

Natural Language Understanding - E1246

Assignment 2

Sequence to Sequence model using Attention for Machine Translation

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1 Introduction

In this assignment, we have implemented seq2seq encoder decoder model with attention for machine translation task from English to German and English to Hindi language.

2 Solution Sketch

In this assignment we had to implement four kinds of attention mechanism, out of which I could complete only three, namely additive, scaled dot product and multiplicative attention.

2.1 Hyperparameters of the model

Batch size = 1

The hidden layer size for both encoder and decoder = 256

Learning rate = 0.001

No of layers in encoder and decoder = 1

2.2 Approach

1. **Data Preprocessing** - Preprocessing for Hindi corpus was slightly different from that of German because in Hindi, unicode to ascii conversion was not done.
2. Vocabulary creation and tokens generation
3. Source and target language pair generation
4. For every source - target pair,
 - (a) Pass the input sequence to the encoder
 - (b) Generate and store the encoder outputs for every time step
 - (c) Pass the encoder hidden state to the decoder as input
 - (d) Calculate attention based on the type of attention specified and take a linear

combination of attention along with decoder hidden state to generate the output of the decoder.

- (e) Based on the output probability distribution, generate the predicted word.
- (f) Continue the whole process until either end of sequence token is generated or maximum length is reached.

5. Output: Optimized weights for the encoder and decoder

3 Results

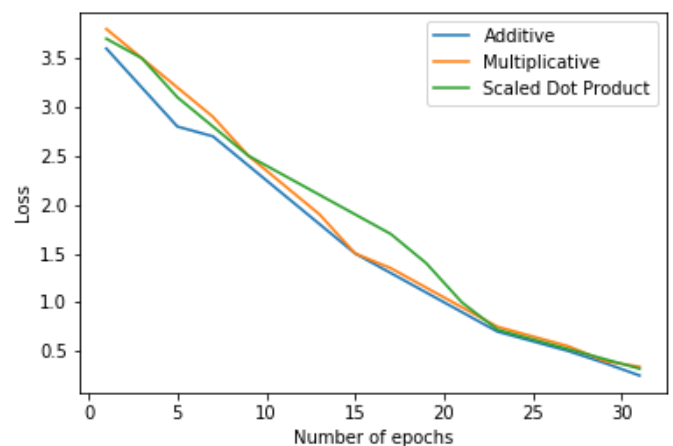
Model trained on 40000 examples from common crawl dataset.

3.1 English to German

Objective function value at the end of 30 epochs

1. Additive : 0.256742
2. Multiplicative : 0.349814
3. Scaled dot product : 0.327951

Plot of no of epochs vs loss function for English to German translation task

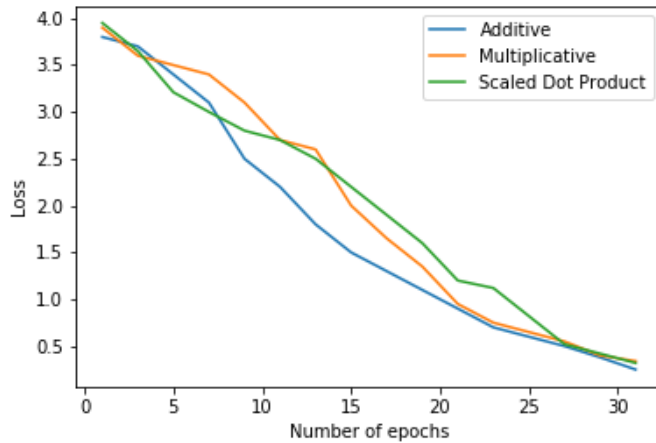


3.2 English to Hindi

Objective function value at the end of 30 epochs

1. Additive : 0.3182
2. Multiplicative : 0.3498
3. Scaled dot product : 0.3141

**Plot of no of epochs vs loss function
for English to Hindi translation task**



3.3 BLEU Score

English to German

1. Additive : 0.0831
2. Multiplicative : 0.0927
3. Scaled dot product : 0.124

English to Hindi

1. Additive : 0.149
2. Multiplicative : 0.0965
3. Scaled dot product : 0.138