

Problem 1

Model Summary:

RNN with Word2Vec

Model: "sequential_9"

Layer (type)	Output Shape	Param #
embedding_9 (Embedding)	(None, 100, 100)	247000
simple_rnn (SimpleRNN)	(None, 100)	20100
dense_3 (Dense)	(None, 1)	101

=====
Total params: 267201 (1.02 MB)
Trainable params: 20201 (78.91 KB)
Non-trainable params: 247000 (964.84 KB)
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LSTM with Word2Vec

Model: "sequential_13"

Layer (type)	Output Shape	Param #
embedding_13 (Embedding)	(None, 100, 100)	247000
bidirectional_2 (Bidirectional)	(None, 200)	121200
dense_5 (Dense)	(None, 1)	201

=====
Total params: 368401 (1.41 MB)
Trainable params: 121401 (474.22 KB)
Non-trainable params: 247000 (964.84 KB)
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GRU with Word2Vec -

Model: "sequential_15"

Layer (type)	Output Shape	Param #
embedding_15 (Embedding)	(None, 100, 100)	247000
bidirectional_3 (Bidirectional)	(None, 200)	121200
dense_7 (Dense)	(None, 1)	201

=====
Total params: 368401 (1.41 MB)
Trainable params: 121401 (474.22 KB)
Non-trainable params: 247000 (964.84 KB)
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Accuracy with Word2Vec embeddings and GRU: 87.99%

RNN with GloVe

Model: "sequential_15"

Layer (type)	Output Shape	Param #
embedding_15 (Embedding)	(None, 100, 100)	247000
bidirectional_3 (Bidirectional)	(None, 200)	121200
dense_7 (Dense)	(None, 1)	201

=====
Total params: 368401 (1.41 MB)
Trainable params: 121401 (474.22 KB)
Non-trainable params: 247000 (964.84 KB)
=====

LSTM with GloVe

Model: "sequential_15"

Layer (type)	Output Shape	Param #
embedding_15 (Embedding)	(None, 100, 100)	247000
bidirectional_3 (Bidirectional)	(None, 200)	121200
dense_7 (Dense)	(None, 1)	201

=====
Total params: 368401 (1.41 MB)
Trainable params: 121401 (474.22 KB)
Non-trainable params: 247000 (964.84 KB)
=====

Accuracy with GloVe embeddings and LSTM: 87.54%

GRU with GloVe

Model: "sequential_15"

Layer (type)	Output Shape	Param #
embedding_15 (Embedding)	(None, 100, 100)	247000
bidirectional_3 (Bidirectional)	(None, 200)	121200
dense_7 (Dense)	(None, 1)	201

=====
Total params: 368401 (1.41 MB)
Trainable params: 121401 (474.22 KB)
Non-trainable params: 247000 (964.84 KB)
=====

Accuracy with GloVe embeddings and GRU: 86.34%

Model	Epochs
Word2Vec - RNN	10
Word2Vec - LSTM	10
Word2Vec - GRU	5
GloVe - RNN	5
GloVe - LSTM	5
GloVe - GRU	10

The below applies for all model and embedding combinations:

Learning Rate - Default

Metric – Accuracy

Activation (Hidden) – Tanh

Activation (Output) – Sigmoid

Weight Initializer – Glorot

Hidden Layers – 1

Neurons in Hidden Layers – 100

Loss Function – Binary Cross Entropy

Optimizer - Adam

The best performing combination was **Word2Vec with RNN and GRU, LSTM** and **GRU with GloVe** with Accuracy **87.99%, 87.54%, 86.34%**.

Embedding	Model	Accuracy	Confusion Matrix	Classification Report				
Word2Vec	RNN	87.99%	[[4296 665] [536 4503]]	precision	recall	f1-score	support	
				0	0.89	0.87	0.88	4961
				1	0.87	0.89	0.88	5039
				accuracy			0.88	10000
				macro avg	0.88	0.88	0.88	10000
				weighted avg	0.88	0.88	0.88	10000
				precision	recall	f1-score	support	
				0	0.77	0.80	0.79	4961
				1	0.80	0.77	0.78	5039
				accuracy			0.79	10000
Word2Vec	LSTM	78.6%	[[3991 970] [1170 3869]]	macro avg	0.79	0.79	0.79	10000
				weighted avg	0.79	0.79	0.79	10000
				precision	recall	f1-score	support	
				0	0.89	0.87	0.88	4961
				1	0.87	0.89	0.88	5039
				accuracy			0.88	10000
				macro avg	0.88	0.88	0.88	10000
				weighted avg	0.88	0.88	0.88	10000
				precision	recall	f1-score	support	
				0	0.55	0.53	0.54	4961
Word2Vec	GRU	87.99%	[[4296 665] [536 4503]]	1	0.56	0.58	0.57	5039
				accuracy			0.55	10000
				macro avg	0.55	0.55	0.55	10000
				weighted avg	0.55	0.55	0.55	10000
				precision	recall	f1-score	support	
				0	0.89	0.86	0.87	4961
				1	0.86	0.90	0.88	5039
				accuracy			0.88	10000
				macro avg	0.88	0.88	0.88	10000
				weighted avg	0.88	0.88	0.88	10000
GloVe	RNN	55.43%	[[2609 2352] [2105 2934]]	precision	recall	f1-score	support	
				0	0.84	0.89	0.87	4961
				1	0.89	0.83	0.86	5039
				accuracy			0.86	10000
				macro avg	0.86	0.86	0.86	10000
				weighted avg	0.86	0.86	0.86	10000
				precision	recall	f1-score	support	
				0	0.89	0.86	0.87	4961
				1	0.86	0.90	0.88	5039
				accuracy			0.88	10000
GloVe	LSTM	87.54%	[[4244 717] [529 4510]]	macro avg	0.88	0.88	0.88	10000
				weighted avg	0.88	0.88	0.88	10000
				precision	recall	f1-score	support	
				0	0.89	0.86	0.87	4961
				1	0.86	0.90	0.88	5039
				accuracy			0.88	10000
				macro avg	0.88	0.88	0.88	10000
				weighted avg	0.88	0.88	0.88	10000
				precision	recall	f1-score	support	
				0	0.84	0.89	0.87	4961
GloVe	GRU	86.34%	[[4433 528] [838 4201]]	1	0.89	0.83	0.86	5039
				accuracy			0.86	10000
				macro avg	0.86	0.86	0.86	10000
				weighted avg	0.86	0.86	0.86	10000
				precision	recall	f1-score	support	
				0	0.89	0.86	0.87	4961
				1	0.86	0.90	0.88	5039
				accuracy			0.88	10000
				macro avg	0.88	0.88	0.88	10000
				weighted avg	0.88	0.88	0.88	10000

Problem 2

Text generation model:

Model achieved an accuracy of 99.99%

```
model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #
embedding (Embedding)	(None, 24, 100)	272800
gru (GRU)	(None, 24, 100)	60600
gru_1 (GRU)	(None, 100)	60600
dense (Dense)	(None, 2728)	275528

=====
Total params: 669528 (2.55 MB)
Trainable params: 669528 (2.55 MB)
Non-trainable params: 0 (0.00 Byte)

Hyperparameter	Value
Activation Function (Hidden)	Linear for Embedding, Tanh for GRU
Activation (Output)	SoftMax
Weight_INITIALIZER	Uniform
Hidden Layers	2
Neurons in Hidden Layer	100
Loss Function	Categorical Cross entropy
Optimizer	Adam
Epochs	60
Evaluation Metric	Accuracy

Transfer learning: (word2vec word embeddings)

```
Model: "sequential_2"
```

Layer (type)	Output Shape	Param #
embedding_2 (Embedding)	(None, 25, 100)	247000
gru_2 (GRU)	(None, 25, 100)	60600
gru_3 (GRU)	(None, 100)	60600
dense_2 (Dense)	(None, 2470)	249470

=====
Total params: 617670 (2.36 MB)
Trainable params: 617670 (2.36 MB)
Non-trainable params: 0 (0.00 Byte)

Hyperparameter	Value
Activation Function (Hidden)	Tanh for LSTM
Activation (Output)	SoftMax
Weight Initializer	Uniform
Hidden Layers	1 (LSTM Layer)
Neurons in Hidden Layer	100
Loss Function	Categorical Cross entropy
Optimizer	Adam
Epochs	50
Evaluation Metric	Accuracy