

DL HW3

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1. Preprocessing of Text

```
data_path = 'shakespeare_train.txt'

with open(data_path, 'r', encoding='UTF-8') as f:
    train_text = f.read()

with open(data_path, 'r', encoding='UTF-8') as f:
    valid_text = f.read()

vocab_to_int = tf.keras.layers.StringLookup(
    output_mode='int',
    vocabulary=list(set(train_text)),
)

int_to_vocab = tf.keras.layers.StringLookup(
    output_mode='int',
    vocabulary=vocab_to_int.get_vocabulary(),
    invert=True,
)

train_data = tf.strings.unicode_split(train_text, 'UTF-8')
train_data = vocab_to_int(train_data)

valid_data = tf.strings.unicode_split(valid_text, 'UTF-8')
valid_data = vocab_to_int(valid_data)
```

2. Recurrent Neural Network

2-1 Construct a standard RNN then show your (1) network architecture, (2) learning curve, (3) training error rate and (4) validation error rate.

2-1-1 Network architecture

Model: "sequential"

Layer (type)	Output Shape	Param #
embedding (Embedding)	(None, None, 32)	2176
simple_rnn (SimpleRNN)	(None, 128)	20608
dense (Dense)	(None, 128)	16512
dense_1 (Dense)	(None, 68)	8772

Total params: 48068 (187.77 KB)

Trainable params: 48068 (187.77 KB)

Non-trainable params: 0 (0.00 Byte)

2-1-2~2-1-4 Learning curve/training accuracy/validation accuracy

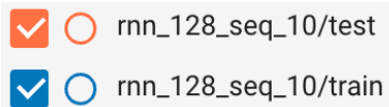
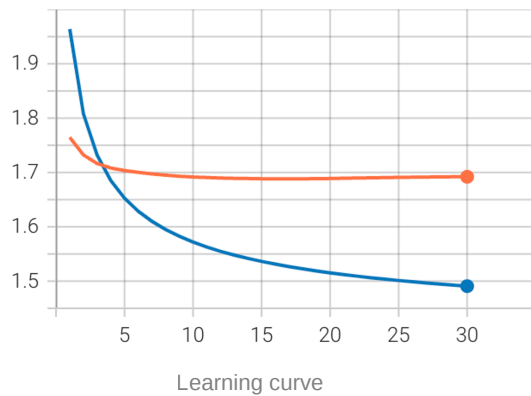
Implementation details:

- epoch: 30
- batch size: 1024
- learning rate: 10^{-3}
- hidden layer: 128
- sequence: 20

Learning curve

- train: 1.512
- test: 1.701

loss
tag: loss

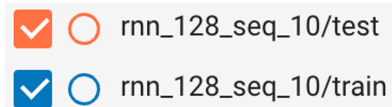


Legend

Training/Validation acc

- train: 0.551
- test: 0.522

accuracy
tag: accuracy



Legend

2-2 Choose 5 breakpoints during your training process to show how well your network learns through more epochs. Feed some part of your training text into RNN and show the text output.

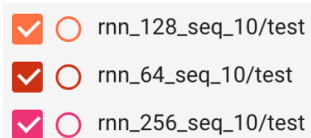
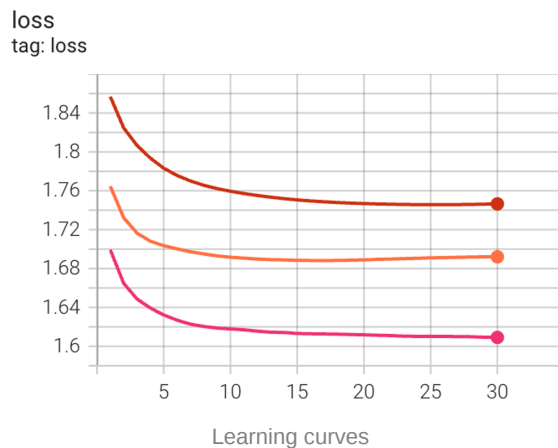
sample text	epoch 6	epoch 12	epoch 18	epoch 24	epoch 30
their intents, Extre	their intents, Extremy be't, thou made shall gratter thank woo! Dry his life and faults, 'tis sir.TALBOT: You lauteſt;	their intents, Extreme in theirs flesh day with forty ſign here, Near and friendſhited ripering gromes! Sir, floral ſour	their intents, Extreme here, teach thou ſhaminice is, for breath and Stave into a huele dares and aſſurſents and caparks	their intents, Extremy, women the ſlippre? HAMLET: Yet a firſt ſhall Romans Bit unjorht uſ in the prince of your daug	their intents, Extreme is lord, tell you on ſo unſeemro, my Lord Hoſtlan had but would your faſhion, it is pittracted, it
his ſeat; And to ſu	his ſeat; And to ſupe of; thy king is bill'd all thy cray me to thy o'ers Of nature, Well, my word, I fell. 'Thop's the	his ſeat; And to ſupple, he day of the adain a ſooner'd with ſooner of about.TIMON: For violeſted from it: Unclocks,	his ſeat; And to ſun Hero, Bruck ouſelf-aſ't upon me o' Gook command To been to take him perola! That an any water.B	his ſeat; And to ſure, I throat I ſtaggers' too, come.CLOTEN: My Limb: and he cannot we long Herefold, It be me eſti	his ſeat; And to ſuch offenculder thuſt hear no, that. You are out his ſirs.HAMLET: War murders untivity my Lord had
one another. The wa	one another. The way.MONTAGUE: What love myſelf, But well, there's now! he's reaſon: then is reaſerſior, ſir!HORATI	one another. The way done.TIMON: What good my lord, I would not a man. 'Tis I ſold thee, ſir, In your virtue roon'd u	one another. The way of it, And Service upon thee, we'll ſo for them weep Or he is there?ULYSSES: No, thou'rt how, it	one another. The way.LEONTES: The enemy a favour to trumbrit and your life fury for all poſitch'd! o, but I am nothin	one another. The wate men garcaſtevatē; being God we look to wine onzand in our face: We hope, low no bedenn where thou
tell you ſtrange ne	tell you ſtrange new-thought it: give his writ 'tiſe. Turn. Why, killary thuſ. Kell talking in the gentle, put away As	tell you ſtrange neightle nature: If graignſhipans hot left, then paſtain of our picile to night, my lords and true tha	tell you ſtrange neſt yeer die.POSTHUMUS CA PRETHICEY: Sir Seace you tell thy ſue; he confirmation will beſt be well-	tell you ſtrange nell'd ſo brothing the fool of thy gued me to make thy lord, they And buy?	tell you ſtrange need and laſt? all Bellow the reward; Like the young men probuſt ſweeter, no bar, and give Beatring to

2-3 Compare the results of choosing different size of hidden states and sequence length by plotting the training loss vs. different parameters.

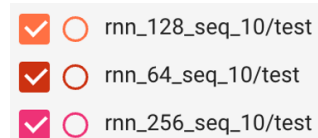
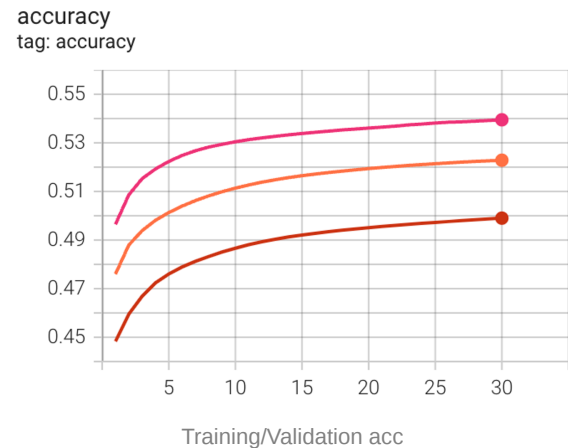
1. Different size of hidden layer

Compare three sizes (64, 128, 256) of hidden layer

Learning curves



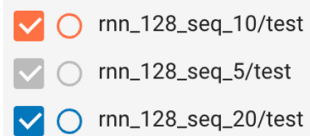
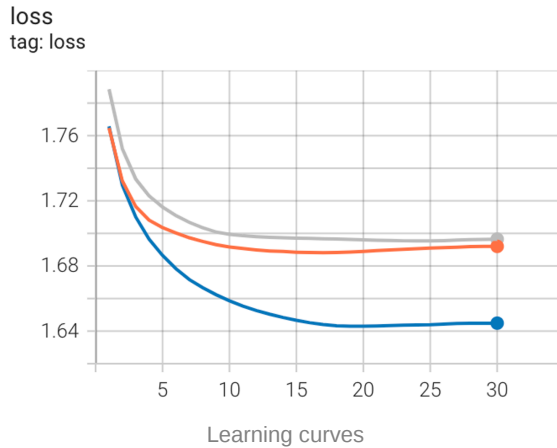
Training/Validation acc



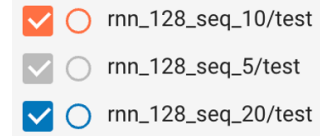
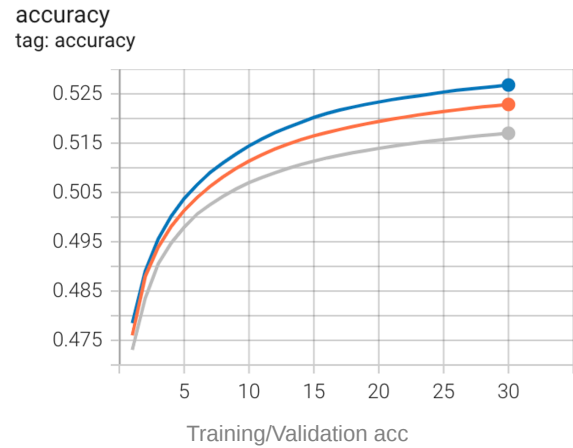
2. Different size of sequence

Compare three sizes (5, 10, 20) of sequence

Learning curves



Training/Validation acc



2-4 Construct another RNN with LSTM then redo 1. to 3. Also discuss the difference of the results between standard RNN and LSTM.

1. Network architecture

Model: "sequential"

Layer (type)	Output Shape	Param #
=====		
embedding (Embedding)	(None, None, 32)	2176
lstm (LSTM)	(None, 128)	82432
dense (Dense)	(None, 128)	16512
dense_1 (Dense)	(None, 68)	8772
=====		

Total params: 109,892
Trainable params: 109,892
Non-trainable params: 0

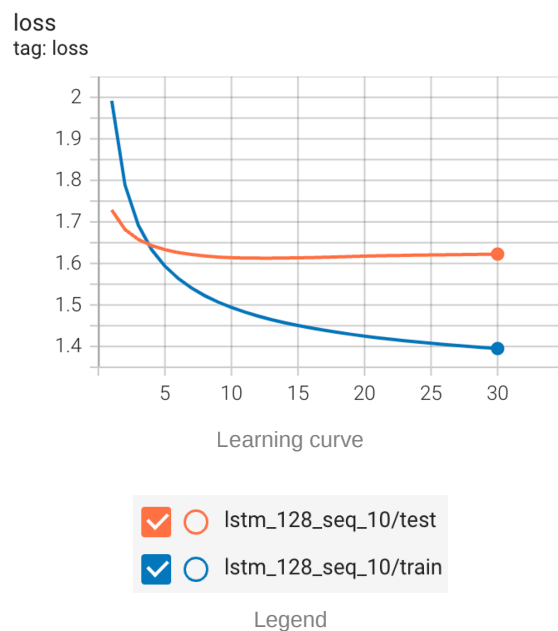
1. Baseline

Implementation details:

- epoch: 30
- batch size: 1024
- learning rate: 10^{-3}
- hidden layer: 128
- sequence: 20

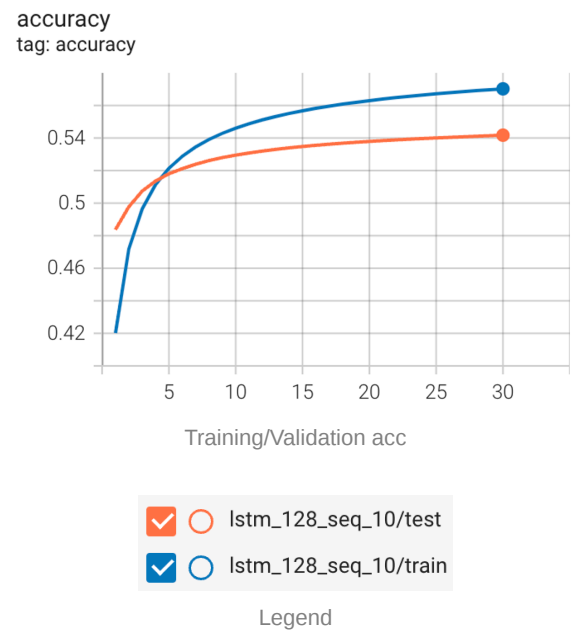
Learning curve

- train: 1.387
- test: 1.611



Training/Validation acc

- train: 0.568
- test: 0.541



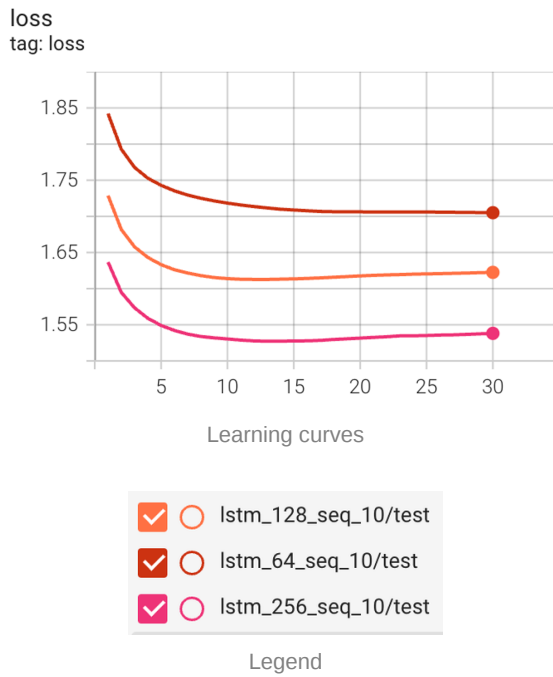
2. Generate text at breakpoints

sample text	epoch 6	epoch 12	epoch 18	epoch 24	epoch 30
urdering innocents b	urdering innocents bear.VALENTINE: As I thank you, crude yor where you may suce. O my Bassheran's consent And leve and	urdering innocents before Altigus Apold.KING HENRY VIND: A break all, she's as yours'lors the curbatter. How next out	urdering innocents before a brought of the very giarl her on a pleam awaughs The peace'enet or for Claudio do it; deam M	urdering innocents before his early physicier dudted with me, lest the trunches of his conques frown, What wit, sings th	urdering innocents bednead slow. Vitched, good letter-majesty to't. Readiness of his loss, By that day out of Clausured
ell this was Signior	ell this was Signior out neglenge of your conning in so arm it-de emining The such a lifes she she be made kence, bind,	ell this was Signior minister, elied: the Hectorage and words ours and free, Our pull-- and may behold in fine, Titue? Bu	ell this was Signior softon. You are too sway with his lock'st brother intentify that we did quiet Pomp his controllows	ell this was Signior as time that close me affected and noiseven be whatking. The nostor Offence' turns so my fiends; on	ell this was Signior AETorery of his beard Hath been minded me no better things To the emperor, yet, Anneass To do this
US: Sir, it is; And	US: Sir, it is; And for a holding and even coind war; But so stray use and thy gown make, Hath our brother beweratelard	US: Sir, it is; And therefore's some Mercy, with his lady's labours will strudged, an Itala, thou could, good grief befo	US: Sir, it is; And therefore I sed up Venic lives pleased, I have alter such sprites ere you have sland in my thoughts	US: Sir, it is; And so will beed o'erchessed appetations, Assemble your days, We see my king; follow,' the proof sworn	US: Sir, it is; And I honour action with time yonder with you.DON ADRIANO: Sir, but I know you to find his power ho br
our eyes begin to lo	our eyes begin to looks The sillless and the received to make thee sword of day, I accompant this rogue and so, the regui	our eyes begin to loses about as traitor to-day For him that's here to keep your unjust for companionind; And super fals	our eyes begin to love At thou she's not, a present, and see that to take her, nor to me, Too hearted spirit, and the wa	our eyes begin to love the blunt savagements at have, Thou shalt a thing thee in noble Caeynow lacking strikes.Samasas	our eyes begin to lock for this be of me: When smiles a moneys, and greet Hector, parting Venus.ISABELLA: Gentlemen, y

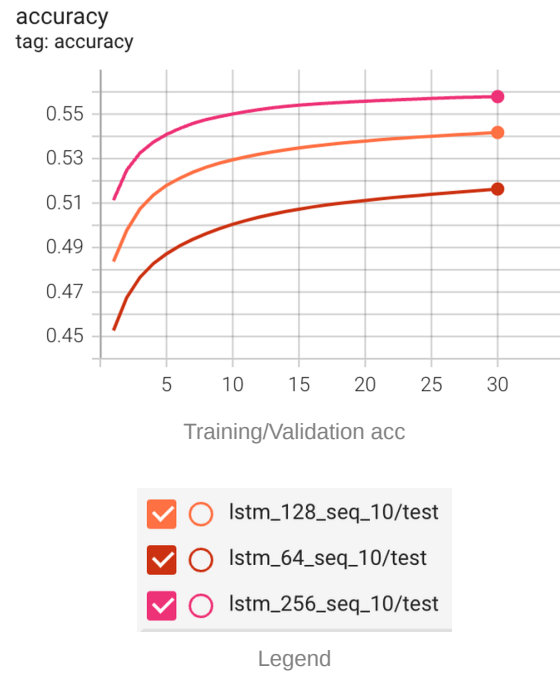
3. Different size of hidden layer

Compare three sizes (64, 128, 256) of hidden layer

Learning curves



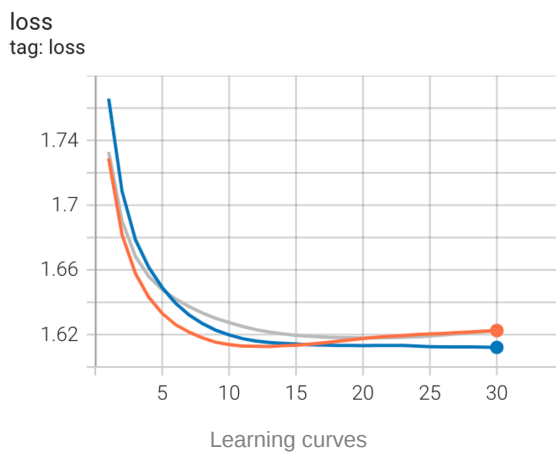
Training/Validation acc



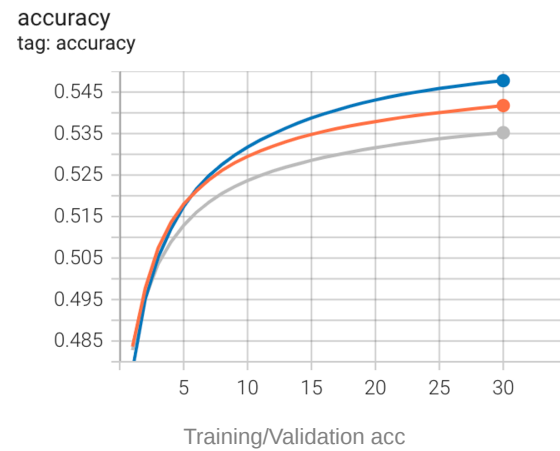
4. Different size of sequence

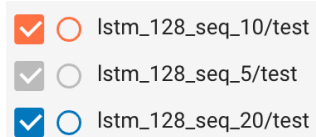
Compare three sizes (5, 10, 20) of sequence

Learning curves

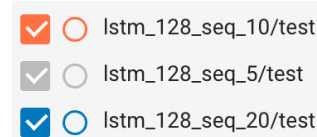


Training/Validation acc





Legend



Legend

2-5 Use RNN or LSTM to generate some words by priming the model with a word related to your dataset. Priming the model means giving it some input text to create context and then take the output of the RNN. For example, use "JULIET" as the prime text of Shakespeare dataset and run the model to generate 10 to 15 lines of output.

model / prime text	JULIET
RNN	<p>JULIETH: CORDELIA: Who do thou saysrive thraid Than away And some enter'd: A noblesour to poor further for. For I scarched. MISTRESS FORD: Hath no gentle wrants me of allow armsh a manner. How lion. Old Ceace is purs their hade, And you are more on highments And de'll me, hear, would I farewell! my lord! sobe and follow her so servant- better and hence: and how take of thirts, Williple? OPHELIA: Even any fought is jates, to more succoild not the Whom? I know thou nere:' with bacicuroly for his curk</p>
LSTM	<p>JULIETe Do: You will be so blind to vile sum-popprised, And but use smilest of us that shall the bargal capabule, to read an ice no'er more or doing twenty after. LAERTES: That I could hear you now, doubt; and we shall be once and confider. HASTINGRANDS: Let him be not been ungentle: Let him alone comes not here.</p>

RICHARD:

Let us by my teirde for thy will I be, a kiss, which from whom I love her would find
not, as she she be
now take been no money days?
No, love thy hearts this recus,
Would a more d