

Team Members:

- Aayush Shangani
- Darsh Shetty
- Pavan Antala
- Sheroz Shaikh



DS595:
Natural Language Processing



Team Contribution





Team Contribution

Aayush

- ML + TF IDF + BERT

Darsh

- ML + Word2VEC + DL BERT FINE TUNE

Pavan

- ML POS + DL BERT FINE TUNE LORA + RNN

Sheroz

- DL LSTM GRU BI-LSTM





Motivation





Motivation

Assuming:

We are working for the multinational company similar to Deloitte, Mckinsey etc.



Client



Pizza



NLP Engineer/Data
Scientist

Business Problem





Dataset Overview

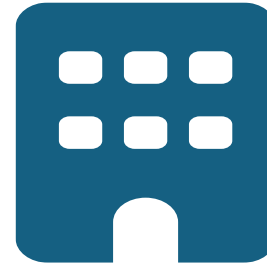
We are working for the multinational company similar to Deloitte, Mckinsey etc.



Users



Ranking



Business



Reviews



Tips



User-Checkins





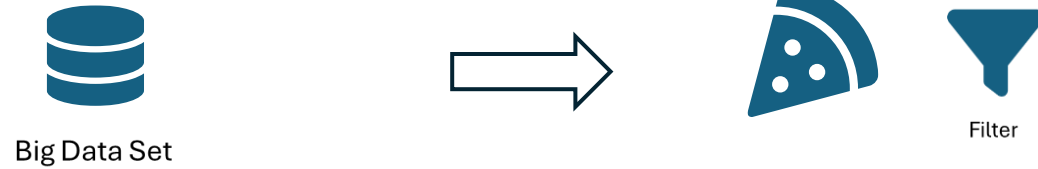
Problem Domain





Problem Domain

How data filtered:



What we finalized:



Market Competitors



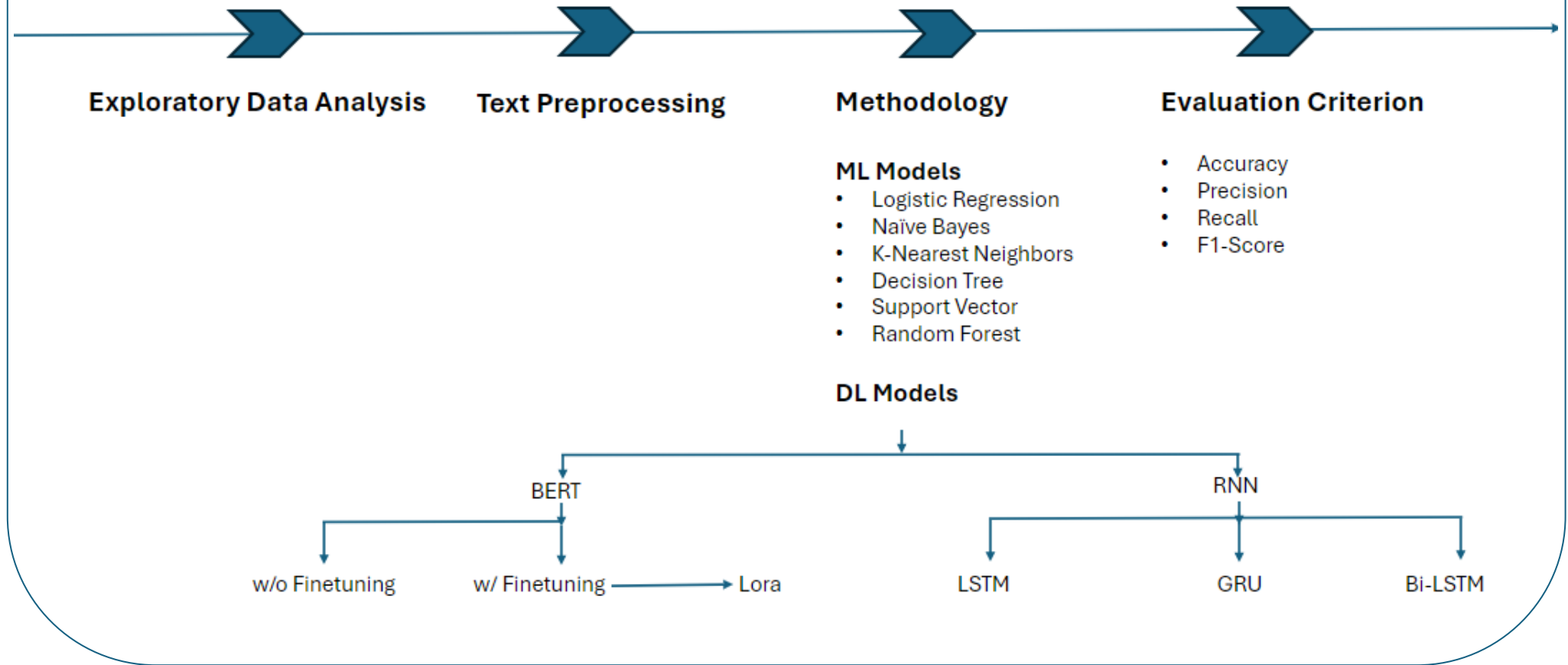


Approach





Approach





state

- FL
- PA
- TN

day name	FL	PA	TN
Friday	6842	9117	3057
Monday	4350	5800	2437
Saturday	8776	10500	4355
Sunday	7861	9224	3939
Thursday	5115	6943	2409
Tuesday	4423	6038	2016
Wednesday	4907	6586	2235





Features

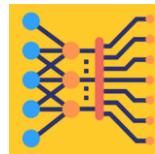
TF-IDF



Part of Speech

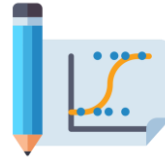


Word2Vec

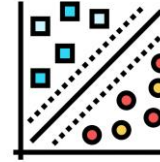


ML Models

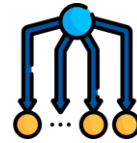
Logistic-Regression



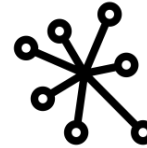
SVM



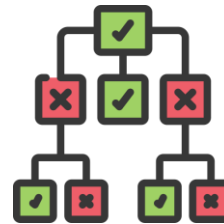
Naïve Bayes



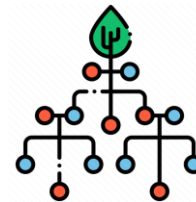
KNN



Decision Tree



Random Forest

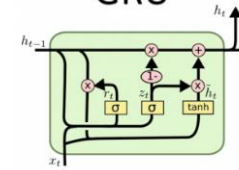


DL Models

BERT



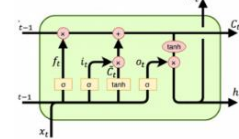
GRU



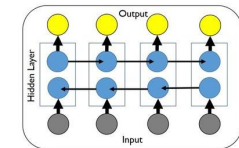
RNN



LSTM



Bi-LSTM





Approach

Features

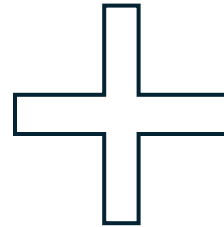
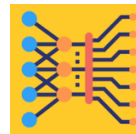
TF-IDF



Part of Speech

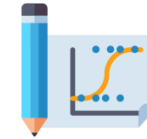


Word2Vec

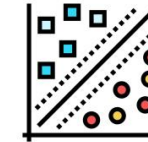


ML Models

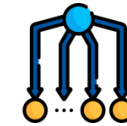
Logistic-Regression



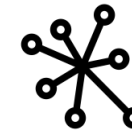
SVM



Naïve Bayes



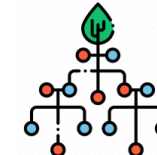
KNN



Decision Tree



Random Forest



Mixture of Models



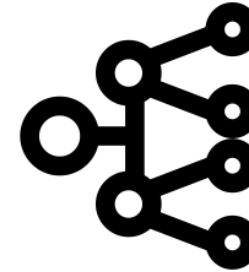


DL Models

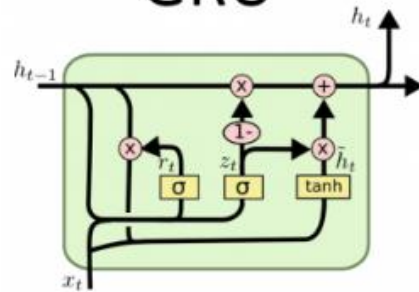
BERT



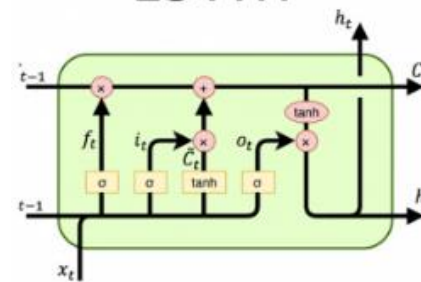
RNN



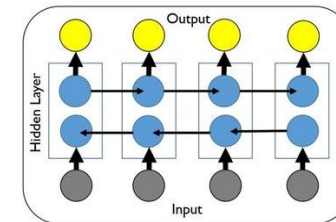
GRU



LSTM



Bi-LSTM



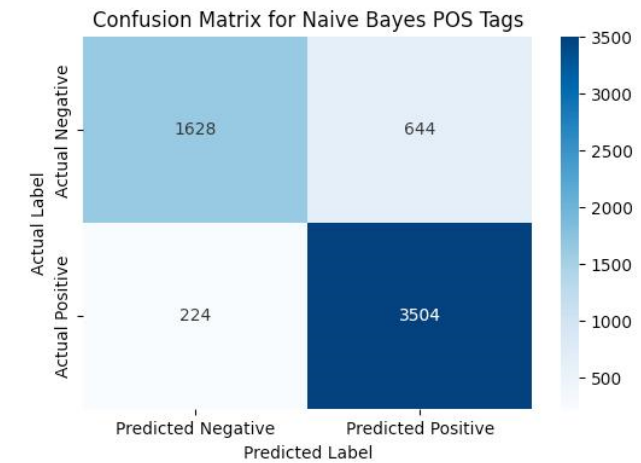
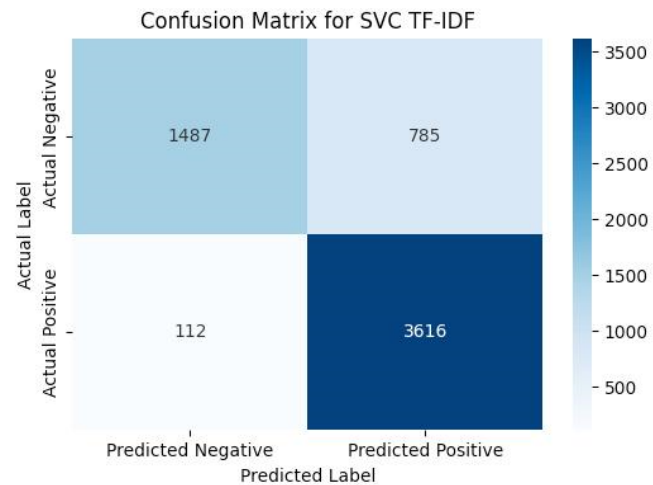
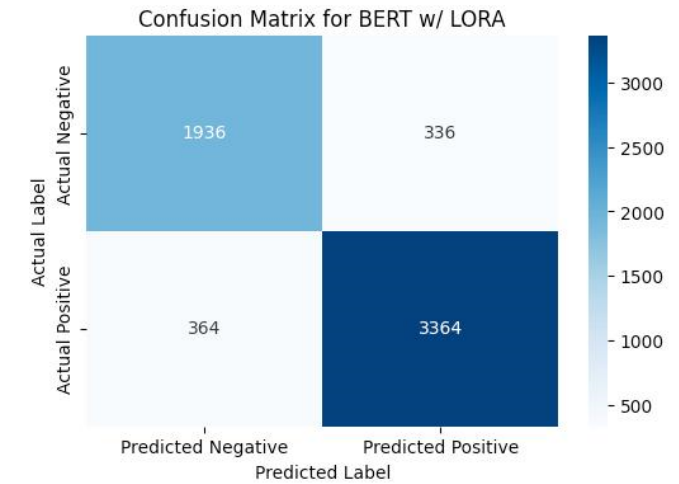
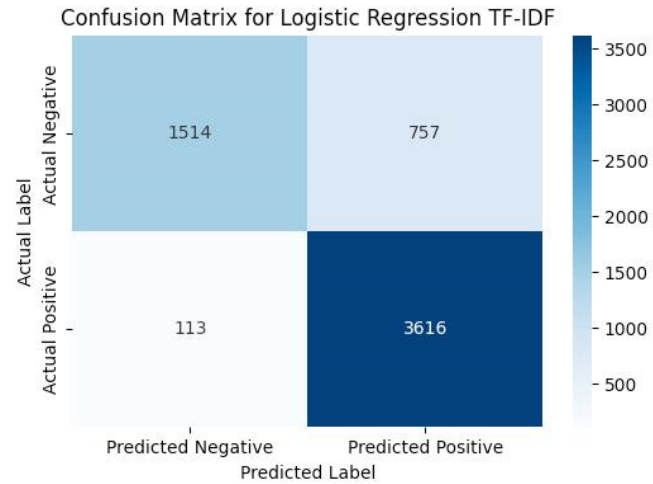


Approach

ML Model	Feature	Accuracy	Precision	Recall	F1-Score
Logistic Regression	TF-IDF	85.51	82.69	96.99	89.27
Naive Bayes	Part of Speech Tag	85.51	84.46	93.98	88.97
Support Vector	TF-IDF	85.05	82.17	96.99	88.97
Support Vector	Part of Speech Tag	84.58	85.71	90.23	87.91
K-Nearest Neighbors	TF-IDF	82.71	82.88	90.98	86.74
Random Forest	TF-IDF	80.84	78.75	94.74	86.01
Logistic Regression	Part of Speech Tag	81.78	85.07	85.17	85.39
Random Forest	Part of Speech Tag	78.97	76.50	95.49	84.95
Naive Bayes	TF-IDF	78.04	74.16	99.25	84.89
Decision Tree	Word2Vec	76.34	85.51	83.91	84.70
Random Forest	Word2Vec	73.36	74.68	86.47	80.14
K-Nearest Neighbors	Part of Speech Tag	64.95	64.22	98.50	77.74
Support Vector	Word2Vec	62.15	62.15	100.00	76.66
Decision Tree	Part of Speech Tag	71.03	78.86	72.93	75.78
Decision Tree	TF-IDF	69.16	74.81	75.94	75.37
Logistic Regression	Word2Vec	61.68	63.63	94.93	74.38
K-Nearest Neighbors	Word2Vec	64.02	67.50	81.20	73.72
Naive Bayes	Word2Vec	57.48	75.00	47.37	58.06

Evaluation Table (ML)







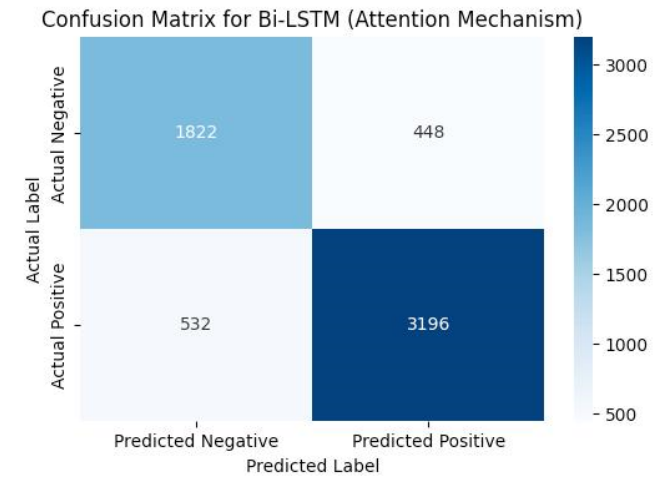
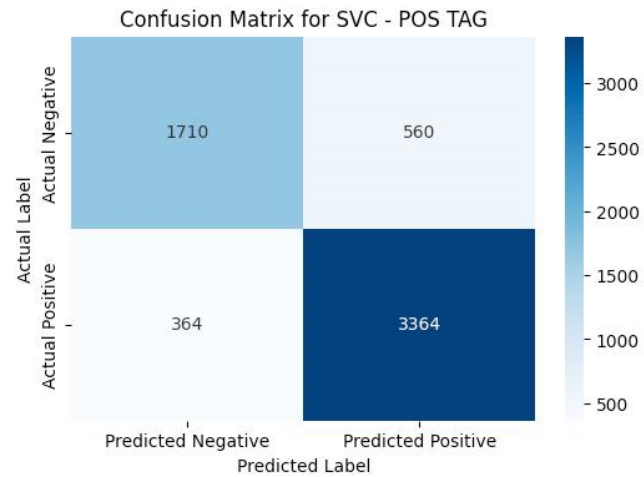
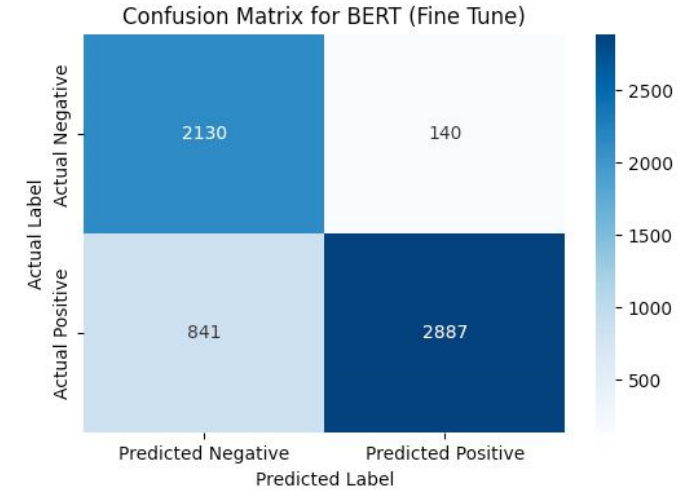
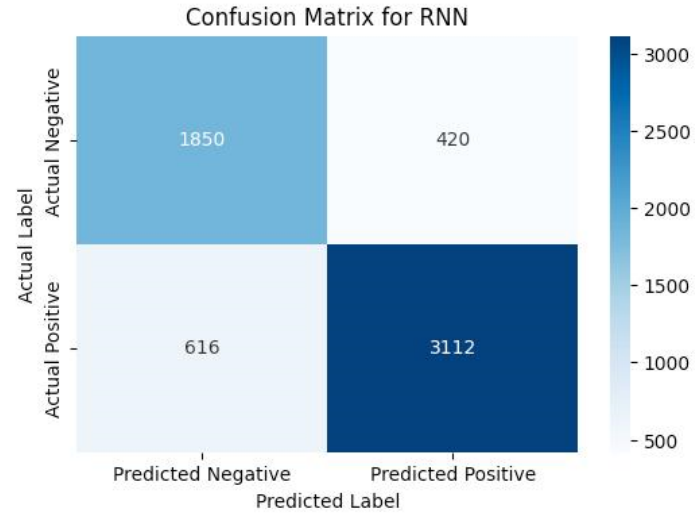
DL Model	Feature	Accuracy	Precision	Recall	F1-Score
BERT	Lora	88.32	90.91	90.23	90.57
Bi-LSTM	Attention Mechanism	83.64	87.69	85.71	86.69
RNN	-	82.71	88.10	83.46	85.71
BERT	Fine Tune	83.64	95.37	77.44	85.48
BERT	w/o Fine Tune	82.06	90.33	79.36	84.49
LSTM	-	83.18	89.09	80.33	84.48
GRU	-	74.77	78.33	77.05	77.69

Evaluation Table (DL)





Approach



Confusion Matrix (DL)





Approach

ML + DL Model	Feature	Accuracy	Precision	Recall	F1-Score
BERT	Lora	88.32	90.91	90.23	90.57
Logistic Regression	TF-IDF	85.51	82.69	96.99	89.27
Naive Bayes	Part of Speech Tag	85.51	84.46	93.98	88.97
Support Vector	TF-IDF	85.05	82.17	96.99	88.97
Support Vector	Part of Speech Tag	84.58	85.71	90.23	87.91
K-Nearest Neighbors	TF-IDF	82.71	82.88	90.98	86.74
Bi-LSTM	Attention Mechanism	83.64	87.69	85.71	86.69
Random Forest	TF-IDF	80.84	78.75	94.74	86.01
RNN	-	82.71	88.10	83.46	85.71
BERT	Fine Tune	83.64	95.37	77.44	85.48
Logistic Regression	Part of Speech Tag	81.78	85.07	85.17	85.39
Random Forest	Part of Speech Tag	78.97	76.50	95.49	84.95
Naive Bayes	TF-IDF	78.04	74.16	99.25	84.89
Decision Tree	Word2Vec	76.34	85.51	83.91	84.70
BERT	w/o Fine Tune	82.06	90.33	79.36	84.49
LSTM	-	83.18	89.09	80.33	84.48
Random Forest	Word2Vec	73.36	74.68	86.47	80.14
K-Nearest Neighbors	Part of Speech Tag	64.95	64.22	98.50	77.74
GRU	-	74.77	78.33	77.05	77.69
Support Vector	Word2Vec	62.15	62.15	100.00	76.66
Decision Tree	Part of Speech Tag	71.03	78.86	72.93	75.78
Decision Tree	TF-IDF	69.16	74.81	75.94	75.37
Logistic Regression	Word2Vec	61.68	63.63	94.93	74.38
K-Nearest Neighbors	Word2Vec	64.02	67.50	81.20	73.72
Naive Bayes	Word2Vec	57.48	75.00	47.37	58.06

Evaluation Table (ML + DL)





Conclusion





Conclusion

- A combined model that incorporates an attention mechanism could yield improved results.
- A model that merges attention mechanisms with NLP techniques may surpass other approaches in performance.

Feature Scope



