

Shiva Kumar

CS 6320

Sak220007

Homework 2 Results

HMM Results:

Test Sentence 1:

the planet jupiter and its moons are in effect a mini solar system .

Results:

```
['DETERMINER', 'NOUN', 'NOUN', 'CONJUNCTION', 'PRONOUN', 'NOUN', 'VERB', 'PREPOSITION', 'NOUN', 'DETERMINER', 'NOUN', 'PUNCT', 'NOUN', 'PUNCT']
```

```
['DETERMINER', 'NOUN', 'NOUN', 'CONJUNCTION', 'PRONOUN', 'NOUN', 'VERB', 'PREPOSITION', 'NOUN', 'DETERMINER', 'NOUN', 'PUNCT', 'NOUN', 'PUNCT']
```

Test Sentence 2:

computers process programs accurately .

Results:

```
['DETERMINER', 'NOUN', 'NOUN', 'CONJUNCTION', 'NOUN', 'VERB', 'NOUN', 'ADVERB', 'PUNCT']
```

```
['NOUN', 'NOUN', 'NOUN', 'ADVERB', 'PUNCT']
```

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RNN Results:

Model Summary

Layer (type)	Output Shape	Param #
embedding (Embedding)	(None, 180, 128)	6366976
lstm (LSTM)	(None, 180, 256)	394240
time_distributed (TimeDistributed)	(None, 180, 12)	3084
=====		
Total params: 6,764,300		
Trainable params: 6,764,300		
Non-trainable params: 0		
=====		
Epoch 1/10		

Test Sentence 1:

the planet jupiter and its moons are in effect a mini solar system .

```
RNN POS Tag
Output: ['DETERMINER', 'NOUN', 'NOUN', 'CONJUNCTION', 'PRONOUN', 'NOUN', 'VERB', 'PREPOSITION', 'NOUN', 'DETERMINER', 'NOUN', 'ADJECTIVE', 'NOUN', 'PUNCT']
```

['DETERMINER', 'NOUN', 'NOUN', 'CONJUNCTION', 'PRONOUN', 'NOUN', 'VERB', 'PREPOSITION', 'NOUN', 'DETERMINER', 'NOUN', 'ADJECTIVE', 'NOUN', 'PUNCT']

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Test Sentence 2:

computers process programs accurately .

```
RNN POS Tag
Output: ['NOUN', 'NOUN', 'NOUN', 'ADVERB', 'PUNCT']
```

Google Collab Output:

```
['DETERMINER', 'NOUN', 'NOUN', 'CONJUNCTION', 'PRONOUN', 'NOUN', 'VERB', 'PREPOSITION', 'NOUN', 'DETERMINER', 'NOUN', 'PUNCT', 'NOUN', 'PUNCT']
['NOUN', 'NOUN', 'NOUN', 'ADVERB', 'PUNCT']
Model: "sequential"
```

Layer (type)	Output Shape	Param #
embedding (Embedding)	(None, 180, 128)	6366976
lstm (LSTM)	(None, 180, 256)	394240
time_distributed (TimeDistributed)	(None, 180, 12)	3084

```
=====  
Total params: 6,764,300  
Trainable params: 6,764,300  
Non-trainable params: 0
```

```
Epoch 1/40  
359/359 [=====] - 54s 128ms/step - loss: 0.0364 - accuracy: 0.9161 - val_loss: 0.0223 - val_accuracy: 0.9378  
Epoch 2/40  
359/359 [=====] - 20s 56ms/step - loss: 0.0182 - accuracy: 0.9551 - val_loss: 0.0118 - val_accuracy: 0.9819  
Epoch 3/40  
359/359 [=====] - 14s 38ms/step - loss: 0.0070 - accuracy: 0.9916 - val_loss: 0.0049 - val_accuracy: 0.9935  
Epoch 4/40  
359/359 [=====] - 13s 35ms/step - loss: 0.0040 - accuracy: 0.9948 - val_loss: 0.0041 - val_accuracy: 0.9940  
Epoch 5/40  
359/359 [=====] - 12s 33ms/step - loss: 0.0027 - accuracy: 0.9956 - val_loss: 0.0039 - val_accuracy: 0.9943  
Epoch 6/40  
359/359 [=====] - 12s 34ms/step - loss: 0.0023 - accuracy: 0.9959 - val_loss: 0.0039 - val_accuracy: 0.9945  
Epoch 7/40
```

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```
Epoch 1/40
359/359 [=====] - 54s 128ms/step - loss: 0.0364 - accuracy: 0.9161 - val_loss: 0.0223 - val_accuracy: 0.9378
Epoch 2/40
359/359 [=====] - 20s 56ms/step - loss: 0.0182 - accuracy: 0.9551 - val_loss: 0.0118 - val_accuracy: 0.9819
Epoch 3/40
359/359 [=====] - 14s 38ms/step - loss: 0.0070 - accuracy: 0.9916 - val_loss: 0.0049 - val_accuracy: 0.9935
Epoch 4/40
359/359 [=====] - 13s 35ms/step - loss: 0.0040 - accuracy: 0.9948 - val_loss: 0.0041 - val_accuracy: 0.9940
Epoch 5/40
359/359 [=====] - 12s 33ms/step - loss: 0.0027 - accuracy: 0.9956 - val_loss: 0.0039 - val_accuracy: 0.9943
Epoch 6/40
359/359 [=====] - 12s 34ms/step - loss: 0.0023 - accuracy: 0.9959 - val_loss: 0.0039 - val_accuracy: 0.9945
Epoch 7/40
359/359 [=====] - 12s 34ms/step - loss: 0.0024 - accuracy: 0.9961 - val_loss: 0.0041 - val_accuracy: 0.9946
Epoch 8/40
359/359 [=====] - 12s 33ms/step - loss: 0.0021 - accuracy: 0.9963 - val_loss: 0.0041 - val_accuracy: 0.9946
Epoch 9/40
359/359 [=====] - 11s 32ms/step - loss: 0.0019 - accuracy: 0.9964 - val_loss: 0.0036 - val_accuracy: 0.9948
Epoch 10/40
359/359 [=====] - 12s 34ms/step - loss: 0.0018 - accuracy: 0.9966 - val_loss: 0.0039 - val_accuracy: 0.9949
Epoch 11/40
359/359 [=====] - 12s 32ms/step - loss: 0.0017 - accuracy: 0.9967 - val_loss: 0.0043 - val_accuracy: 0.9946
Epoch 12/40
359/359 [=====] - 11s 31ms/step - loss: 0.0017 - accuracy: 0.9968 - val_loss: 0.0039 - val_accuracy: 0.9949
Epoch 13/40
359/359 [=====] - 12s 33ms/step - loss: 0.0018 - accuracy: 0.9969 - val_loss: 0.0039 - val_accuracy: 0.9950
Epoch 14/40
359/359 [=====] - 11s 31ms/step - loss: 0.0016 - accuracy: 0.9970 - val_loss: 0.0039 - val_accuracy: 0.9951
Epoch 15/40
359/359 [=====] - 11s 31ms/step - loss: 0.0015 - accuracy: 0.9971 - val_loss: 0.0038 - val_accuracy: 0.9952
Epoch 16/40
359/359 [=====] - 12s 33ms/step - loss: 0.0015 - accuracy: 0.9972 - val_loss: 0.0045 - val_accuracy: 0.9950
Epoch 17/40
359/359 [=====] - 11s 32ms/step - loss: 0.0016 - accuracy: 0.9972 - val_loss: 0.0038 - val_accuracy: 0.9952
Epoch 18/40
359/359 [=====] - 11s 32ms/step - loss: 0.0014 - accuracy: 0.9974 - val_loss: 0.0038 - val_accuracy: 0.9953
Epoch 19/40
359/359 [=====] - 12s 32ms/step - loss: 0.0014 - accuracy: 0.9975 - val_loss: 0.0044 - val_accuracy: 0.9950
Epoch 20/40
359/359 [=====] - 11s 30ms/step - loss: 0.0015 - accuracy: 0.9975 - val_loss: 0.0041 - val_accuracy: 0.9952
Epoch 21/40
359/359 [=====] - 11s 32ms/step - loss: 0.0017 - accuracy: 0.9974 - val_loss: 0.0047 - val_accuracy: 0.9949
Epoch 22/40
359/359 [=====] - 11s 31ms/step - loss: 0.0017 - accuracy: 0.9974 - val_loss: 0.0046 - val_accuracy: 0.9950
Epoch 23/40
359/359 [=====] - 11s 31ms/step - loss: 0.0015 - accuracy: 0.9974 - val_loss: 0.0040 - val_accuracy: 0.9952
```

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```
Epoch 16/40
359/359 [=====] - 12s 33ms/step - loss: 0.0015 - accuracy: 0.9972 - val_loss: 0.0045 - val_accuracy: 0.9950
Epoch 17/40
359/359 [=====] - 11s 32ms/step - loss: 0.0016 - accuracy: 0.9972 - val_loss: 0.0038 - val_accuracy: 0.9952
Epoch 18/40
359/359 [=====] - 11s 32ms/step - loss: 0.0014 - accuracy: 0.9974 - val_loss: 0.0038 - val_accuracy: 0.9953
Epoch 19/40
359/359 [=====] - 12s 32ms/step - loss: 0.0014 - accuracy: 0.9975 - val_loss: 0.0044 - val_accuracy: 0.9950
Epoch 20/40
359/359 [=====] - 11s 30ms/step - loss: 0.0015 - accuracy: 0.9975 - val_loss: 0.0041 - val_accuracy: 0.9952
Epoch 21/40
359/359 [=====] - 11s 32ms/step - loss: 0.0017 - accuracy: 0.9974 - val_loss: 0.0047 - val_accuracy: 0.9949
Epoch 22/40
359/359 [=====] - 11s 31ms/step - loss: 0.0017 - accuracy: 0.9974 - val_loss: 0.0046 - val_accuracy: 0.9950
Epoch 23/40
359/359 [=====] - 11s 31ms/step - loss: 0.0015 - accuracy: 0.9974 - val_loss: 0.0040 - val_accuracy: 0.9952
Epoch 24/40
359/359 [=====] - 11s 31ms/step - loss: 0.0015 - accuracy: 0.9976 - val_loss: 0.0041 - val_accuracy: 0.9953
Epoch 25/40
359/359 [=====] - 11s 32ms/step - loss: 0.0014 - accuracy: 0.9976 - val_loss: 0.0041 - val_accuracy: 0.9953
Epoch 26/40
359/359 [=====] - 12s 32ms/step - loss: 0.0012 - accuracy: 0.9978 - val_loss: 0.0041 - val_accuracy: 0.9953
Epoch 27/40
359/359 [=====] - 11s 30ms/step - loss: 0.0011 - accuracy: 0.9980 - val_loss: 0.0044 - val_accuracy: 0.9953
Epoch 28/40
359/359 [=====] - 11s 30ms/step - loss: 0.0011 - accuracy: 0.9981 - val_loss: 0.0045 - val_accuracy: 0.9952
Epoch 29/40
359/359 [=====] - 11s 31ms/step - loss: 0.0019 - accuracy: 0.9976 - val_loss: 0.0071 - val_accuracy: 0.9934
Epoch 30/40
359/359 [=====] - 11s 30ms/step - loss: 0.0016 - accuracy: 0.9977 - val_loss: 0.0050 - val_accuracy: 0.9948
Epoch 31/40
359/359 [=====] - 11s 31ms/step - loss: 0.0020 - accuracy: 0.9975 - val_loss: 0.0049 - val_accuracy: 0.9950
Epoch 32/40
359/359 [=====] - 11s 31ms/step - loss: 0.0014 - accuracy: 0.9979 - val_loss: 0.0049 - val_accuracy: 0.9951
Epoch 33/40
359/359 [=====] - 11s 31ms/step - loss: 0.0013 - accuracy: 0.9981 - val_loss: 0.0051 - val_accuracy: 0.9950
Epoch 34/40
359/359 [=====] - 12s 32ms/step - loss: 0.0013 - accuracy: 0.9982 - val_loss: 0.0052 - val_accuracy: 0.9951
Epoch 35/40
359/359 [=====] - 12s 33ms/step - loss: 0.0013 - accuracy: 0.9981 - val_loss: 0.0052 - val_accuracy: 0.9950
Epoch 36/40
359/359 [=====] - 11s 31ms/step - loss: 0.0020 - accuracy: 0.9977 - val_loss: 0.0086 - val_accuracy: 0.9936
Epoch 37/40
359/359 [=====] - 12s 32ms/step - loss: 0.0017 - accuracy: 0.9978 - val_loss: 0.0049 - val_accuracy: 0.9950
Epoch 38/40
359/359 [=====] - 11s 31ms/step - loss: 0.0026 - accuracy: 0.9972 - val_loss: 0.0051 - val_accuracy: 0.9949
Epoch 39/40
359/359 [=====] - 11s 31ms/step - loss: 0.0017 - accuracy: 0.9977 - val_loss: 0.0047 - val_accuracy: 0.9951
Epoch 40/40
359/359 [=====] - 11s 30ms/step - loss: 0.0015 - accuracy: 0.9979 - val_loss: 0.0047 - val_accuracy: 0.9952

Epoch 39/40
359/359 [=====] - 11s 31ms/step - loss: 0.0017 - accuracy: 0.9977 - val_loss: 0.0047 - val_accuracy: 0.9951
Epoch 40/40
359/359 [=====] - 11s 30ms/step - loss: 0.0015 - accuracy: 0.9979 - val_loss: 0.0047 - val_accuracy: 0.9952
Sentence the planet jupiter and its moons are in effect a mini solar system .
1/1 [=====] - 0s 379ms/step
Output: ['DETERMINER', 'NOUN', 'NOUN', 'CONJUNCTION', 'PRONOUN', 'PAD', 'VERB', 'PREPOSITION', 'NOUN', 'DETERMINER', 'DETERMINER', 'ADJECTIVE', 'NOUN', 'PUNCT']
Sentence computers process programs accurately .
1/1 [=====] - 0s 19ms/step
Output: ['NOUN', 'NOUN', 'NOUN', 'ADVERB', 'PUNCT']
```