CPSC 8430- DEEP LEARNING

Homework3 Report

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GitHub link: https://github.com/PallaviRaguri/deep-learning_hw3.git

Introduction:

Google made a smart tool called BERT (Bidirectional Encoder Representations from Transformers) in 2018. It's a type of program that understands how words in sentences or paragraphs connect with each other. The cool thing about BERT is that it learns by itself from lots of written text, without needing someone to teach it directly. This learning style doesn't require any special examples to start with. So, BERT can get the hang of language by just reading a lot, helping it understand the way words work together in different situations.

Since it started in 2018, BERT has really changed the game in understanding language for computers. It's awesome at jobs like figuring out names in texts, sorting articles into groups, feeling out the mood of words, and finding answers to questions. Both big companies and schools are using it a lot because it works so well. Now, BERT is a super important tool that helps computers get better at dealing with language, making it a big deal in the world of natural language processing.

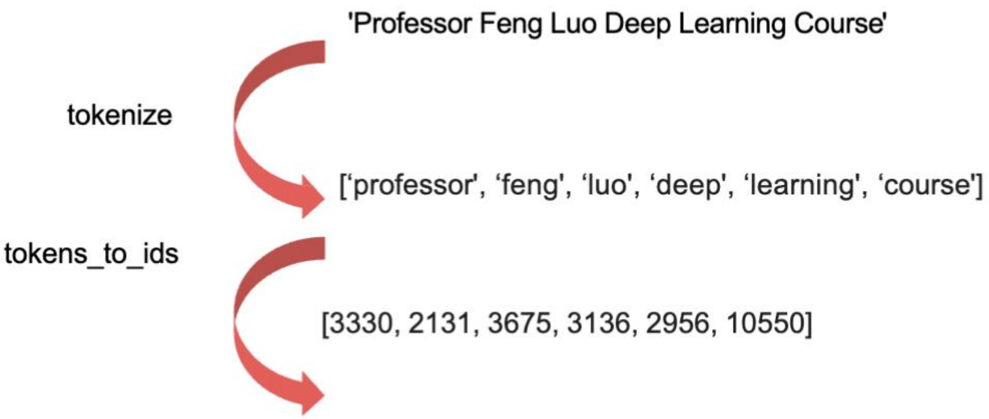
Dataset:

In this, we are using the Spoken-SQuAD dataset. This is a modified version of the original SQuAD dataset and it has spoken words turned into text on many subjects. We're using this to see how well we can train a BERT model, which is a type of AI, to answer questions. We'll play around with different settings and ways of training to see what works best.

Here, we mixed two levels of background noise (we call this 'white noise') into the audio files we used for testing. We did this to see how well the computer can understand speech when the sound isn’t clear. Because of this, we noticed different levels of mistakes in the words the computer picked up, which we call word error rates (WERs).

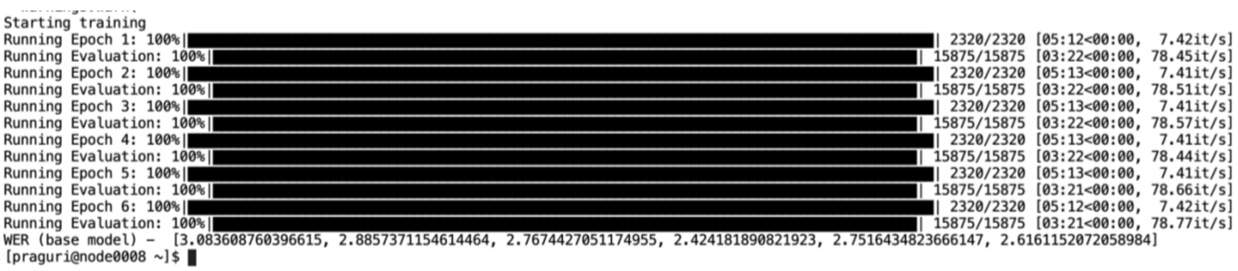
Tokenization:

Tokenization is when we split up written text into smaller chunks, known as tokens. These tokens are like the basic pieces we use for computer tasks that deal with language, such as finding specific names, figuring out if a piece of writing is happy or sad, or translating from one language to another.


'Professor Feng Luo Deep Learning Course'
tokenize
['professor', 'feng', 'luo', 'deep', 'learning', 'course']
tokens_to_ids
[3330, 2131, 3675, 3136, 2956, 10550]

Base Model Implementation:

We're using a pre-trained base model, which we got from Hugging Face, to help with our question and answer activity.



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Starting training
Running Epoch 1: 100%|███████████████████████████████████| 2320/2320 [05:12<00:00,  7.42it/s]
Running Evaluation: 100%|███████████████████████████████| 15875/15875 [03:22<00:00, 78.45it/s]
Running Epoch 2: 100%|███████████████████████████████████| 2320/2320 [05:13<00:00,  7.41it/s]
Running Evaluation: 100%|███████████████████████████████| 15875/15875 [03:22<00:00, 78.51it/s]
Running Epoch 3: 100%|███████████████████████████████████| 2320/2320 [05:13<00:00,  7.41it/s]
Running Evaluation: 100%|███████████████████████████████| 15875/15875 [03:22<00:00, 78.57it/s]
Running Epoch 4: 100%|███████████████████████████████████| 2320/2320 [05:13<00:00,  7.41it/s]
Running Evaluation: 100%|███████████████████████████████| 15875/15875 [03:22<00:00, 78.44it/s]
Running Epoch 5: 100%|███████████████████████████████████| 2320/2320 [05:13<00:00,  7.41it/s]
Running Evaluation: 100%|███████████████████████████████| 15875/15875 [03:21<00:00, 78.66it/s]
Running Epoch 6: 100%|███████████████████████████████████| 2320/2320 [05:12<00:00,  7.42it/s]
Running Evaluation: 100%|███████████████████████████████| 15875/15875 [03:21<00:00, 78.77it/s]
WER (base model) -  [3.083608760396615, 2.8857371154614464, 2.7674427051174955, 2.424181890821923, 2.7516434823666147, 2.6161152072058984]
[praguri@node0008 ~]$ █
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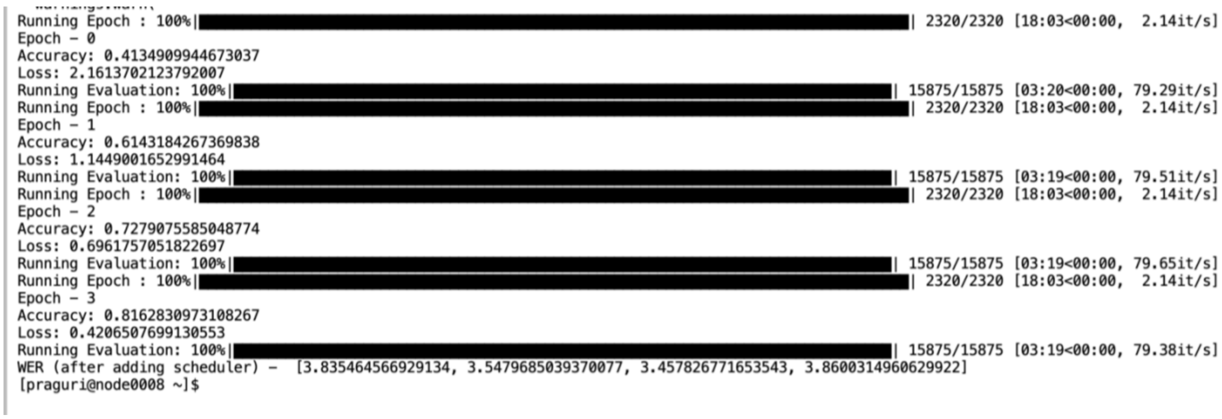
Implementing linear scheduler:

we used a method called a linear scheduler to slowly lower the learning rate every time we went through all the data, or each "epoch". This means that as we kept training, the amount by which our model learned each time got smaller and smaller until it was almost nothing by the time we finished.



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  warnings.warn(
Running Epoch : 100%|████████████████████████████████████████| 2320/2320 [18:03<00:00,  2.14it/s]
Epoch - 0
Accuracy: 0.4134909944673037
Loss: 2.1613702123792007
Running Evaluation: 100%|█████████████████████████████████████| 15875/15875 [03:20<00:00, 79.29it/s]
Running Epoch : 100%|████████████████████████████████████████| 2320/2320 [18:03<00:00,  2.14it/s]
Epoch - 1
Accuracy: 0.6143184267369838
Loss: 1.1449001652991464
Running Evaluation: 100%|█████████████████████████████████████| 15875/15875 [03:19<00:00, 79.51it/s]
Running Epoch : 100%|████████████████████████████████████████| 2320/2320 [18:03<00:00,  2.14it/s]
Epoch - 2
Accuracy: 0.7279075585048774
Loss: 0.6961757051822697
Running Evaluation: 100%|█████████████████████████████████████| 15875/15875 [03:19<00:00, 79.65it/s]
Running Epoch : 100%|████████████████████████████████████████| 2320/2320 [18:03<00:00,  2.14it/s]
Epoch - 3
Accuracy: 0.8162830973108267
Loss: 0.4206507699130553
Running Evaluation: 100%|█████████████████████████████████████| 15875/15875 [03:19<00:00, 79.38it/s]
WER (after adding scheduler) -  [3.835464566929134, 3.5479685039370077, 3.457826771653543, 3.8600314960629922]
[praguri@node0008 ~]$
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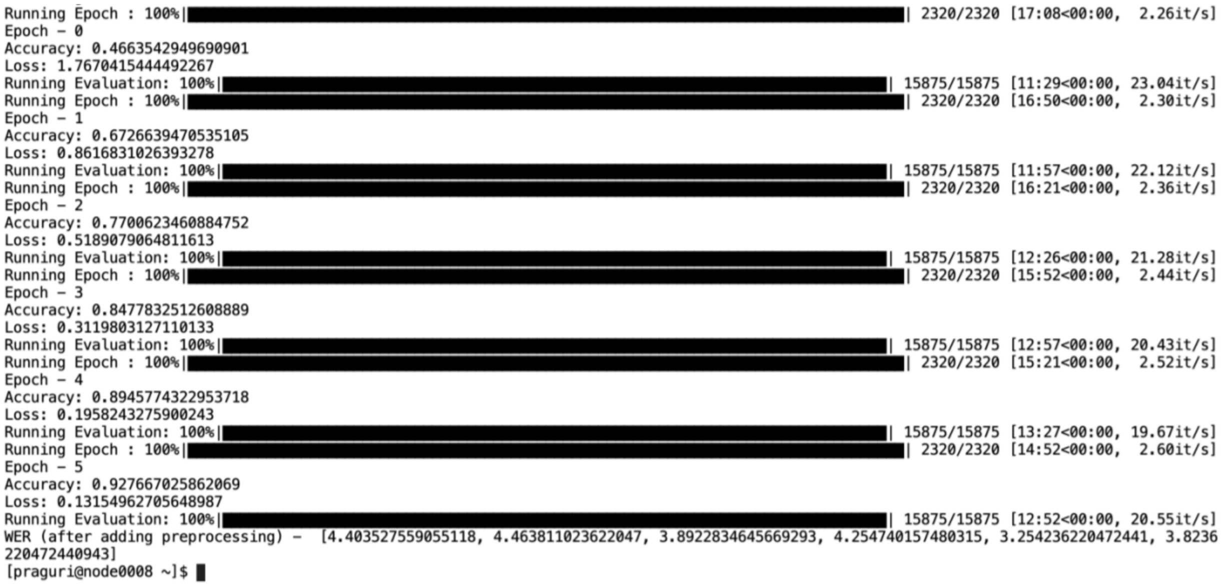
Preprocessing and Doc Stride:



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Running Epoch : 100%|████████████████████████████████████████| 2320/2320 [17:08<00:00,  2.26it/s]
Epoch - 0
Accuracy: 0.4663542949690901
Loss: 1.7670415444492267
Running Evaluation: 100%|█████████████████████████████████████| 15875/15875 [11:29<00:00, 23.04it/s]
Running Epoch : 100%|████████████████████████████████████████| 2320/2320 [16:50<00:00,  2.30it/s]
Epoch - 1
Accuracy: 0.6726639470535105
Loss: 0.8616831026393278
Running Evaluation: 100%|█████████████████████████████████████| 15875/15875 [11:57<00:00, 22.12it/s]
Running Epoch : 100%|████████████████████████████████████████| 2320/2320 [16:21<00:00,  2.36it/s]
Epoch - 2
Accuracy: 0.7700623460884752
Loss: 0.5189079064811613
Running Evaluation: 100%|█████████████████████████████████████| 15875/15875 [12:26<00:00, 21.28it/s]
Running Epoch : 100%|████████████████████████████████████████| 2320/2320 [15:52<00:00,  2.44it/s]
Epoch - 3
Accuracy: 0.8477832512608889
Loss: 0.3119803127110133
Running Evaluation: 100%|█████████████████████████████████████| 15875/15875 [12:57<00:00, 20.43it/s]
Running Epoch : 100%|████████████████████████████████████████| 2320/2320 [15:21<00:00,  2.52it/s]
Epoch - 4
Accuracy: 0.8945774322953718
Loss: 0.1958243275900243
Running Evaluation: 100%|█████████████████████████████████████| 15875/15875 [13:27<00:00, 19.67it/s]
Running Epoch : 100%|████████████████████████████████████████| 2320/2320 [14:52<00:00,  2.60it/s]
Epoch - 5
Accuracy: 0.927667025862069
Loss: 0.13154962705648987
Running Evaluation: 100%|█████████████████████████████████████| 15875/15875 [12:52<00:00, 20.55it/s]
WER (after adding preprocessing) -  [4.403527559055118, 4.463811023622047, 3.8922834645669293, 4.254740157480315, 3.254236220472441, 3.8236
220472440943]
[praguri@node0008 ~]$ █
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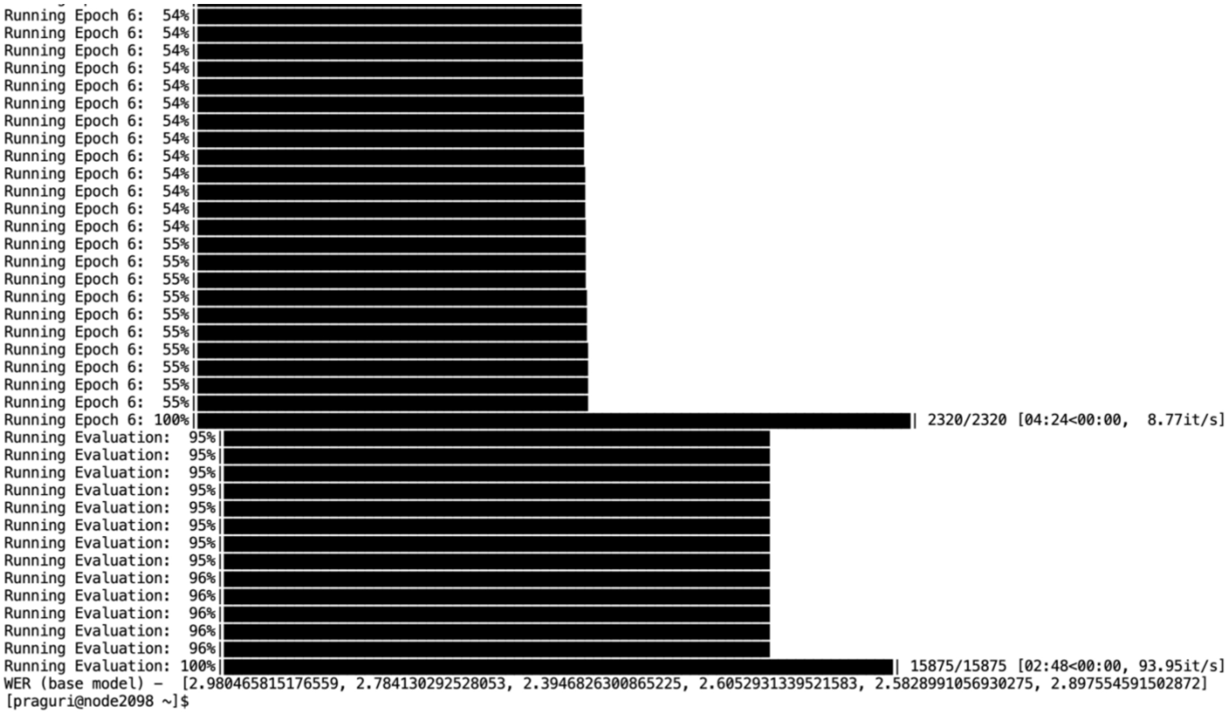

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Running Evaluation: 100%|██████████████████████████████████████████████████████████████████████████████| 15875/15875 [02:48<00:00, 93.95it/s]
WER (base model) -  [2.980465815176559, 2.784130292528053, 2.3946826300865225, 2.6052931339521583, 2.5828991056930275, 2.897554591502872]
[praguri@node2098 ~]$
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