

Machine Learning Engineer Course

Day 31

- 🎉 Seq2Seq 🎉 -



DIVE INTO CODE

Thursday November 18, 2021
DIOP Mouhamed



Agenda

- 1 Check-in**
- 2 Quick Review**
- 3 Seq2Seq**
- 4 Sample code**
- 5 To do by next class**
- 6 Check-out**



Check-in

3 minutes Please post the following point to Zoom chat.

Q. Have you started working on your graduation project ?



Quick Review (LSTM)

- Gated Recurrent Neural Networks



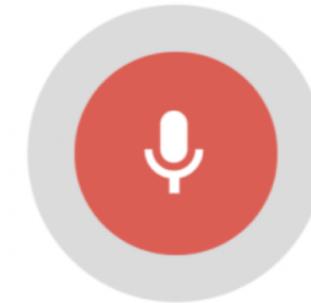
Seq2Seq

Series transformation model

A model that takes a series, transforms it into another series, and outputs a probability

Series transformation models are behind many of the systems we face on a daily basis.

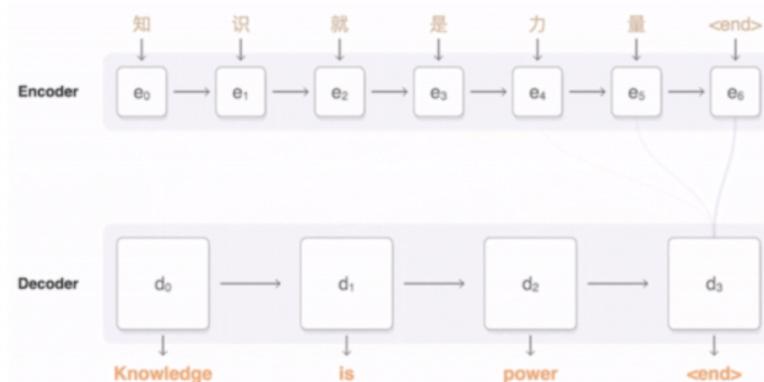
Examples include applications such as Google Translate, voice-enabled devices, online chatbots, and video captioning.



Google

Input sentence:	Translation (PBMT):	Translation (GNMT):	Translation (human):
李克強此行將啟動中加總理年度對話機制，與加拿大總理杜魯多舉行兩國總理首次年度對話。	Li Keqiang premier added this line to start the annual dialogue mechanism with the Canadian Prime Minister Trudeau two prime ministers held its first annual session.	Li Keqiang will start the annual dialogue mechanism with Prime Minister Trudeau of Canada and hold the first annual dialogue between the two premiers.	Li Keqiang will initiate the annual dialogue mechanism between premiers of China and Canada during this visit, and hold the first annual dialogue with Premier Trudeau of Canada.

An example of a translation produced by our system for an input sentence sampled from a news site. Go [here](#) for more examples of translations for input sentences sampled randomly from news sites and books.



<https://ai.googleblog.com/2016/09/a-neural-network-for-machine.html>



Series transformation model

This model solves the problem of series, that is, the problem of different sizes and categories of input and output.

For example, if you want to translate "What are you doing today?" from English to Chinese, you need an input of 5 words and an output of 7 symbols (今天你在做什麼?). is required.

In this case, we cannot use a naive LSTM network to map each word from an English sentence to a Chinese sentence.



Seq2Seq

seq2seq

Sequence to sequence

Sequence Transformation Model

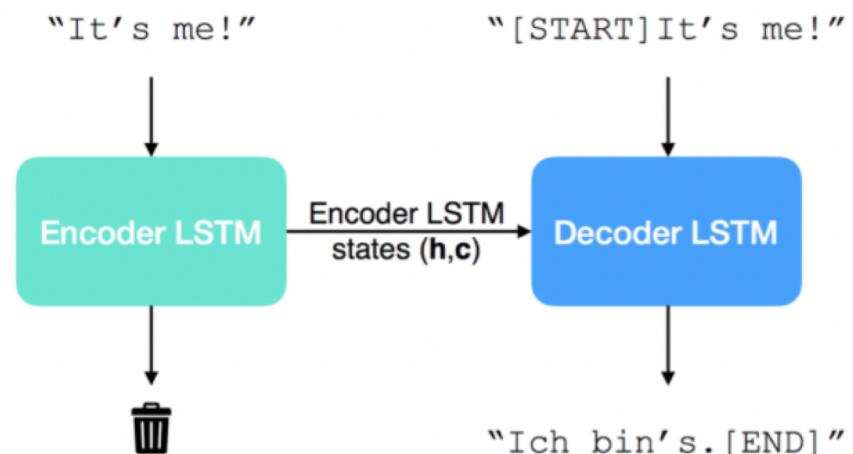
Sequence-to-sequence (seq2seq) model: 2014

<https://papers.nips.cc/paper/5346-sequence-to-sequence-learning-with-neural-networks.pdf>

Application area: machine translation, speech recognition, text summarization, etc.

First task: Neural Machine Translation (NMT), which consists of three main autoencoder-like components.

- Encoder
- Intermediate Vector
- Decoder



<https://nextjournal.com/okoehter/machine-translation-seq2seq-cpu>



Seq2Seq

What is AutoEncoder?

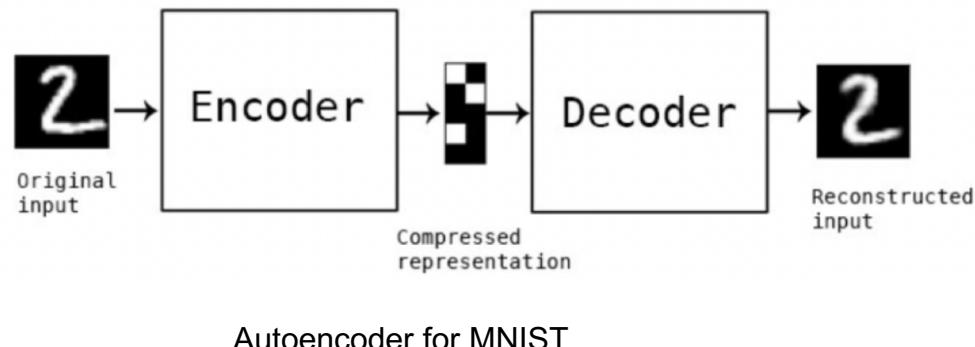
Autoencoders (self-encoders)

The components that appear in the network architecture of autoencoders are called encoder and decoder.

encoder : The model learns how to reduce the input dimension and compress the input data into an encoded representation.

bottleneck : The layer that contains the compressed representation of the input data. This is the minimum possible dimension of the input data.

decoder : The model learns how to reconstruct the data from the encoded representation so that it is as close as possible to the original input.



<https://towardsdatascience.com/auto-encoder-what-is-it-and-what-is-it-used-for->

https://deeplearning.net/deep_learning/2016/10/09/deeplearning_autoencoder.html



Mechanism to align the vector length for each batch

Fixed length vector (padding the vector to fix it)

1. <GO> (<BOS>) simply means the beginning of a statement. In many cases, it is placed at the beginning to signal the start of the output.
2. <EOS> means the end of a sentence. It is often the first thing a model learns. It learns to stop output when it appears after some words. If the training data does not contain this signal, the model will most likely try to fill the sentence with a random word.
3. <UNK> is a placeholder to indicate that those words are not present in the word.
4. Since most sequences are variable length, we use <PAD> to pad the sequence to a fixed length so that the model can perform batch calculations.



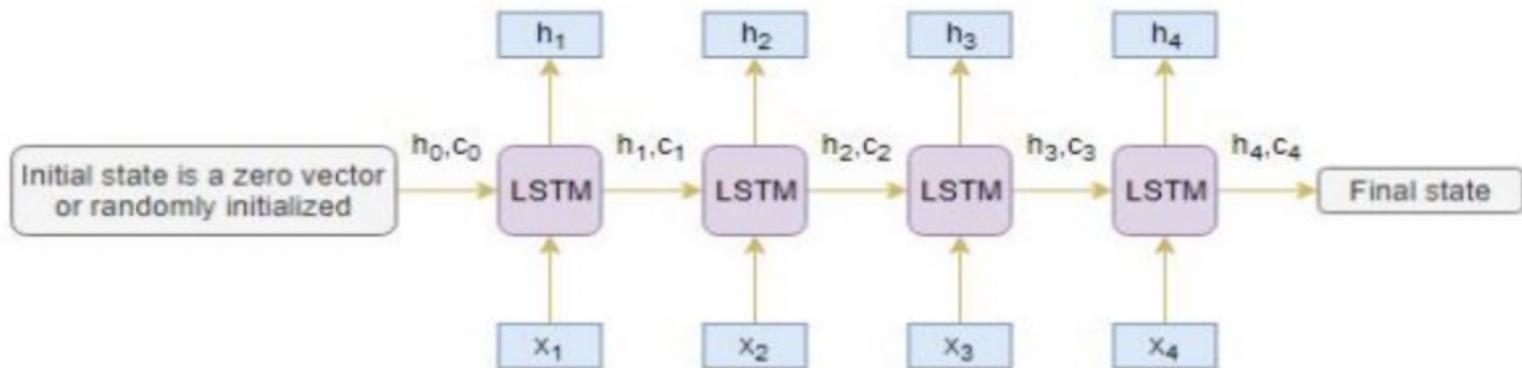
Seq2Seq

Seq2Seq encoder

Input vector: for machine translation, a vector of words in the original language

Output vector: hidden states & cell states

The hidden state (h_i) and cell state (c_i) of the last time step are used to initialize the decoder's short-term and long-term memory.





Seq2Seq encoder

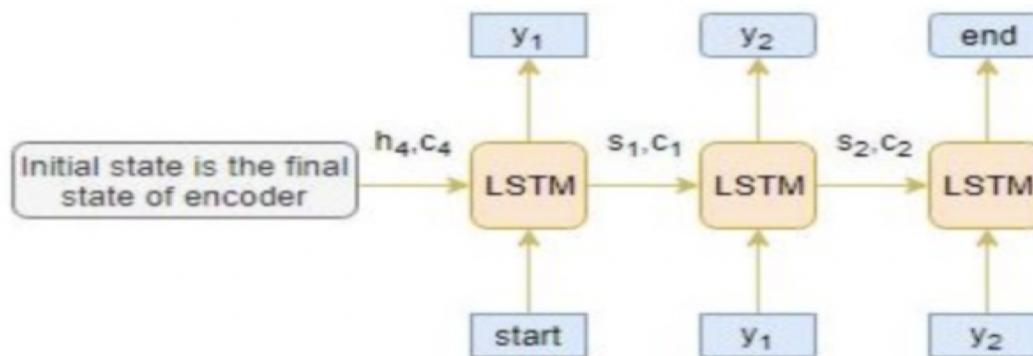
※ Training

Input vector 1: For machine translation, <EOS> + vector of words in the target language

Input vector 2: encoder's hidden state & cell state

Correct Label: For machine translation, a vector of words in the target language +<EOS>.

Output vector: For machine translation, a probability vector that predicts the next word in the sequence in the target language





Seq2Seq

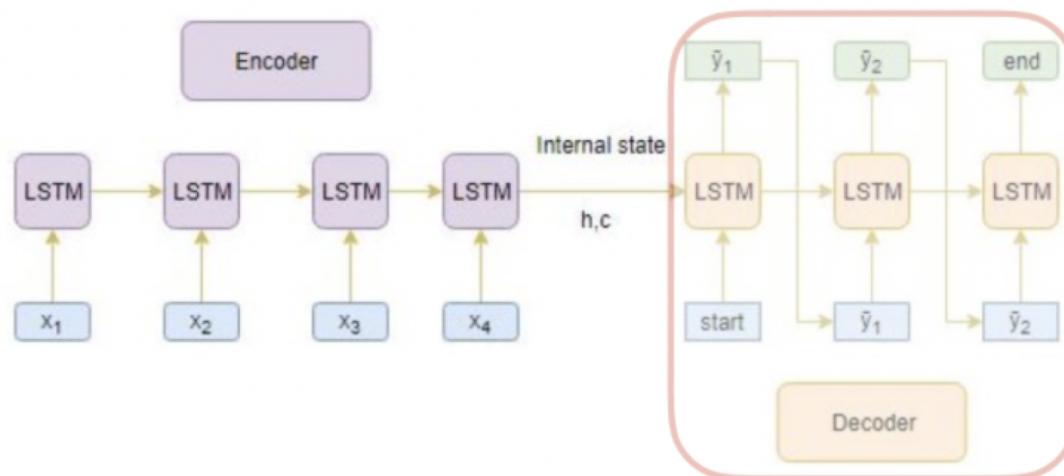
Seq2Seq encoder

※estimated time

Input vector 1: The first step is to take <EOS> as the input of Decoder LSTM.

From the next step, the output vector of the Decoder LSTM is used as the input of the Decoder LSTM at the next point in time.

Input vector 2: encoder's hidden state & cell state

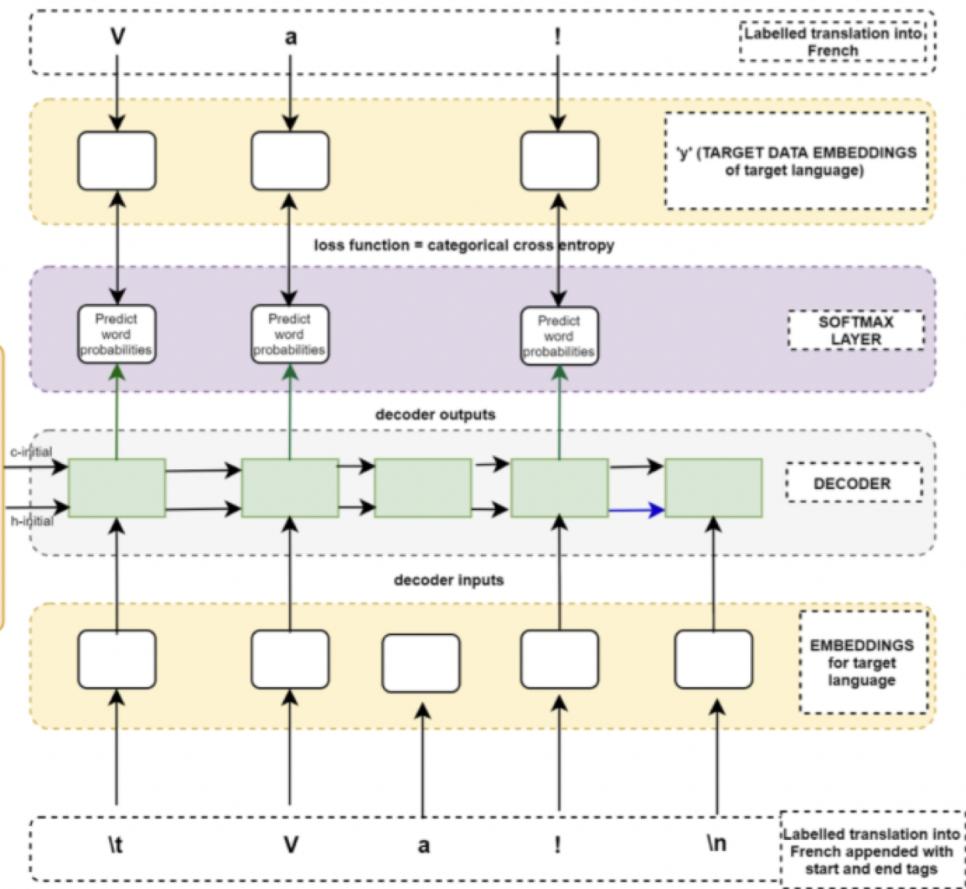
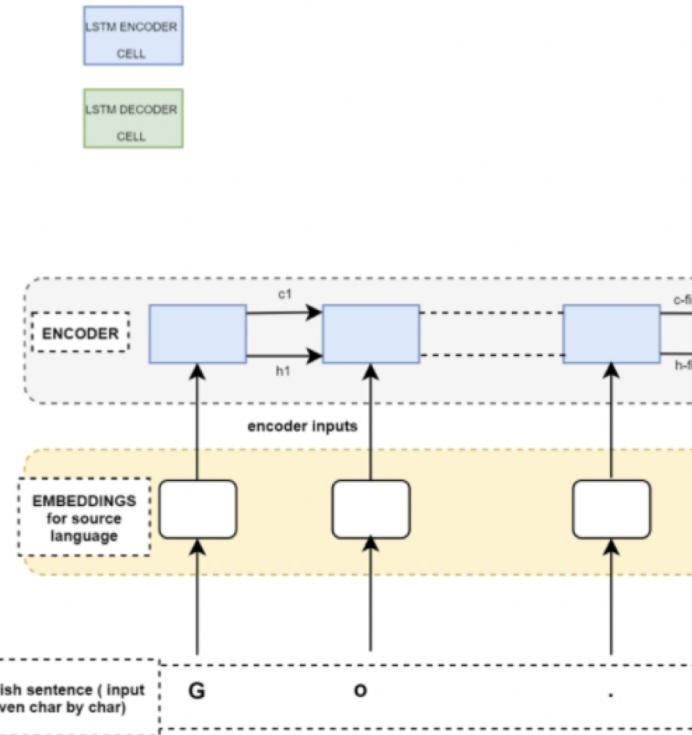




Seq2Seq

System Overview

ENCODER - DECODER TRAINING NETWORK ARCHITECTURE FOR NEURAL MACHINE TRANSLATION





Sample code

How to solve problems “Seq2Seq”

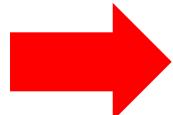
- [Problem 1] Performing machine translation and code reading
- [Problem 2] Execution of a trained model of image captioning
- [Problem 3] Investigate what to do if you want to run it in Keras



Sprint 24 – Seq2Seq

Explanation about this Sprint is given but please try it on your own first.

Sprint 24 – Seq2Seq



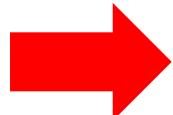
Please work on your own after class and submit your assignments on DIVER.



Sprint 24 – Seq2Seq

A Sample Code of this Sprint is given but please try it on your own.

Sprint 24 – Seq2Seq



Please work on your own after class and submit your assignments on DIVER.



ToDo

Next mentoring session will be on Zoom: Tomorrow, November 19th 2021 & REVIEWS start from Next Week

⭐ ToDo – Last Assignment : Graduation Assignment
<https://diveintocode.jp/curriculums/2307>



Check-out

3 minutes Please post the following point to Zoom chat.

Q. Current feelings and reflections
(joy, anger, sorrow, anticipation, nervousness, etc.)



Thank You For Your Attention

