Mid Term Evaluation

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Presented By:-
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Agenda

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Problem Statement

Sentiment Analysis and Summarization of Product Reviews using Deep Learning Techniques

Project Description

- To provide a brief abstractive summary of a product with a large number of reviews available in order to take a quick glance at both the pros and cons of any product.
- We will tackle the above problem using deep learning techniques like LSTM-attention mechanism and/or BERT.
- We will have 2 phases: classification and summarization
- Processing techniques will be same for summarization, we only have to perform processing once.

Project Motivation

- As potential customers, people usually seek help from the online portals to gain knowledge on a particular product, and finally, decide if the purchase should be made or not.
- It takes several hours to read all the reviews, sometimes even leading to missing out the important ones, thus ending up making the wrong decision on purchasing the product.
- Each product has thousands of reviews each, and it is tedious for the customer to make a decision based on the varying user reviews.
- A more well defined and concise product review is proposed such that the user need not skim through all the reviews, thus saving their time and effort.
- As a solution to the ongoing problem that the customer experiences daily, automatic review summarization will be used to analyze the product reviews and convert them into a user-readable and in a more concise and precise format.

Literature Survey

Review Classification

Sr. No.	Paper Title	Publisher Name	Year of Publication	Technologies/ Algorithms used	Research Gaps
1.	Business Intelligence Visualization Using Deep Learning Based Sentiment Analysis on Amazon Review Data	IEEE	2021	Decision Tree, Logistic Regression, Stochastic Gradient Descent, Multinomial NB, SVM, BERT, and LSTM	Large model of BERT can be used to achieve high accuracy, there are various irregularities and ambiguities like sarcasm, dialect differences, metaphors, lack of context, homonyms, idioms, etc., in human language which impairs the ability of algorithms to acquire better efficiency.

Sr. No.	Paper Title	Publisher Name	Year of Publication	Technologies/ Algorithms used	Research Gaps
2.	Product Sentiment Analysis of Amazon reviews*	International Journal of Computer Science and IT (IJCSIT)	2021	BERT model, Bi-LSTM, NB, Random forest classification were used and compared.	Machine learning algorithms doesn't give good accuracy, sentimental analysis done on mobile reviews only, advanced feature extraction techniques can be used to achieve high accuracy.
3.	Sentiment Analysis of Ecommerce Product Review Data Based on Deep Learning	IEEE	2021	Convolutional Neural Network, BOW to perform Word Vector.	The model has been trained for chinese characters dataset and the implementation in english is yet to be done.

Sr. No.	Paper Title	Publisher Name	Year of Publication	Technologies/ Algorithms used	Research Gaps
4.	Classification of Shopify App User Reviews Using Novel Multi Text Features	IEEE	2020	**Feature engineering:-** TF-IDF, Chi, Chi-2, Bag of Words **ML Algorithms**: Random Forest, Adaboost Classifier, Logistic Regression	Only been experimented on a single dataset (the Shopify app dataset) and also does not discuss about deep machine learning models on different text and categorical datasets for the purpose of user review classification.

Review Summarization

Sr. No.	Paper Title	Publisher Name	Year of Publication	Technologies/ Algorithms used	Research Gaps
5.	Summarization and Prioritization of Amazon Reviews based on multi-level credibility attributes	IEEE	2021	LSTM, NLTK, TF-IDF	The paper discusses how we can find the credibility of reviews and summarizes the rest reviews based on positive and negative keywords.

Sr. No.	Paper Title	Publisher Name	Year of Publication	Technologies/ Algorithms used	Research Gaps
6.	Text Summarization for Thai Food Reviews using Simplified Sentiment Analysis	IEEE	2021	Simplified Sentiment Analysis, Multi-dimensional lexicon.	Processes only on 1 comment and summarizes it. Applied to Thai language dataset.
7.	Automatic Text Summarization: A Comprehensive Survey	Science Direct	2021	Survey paper	

Sr. No.	Paper Title	Publisher Name	Year of Publication	Technologies/ Algorithms used	Research Gaps
8.	Natural Language Processing based Abstractive Text Summarization of Reviews	IEEE	2020	Preprocessing techniques like Lemmatization,removal of stop words etc., TF-IDF vectorization technique, LSTM model is used.	Text summarization done on food reviews of amazon dataset, Summarized reviews results are not upto the mark it can be improved.
9.	Massive Multi-Document Summarization of Product Reviews with Weak Supervision*	ACM Chapter	2020	Weak Supervision, Clustering, Multi-Document Summarization.	The proposed work only gives the result in a single summarized manner and do not lists the pros and cons of the products by classifying positive and negative reviews.

Sr. No.	Paper Title	Publisher Name	Year of Publication	Technologies/ Algorithms used	Research Gap
10.	A Survey on NLP based Text Summarization for Summarizing Product Reviews	IEEE	2020	Survey paper	
11.	Summarizing Product Reviews Using NLP Based Text Summarization	IRJST	2019	Seq2seq model for summarization, used LSTM layers for encoding and decoding modules during the summarization.	Only 1 comment can be processed at a time and multi-document summarization is not compatible, Other models can used to achieve high accuracy.

Sr. No.	Paper Title	Publisher Name	Year of Publication	Technologies/ Algorithms used	Research Gaps
12.	Extractive Multi-document Summarization Using Multilayer Networks	Physical A Journal: Elsevier	2018	Extractive multi document summarization, multilayer networks, PageRank algorithm	Abstractive text summarization not explored and also sentiment analysis not looked into

Review Classification + Summarization

Sr. No.	Paper Title	Publisher Name	Year of Publication	Technologies/ Algorithms used	Research Gaps
13.	A Unified Dual-view Model for Review Summarization and Sentiment Classification with Inconsistency Loss	ACM SIGIR	2020	Shared text encoder, summary decoder, Dual-view Sentiment Classification Module	Multi-document summarization is not been considered here, Results are not upto the mark.
14.	A Hierarchical End-to-End Model for Jointly Improving Text Summarization and Sentiment Classification	2018 International Joint Conference on Artificial Intelligence	2018	A hierarchical end-to end model, which consists of a summarization layer and a sentiment classification layer	Results are not satisfactory. Only 1 comment can be processed at a time and multi-document summarization is not compatible.

Research Gap

- Research on Abstractive Multi-Document Summarization is still going on and to be tapped.
- Many of the papers discuss review summarization for only one category of product.
- No paper discuss how we can summarize the reviews and list out them as pros and cons list.

Comparative Analysis on Sentiment Analysis

Paper Title	Model	Processing Technique	Results
Classification of Shopify App User Reviews Using Novel Multi Text Features **Dataset** - Shopify app store dataset (Publicly available on kaggle)	Linear Regression	TF-IDF and Chi2	83% accuracy
Product Sentiment Analysis of Amazon reviews **Dataset** - Amazon dataset extracted via Prompt Cloud (Publicly available on kaggle)	BERT	-	98.3 % - Validation dataset 98.4% - Test dataset

Paper Title	Model	Results
Sentiment Analysis of Ecommerce Product Review Data Based on Deep Learning **Dataset** - Scraped data from ecommerce websites and collected around 16000 reviews.	FCNN(Fully Convolutional Neural Network) network	97% accuracy with better performance in all aspects.
Business Intelligence Visualization Using Deep Learning Based Sentiment Analysis On Amazon Review Data **Dataset** - Amazon Reviews: Unlocked Mobile Phones	BERT - 12-layer, 768-hidden, 12-heads, 110 million parameter neural network architecture. Adam - optimizer, SparseCategoricalAccuracy - accuracy metric, CategoricalCrossentropy - loss function	98.51% - validation accuracy

Comparative Analysis on Summarization

| Paper Title	Model	Results
Summarizing Product Reviews Using NLP Based Text Summarization **Dataset** - Amazon Food Reviews	Seq2seq model with default parameters (no parameter tuning done) with an attention mechanism in between (default parameters)	Loss function - 0.263
Massive Multi-Document Summarization of Product Reviews with Weak Supervision **Dataset** - Amazon Customer Reviews	Fast Abstractive Summarization (FAS) Additional parameter - max_edit_dist = 0.7	Refer paper

Paper Title	Model	Results
Summarization and Prioritization of Amazon Reviews based on multi-credibility attributes **Dataset** - Amazon Food Reviews	LSTM recurrent neural network with feedback connections	1. Average accuracy Of model was 90.28% 2. Average helpfulness Of summarized review increased after review filtering

# Comparative Analysis on Text Summarization + Classification

Paper Title	Model	Results
Text Summarization for Thai Food Reviews using simplified sentiment analysis **Dataset** - Thai food reviews from the Wongnai	Multi Dimensional Lexicon Embedding	The average accuracy in analyzing the negative, positive and all sentiments is 31.96, 90.26 and 85.05 resp.
A Hierarchical End-to-End Model for Jointly Improving Text Summarization and Sentiment Classification. **Dataset -** (Amazon Stanford Network Analysis Project(SNAP) Review Dataset [2016])	Hierarchical End-to-end model Bi-LSTM for Text Decoder, uni-LSTM for Summary Decoder	RG-1 score = 14.52 RG-2 score = 4.84 RG-L score = 13.42 Accuracy for sentiment Analysis = 92.1%
A Unified Dual-view Model for Review Summarization and Sentiment Classification with Inconsistency Loss **Dataset** - Amazon 5-core review repository	● bi-directional GRU for Shared Text Encoder (M1) ● forward GRU for Summary Decoder	ROUGE-1 score = 14.22±.06 ROUGE-2 score = 5.75±.05 ROUGE-L score = 13.90±.06 Accuracy for sentiment Analysis:= 62.00%

Architecture

High Level Architecture Diagram
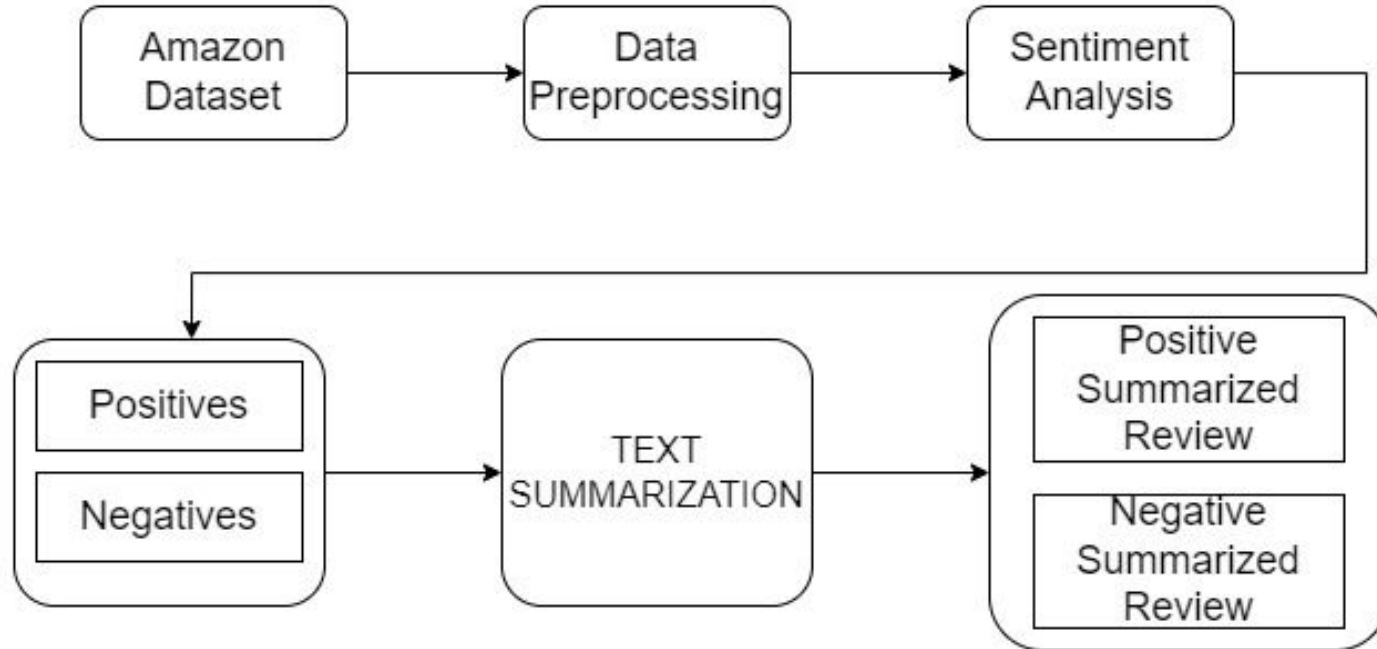
Low Level - Text Summarization
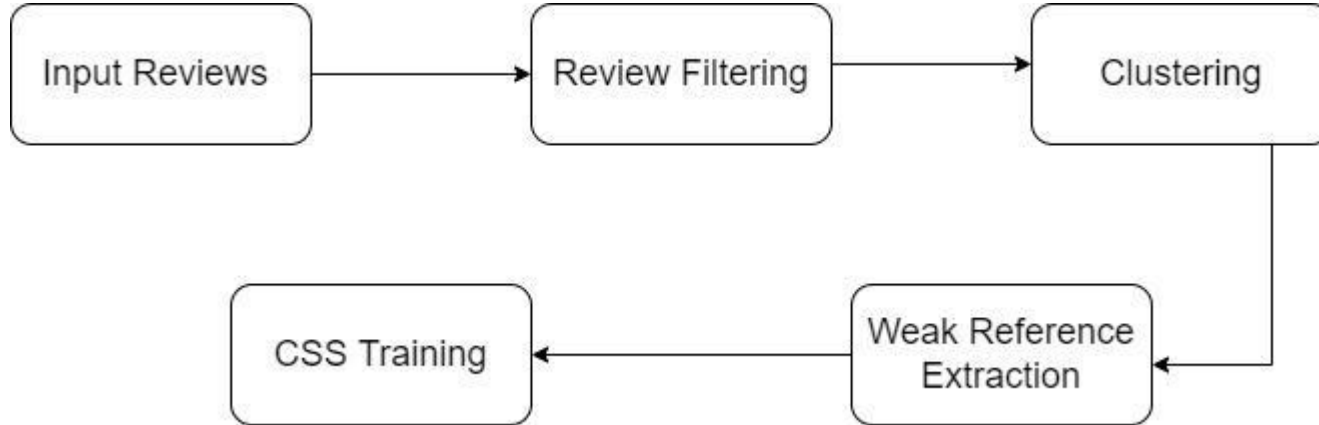
Next Steps

Data pre-processing techniques has been discussed before.

For sentiment analysis, we will proceed with BERT as it is giving the highest results.

For summarization, we will try for abstractive text summarization and will most likely use seq2seq model with attention layer.

In terms of technology, we will most likely proceed with NLTK package and TensorFlow.

Thank You !!