## **LIST OF CONTENTS**

CHAP	rer- I	INTRODUCTION	1 – 21
1.1	Overv	view	1
	1.1.1	Types of Sentiment Analysis	2
		1.1.1.1 Document Level	3
		1.1.1.2 Sentence Level	3
		1.1.1.3 Phrase Level	3
		1.1.1.4 Aspect Level	4
	1.1.2	Approaches for Sentiment Analysis	5
		1.1.2.1 Lexicon – Based Approach	5
		1.1.2.2 Machine Learning – Based Approach	7
		1.1.2.3 Hybrid Approach	7
		1.1.2.4 Other Approaches	8
		1.1.2.5 Comparison of Lexicon-Based and Machine	9
		Learning-Based Approach	
	1.1.3	Importance of Sentiment Analysis	9
	1.1.4	E-Commerce Recommendation Systems (RSs)	10
		1.1.4.1 Function of E-Commerce Recommender System	10
		1.1.4.2 Recommender System Algorithms	11
1.2	Backg	ground	13
1.3	Challe	enges	14
	1.3.1	Structured Sentiments	15
	1.3.2	Semi-Structured Sentiments	15
	1.3.3	Unstructured Sentiment	15
1.4	Applie	cations	15
	1.4.1	Business Analysis	16
		1.4.1.1 Product Reviews	17
		1.4.1.2 Market survey and Opponent Analysis	17
	1.4.2	Healthcare and Medical Domain	17
		1.4.2.1 Reputation Management	18
	1.4.3	Review Analysis	18

		Index
	1.4.4 Stock Market	18
	1.4.5 Customer Feedback	19
	1.4.6 Social Media Monitoring	19
1.5	Objectives	19
1.6	Problem Statement	19
1.7	Motivation	19
1.8	Description of the tool	20
1.9	Organization of the Thesis	20
CHAPI	TER- II LITERATURE SURVEY	22 - 48
2.1	Product Opinion Analysis for Websites using Deep Learning	22
2.2	Product Opinion Analysis using Machine Learning	34
2.3	Problem Statement	47
2.4	Summary	47
СНАРТ	TER- III STUDY ON PRODUCT OPINION ANALYSIS FOR	49 –57
CUSTO	OMER SATISFACTION ON E-COMMERCE WEBSITES	
3.1	Introduction	49
3.2	Problem Statement	50
3.3	Contribution	51
3.4	Proposed Method	51
	3.4.1 Dataset	52
	3.4.2 Text Extraction	52
	3.4.3 Pre-Processing	52
	3.4.3.1 Tokenization	53
	3.4.3.2 Removal of Punctuation	53
	3.4.3.3 Removing Stop Words	53
	3.4.3.4 Lemmatization	53
	3.4.4 Semantic Analysis	54
	3.4.5 Feature Selection	54
	3.4.6 Deep Learning Approach	54
	3.4.7 Opinion Analysis	55
	3.4.8 Recommended Site	55
35	Results and Discussion	55

3.6	Conclusion	56
CHAP	TER- IV WORD EMBEDDING ATTENTION & BALANCED	58 – 78
CROSS	ENTROPY TECHNIQUE FOR SENTIMENT ANALYSIS	
4.1	Introduction	58
4.2	Problem Statement	60
4.3	Contributions	60
4.4	Proposed Method	61
	4.4.1 Convolutional Neural Network	62
	4.4.1.1 Convolutional Layer	62
	4.4.1.2 Activation Function	63
	4.4.1.3 Pooling	63
	4.4.1.4 Fully Connected Layer	63
	4.4.2 Attention Layer	64
	4.4.3 Bi- LSTM Model	65
	4.4.4 Balanced Cross-Entropy	68
4.5	Results and Discussion	68
4.6	Summary	78
CHAP	TER- V CONCLUSION AND FUTURE SCOPE	79 – 80
5.1	Future scope	79
REFER	RENCES	81 - 89
PUBLI	CATIONS	
CERTI	FICATES	

## LIST OF TABLE

Table No.	Particulars	Chapter Page No.
3.1	Comparison between proposed and traditional approaches	56
4.1	Performance of WEA-Bi-LSTM model for various iterations	69
4.2	The WEA-BiLSTM model classifier comparison on sentiment analysis	71
4.3	The WEA-BiLSTM model performance for various categories	72
4.4	WEA-BiLSTM model MAE on sentiment analysis	74
4.5	WEA-BiLSTM RMSE on sentiment analysis	75
4.6	WEA-BiLSTM model for sentiment analysis	76

## LIST OF FIGURE

FIGURE No.	Particulars	Chapter Page No.
1.1	Types of Sentimental Analysis	2
1.2	Sentimental Analysis Approaches	5
1.3	Types of Transfer Learning approaches	8
1.4	Recommendation system algorithms	11
1.5	Challenges of Sentimental Analysis	14
1.6	Applications of Sentimental Analysis	16
3.1	Overview of proposed Model	51
3.2	Graphical representation of comparative analysis	56
4.1	The flow of WEA-Bi-LSTM model for sentiment classification	61
4.2	CNN architecture model for feature extraction	62
4.3	CNN model's fully connected layer	64
4.4	The LSTM unit comprises of input, output and forget gate in Bi-LSTM	65
4.5	Attention layer in Bi-LSTM model for sentiment classification	67
4.6	Accuracy and F-Measure of WEA-BiLSTM model for various iterations	69
4.7	Accuracy of the WEA-BiLSTM model	70
4.8	The WEA-BiLSTM model classifier comparison on sentiment analysis	71
4.9	WEA-BiLSTM precision and recall on sentiment analysis	72
4.10	Accuracy and F-measure of the WEA-BiLSTM model for different categories	73
4.11	The WEA-BiLSTM model Precision and Recall for various categories	74
4.12	MAE of WEA-BiLSTM model on sentiment analysis	75
4.13	RMSE of WEA-BiLSTM model on sentiment analysis	76

Index

FIGURE No.	Particulars	Chapter Page No.
4.14	The WEA-BiLSTM model for user cold start	77
4.15	The WEA-BiLSTM model for Item cold start	77
4.16	WEA-BiLSTM model for user Item cold start	78

Aspect Level or Aspect Based Sentiment Analysis	ABSA
Bag of Words	BOW
Collaborative Filtering	CF
Content-Based	CB
Convolutional Neural Network	CNN
Convolutional Neural Network	CNN
Deep Learning	DL
Fake Review Detection Framework	FRDF
Gated Recurrent Unit	GRU
Gensim Lemmatization	GL
Hybrid Recommendation System	HRS
Latent Dirichlet Allocation	LDA
Local Search Improvised Bat Algorithm based Elman	LSIBA-ENN
Neural Network	
Long Short Term Memory	LSTM
Machine Learning	ML
Machine Learning Classifiers	MLC
Naive Bayes	NB
Natural Language Processing	NLP
Pointwise Mutual Information	PMI
Product Comment Summarizer and Analyzer	PCSA
Snow-Ball Stemming	SBS
Support Vector Machines	SVM
Transfer learning	TL
User-Generated Content	UGC
User-Generated Content	UGC
Waikato Environment for Knowledge Analysis	WEKA
Web Scrapping Tool	WST
Word Embedding Attention	WEA
World Wide Web	WWW

## LIST OF ABBREVIATIONS