Assignment 4 NLP

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Part 1 - Comprehensive Test

a. (20 points) What are the purposes of *pack_padded_sequence()* and *pad_packed_sequence()* functions used at the *get_all_hidden()* method (line 57) in the *core_nns.py* file

Answer:

pack_padded_sequence(): Packs a tensor containing padded sequences of variable length. If batch first is true then first comes batch, then length and then the input tensor. If enforce_sorted is set to true then the sequences should be sorted by the lenght in decreasing order and passed to the function. This function accepts any input that has at least two dimensions. You can apply it to pack the labels, and use the output of the RNN with them to compute the loss directly. Then a tensor can be retrieved from a packed sequence object by accessing its data attribute. pack_padded_sequence() function is applied before feeding into RNN. *input_lengths.cpu()* is the length of the individual sequence before padding. It is a data structure of PyTorch that allows the model to operate only up to the exact length of a given sequence without adding padding.

pad_packed_sequence(): This function is used on our packed RNN output Now we do packing so that the RNN doesn't see the unwanted padded index while processing the sequence which would affect the overall performance. It is an inverse operation to pack_padded_sequence. It pads a packed batch of variable length sequences. The returned Tensor's data will be of size T x B x *, where T is the length of the longest sequence and B is the batch size. If batch_first is True, the data will be transposed into B x T x * format. It also returns the list of lengths of each sequence in the batch. Batch elements will be reordered as they were ordered originally when the batch was passed to pack_padded_sequence or pack_sequence.

b. (20 points) Why do we need to use *sort_tensors()* and *resort_tensors()* methods at the *forward()* method (line 43) in the *core_nns.py* file

Answer:

sort_tensors(input_tensor, input_lengths): Sort input tensors by their lengths in a descending order. It sorts in descending order so we get the larget sentence first so based on the number of words or tokens in the largest sentence the other sentences are then padded accordingly. Sorting is done so words can then be padded or masked accordingly based on the largest length of the sentence or document. So for example if the largest document has 200 words and other documents have less than 200 words then sorting in descending gives the largest document first so then other documents are padded to match the lenght of the largest document that is 200 words.

resort_tensors(inp_tensor, reorder_tensor, dim=0): Recover the original order of inp_tensor on dim dimension which orders are stored in reorder_tensor. This function is used to get the original order of the tensor is used to calculate the losss. Based on the dimension it slices the input_tensor. If dimension is equal to 1 then input_tensor= inp_tensor[reorder_tensor]. Here the reorder_tensor is the original order output with padding of the input_tensor from sort_tensor function. If dimension is equal to 1 then inp_tensor = inp_tensor[:, reorder_tensor, :], and if deimension is equal to 2 then inp_tensor = inp_tensor[:, :, reorder_tensor]

Performance comparison of the models:

<table>
<tr><th>UNILSTM
model.py</th><th>BILSTM
model.py</th><th>BILSTM with F1 Score
_imp_metric.py</th><th>BILSTM with f1 score and glove embedding
_imp_emb.py</th></tr>
<tr><td>| EPOCH 1: TRAINING | time: 846.09s | loss 1.26 | documents 17495 | documents/s 20.68 |</td><td>| EPOCH 1: TRAINING | time: 1033.78s | loss 1.27 | documents 17495 | documents/s 16.92 |</td><td>| EPOCH 1: TRAINING | time: 1033.77s | loss 1.27 | documents 17495 | documents/s 16.92 |</td><td>| EPOCH 1: TRAINING | time: 626.64s | loss 1.27 | documents 17495 | documents/s 27.92 |</td></tr>
<tr><td>| EPOCH 1: EVALUATING | time: 10.46s | loss 1.23 | f1 6.30 | documents 3749 | documents/s 10.46 |</td><td>| EPOCH 1: EVALUATING | time: 16.80s | loss 1.24 | f1 6.82 | documents 3749 | documents/s 16.80 |</td><td>| EPOCH 1: EVALUATING | time: 17.06s | loss 1.24 | f1 6.82 | documents 3749 | documents/s 17.05 |</td><td>| EPOCH 1: EVALUATING | time: 15.14s | loss 1.24 | f1 8.63 | documents 3749 | documents/s 15.13 |</td></tr>
<tr><td>| EPOCH 2: TRAINING | time: 833.73s | loss 1.23 | documents 17495 | documents/s 20.98 |</td><td>| EPOCH 2: TRAINING | time: 1034.88s | loss 1.24 | documents 17495 | documents/s 16.91 |</td><td>| EPOCH 2: TRAINING | time: 1037.75s | loss 1.24 | documents 17495 | documents/s 16.86 |</td><td>| EPOCH 2: TRAINING | time: 634.22s | loss 1.24 | documents 17495 | documents/s 27.59 |</td></tr>
<tr><td>| EPOCH 2: EVALUATING | time: 10.30s | loss 1.21 | f1 6.30 | documents 3749 | documents/s 10.29 |</td><td>| EPOCH 2: EVALUATING | time: 16.80s | loss 1.21 | f1 11.72 | documents 3749 | documents/s 16.79 |</td><td>| EPOCH 2: EVALUATING | time: 16.93s | loss 1.21 | f1 11.72 | documents 3749 | documents/s 16.93 |</td><td>| EPOCH 2: EVALUATING | time: 15.13s | loss 1.21 | f1 6.52 | documents 3749 | documents/s 15.13 |</td></tr>
<tr><td>| EPOCH 3: TRAINING | time: 847.91s | loss 1.21 | documents 17495 | documents/s 20.63 |</td><td>| EPOCH 3: TRAINING | time: 1034.27s | loss 1.21 | documents 17495 | documents/s 16.92 |</td><td>| EPOCH 3: TRAINING | time: 1038.09s | loss 1.21 | documents 17495 | documents/s 16.85 |</td><td>| EPOCH 3: TRAINING | time: 639.85s | loss 1.21 | documents 17495 | documents/s 27.34 |</td></tr>
<tr><td>| EPOCH 3: EVALUATING | time: 10.12s | loss 1.19 | f1 6.30 | documents 3749 | documents/s 10.12 |</td><td>| EPOCH 3: EVALUATING | time: 16.81s | loss 1.20 | f1 7.15 | documents 3749 | documents/s 16.80 |</td><td>| EPOCH 3: EVALUATING | time: 16.98s | loss 1.20 | f1 7.15 | documents 3749 | documents/s 16.97 |</td><td>| EPOCH 3: EVALUATING | time: 15.29s | loss 1.20 | f1 6.11 | documents 3749 | documents/s 15.29 |</td></tr>
<tr><td>| EPOCH 4: TRAINING | time: 847.91s | loss 1.19 | documents 17495 | documents/s 20.63 |</td><td>| EPOCH 4: TRAINING | time: 1033.00s | loss 1.20 | documents 17495 | documents/s 16.94 |</td><td>| EPOCH 4: TRAINING | time: 1045.07s | loss 1.24 | documents 17495 | documents/s 16.74 |</td><td>| EPOCH 4: TRAINING | time: 630.97s | loss 1.20 | documents 17495 | documents/s 27.73 |</td></tr>
</table>

| EPOCH 4: EVALUATING | time: 10.08s | loss 1.18 | f1 6.30 | documents 3749 | documents/s 10.07 |	| EPOCH 4: EVALUATING | time: 16.72s | loss 1.18 | f1 7.00 | documents 3749 | documents/s 16.72 |	| EPOCH 4: EVALUATING | time: 16.90s | loss 1.21 | f1 11.36 | documents 3749 | documents/s 16.89 |	| EPOCH 4: EVALUATING | time: 15.02s | loss 1.18 | f1 6.11 | documents 3749 | documents/s 15.01 |
| EPOCH 5: TRAINING | time: 852.93s | loss 1.18 | documents 17495 | documents/s 20.51 |	| EPOCH 5: TRAINING | time: 1035.49s | loss 1.18 | documents 17495 | documents/s 16.90 |	| EPOCH 5: TRAINING | time: 1035.73s | loss 1.24 | documents 17495 | documents/s 16.89 |	| EPOCH 5: TRAINING | time: 624.95s | loss 1.18 | documents 17495 | documents/s 27.99 |
| EPOCH 5: EVALUATING | time: 10.10s | loss 1.17 | f1 6.30 | documents 3749 | documents/s 10.10 |	| EPOCH 5: EVALUATING | time: 16.89s | loss 1.17 | f1 7.00 | documents 3749 | documents/s 16.89 |	| EPOCH 5: EVALUATING | time: 16.93s | loss 1.21 | f1 10.76 | documents 3749 | documents/s 16.92 |	| EPOCH 5: EVALUATING | time: 15.25s | loss 1.17 | f1 6.11 | documents 3749 | documents/s 15.25 |
| EPOCH 6: TRAINING | time: 856.10s | loss 1.17 | documents 17495 | documents/s 20.44 |	| EPOCH 6: TRAINING | time: 1032.02s | loss 1.17 | documents 17495 | documents/s 16.95 |	| EPOCH 6: TRAINING | time: 1035.81s | loss 1.24 | documents 17495 | documents/s 16.89 |	| EPOCH 6: TRAINING | time: 629.60s | loss 1.20 | documents 17495 | documents/s 27.79 |
| EPOCH 6: EVALUATING | time: 10.18s | loss 1.16 | f1 6.30 | documents 3749 | documents/s 10.17 |	| EPOCH 6: EVALUATING | time: 16.79s | loss 1.16 | f1 11.78 | documents 3749 | documents/s 16.79 |	| EPOCH 6: EVALUATING | time: 16.97s | loss 1.21 | f1 11.68 | documents 3749 | documents/s 16.97 |	| EPOCH 6: EVALUATING | time: 15.22s | loss 1.18 | f1 6.11 | documents 3749 | documents/s 15.21 |
| EPOCH 7: TRAINING | time: 846.52s | loss 1.16 | documents 17495 | documents/s 20.67 |	| EPOCH 7: TRAINING | time: 1031.63s | loss 1.17 | documents 17495 | documents/s 16.96 |	| EPOCH 7: TRAINING | time: 1040.54s | loss 1.24 | documents 17495 | documents/s 16.81 |	| EPOCH 7: TRAINING | time: 626.32s | loss 1.20 | documents 17495 | documents/s 27.93 |
| EPOCH 7: EVALUATING | time: 10.45s | loss 1.15 | f1 6.30 | documents 3749 | documents/s 10.44 |	| EPOCH 7: EVALUATING | time: 16.84s | loss 1.15 | f1 7.37 | documents 3749 | documents/s 16.84 |	| EPOCH 7: EVALUATING | time: 16.68s | loss 1.21 | f1 11.56 | documents 3749 | documents/s 16.68 |	| EPOCH 7: EVALUATING | time: 15.66s | loss 1.18 | f1 6.11 | documents 3749 | documents/s 15.66 |
| EPOCH 8: TRAINING | time: 826.30s | loss 1.16 | documents 17495 | documents/s 21.17 |	| EPOCH 8: TRAINING | time: 1039.09s | loss 1.16 | documents 17495 | documents/s 16.84 |	| EPOCH 8: TRAINING | time: 1036.62s | loss 1.24 | documents 17495 | documents/s 16.88 |	| EPOCH 8: TRAINING | time: 630.17s | loss 1.20 | documents 17495 | documents/s 27.76 |

| EPOCH 8: EVALUATING | time: 10.24s | loss 1.15 | f1 6.30 | documents 3749 | documents/s 10.23 |	| EPOCH 8: EVALUATING | time: 16.89s | loss 1.15 | f1 7.00 | documents 3749 | documents/s 16.89 |	| EPOCH 8: EVALUATING | time: 16.99s | loss 1.21 | f1 10.82 | documents 3749 | documents/s 16.99 |	| EPOCH 8: EVALUATING | time: 15.28s | loss 1.18 | f1 6.11 | documents 3749 | documents/s 15.28 |
| BEST EPOCH 8: TESTING | time: 10.89s | loss 1.17 | f1 6.65 | documents 3749 | documents/s 10.89 |	| BEST EPOCH 8: TESTING | time: 17.50s | loss 1.17 | f1 6.95 | documents 3749 | documents/s 17.50 |	| BEST EPOCH 1: TESTING | time: 16.95s | loss 1.27 | f1 6.60 | documents 3749 | documents/s 16.94 |	| BEST EPOCH 3: TESTING | time: 15.52s | loss 1.23 | f1 6.67 | documents 3749 | documents/s 15.51 |

It can be seen with F1 score as evaluation in _imp_metric.py and F1 score as evaluation metric combined with glove embedding in _imp_emb.py the model converges faster and reaches an early stopping stage after which there are no significant improvements but it runs for 8 epochs and testing accuracy remains the same throught out the epochs. Also with glove embedding in first epoch only highest f1 score of 8.63 is achieved.

Detailed output of each model:
1) UNILSTM Model
Building dataset...
Extracting vocabulary from 21244 total samples: 21244 total labels, 5 unique labels 2265241 total tokens; 84876 unique tokens 84876 unique tokens appearing at least 1 times Writing hyper-parameters into ./results/senti_cls_unilstm.args
----
| EPOCH 1: TRAINING | time: 846.09s | loss 1.26 | documents 17495 | documents/s 20.68 |
| EPOCH 1: EVALUATING | time: 10.46s | loss 1.23 | f1 6.30 | documents 3749 | documents/s 10.46 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 2: TRAINING | time: 833.73s | loss 1.23 | documents 17495 |
| EPOCH 2: EVALUATING | time: 10.30s | loss 1.21 | f1 6.30 | documents 3749 | documents/s 10.29 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 3: TRAINING | time: 847.91s | loss 1.21 | documents 17495 | documents/s 20.63 |
| EPOCH 3: EVALUATING | time: 10.12s | loss 1.19 | f1 6.30 | documents 3749 | documents/s 10.12 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 4: TRAINING | time: 847.91s | loss 1.19 | documents 17495 | documents/s 20.63 |
| EPOCH 4: EVALUATING | time: 10.08s | loss 1.18 | f1 6.30 | documents 3749 | documents/s 10.07 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----

| EPOCH 5: TRAINING | time: 852.93s | loss 1.18 | documents 17495 | documents/s 20.51 |
| EPOCH 5: EVALUATING | time: 10.10s | loss 1.17 | f1 6.30 | documents 3749 | documents/s 10.10 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 6: TRAINING | time: 856.10s | loss 1.17 | documents 17495 | documents/s 20.44 |
| EPOCH 6: EVALUATING | time: 10.18s | loss 1.16 | f1 6.30 | documents 3749 | documents/s 10.17 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 7: TRAINING | time: 846.52s | loss 1.16 | documents 17495 | documents/s 20.67 |
| EPOCH 7: EVALUATING | time: 10.45s | loss 1.15 | f1 6.30 | documents 3749 | documents/s 10.44 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 8: TRAINING | time: 826.30s | loss 1.16 | documents 17495 | documents/s 21.17 |
| EPOCH 8: EVALUATING | time: 10.24s | loss 1.15 | f1 6.30 | documents 3749 | documents/s 10.23 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----

| BEST EPOCH 8: TESTING | time: 10.89s | loss 1.17 | f1 6.65 | documents 3749 | documents/s 10.89 | ---

2)BILSTM Model
Building dataset...
Extracting vocabulary from 21244 total samples: 21244 total labels, 5 unique labels 2265241 total tokens; 84876 unique tokens 84876 unique tokens appearing at least 1 times Writing hyper-parameters into ./results/senti_cls_bilstm.args
----
| EPOCH 1: TRAINING | time: 1033.78s | loss 1.27 | documents 17495 | documents/s 16.92 |
| EPOCH 1: EVALUATING | time: 16.80s | loss 1.24 | f1 6.82 | documents 3749 | documents/s 16.80 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 2: TRAINING | time: 1034.88s | loss 1.24 | documents 17495 | documents/s 16.91 |
| EPOCH 2: EVALUATING | time: 16.80s | loss 1.21 | f1 11.72 | documents 3749 | documents/s 16.79 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 3: TRAINING | time: 1034.27s | loss 1.21 | documents 17495 | documents/s 16.92 |
| EPOCH 3: EVALUATING | time: 16.81s | loss 1.20 | f1 7.15 | documents 3749 | documents/s 16.80 |

| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 4: TRAINING | time: 1033.00s | loss 1.20 | documents 17495 | documents/s 16.94 |
| EPOCH 4: EVALUATING | time: 16.72s | loss 1.18 | f1 7.00 | documents 3749 | documents/s 16.72 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 5: TRAINING | time: 1035.49s | loss 1.18 | documents 17495 | documents/s 16.90 |
| EPOCH 5: EVALUATING | time: 16.89s | loss 1.17 | f1 7.00 | documents 3749 | documents/s 16.89 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 6: TRAINING | time: 1032.02s | loss 1.17 | documents 17495 | documents/s 16.95 |
| EPOCH 6: EVALUATING | time: 16.79s | loss 1.16 | f1 11.78 | documents 3749 | documents/s 16.79 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 7: TRAINING | time: 1031.63s | loss 1.17 | documents 17495 | documents/s 16.96 |
| EPOCH 7: EVALUATING | time: 16.84s | loss 1.15 | f1 7.37 | documents 3749 | documents/s 16.84 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 8: TRAINING | time: 1039.09s | loss 1.16 | documents 17495 | documents/s 16.84 |
| EPOCH 8: EVALUATING | time: 16.89s | loss 1.15 | f1 7.00 | documents 3749 | documents/s 16.89 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| BEST EPOCH 8: TESTING | time: 17.50s | loss 1.17 | f1 6.95 | documents 3749 | documents/s 17.50 | ---

3)_imp_metric.py f1 score model
Building dataset...
Extracting vocabulary from 21244 total samples: 21244 total labels, 5 unique labels 2265241 total tokens; 84876 unique tokens 84876 unique tokens appearing at least 1 times Writing hyper-parameters into ./results/imp_metric_senti_cls_bilstm.args
----
| EPOCH 1: TRAINING | time: 1033.77s | loss 1.27 | documents 17495 | documents/s 16.92 |
| EPOCH 1: EVALUATING | time: 17.06s | loss 1.24 | f1 6.82 | documents 3749 | documents/s 17.05 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
----
| EPOCH 2: TRAINING | time: 1037.75s | loss 1.24 | documents 17495 | documents/s 16.86 |
| EPOCH 2: EVALUATING | time: 16.93s | loss 1.21 | f1 11.72 | documents 3749 | documents/s 16.93 |

| EPOCH 3: TRAINING | time: 1038.09s | loss 1.21 | documents 17495 | documents/s 16.85 |
| EPOCH 3: EVALUATING | time: 16.98s | loss 1.20 | f1 7.15 | documents 3749 | documents/s 16.97 |
| ---------> EARLY STOPPING at epoch 3
| BEST EPOCH 1: TESTING | time: 17.27s | loss 1.27 | f1 6.60 | documents 3749 | documents/s 17.26 |

| EPOCH 4: TRAINING | time: 1045.07s | loss 1.24 | documents 17495 | documents/s 16.74 |
| EPOCH 4: EVALUATING | time: 16.90s | loss 1.21 | f1 11.36 | documents 3749 | documents/s 16.89 |
| ---------> EARLY STOPPING at epoch 4
| BEST EPOCH 1: TESTING | time: 17.60s | loss 1.27 | f1 6.60 | documents 3749 | documents/s 17.60 |

| EPOCH 5: TRAINING | time: 1035.73s | loss 1.24 | documents 17495 | documents/s 16.89 |
| EPOCH 5: EVALUATING | time: 16.93s | loss 1.21 | f1 10.76 | documents 3749 | documents/s 16.92 |
| ---------> EARLY STOPPING at epoch 5
| BEST EPOCH 1: TESTING | time: 16.96s | loss 1.27 | f1 6.60 | documents 3749 | documents/s 16.96 |

| EPOCH 6: TRAINING | time: 1035.81s | loss 1.24 | documents 17495 | documents/s 16.89 |
| EPOCH 6: EVALUATING | time: 16.97s | loss 1.21 | f1 11.68 | documents 3749 | documents/s 16.97 |
| ---------> EARLY STOPPING at epoch 6
| BEST EPOCH 1: TESTING | time: 17.10s | loss 1.27 | f1 6.60 | documents 3749 | documents/s 17.10 |

EPOCH 7: TRAINING	time: 1040.54s	loss 1.24	documents 17495	documents/s 16.81
EPOCH 7: EVALUATING	time: 16.68s	loss 1.21	f1 11.56	documents 3749	documents/s 16.68
---------> EARLY STOPPING at epoch 7	BEST EPOCH 1: TESTING	time: 17.01s	loss 1.27	f1 6.60	documents 3749	documents/s 17.00

| EPOCH 8: TRAINING | time: 1036.62s | loss 1.24 | documents 17495 | documents/s 16.88 |
| EPOCH 8: EVALUATING | time: 16.99s | loss 1.21 | f1 10.82 | documents 3749 | documents/s 16.99 |
| ---------> EARLY STOPPING at epoch 8
| BEST EPOCH 1: TESTING | time: 16.95s | loss 1.27 | f1 6.60 | documents 3749 | documents/s 16.94 | ---
| BEST EPOCH 1: TESTING | time: 17.38s | loss 1.27 | f1 6.60 | documents 3749 | documents/s 17.38 | ---

4)_imp_emb.py F1 score and glove embeddings combined

Building dataset...

Extracting vocabulary from 21244 total samples: 21244 total labels, 5 unique labels 2265241 total tokens; 84876 unique tokens 84876 unique tokens appearing at least 1 times Writing hyper-parameters into ./results/emb_metric_senti_cls_bilstm.args .vector_cache/glove.6B.zip: 862MB [02:43, 5.28MB/s] 100% 398366/400000 [00:14<00:00, 23542.10it/s]/content/drive/My Drive/assignment4/utils/core_nns_emb.py:52: 100% 398366/400000 [00:30<00:00, 23542.10it/s]

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------------------------------------------------------------------------------------------
| EPOCH 1: TRAINING | time: 626.64s | loss 1.27 | documents 17495 | documents/s 27.92 |
| EPOCH 1: EVALUATING | time: 15.14s | loss 1.24 | f1 8.63 | documents 3749 | documents/s 15.13 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
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| EPOCH 2: TRAINING | time: 634.22s | loss 1.24 | documents 17495 | documents/s 27.59 |
| EPOCH 2: EVALUATING | time: 15.13s | loss 1.21 | f1 6.52 | documents 3749 | documents/s 15.13 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
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| EPOCH 3: TRAINING | time: 639.85s | loss 1.21 | documents 17495 | documents/s 27.34 |
| EPOCH 3: EVALUATING | time: 15.29s | loss 1.20 | f1 6.11 | documents 3749 | documents/s 15.29 |
| ---------> NEW IMPROVEMENT ---------> Save the model to file
------------------------------------------------------------------------------------------------------------------------------------------------------------------
| EPOCH 4: TRAINING | time: 630.97s | loss 1.20 | documents 17495 | documents/s 27.73 |
| EPOCH 4: EVALUATING | time: 15.02s | loss 1.18 | f1 6.11 | documents 3749 | documents/s 15.01 |
------------------------------------------------------------------------------------------------------------------------------------------------------------------
| EPOCH 5: TRAINING | time: 624.95s | loss 1.18 | documents 17495 | documents/s 27.99 |
| EPOCH 5: EVALUATING | time: 15.25s | loss 1.17 | f1 6.11 | documents 3749 | documents/s 15.25 |
| ---------> EARLY STOPPING at epoch 5 | BEST EPOCH 3: TESTING | time: 16.13s | loss 1.23 | f1 6.67 | documents 3749 | documents/s 16.13 |
------------------------------------------------------------------------------------------------------------------------------------------------------------------
| EPOCH 6: TRAINING | time: 629.60s | loss 1.20 | documents 17495 | documents/s 27.79 |
| EPOCH 6: EVALUATING | time: 15.22s | loss 1.18 | f1 6.11 | documents 3749 | documents/s 15.21 |
| ---------> EARLY STOPPING at epoch 6 | BEST EPOCH 3: TESTING | time: 15.50s | loss 1.23 | f1 6.67 | documents 3749 | documents/s 15.50 |
------------------------------------------------------------------------------------------------------------------------------------------------------------------
| EPOCH 7: TRAINING | time: 626.32s | loss 1.20 | documents 17495 | documents/s 27.93 |
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| EPOCH 7: EVALUATING | time: 15.66s | loss 1.18 | f1 6.11 | documents 3749 | documents/s 15.66 |
| ---------> EARLY STOPPING at epoch 7
| BEST EPOCH 3: TESTING | time: 15.49s | loss 1.23 | f1 6.67 | documents 3749 | documents/s 15.48 |

EPOCH 8: TRAINING	time: 630.17s	loss 1.20	documents 17495	documents/s 27.76
EPOCH 8: EVALUATING	time: 15.28s	loss 1.18	f1 6.11	documents 3749	documents/s 15.28
---------> EARLY STOPPING at epoch 8	BEST EPOCH 3: TESTING	time: 15.36s	loss 1.23	f1 6.67	documents 3749	documents/s 15.36

| BEST EPOCH 3: TESTING | time: 15.52s | loss 1.23 | f1 6.67 | documents 3749 | documents/s 15.51 | ---

Code and path changes that can be done:

- parser.add_argument('--bidirect', action='store_false', default=True, help='bidirectional flag') change default=False at in this argument in model.py file to train a unilstm model. By default it generates and trains a bilstm model.
- change path argument and model file in predict.py and app.py to test the results of different models.
- _imp_metric.py file is created for 5a part and it generates file with prefix "imp_metric_senti_cls_bi" for bilstm and with prefix "imp_metric_senti_cls_uni" for unilastm as bilstm model is trained so bilstm prefix will be used for files that are generated in results folder.
- Before running the _imp_emb.py file or cor_nns_emb.py download the
  the package pip install torchtext again. Also the file will download the glove embedding which are required in 5b part
- _imp_emb.py file is created for 5b part and it generates file with prefix "emb_metric_senti_cls_bi" for bilstm and with prefix "emb_metric_senti_cls_uni" for unilastm as bilstm model is trained so bilstm prefix will be used for files that are generated in results folder.
- core_nns_emb.py file is used for _imp_emb.py file and the code is changed to use glove embedding for training the model. Ignore the warnings that are generated.