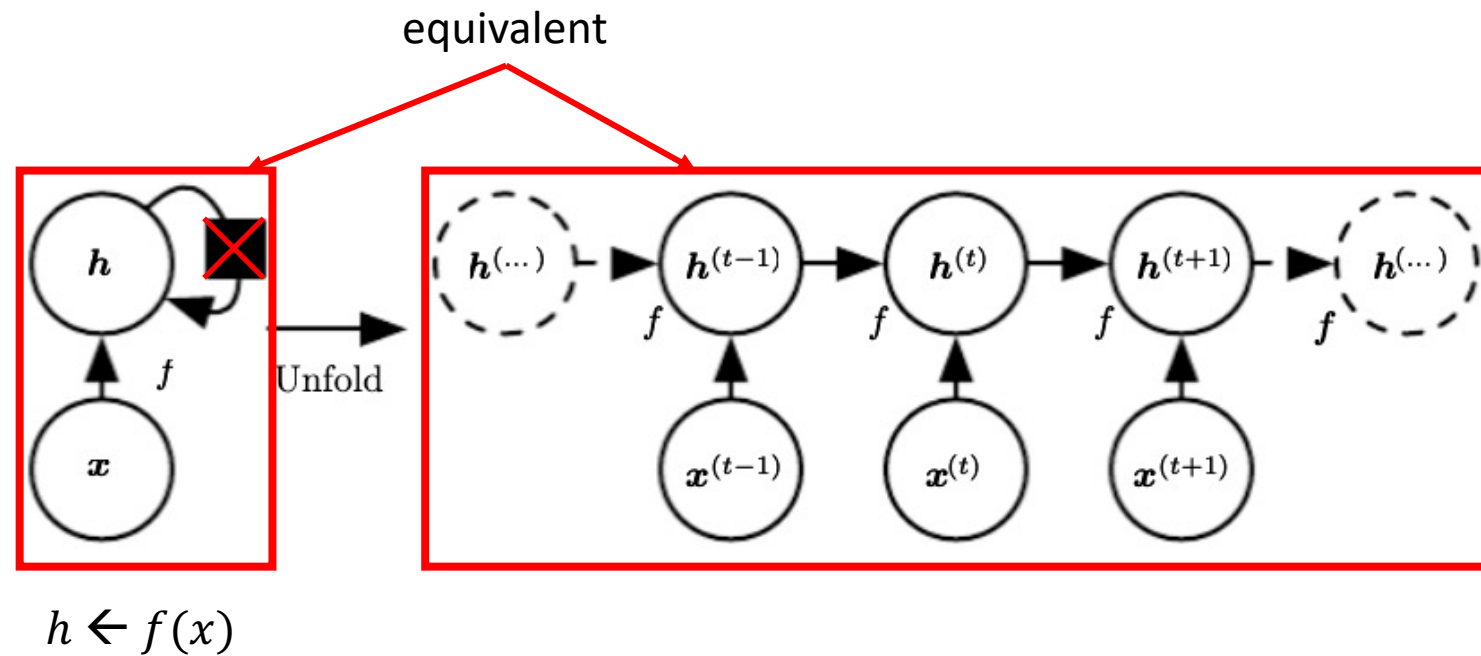
Recurrent networks



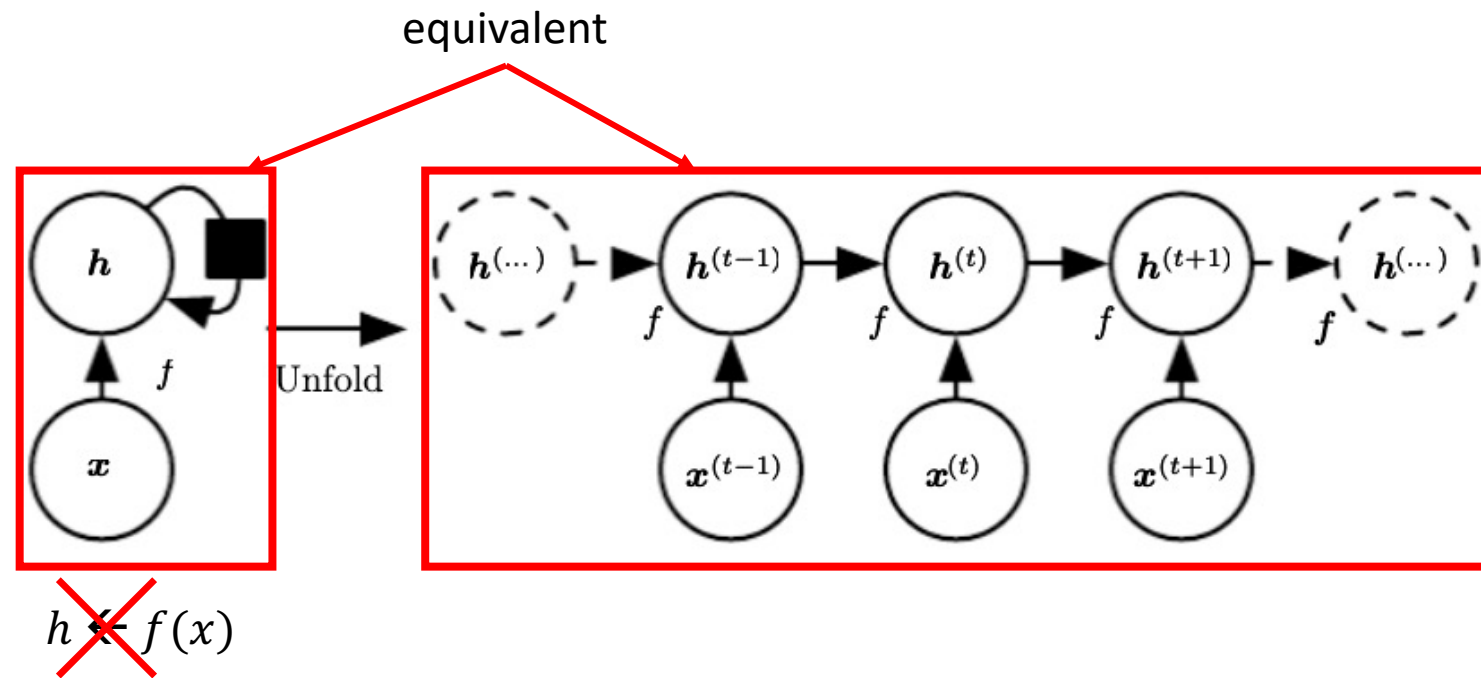
Recurrent networks



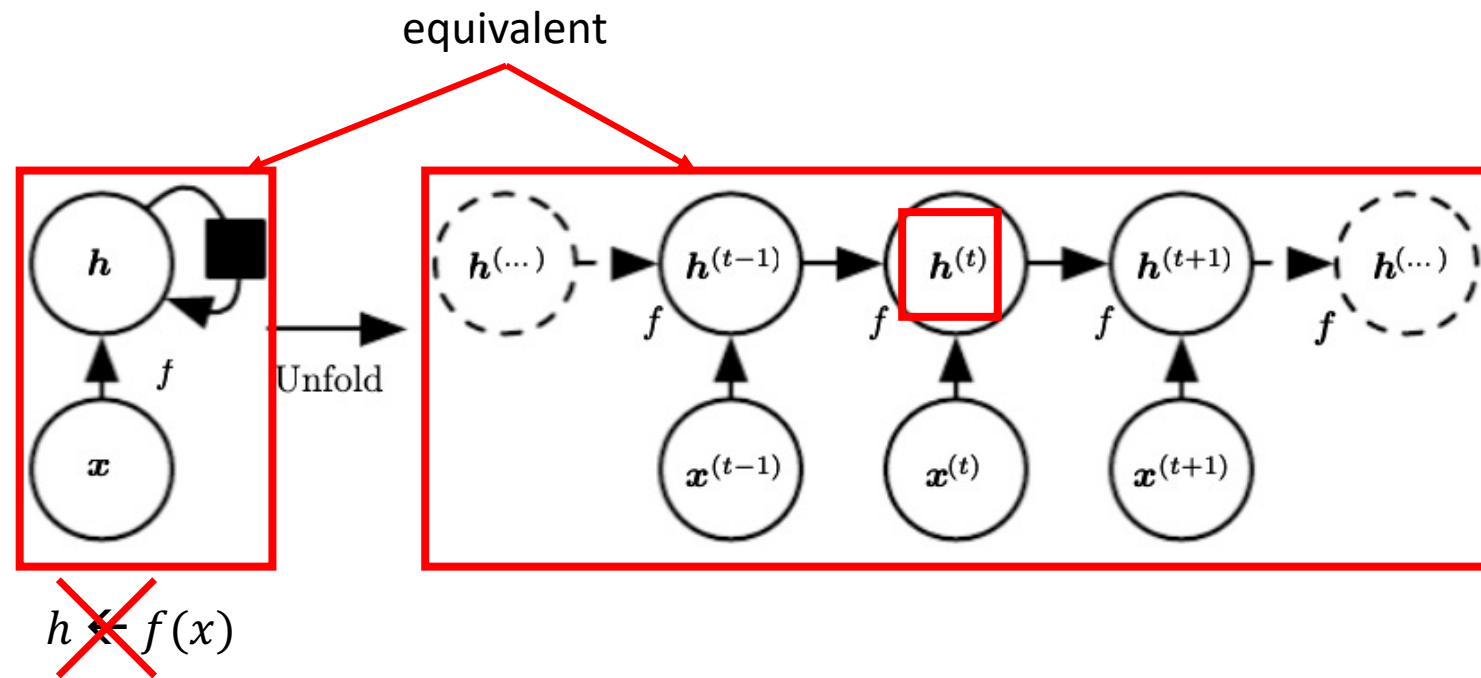
Recurrent networks



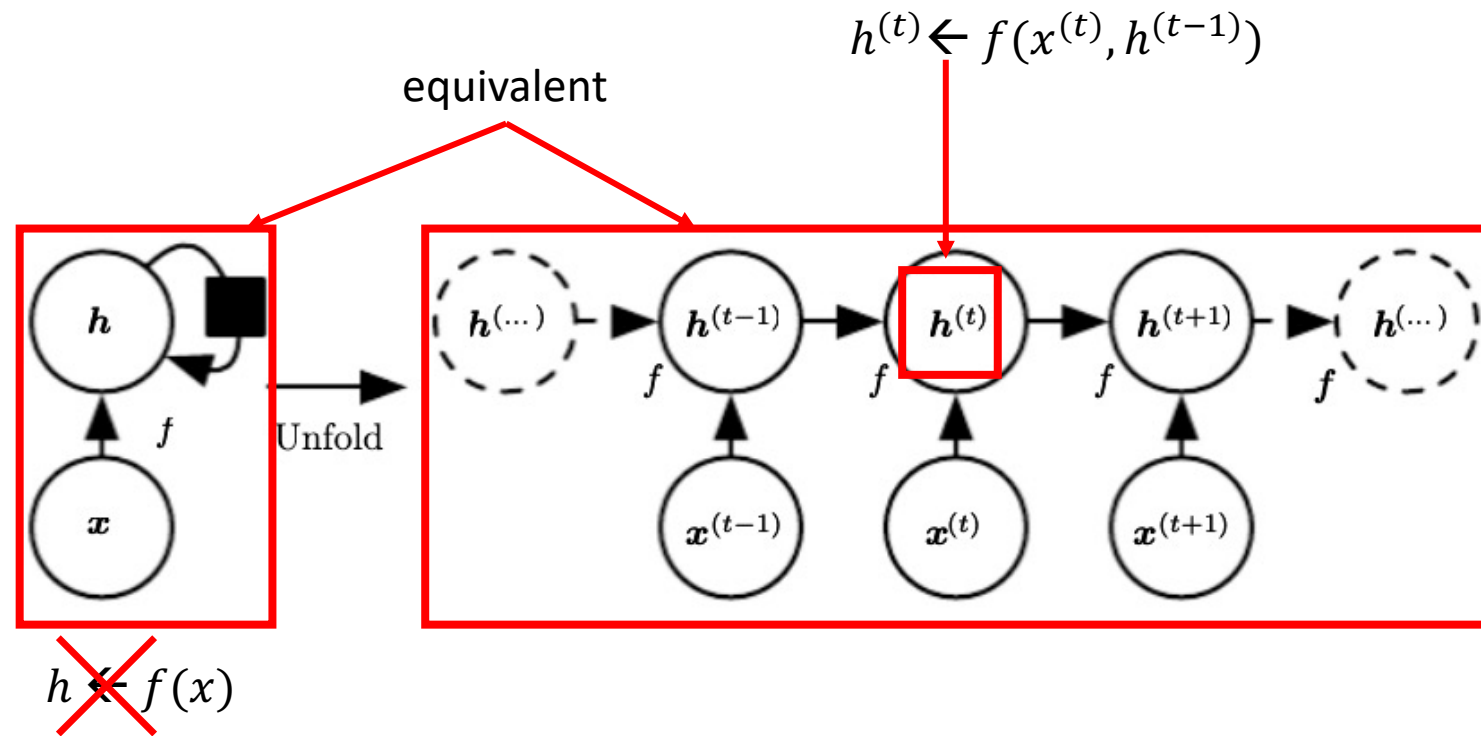
Recurrent networks



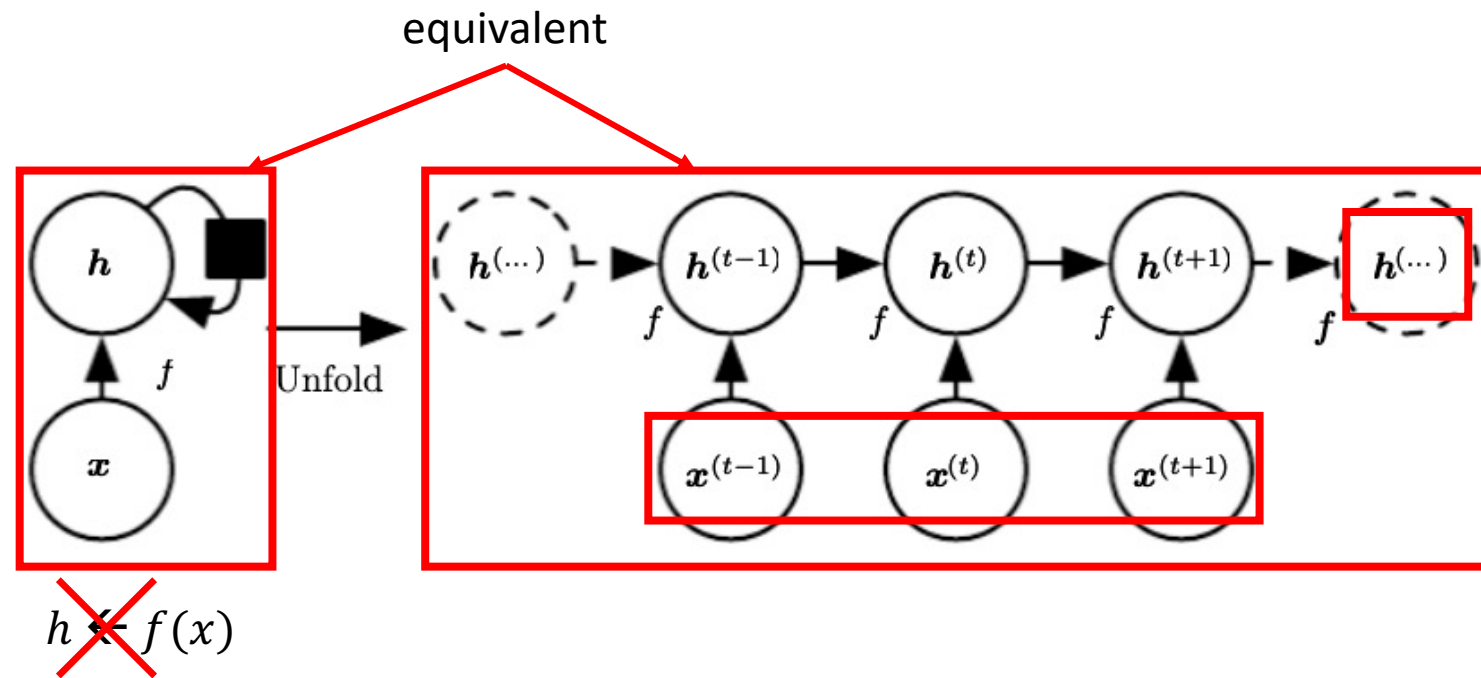
Recurrent networks



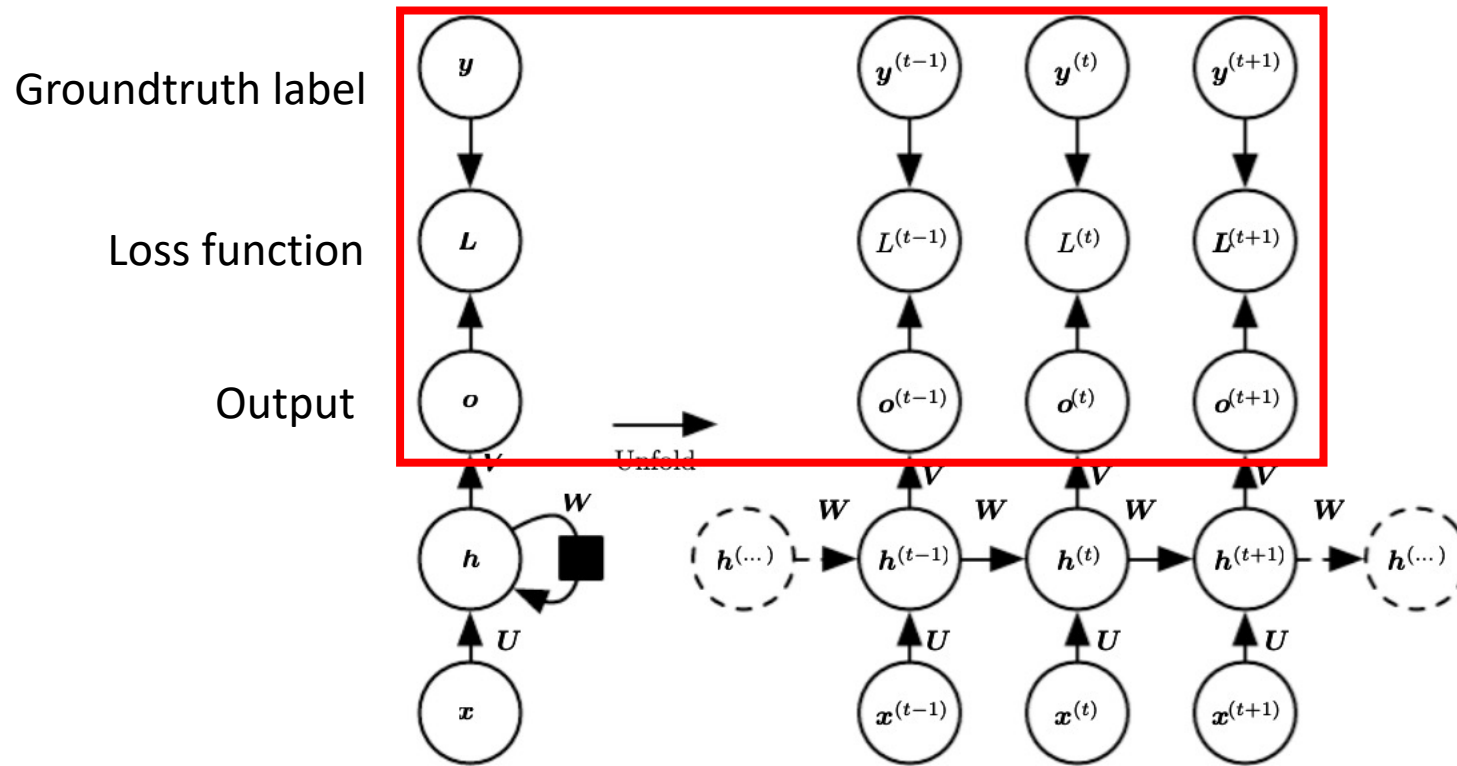
Recurrent networks



Recurrent networks

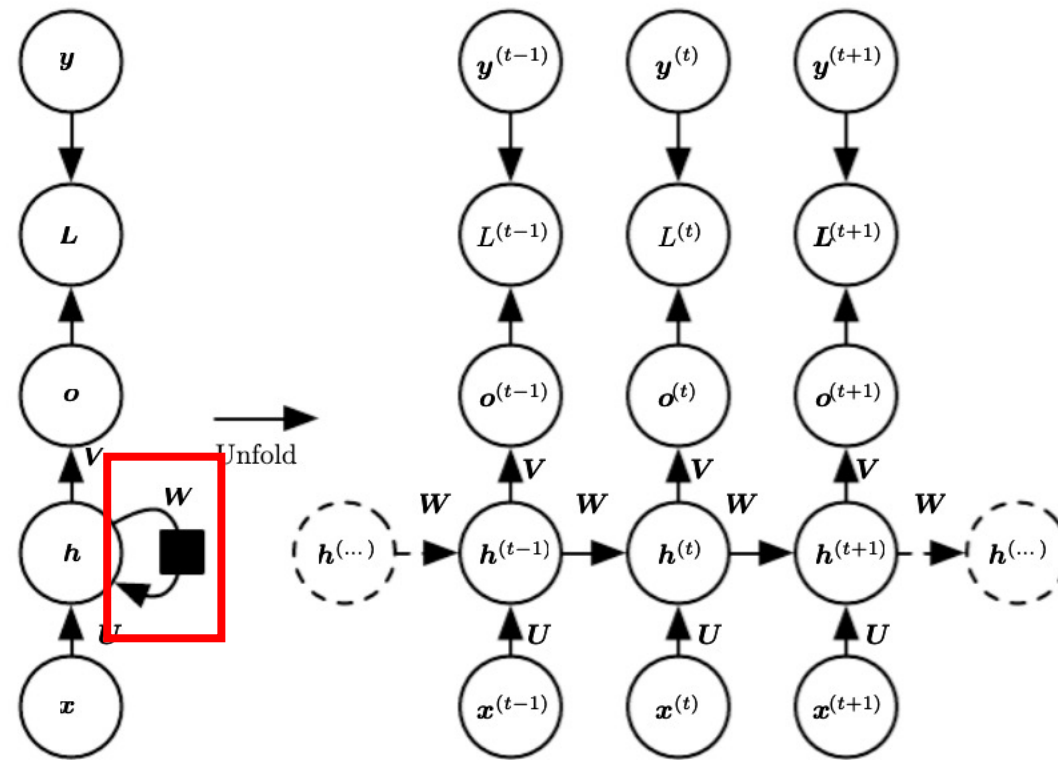


Recurrent networks

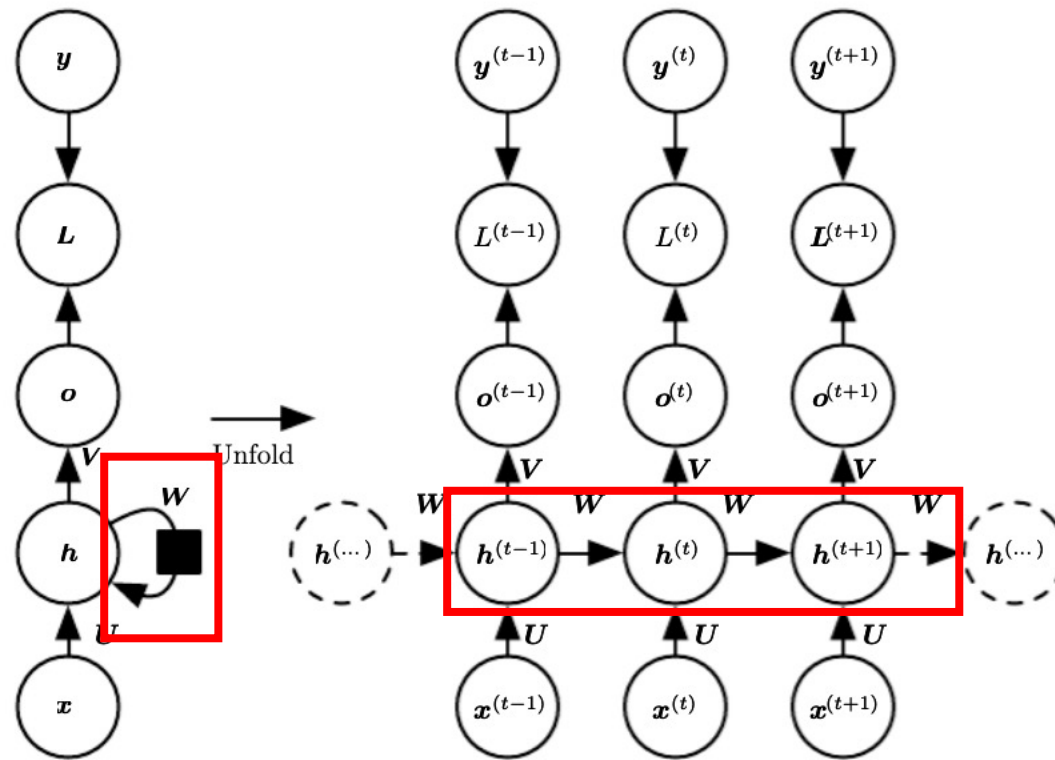


Q: how to describe this structure?

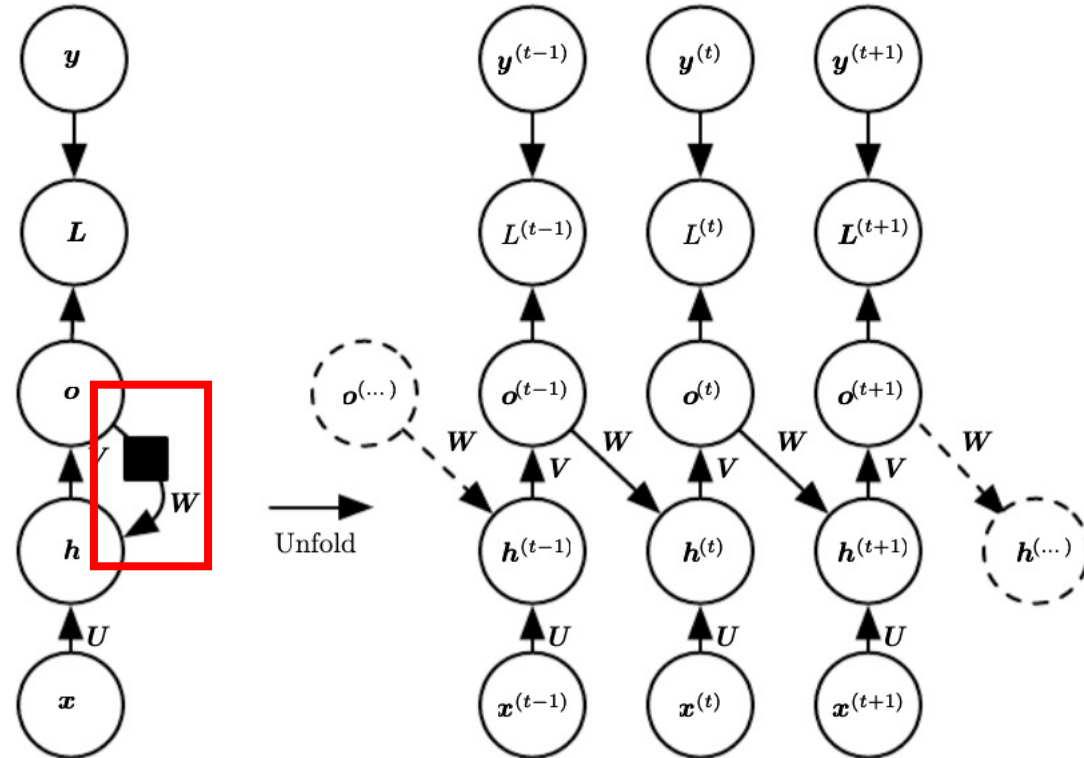
Recurrent networks



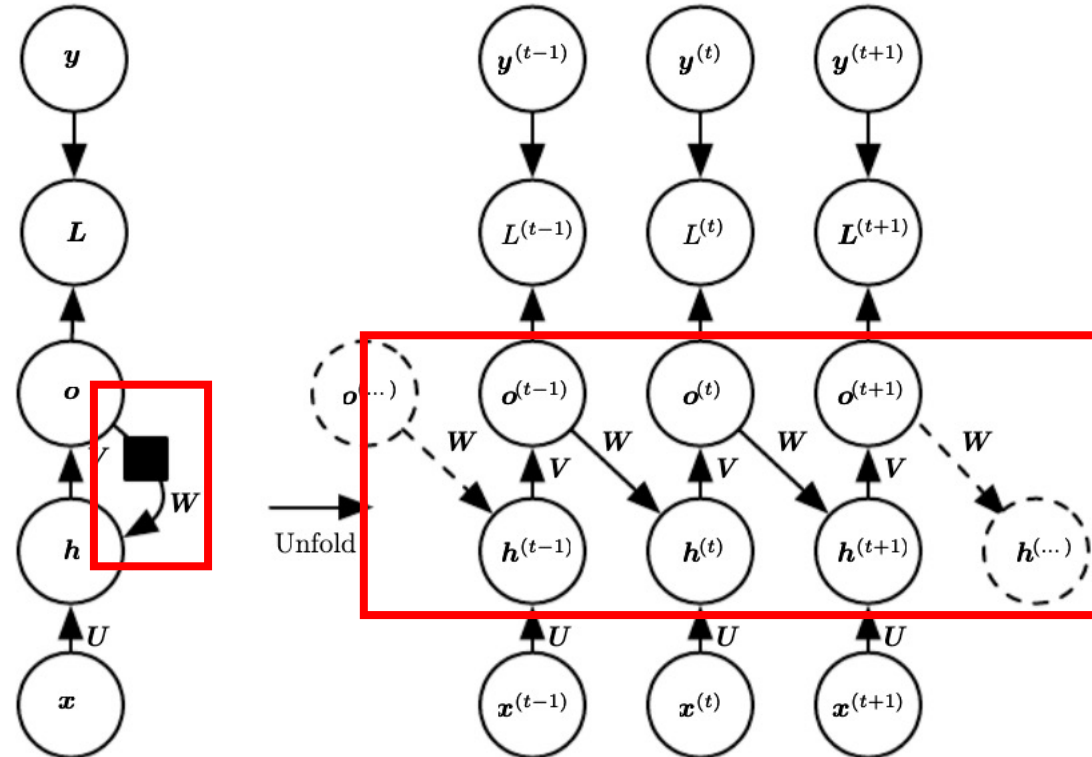
Recurrent networks



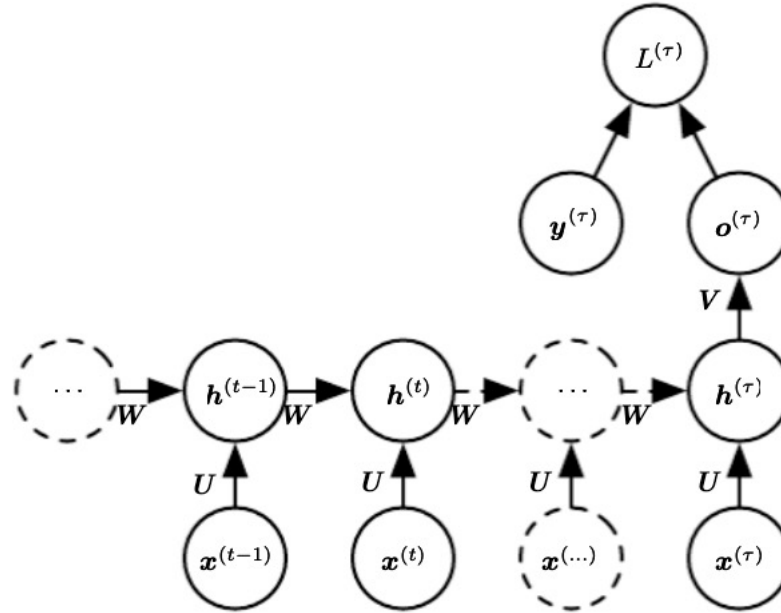
Recurrent networks



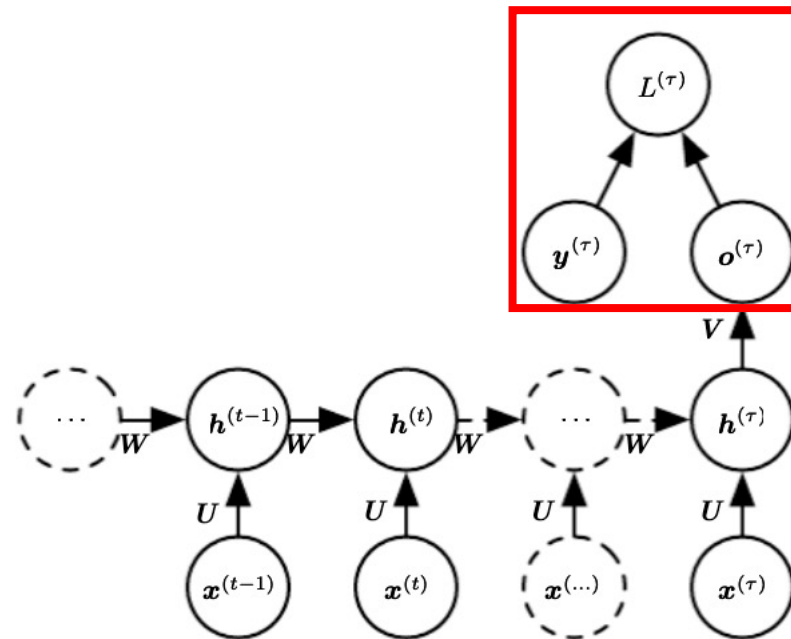
Recurrent networks



Recurrent networks



Recurrent networks



Only one output: summary of a sequence
(Predict a label for a video)