## Phase-2 Submission

**Student Name:** Umesh M

**Register Number:** AU410723104090

**Institution:** Dhanalakshmi College of Engineering

**Department:** computer science engineering

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**GitHub Repository link:**
https://github.com/umeshmohankumar/NM_UmeshM.git

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# Project Title: Decoding Emotions Through Sentiment Analysis of Social Media Conversation

## *1. Problem Statement*

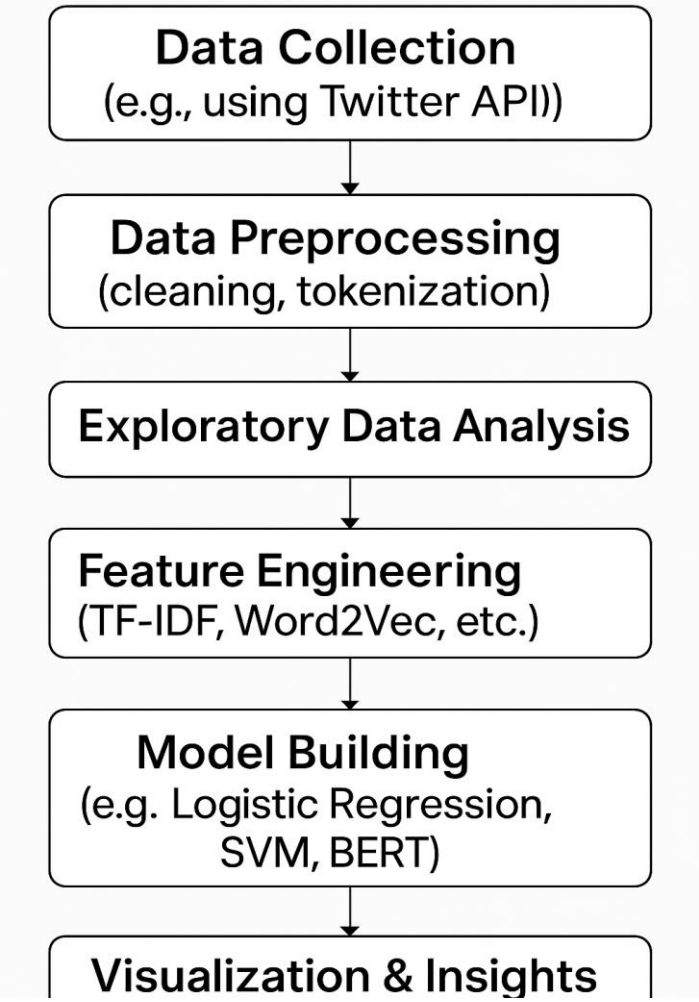
*With the exponential growth of social media platforms like Twitter, Facebook, and Instagram, people now express their thoughts, opinions, and emotions online more than ever. These platforms have become a rich repository of user-generated content, which provides unique opportunities to understand public sentiment across various domains such as politics, mental health, marketing, and customer service.*

## 2. Project Objectives

1. *To collect a diverse dataset of social media text data such as tweets or Facebook comments.*
2. *To preprocess the textual data by cleaning, normalizing, and tokenizing the content.*
3. *To build models capable of performing sentiment classification with high accuracy and robustness.*
4. *To visualize emotional trends across time, location, or topics to better understand public sentiment.*
5. *To address challenges such as sarcasm detection, handling class imbalance, and dealing with multilingual content*

## 3. Flowchart of the Project Workflow

- *Data Collection: Using APIs like Twitter API or extracting data from public datasets on Kaggle.*
- *Data Preprocessing: Cleaning text by removing noise (URLs, hashtags, mentions), normalizing, and tokenizing.*
- *Exploratory Data Analysis: Identifying patterns in data, distribution of sentiments, and word usage.*
- *Feature Engineering: Creating numerical representations of text using techniques like TF-IDF, Word2Vec, or BERT embeddings.*
- *Model Building: Training machine learning models such as Logistic Regression, SVM, or deep learning models like LSTM and BERT.*
- *Model Evaluation: Assessing models using metrics such as accuracy, recall, F1-score, and confusion matrix.*
- *Visualization and Insights: Plotting sentiment trends, keyword importance, and evaluating emotional responses across different dimensions.*




## *4. Data Description*

***Dataset Source:*** *Data is collected from the Twitter API, Reddit threads, or publicly available sentiment datasets on platforms like Kaggle.*

***Data Type:*** *Unstructured text data containing user-generated content.*

***Features:*** *Tweet/comment text, timestamps, user metadata (optional), sentiment labels.*

***Target Variable****: Sentiment classification—commonly Positive, Negative, and Neutral.*

***Nature of Data:*** *Can be static (archived datasets) or dynamic (real-time data from social APIs).*

## 5. Data Preprocessing

***Text Cleaning:*** *Remove punctuation, numbers, stop words, URLs, hashtags, and emojis.*

***Text Normalization:*** *Lowercasing, correcting spelling errors, and expanding contractions.*

***Tokenization and Lemmatization:*** *Breaking text into individual words and reducing them to their root form.*

***Handling Imbalanced Classes:*** *Apply oversampling (e.g., SMOTE) or under sampling techniques if sentiment categories are not evenly distributed.*

## 6. Exploratory Data Analysis (EDA)

- *Analyze most frequently occurring words across sentiment classes.*
- *Generate word clouds to visualize dominant words in positive, negative, and neutral texts.*
- *Assess the distribution of sentiments to understand biases in the data.*
- *Study trends over time or across hashtags to identify sentiment shifts.*

## 7. Feature Engineering

***Text Vectorization:*** *Convert text into numerical format using TF-IDF, Bag of Words, or advanced embeddings like Word2Vec or GloVe.*

***Contextual Embeddings:*** *Use pre-trained language models like BERT to capture contextual relationships in sentences.*

***Linguistic Features:*** *Add parts of speech tags, sentiment lexicons, or n-gram frequency counts.*

## 8. Model Building

*Choose appropriate models such as:*

- *Logistic Regression and SVM for baseline performance*
- *Random Forest for robustness and interpretability*
- *LSTM and BERT for deep learning-based performance*
- *Fine-tune models using cross-validation and hyperparameter tuning.*
- *Evaluate performance using metrics:*
- *Accuracy*
- *Precision, Recall, and F1-score*
- *Confusion Matrix and ROC/AUC*

## 9. Visualization of Results and Model Insights

***Confusion Matrix:*** *Visual representation of prediction performance.*
***ROC/AUC Curve:*** *To analyze model performance at various classification thresholds.*
***Sentiment Over Time:*** *Line plots to visualize how sentiment changes over time.*
***Keyword Contribution:*** *Identify key terms that contribute most to each sentiment class.*

## 10. Tools and Technologies Used

***Programming Language:*** *Python*
***NLP Libraries:*** *NLTK, spaCy, TextBlob, HuggingFace Transformers*
***Data Handling:*** *pandas, numpy*
***Modeling:*** *scikit-learn, TensorFlow, Keras*
***Visualization:*** *matplotlib, seaborn, plotly*
***IDEs:*** *Google Colab, Jupyter Notebook*
***Version Control:*** *GitHub for tracking project development*

## 11. Team Members and Contributions

| Name | Role | Responsibilities |
|---|---|---|
| Umesh | Presentation Designer | Designed and structured the project presentation for clear and effective delivery. |
| Srikanth | Content Researcher | Researched sentiment analysis techniques and contributed to writing project content. |
| Yashwanth | Content Researcher | Helped gather insights and develop detailed write-ups for each section of the project. |
| Ravikumaar | Technical Support & Review | Assisted with reviewing the technical workflow, validating data processing steps, and ensuring overall quality control. |