Play LISP with Recurrent Neural Network

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Goal

- Lisp interpreter read a symbol list then transform to only desired output
- We can think it just a function for sequence to sequence
- Neural Network is a very powerful function aprroximation framework
- Can I training a neural network to be a Lisp interpreter ?

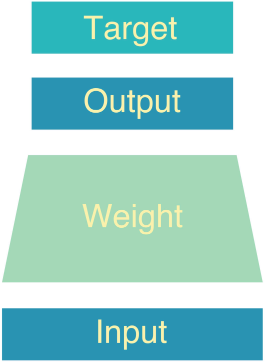
LISP and AI

Physical symbol system hypothesis

A physical symbol system has the necessary and sufficient means for general intelligent action

-Allen Newell and Herbert A. Simon

Neural Network



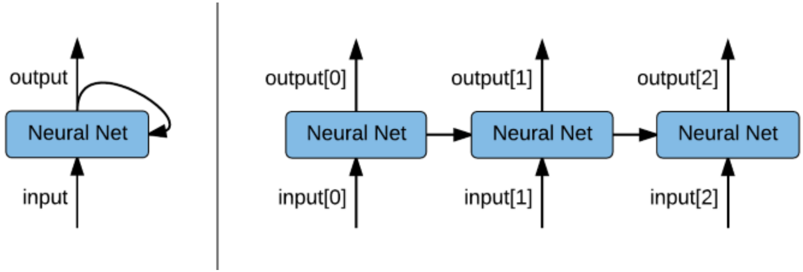
Target

Output

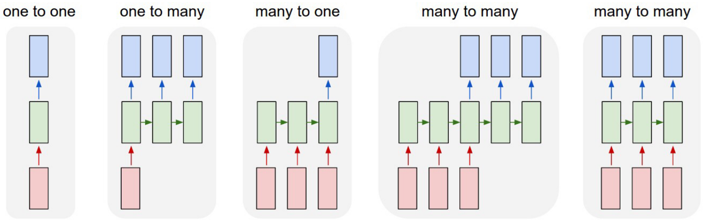
Weight

Input

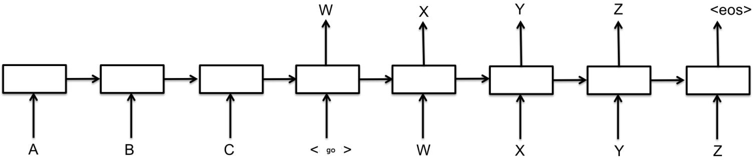
Recurrent Neural Network



Recurrent Neural Network



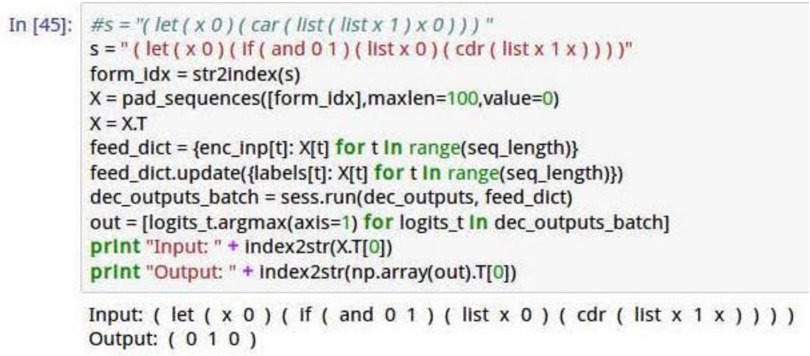
Sequence-to-sequence model



Modeling the LISP interpreter

- Generate a lot LISP forms and evaluation outcome
- Encoding every symbol to vector
- Feed vector time by time into model
- Training model
- For example:
  - {(list 1 0 1) , (1 0 1)} encode to {[1,5,4,3,4,2] , [1,4,3,2]}
  - {(car (list 1 1 1)) , 1 } encode to {[1,6,1,5,4,4,4,2,2] , [4]}
  - {(cdr (list 1 1 1)) , (1 1) } encode to {[1,7,1,5,4,4,4,2,2] , [4,4]}

Demo



In [45]:

```
#s = "( let ( x 0 ) ( car ( list ( list x 1 ) x 0 ) ) ) "
s = " ( let ( x 0 ) ( if ( and 0 1 ) ( list x 0 ) ( cdr ( list x 1 x ) ) ) )"
form_idx = str2index(s)
X = pad_sequences([form_idx],maxlen=100,value=0)
X = X.T
feed_dict = {enc_inp[t]: X[t] for t in range(seq_length)}
feed_dict.update({labels[t]: X[t] for t in range(seq_length)})
dec_outputs_batch = sess.run(dec_outputs, feed_dict)
out = [logits_t.argmax(axis=1) for logits_t in dec_outputs_batch]
print "Input: " + index2str(X.T[0])
print "Output: " + index2str(np.array(out).T[0])
```

```
Input: ( let ( x 0 ) ( if ( and 0 1 ) ( list x 0 ) ( cdr ( list x 1 x ) ) ) )
Output: ( 0 1 0 )
```

Recommend

Course

- CS231n Convolutional Neural Networks for Visual Recognition
- CS224d: Deep Learning for Natural Language Processing
- DL
- Oxford Deep Learning
- Deep Learning
- Creative Applications of Deep Learning with TensorFlow

Books

- DeepLearning book
- Neural Networks and Deep Learning

Tutorial

- UFLDL Tutorial
- Theano DL tutorial
- Deep Learning Summer School

Q & A

Thanks your listening !