Financial Sentiment Analysis using Various NLP Techniques

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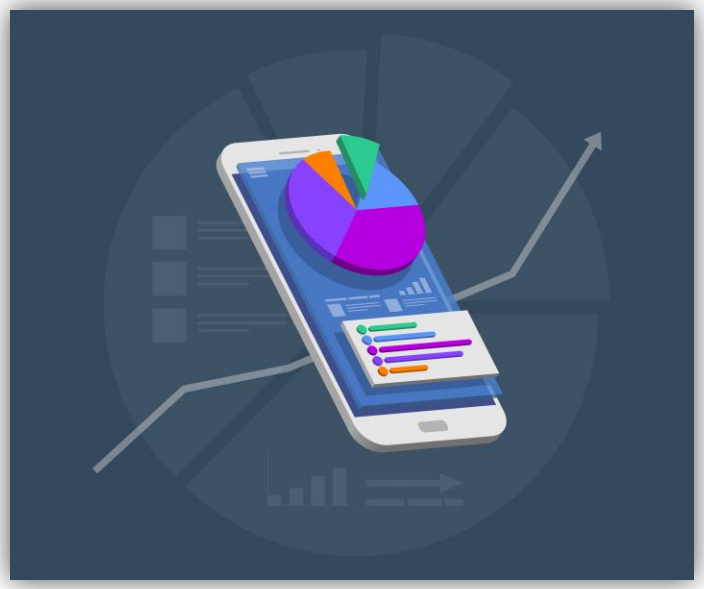
Applied Computational Intelligence, 246/2

Content



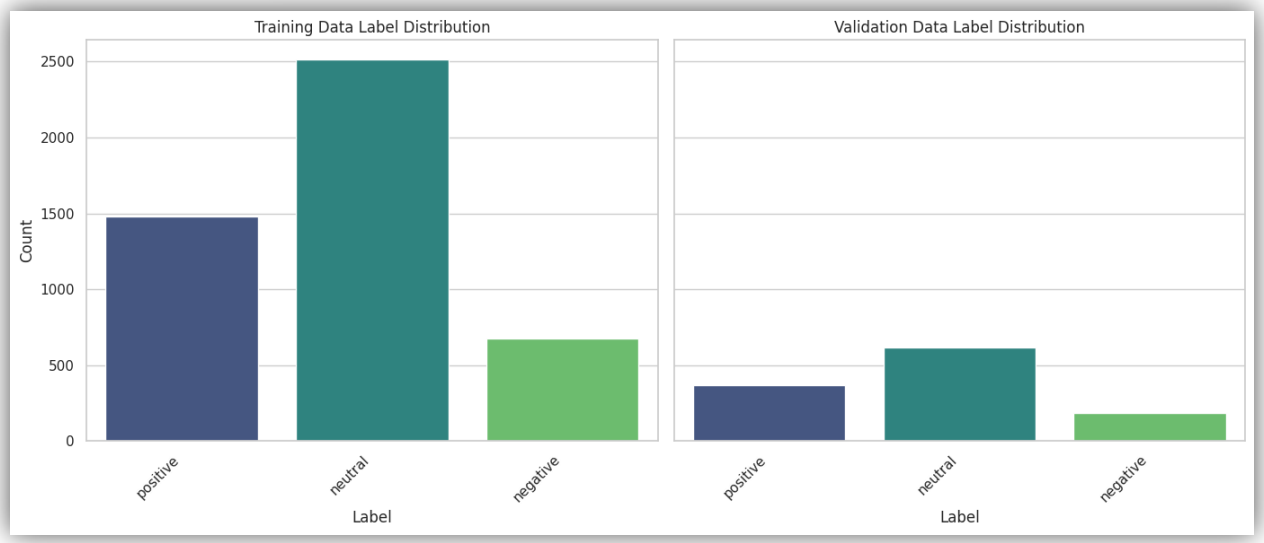
Introduction - Financial Sentiment Analysis

- Loughran-McDonald states that simple sentiment analysis cannot be applied in financial sentiment analysis (e.g. liability often is a neutral word, but in finance it's a negative one)
- It allows:
  - Predicting market movement
  - Managing risk
  - Support decision making
  - Etc.
- **Dataset**: Financial Phrase Bank

Dataset Brief Analysis

Dataset size: 5842
Tokenizer: BertTokenizer
Vocab size: 30522
Max seq: 150

	Sentence	Sentiment
0	The GeoSolutions technology will leverage Bene...	positive
1	$ESI on lows, down $1.50 to $2.50 BK a real po...	negative
2	For the last quarter of 2010 , Componenta 's n...	positive
3	According to the Finnish-Russian Chamber of Co...	neutral
4	The Swedish buyout firm has sold its remaining...	neutral
5	$SPY wouldn't be surprised to see a green close	positive
6	Shell's $70 Billion BG Deal Meets Shareholder ...	negative
7	SSH COMMUNICATIONS SECURITY CORP STOCK EXCHANG...	negative
8	Kone 's net sales rose by some 14 % year-on-ye...	positive
9	The Stockmann department store will have a tot...	neutral



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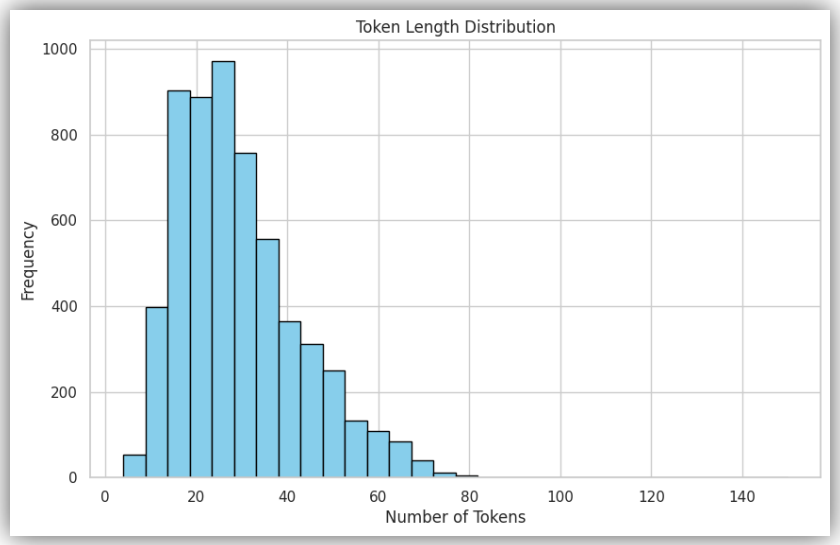

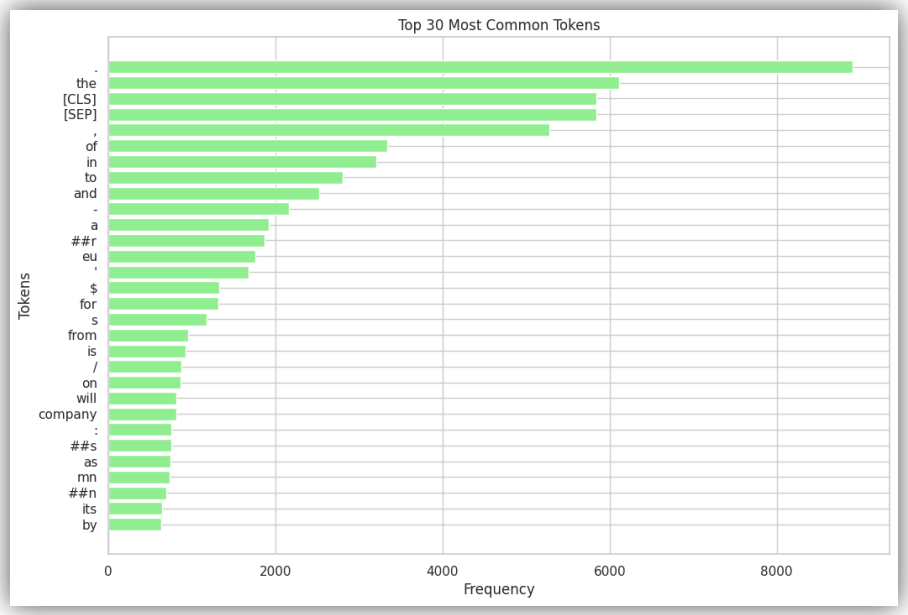

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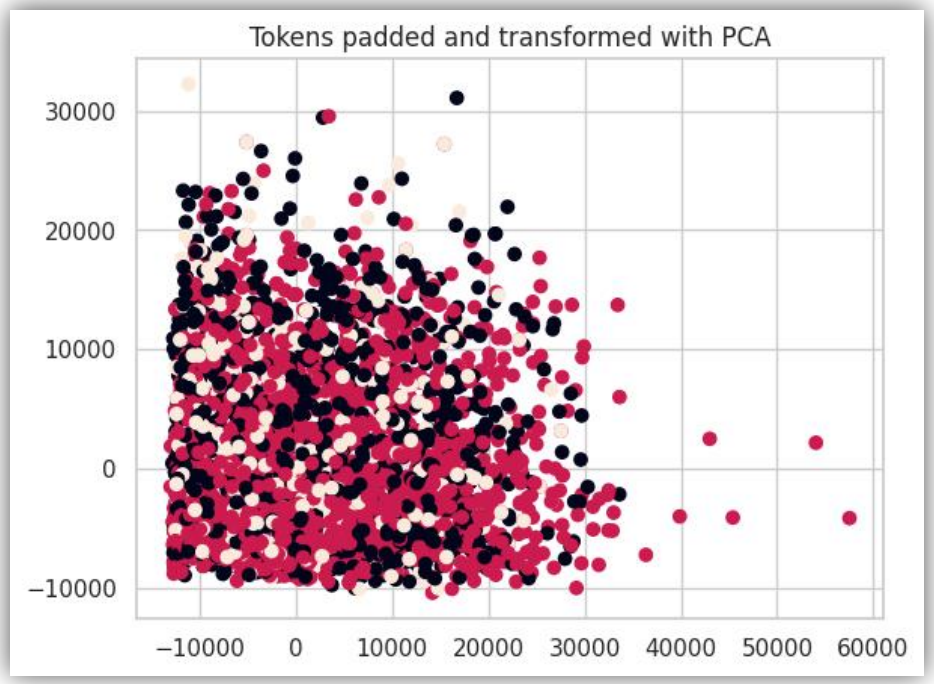
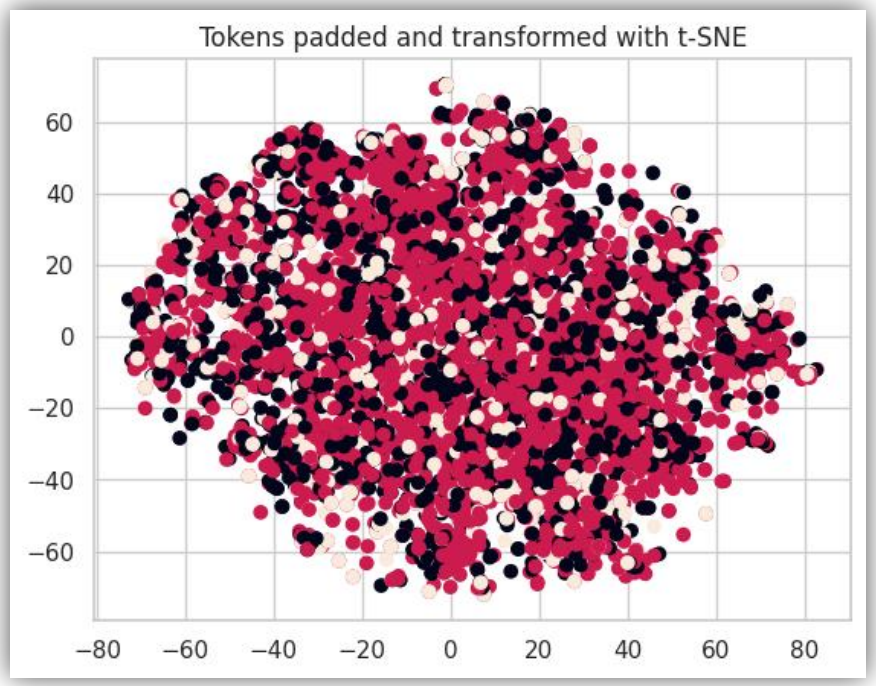
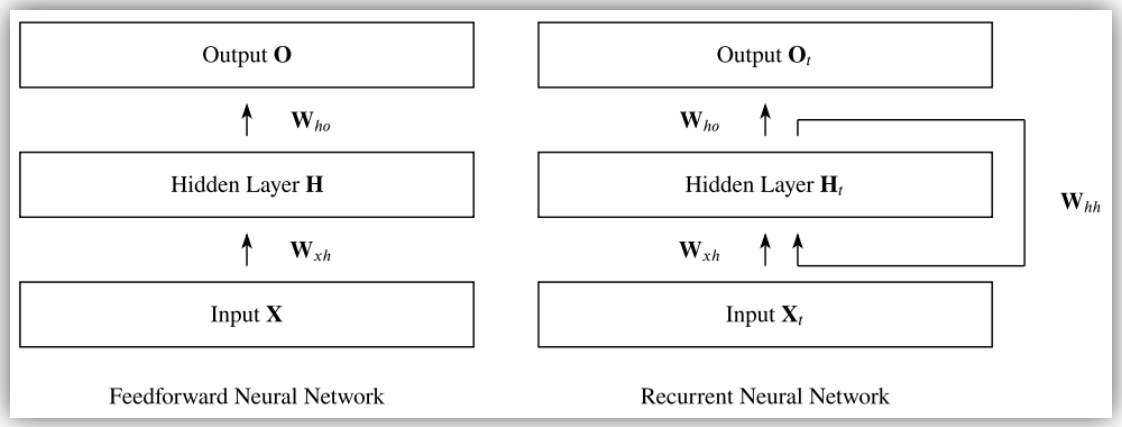
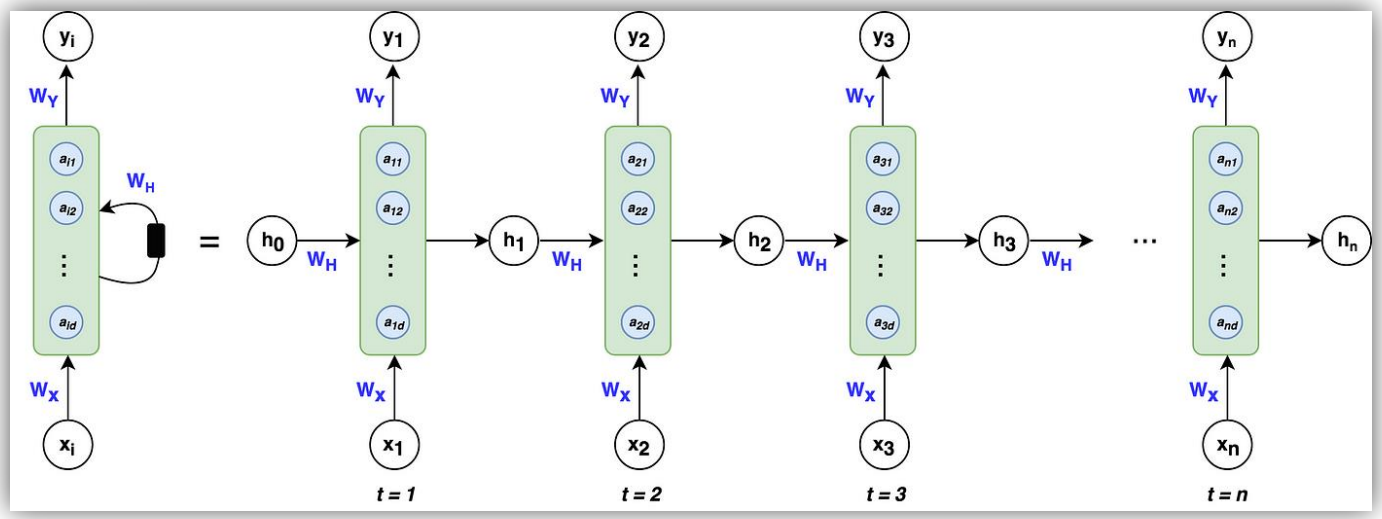


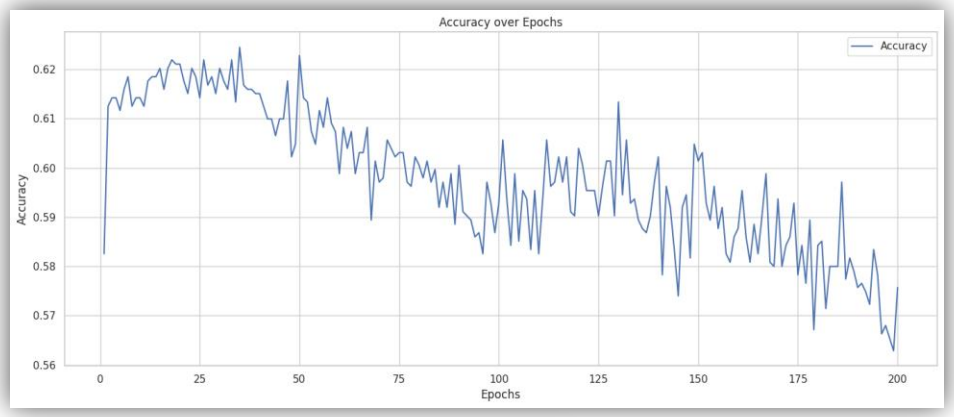


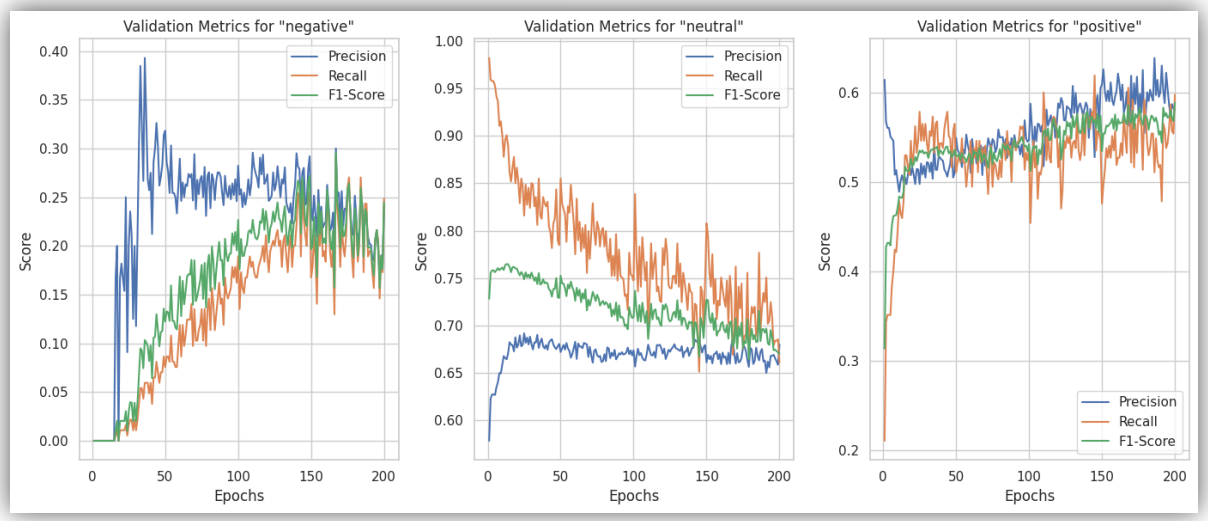
Recurrent Neural Networks



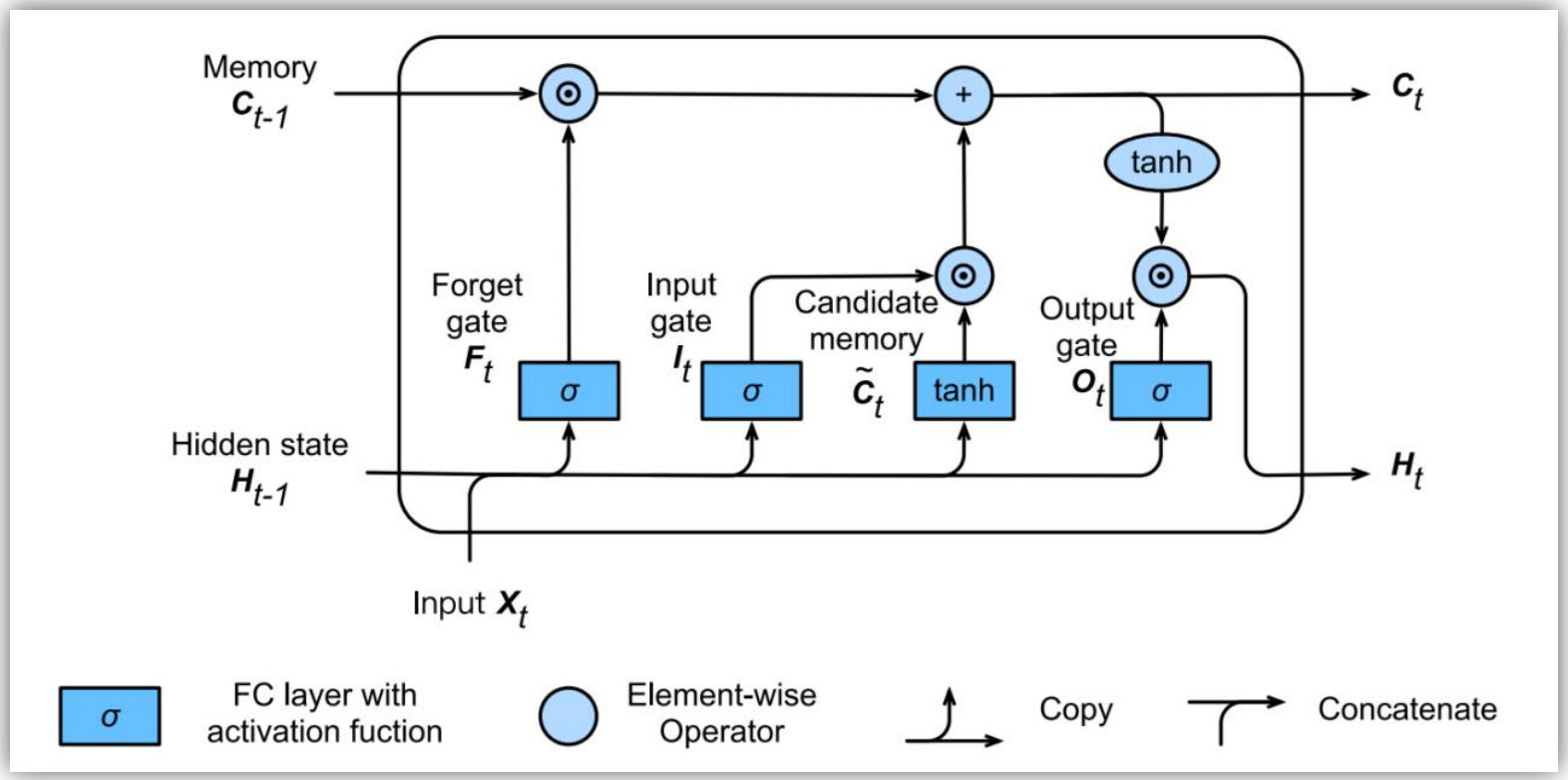


Recurrent Neural Networks - Results

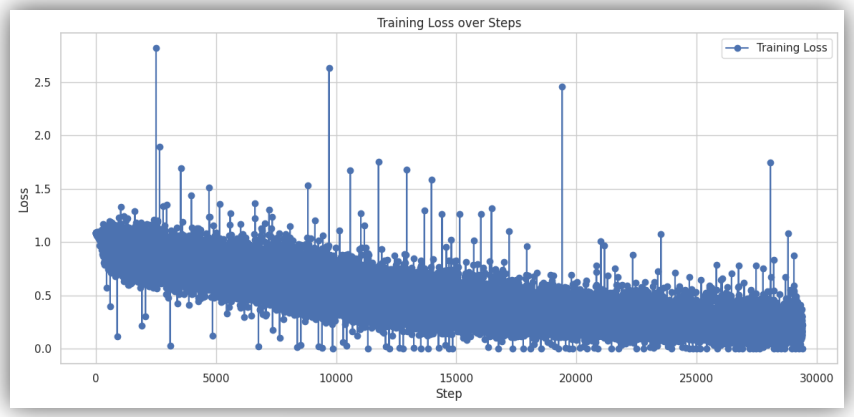


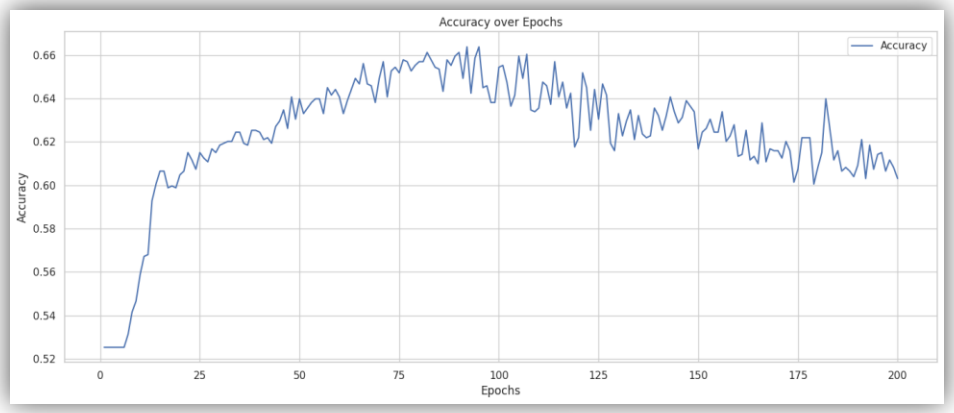


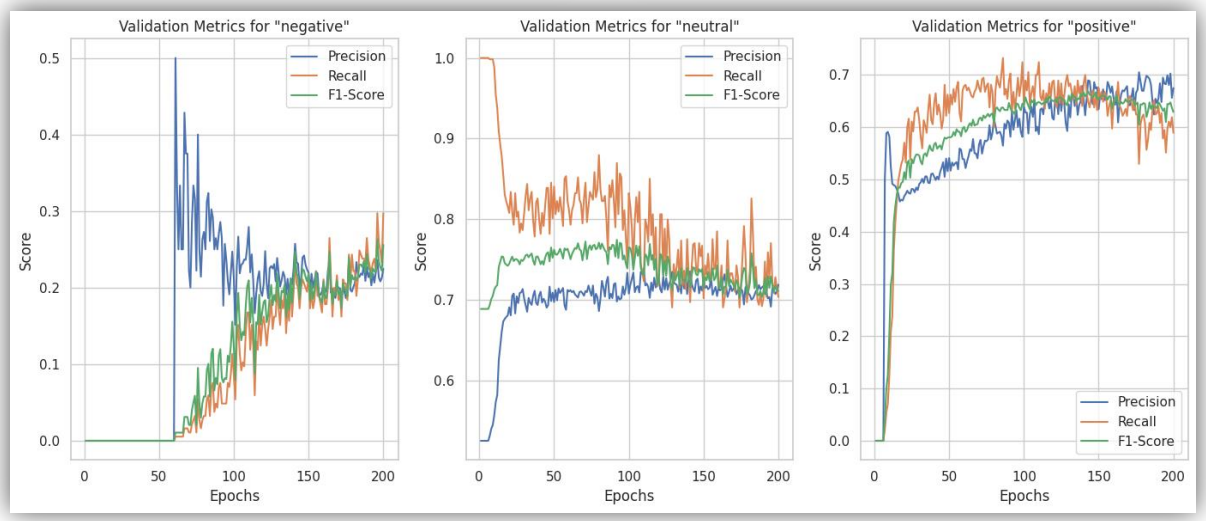
Long Short-Term Memory



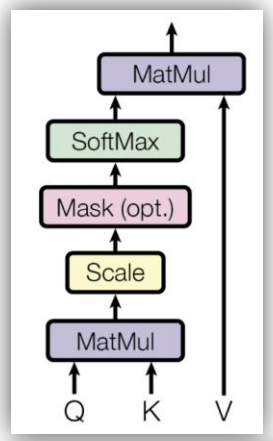
Long Short-Term Memory - Results

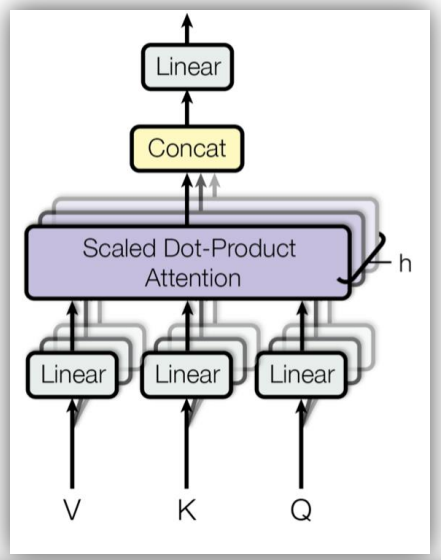


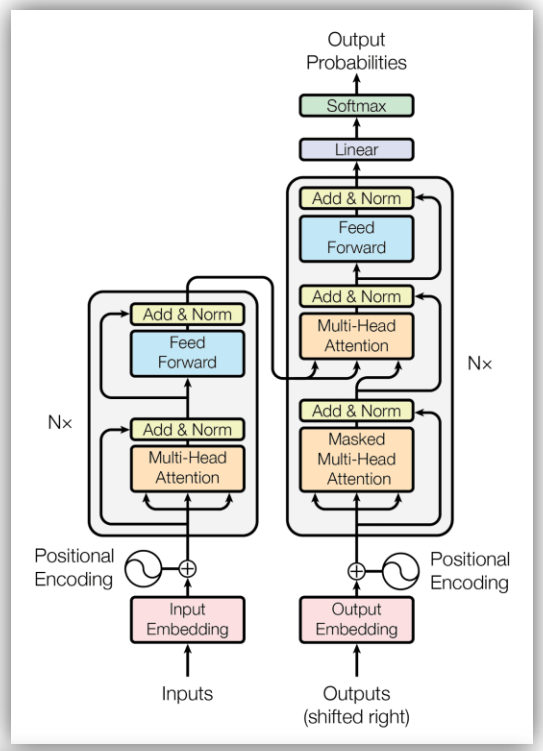


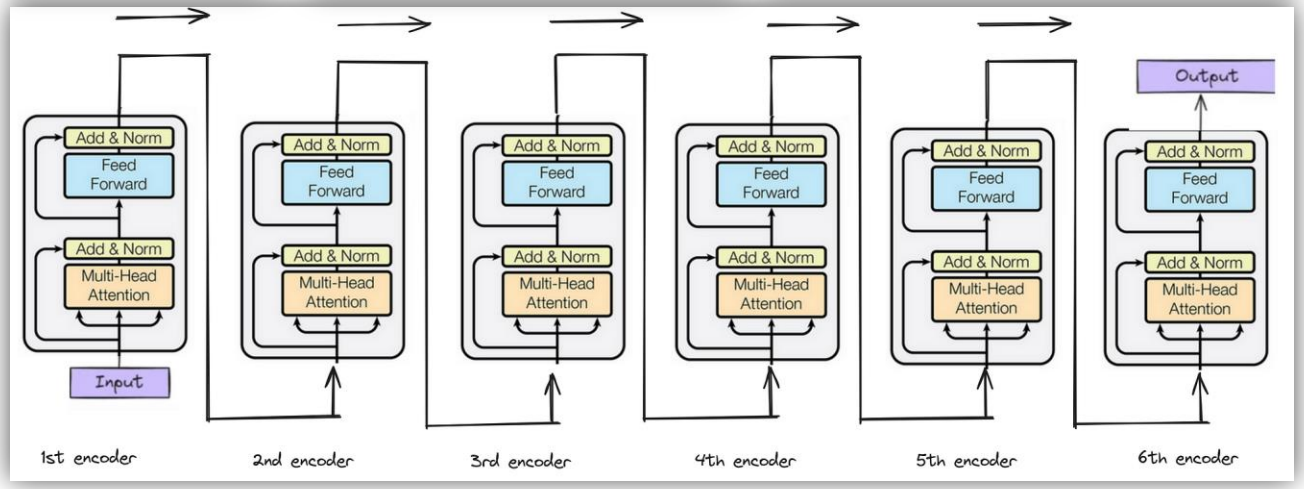


Transformer

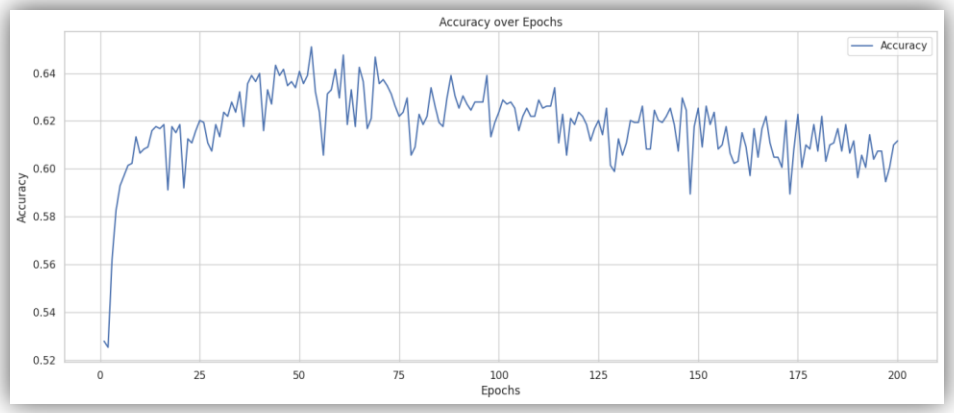


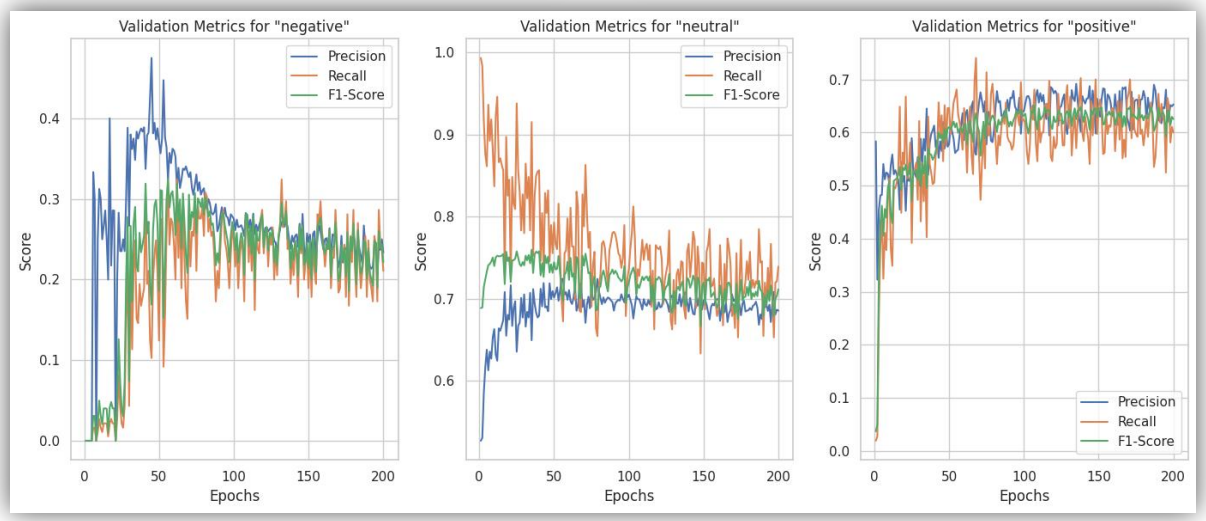






Transformer - Results





Comparing Results

Model	Sentiment	Precision	Recall	F1-Score	Accuracy
RNN	Positive	0.58	0.6	0.59	0.61
	Negative	0.26	0.24	0.25	
	Neutral	0.72	0.75	0.73	
LSTM	Positive	0.62	0.63	0.62	0.6
	Negative	0.3	0.28	0.29	
	Neutral	0.74	0.77	0.75	
Transformer	Positive	0.64	0.65	0.64	0.64
	Negative	0.32	0.31	0.31	
	Neutral	0.76	0.78	0.77	

Conclusions

Model Performance

- **Transformers** demonstrated superior performance with the highest accuracy and consistently strong results across sentiment classes.
- **LSTMs** offered balanced results with good generalization.
- **RNNs** struggled with capturing complex dependencies, showing limited generalization.

Key Challenges

- All models faced difficulties with the negative sentiment class due to data imbalance.
- The complexity of financial language, including nuanced terms and directional expressions, posed challenges for sentiment classification.

Implications

- Transformers are well-suited for financial sentiment analysis and highlight the potential of advanced architectures for handling domain-specific NLP tasks.
- Addressing data imbalance remains critical for improving model performance.

Thanks for your attention!

Bibliography

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