



# Development of Hybrid Model for **Sentiment Classification** for review comments in **Bengali** language

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Ankur Napa

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# PROBLEM STATEMENT

## PROBLEM

As online businesses continue to flourish, customer satisfaction in the digital marketplace has become a focal point for success. A significant challenge in this context is the precise prediction of sentiment in Bengali text. The Bengali language, rich in nuances and cultural context, requires specialized machine learning algorithms for accurate sentiment analysis. Misinterpretation can lead to incorrect market strategies and consumer engagement efforts, making it critical to develop robust methods for understanding the emotional tone of Bengali customer feedback.

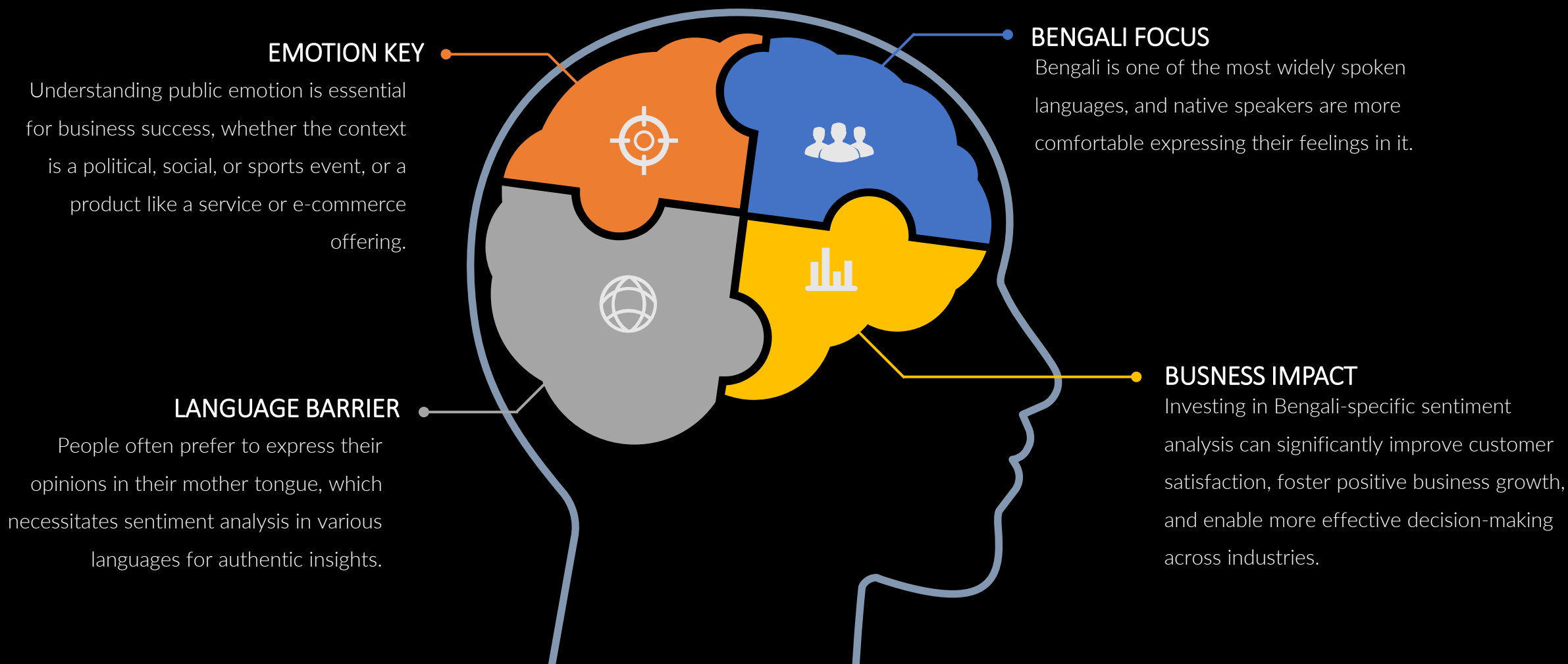


## SOLUTION

This study utilizes a Bengali dataset to train and evaluate pre-existing machine learning models, aiming to precisely predict sentiment in Bengali text. The research is not just academically significant but also has practical implications. The results could serve as a foundation for future scholarly research and practical applications, offering guidance on how to improve sentiment analysis algorithms for the Bengali language. The successful implementation of these models could revolutionize customer engagement strategies and market research.



# SIGNIFICANCE OF THE STUDY

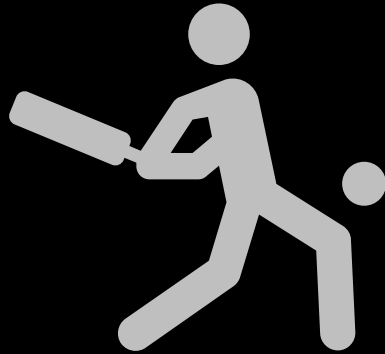


# DATA GATHERING

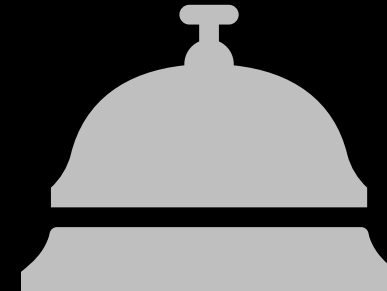
2720 Data point

Negative - 1978  
Positive - 505  
Neutral - 237

**Cricket**



**Restaurant**



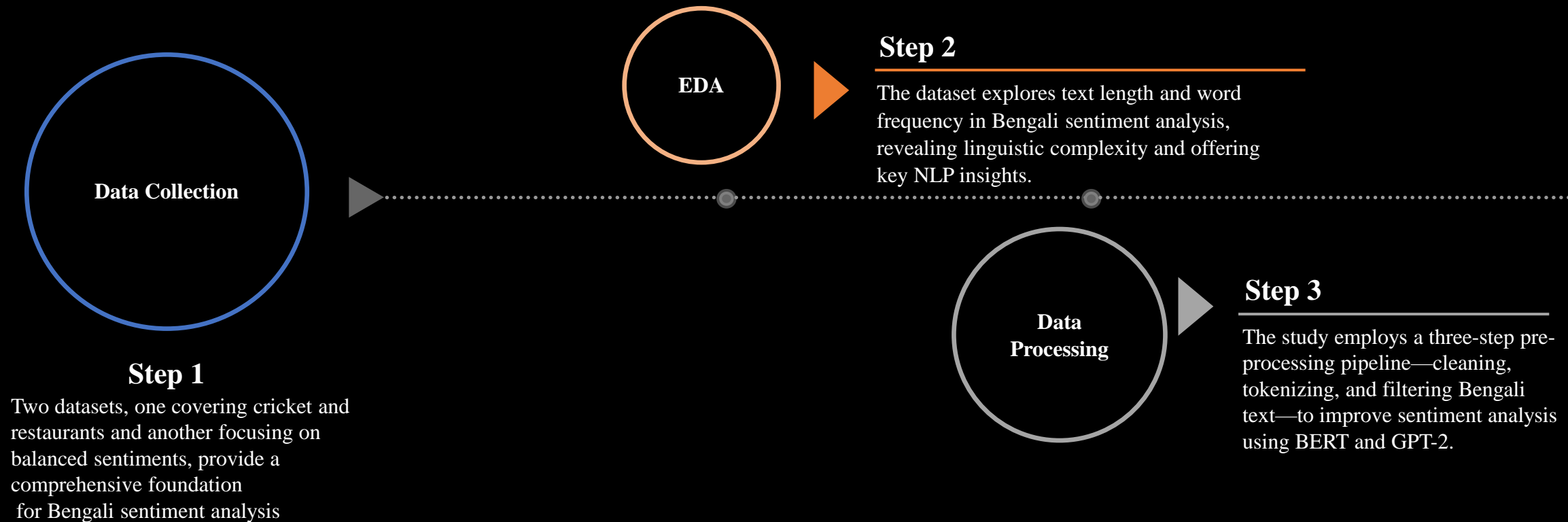
1714 Data point

Negative - 386  
Positive - 992  
Neutral - 236  
Conflict - 100

4434 Data point

negative 2364  
positive 1497  
neutral 473  
conflict 100

# RESEARCH METHODOLOGY



# RESEARCH METHODOLOGY

BERT –  
2 Epochs

## Step 4

Utilizing BERT with just two epoch provides a quick but potentially less accurate sentiment classification in Bengali.

GPT – 2  
Epochs

## Step 6

Using GPT-2 for two epochs offers a balance between speed and accuracy but may still require further optimization for Bengali text.

BERT –  
3 Epochs

## Step 5

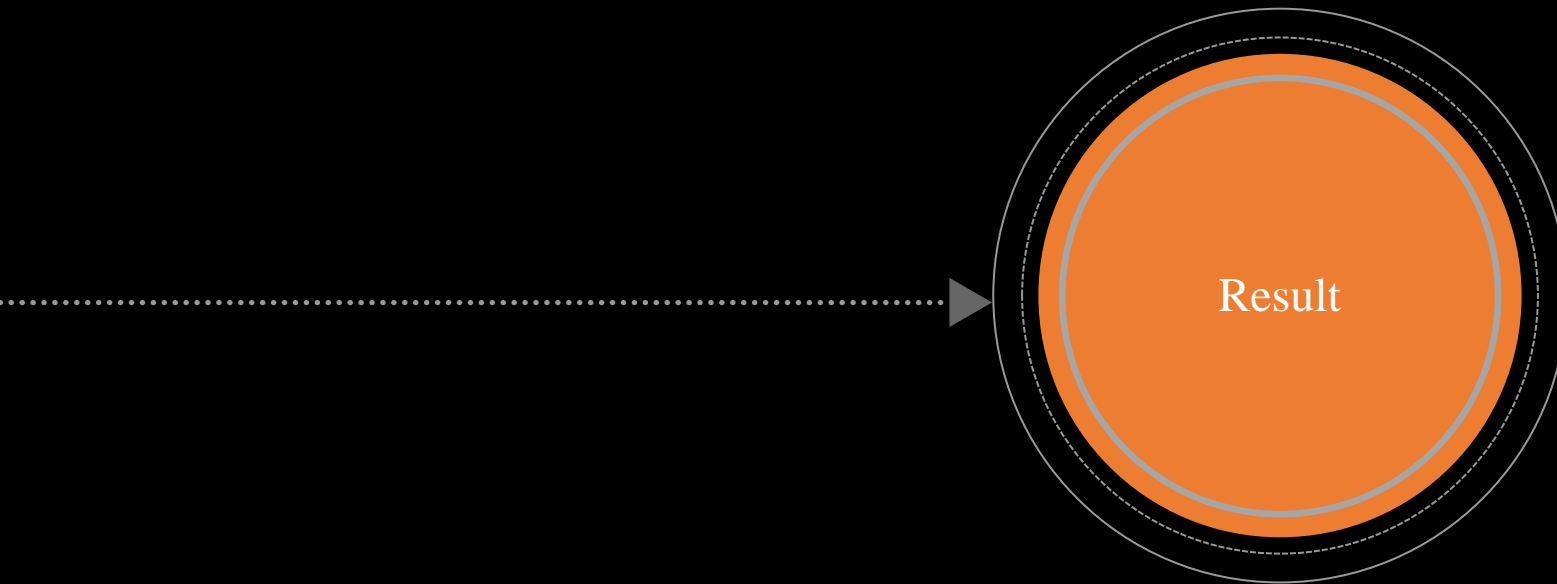
Running BERT for three epochs improves accuracy and generalization, making it more reliable for Bengali sentiment analysis.

GPT – 3  
Epochs

## Step 7

Extending GPT-2 training to three epochs enhances performance, but it might still lag behind BERT in Bengali sentiment classification.

# RESEARCH METHODOLOGY



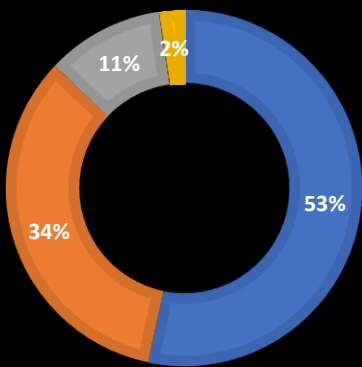
## Final Step

Assessing the model outcomes through performance metrics like F1 scores provides critical insights into the model's efficacy in tasks like sentiment analysis.

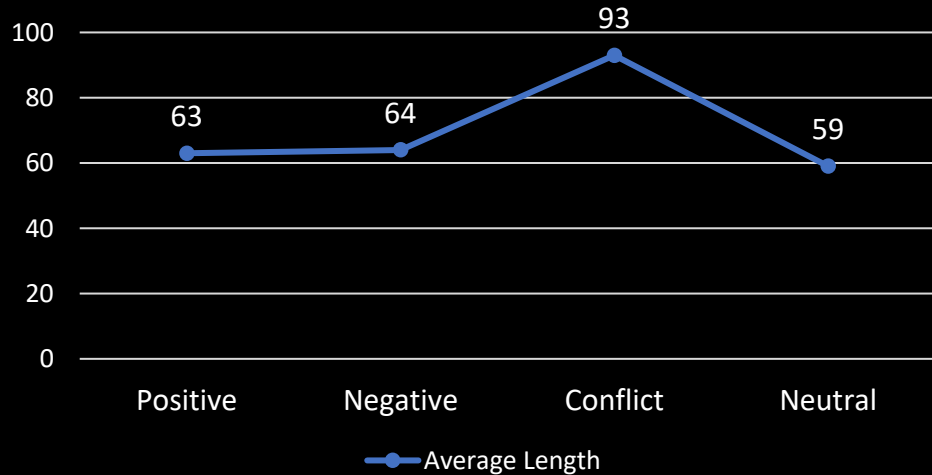


# EXPLORING THE DATA

## POLARITY DISTRIBUTION



## Average Text Length



Word cloud for Neutral sentiment words



Word cloud for Negative sentiment words



Word cloud for Positive sentiment words



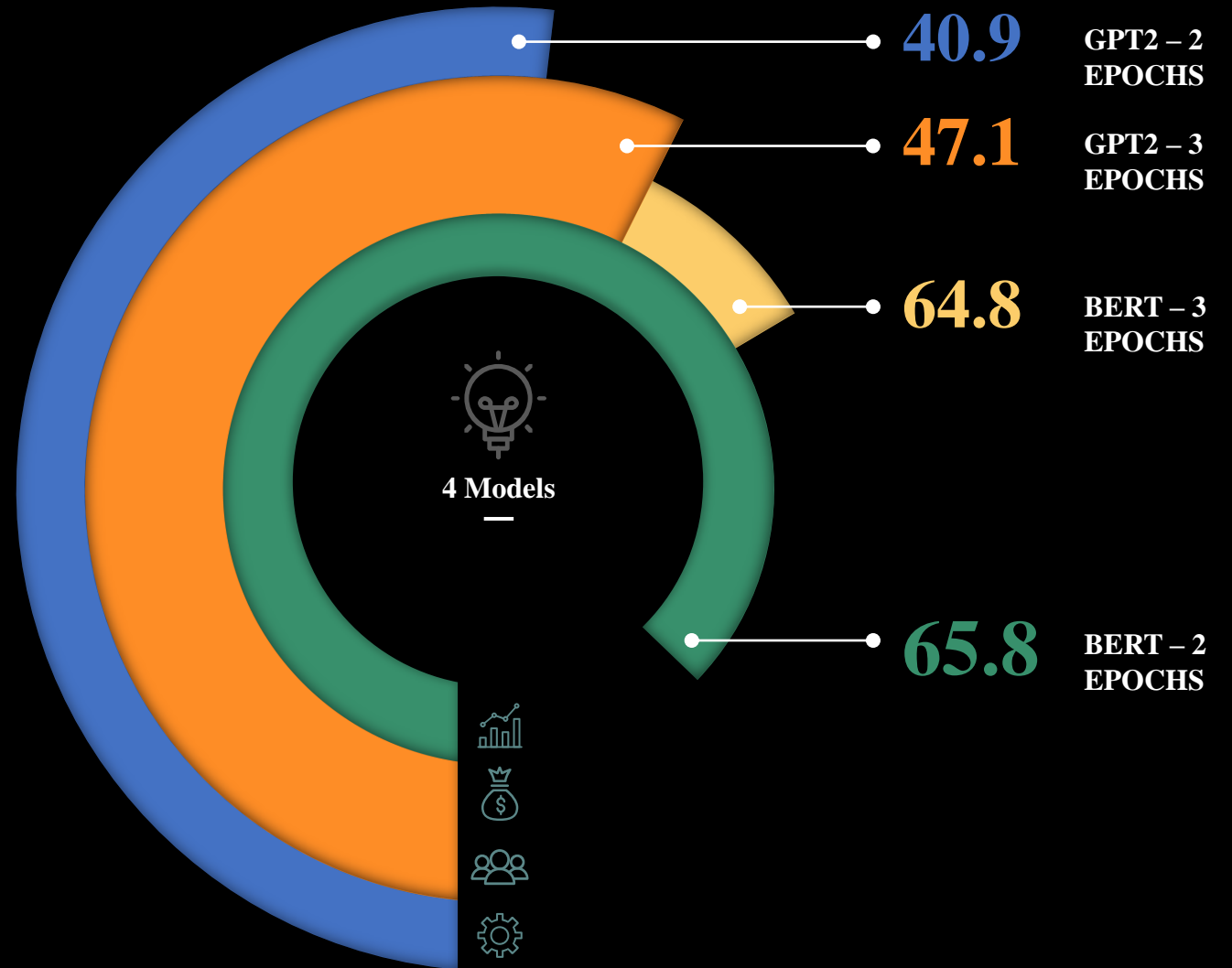
Word cloud for conflict Sentiment words

*Upon examining the dataset, it becomes evident that the distribution of classes is 53% negative, 34% positive, 11% neutral, and 2% conflict. The average word lengths for these classes are 63 for positive, 64 for negative, 93 for conflict, and 59 for neutral. Word clouds for each class effectively highlight the pertinent vocabulary.*

# RESULTS & EVALUATIONS

## Result Summary

BERT quickly grasped Bengali sentiment, reaching an F1 score of 65.83% after two epochs but slightly declined with further training. GPT-2 started slower, improving from 40.94% to 47.13% after three epochs, but lagged behind BERT.



# CONCLUSION



## Research Importance

The study addresses the crucial need for research in sentiment analysis of Bengali review comments, emphasizing its importance in the digital marketplace.



## Model Efficacy

The use of BERT and GPT-2 demonstrated robust and nuanced sentiment classification, underscoring the effectiveness of these models when applied to well-prepared Bengali data.



## BERT's Superiority

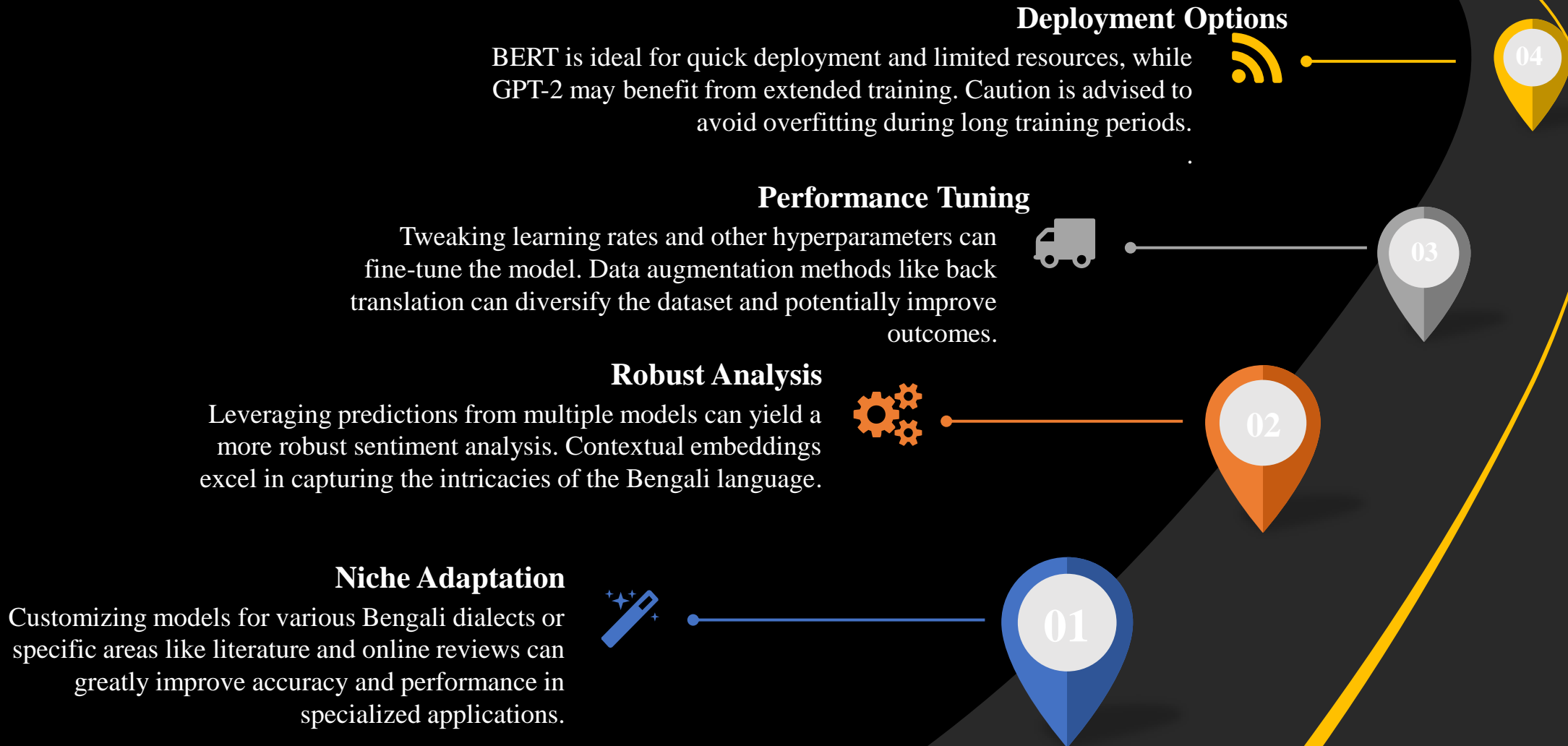
In head-to-head performance, BERT surpassed GPT-2, achieving an impressive F1 score of 65.83% after just two epochs.

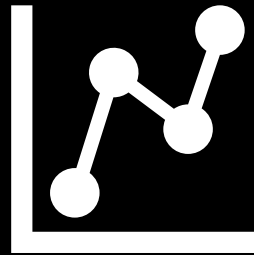


## GPT-2 Potential

Although GPT-2 lagged behind BERT, it showed promise by improving its performance to reach an F1 score of 47.13% in the third epoch, indicating potential for future optimization.

# FUTURE SCOPE





THANK YOU