Team

A Deep Recurrent Neural Network with BiLSTM model for Sentiment Classification

Members:

Pawan Patidar

Vishal Patel

Darshit Khant

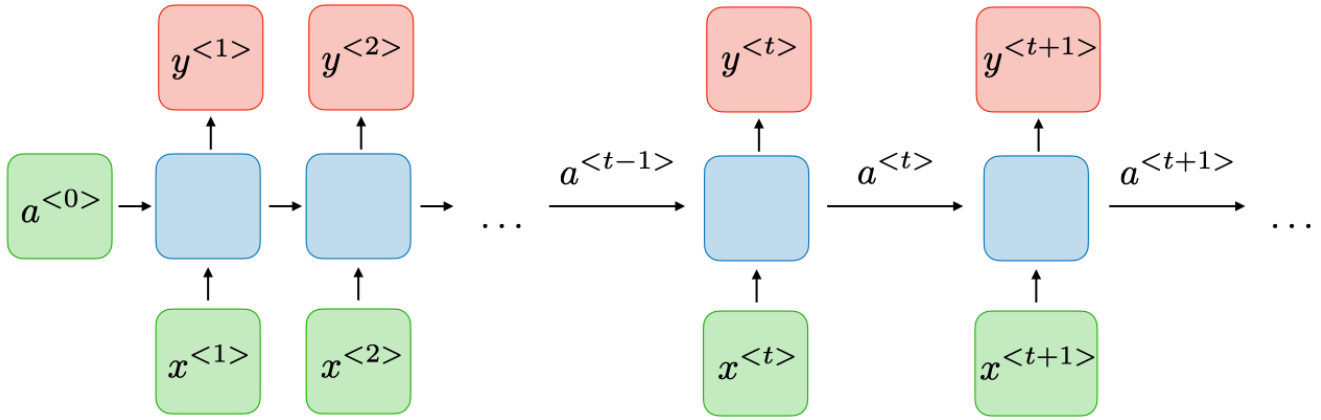
AIM

Experiment multiple models of RNN, LSTM, and BiLSTM with different parameters on multiple Datasets and comparing the Accuracies achieved from them.

Theory

RNN

Recurrent neural networks, also known as RNNs, are a class of neural networks that allow previous outputs to be used as inputs while having hidden states.



CAUTION!!

Curse on RNN!!!

RNNs suffer from the **problem** of vanishing gradients, which hampers learning of long data sequences.

LSTM our *SAVIOUR!!!*

LSTM

Long Short Term Memory networks are a special kind of RNN, capable of learning long-term dependencies.

A common LSTM unit is composed of a **cell**, an **input gate**, an **output gate** and a **forget gate**. The gates use hyperbolic tangent and sigmoid activation functions.

The long term dependencies and relations are encoded in the cell state vectors and it’s the cell state derivative that can prevent the LSTM gradients from vanishing.

Can we Improve??

Sometimes to understand a word we need not just the previous word, but also the coming word, which is not possible in LSTM because information flows from backward to forward.

Yes!!!

Bi-directional LSTM!!!

In Bi-directional LSTM information not only flows backward to forward but also forward to backward using two hidden states. Which is very useful in the works like sentiment classification.

Dataset

IMDB dataset of 50K Movie Reviews

(https://www.kaggle.com/lakshmi25npathi/imdb-dataset-of-50k-movie-reviews)

File Name IMDB Reviews.csv

File size 63.14MB

Number of Features 2

Classification type Binary Class

	review	sentiment
0	One of the other reviewers has mentioned that ...	positive
1	A wonderful little production. The...	positive
2	I thought this was a wonderful way to spend ti...	positive
3	Basically there's a family where a little boy ...	negative
4	Petter Mattei's "Love in the Time of Money" is...	positive
...	...	...
49995	I thought this movie did a down right good job...	positive
49996	Bad plot, bad dialogue, bad acting, idiotic di...	negative
49997	I am a Catholic taught in parochial elementary...	negative
49998	I'm going to have to disagree with the previou...	negative
49999	No one expects the Star Trek movies to be high...	negative

50000 rows × 2 columns

Amazon Fine Food Reviews

(https://www.kaggle.com/snap/amazon-fine-food-reviews)

File Name Reviews.csv

File size 286.97MB

Number of Features 10

Classification type Multi-Class

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	Text
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	1	5	1303862400	Good Quality Dog Food	I have bought several of the Vitality canned d...
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0	1	1346976000	Not as Advertised	Product arrived labeled as Jumbo Salted Peanut...
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	1	4	1219017600	"Delight" says it all	This is a confection that has been around a fe...
3	4	B000UA0QIQ	A395BORC6FGVXV	Karl	3	3	2	1307923200	Cough Medicine	If you are looking for the secret ingredient i...
4	5	B006K2ZZ7K	A1UQRSCLF8GW1T	Michael D. Bigham "M. Wassir"	0	0	5	1350777600	Great taffy	Great taffy at a great price. There was a wid...
...	...	...	...	...	...	...	...	...	...	...
568449	568450	B001EO7N10	A28KG5XORO54AY	Lettie D. Carter	0	0	5	1299628800	Will not do without	Great for sesame chicken..this is a good if no...
568450	568451	B003S1WTCU	A3I8AFVPEE8KI5	R. Sawyer	0	0	2	1331251200	disappointed	I'm disappointed with the flavor. The chocolat...
568451	568452	B004I613EE	A121AA1GQV751Z	pksd "pk_007"	2	2	5	1329782400	Perfect for our maltipoo	These stars are small, so you can give 10-15 o...
568452	568453	B004I613EE	A3IBEVCTXKNOH	Kathy A. Welch "katwel"	1	1	5	1331596800	Favorite Training and reward treat	These are the BEST treats for training and rew...
568453	568454	B001LR2CU2	A3LGQPJCZVL9UC	srfell17	0	0	5	1338422400	Great Honey	I am very satisfied ,product is as advertised,...

568454 rows × 10 columns

Experiments

IMDB Movie Reviews Dataset

Data Pre-processing:

- Clean HTML tags and stop-words
- Find the maximum number of words in a Review
- Padding shorter sequences to make its length equal to the longest word sequence.

Models

Library used: Keras

- SimpleRNN(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘SGD’
- SimpleRNN(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘RMSProp’
- SimpleRNN(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘ADAM’
- SimpleRNN(layers=dense,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘SGD’
- SimpleRNN(layers=dense,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘RMSProp’

- SimpleRNN(layers=dense,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘ADAM’
- LSTM(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘SGD’
- LSTM(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘RMSProp’
- LSTM(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘ADAM’
- LSTM(layers=dense,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘SGD’
- LSTM(layers=dense,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘RMSProp’

- LSTM(layers=dense,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘ADAM’
- Bidirectional LSTM(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘SGD’
- Bidirectional LSTM(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘RMSProp’
- Bidirectional LSTM(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘ADAM’
- Bidirectional LSTM(layers=dense,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘SGD’
- Bidirectional LSTM(layers=dense,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘RMSProp’
- Bidirectional LSTM(layers=dense,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘binary_crossentropy’, Activation=‘sigmoid’, Optimizer=‘ADAM’

Amazon Food Reviews Dataset

Data Pre-processing:

- Dropping Columns except ‘Score’ and ‘Text’
- Clean HTML tags and stop-words
- Find the highest number of words in a Review
- Padding sequences to make its length equal to the longest word sequence.

Models

Library used: Keras

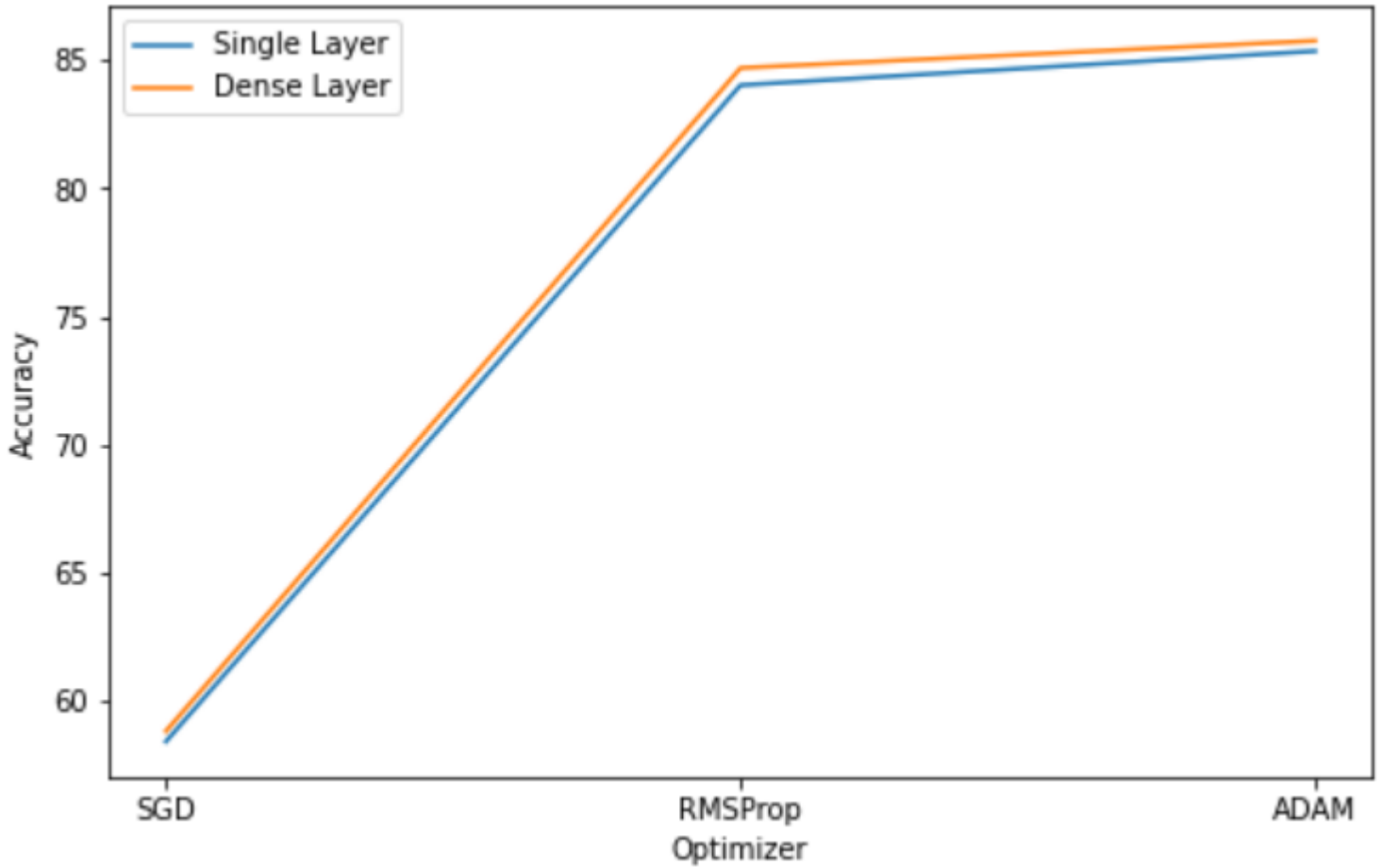
- SimpleRNN(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘categorical_crossentropy’, Activation=‘softmax’, Optimizer=‘ADAM’
- LSTM(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘categorical_crossentropy’, Activation=‘softmax’, Optimizer=‘ADAM’
- Bidirectional LSTM(layers=single,units=100,dropout=0.25), Keras Embedding, Loss Function: ‘categorical_crossentropy’, Activation=‘softmax’, Optimizer=‘ADAM’

Results

IMDB Movies Review Dataset

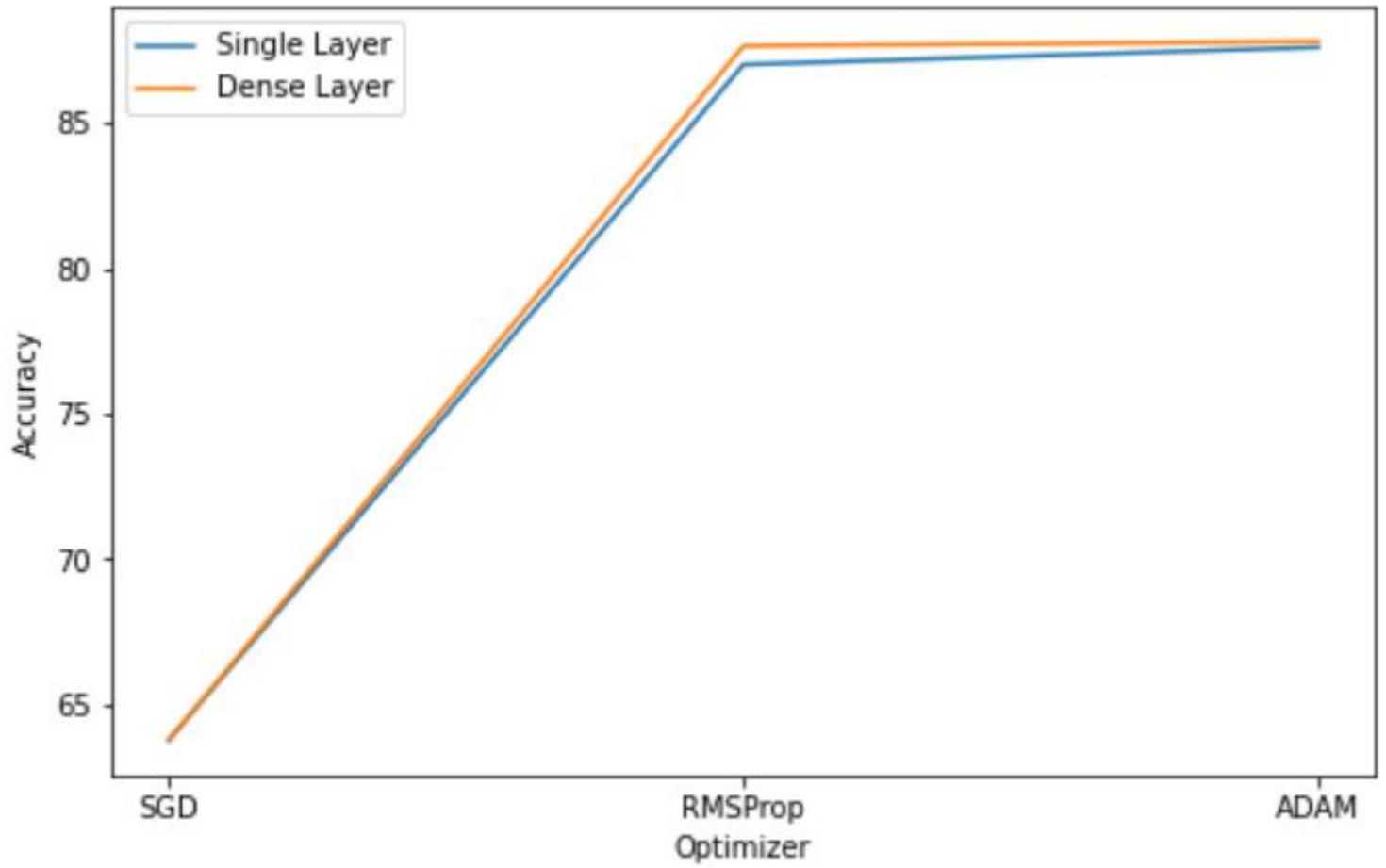
RNN

-Single vs Dense Layers



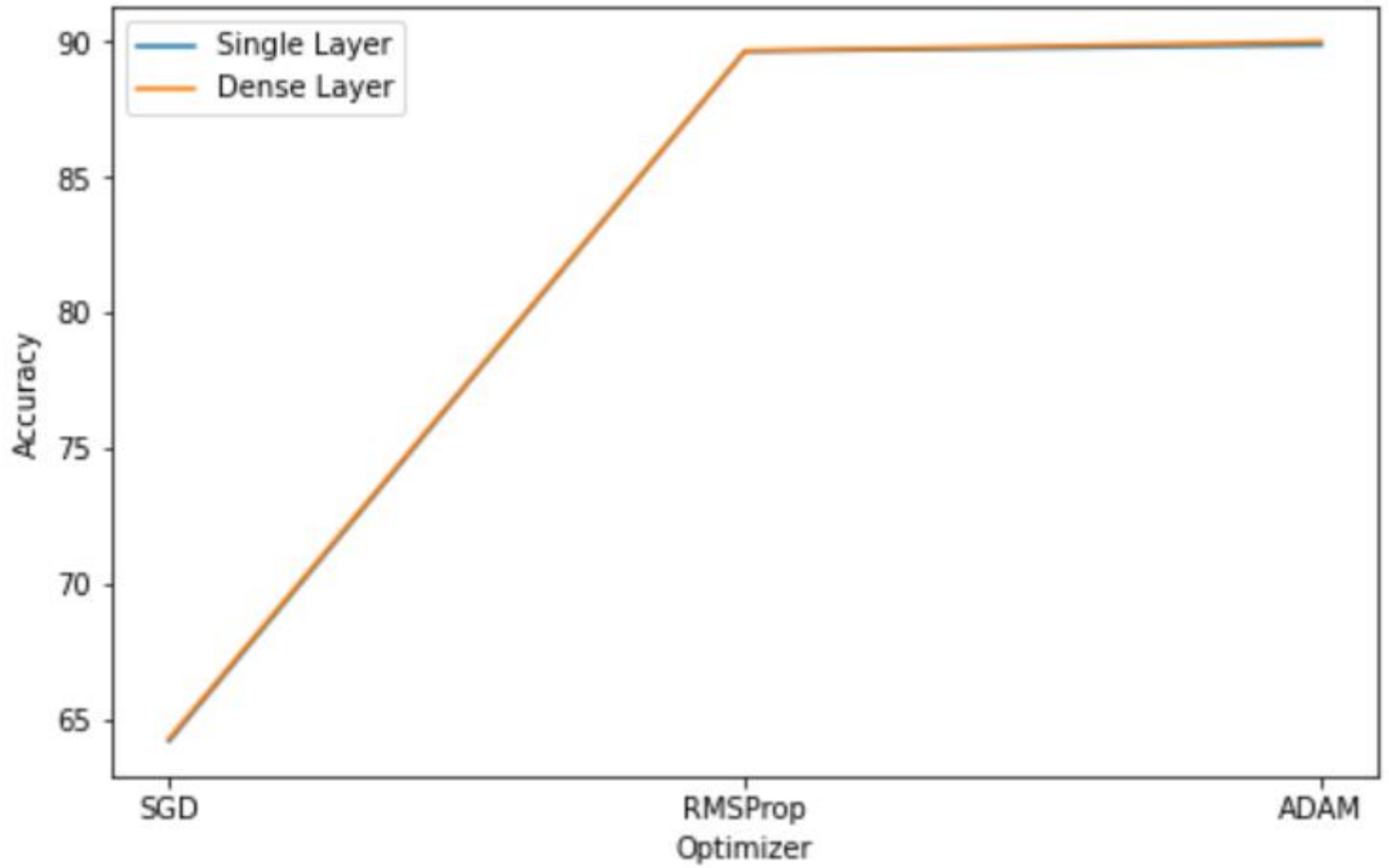
LSTM

-Single vs Dense Layers



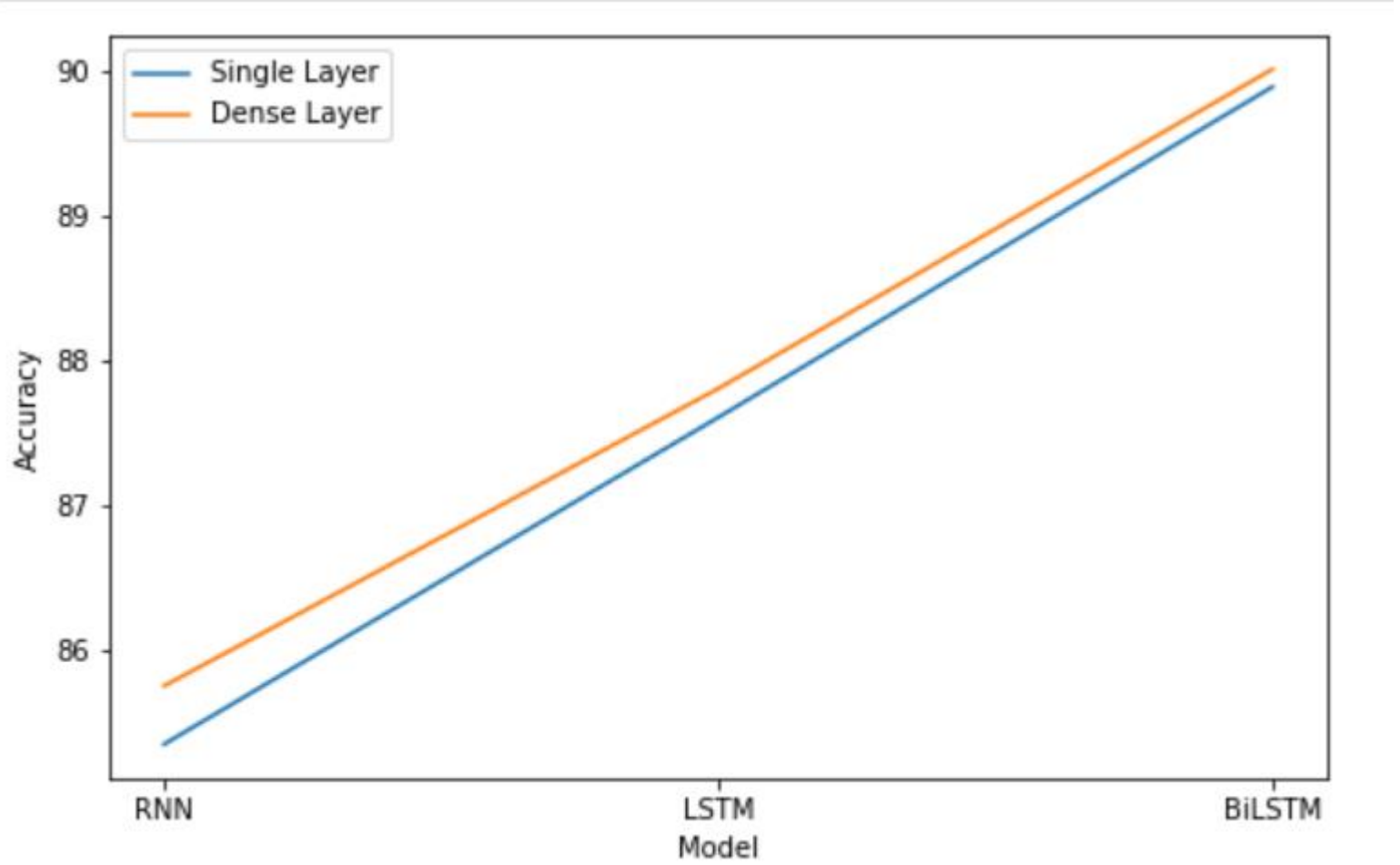
BiLSTM

-Single vs Dense Layers



RNN vs LSTM vs BiLSTM

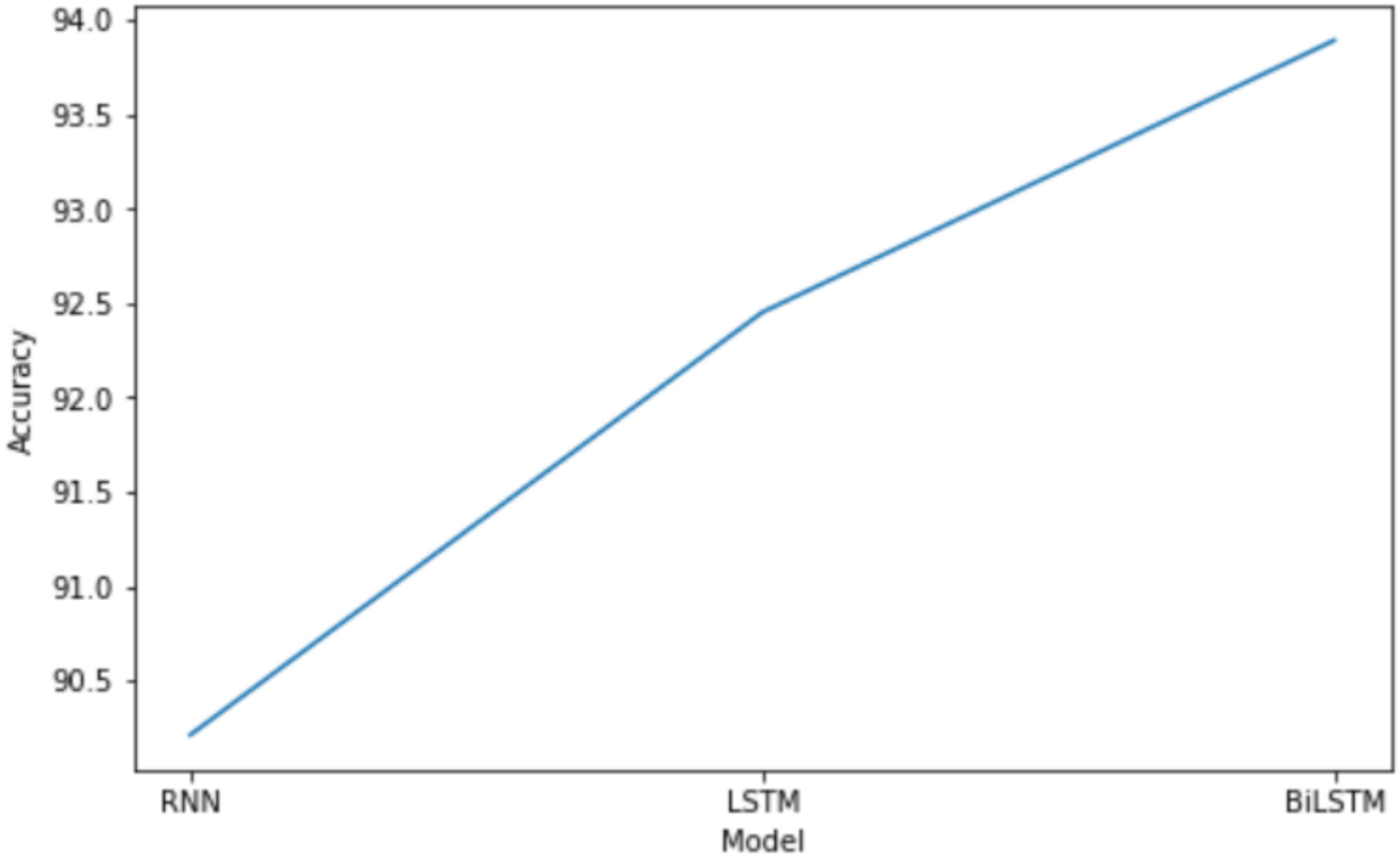
(Dense layer, optimizer='ADAM')



Amazon Foods Review Dataset

RNN vs LSTM vs BiLSTM

(Single layer, Optimizer='ADAM')



Contributions

- **Pawan Patidar**: Experiment on RNN model(IMDB Dataset), Experiment on Amazon Food reviews Model

- **Vishal Patel**: Data Preprocessing(IMDB Dataset), Experiment on LSTM models(IMDB Dataset, Amazon Food Reviews).

- **Darshit Khant**: Experiment on BiLSTM Model(IMDB Dataset, Amazon Food Reviews).