Lab4 Segmentation RCNN in Animal Dataset
Yue Zeng

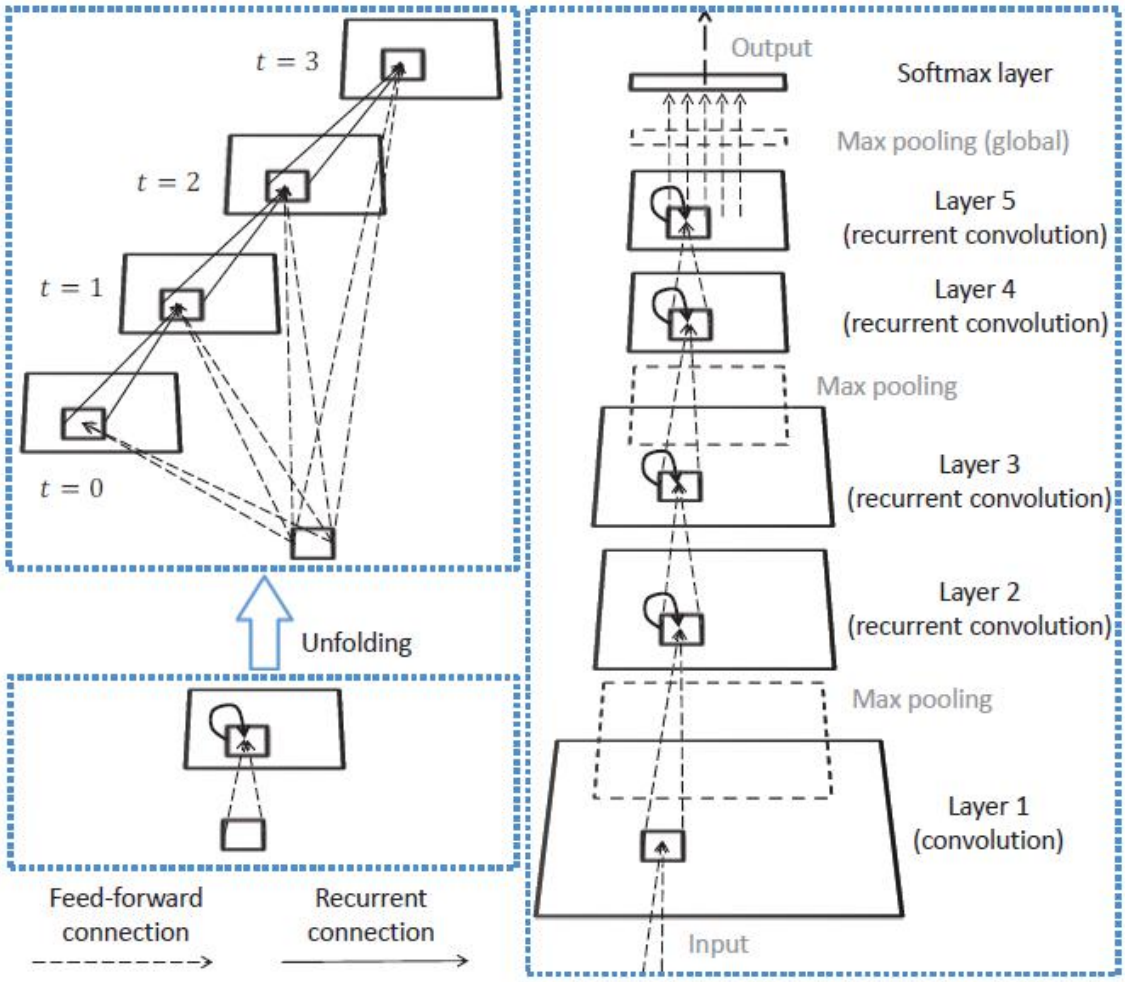
Recurrent Convolutional Neural Network
CNN is a structure based on feed, but recurrent associations are ample in visual system.
The input is unchanged, but the RCNN entity activities develop by the time.

The entity activity is adjusted by the nearby units.
Develop the RCNN by time will generate a random network with steady amount of parameters, just like other RNN.
CNN combine the back propagation algorithm to learn approachable simple pixel area
Fixed-point development is used for assumption, this is the connection between RCNN and sparse coding models.
Supervised learning approach can be combined to the unsupervised learning structure of sparse coding models.
An important part of RCNN is recurrent convolutional layer. Develop the layer with time steps produce a T feed-onward subnetwork of T+1 extent.

There are various paths between input layer to output layer of subnetwork.
The longest one process all developed recurrent network(length = T+1)
The shortest one only process the feed-onward network

RCNN includes the a pile of recurrent convolutionals, with interleaved max-pooling layers by choice.

For saving the space and time, first layer is regular feed-onward convolutional layer excluding recurrent networks, with max pooling layer next.
Only feed-onward network is between recurrent convolutional layer.
Use back propagation through time algorithm(BPTT algorithm) to train the model, it will minimize the intersect entropy loss operation. This is same as using regular back propagation algorithm at a time developed connection.



The comprehensive RCNN model.
Left: the recurrent convolutional layer is developed by time steps where T=3, resulting in a feed-onward subnetwork, its longest path is 4 and shortest path is 1. when t=0, only feed-onward occurs.
Right: the RCNN model includes one convolutional layer, 3 max pooling layers, a softmax layer and four recurrent convolutional layers.

The advantages of RCNN:
It make the unit to combine the context in the large area at the current layer.
The recurrent network expand the depth but use the weight sharing to make the amount of changeable parameters unchanged.

The time developed RCNN is the CNN with various paths from input layer through output layer.
The longer path make the model learn very complex categories while training, while the shorter path can help gradient back propagation for training.
A few repetition of the changing action can generate outstanding result.

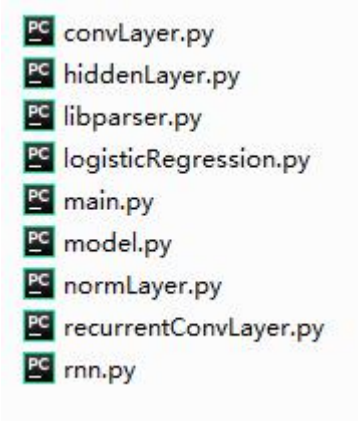
We can compare RCNN with other model to analyze the feature, such as the model that remove the recurrent network of RCNN which become a normal CNN, and remove the recurrent network only in the recurrent convolution layer

With the idea of synapses of human brain, people develop a neuron network to recognize object that called RCNN. It adds recurrent network to each convolutional layer in the feed-onward CNN.

The recurrent network expand the depth while still keep the amount of parameters constant by using the weight sharing.

Implementation

In this lab, we use RCNN to recognize the object in the animal images



There is convolution layer, hidden layer, recurrent convolution layer and normal layer. We use the layer to build the model and train it by using the training data set.