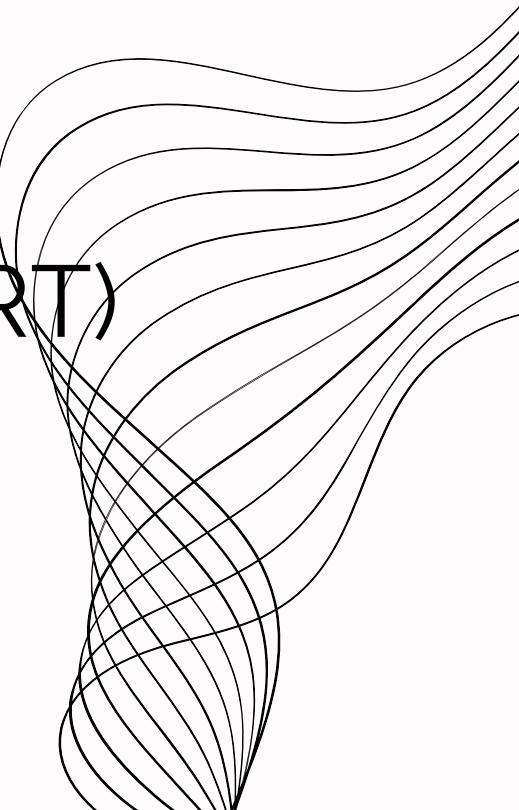




**SENTIMENT ANALYSIS
OF
AMAZON PRODUCT REVIEWS**

WHAT IS SENTIMENT ANALYSIS?

- Applying a mix of statistics, natural language processing (NLP), and machine learning to extract information about reviewer's feelings about a product or service is referred to as sentiment analysis.
- Various models are used for this purpose like:
 - Support Vector Machine
 - Convolutional Neural Networks
 - Bi-directional Encoder Representations from Transformers (BERT)

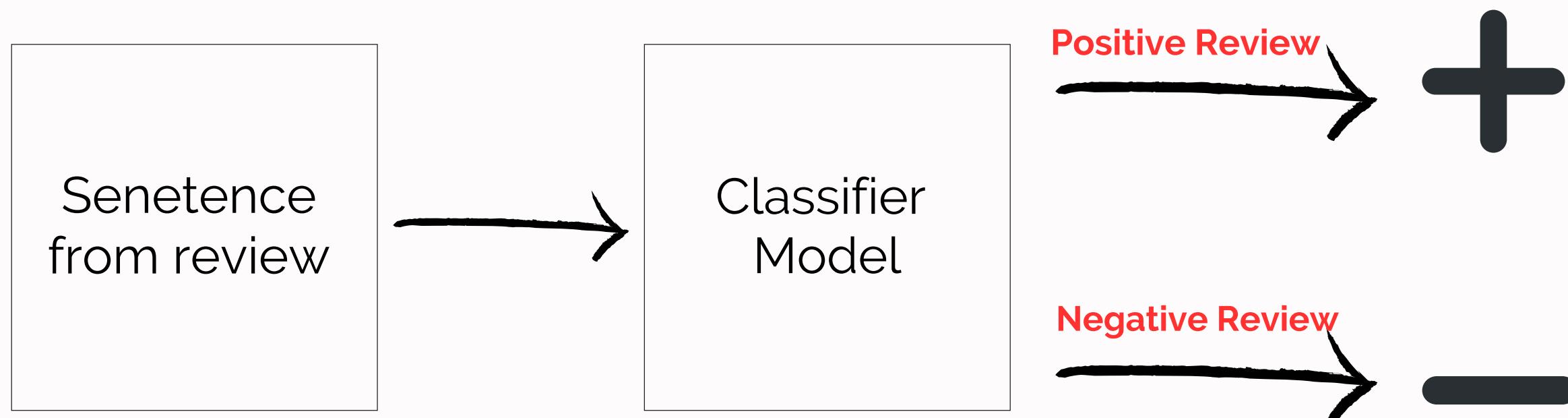


EXISTING SYSTEMS

- Analyzing and understanding data is major part of data analytics and business intelligence.
- There are many existing models for sentiment analysis implemented with algorithms such as Naïve Bayes, KNN(K-nearest neighbors)which are most common classification algorithms, SVM(Support Vector Machine) and LSTM (Least Short-Term Memory).
- Deep-learning neural networks are also popular in the area of sentiment analysis.

PROPOSED SYSTEM

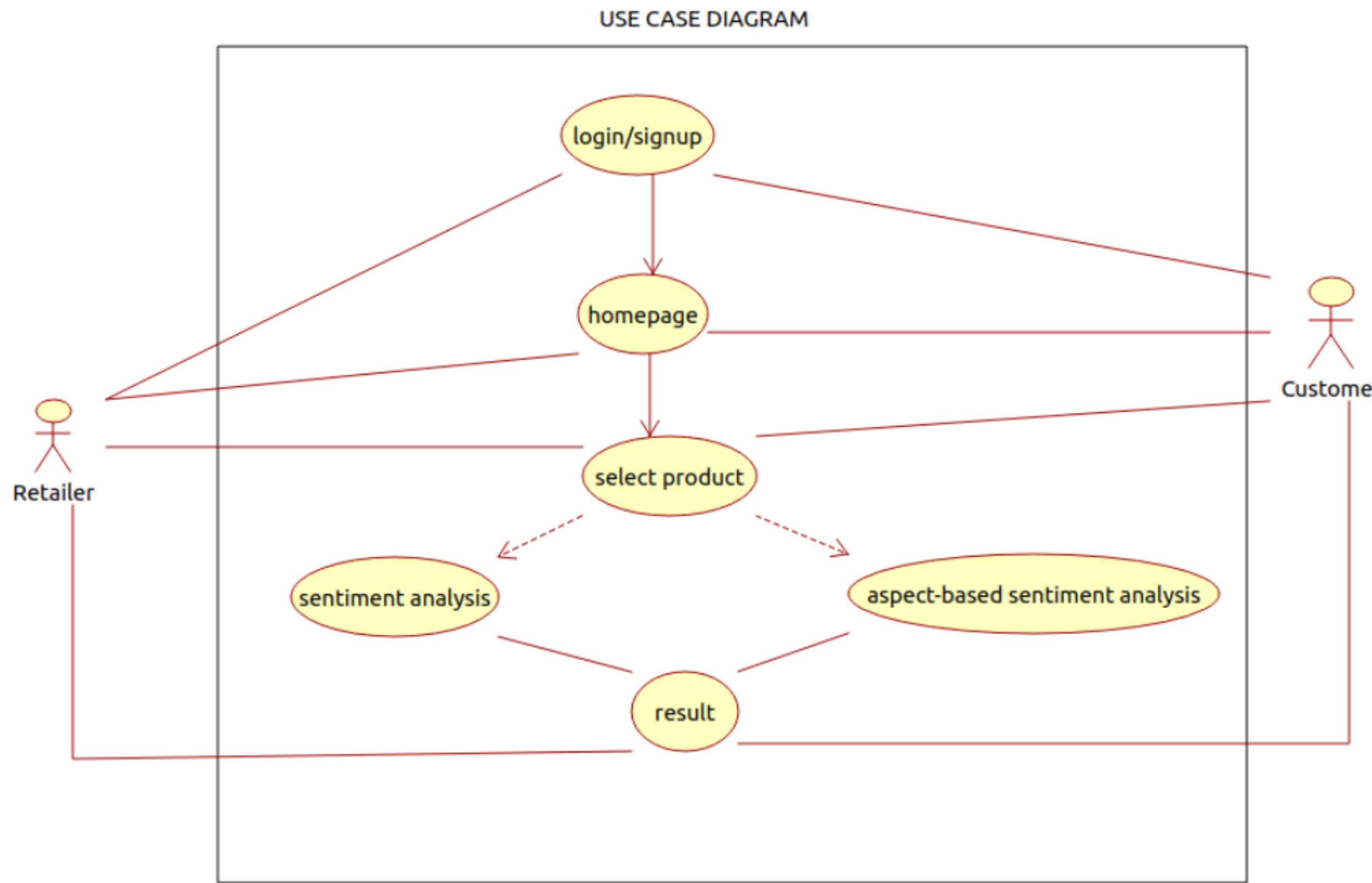
- The proposed system works by taking input as product name on amazon e-commerce site.
- Data is pre-processed and features on which comments are made are extracted.
- BERT uncased-model analyzes the scraped reviews, evaluates the feedback and displays the result as a bar graph on the website.



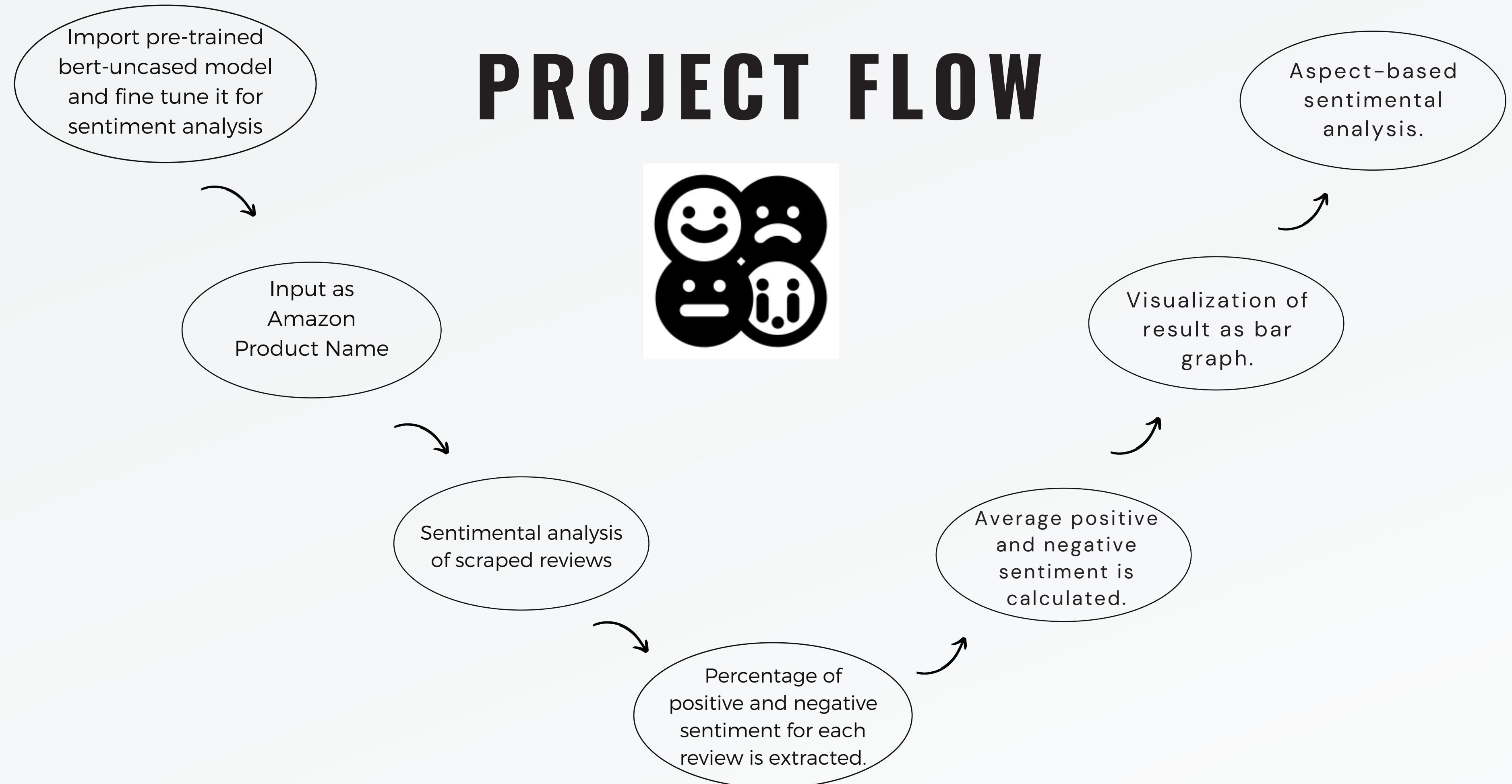
SENTIMENT ANALYSIS USING BERT

- **BERT- Bi-directional Encoder Representations from Transformers**
- It is an open source machine learning framework for natural language processing (NLP).
- In BERT words are defined by their surroundings, not by a pre-fixed identity, so contextually accurate understanding is achieved.
- Fine-tuning the pre-trained BERT model to analyze sentiments from reviews provides highly accurate results.

USE-CASE DIAGRAM



PROJECT FLOW



HARDWARE REQUIREMENTS

CPU

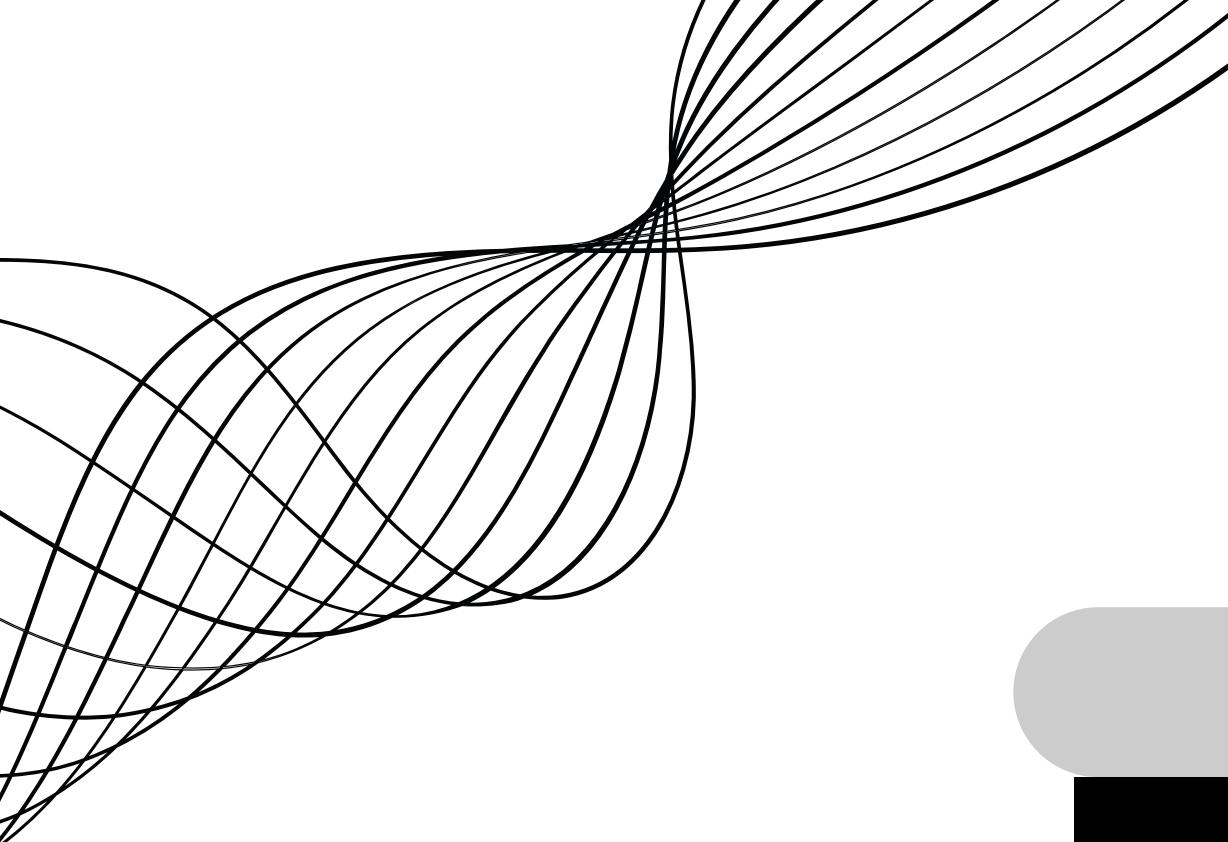
A modern multicore processor, such as an Intel Core i5 or i7.

RAM

A minimum of 8GB of RAM, or more for large datasets.

GPU

A GPU can significantly speed up training and inference of deep learning models.



SOFTWARE REQUIREMENTS

OPERATING SYSTEM

PYTHON

GOOGLE COLAB

TENSORFLOW

LIBRARIES

HTML

CSS

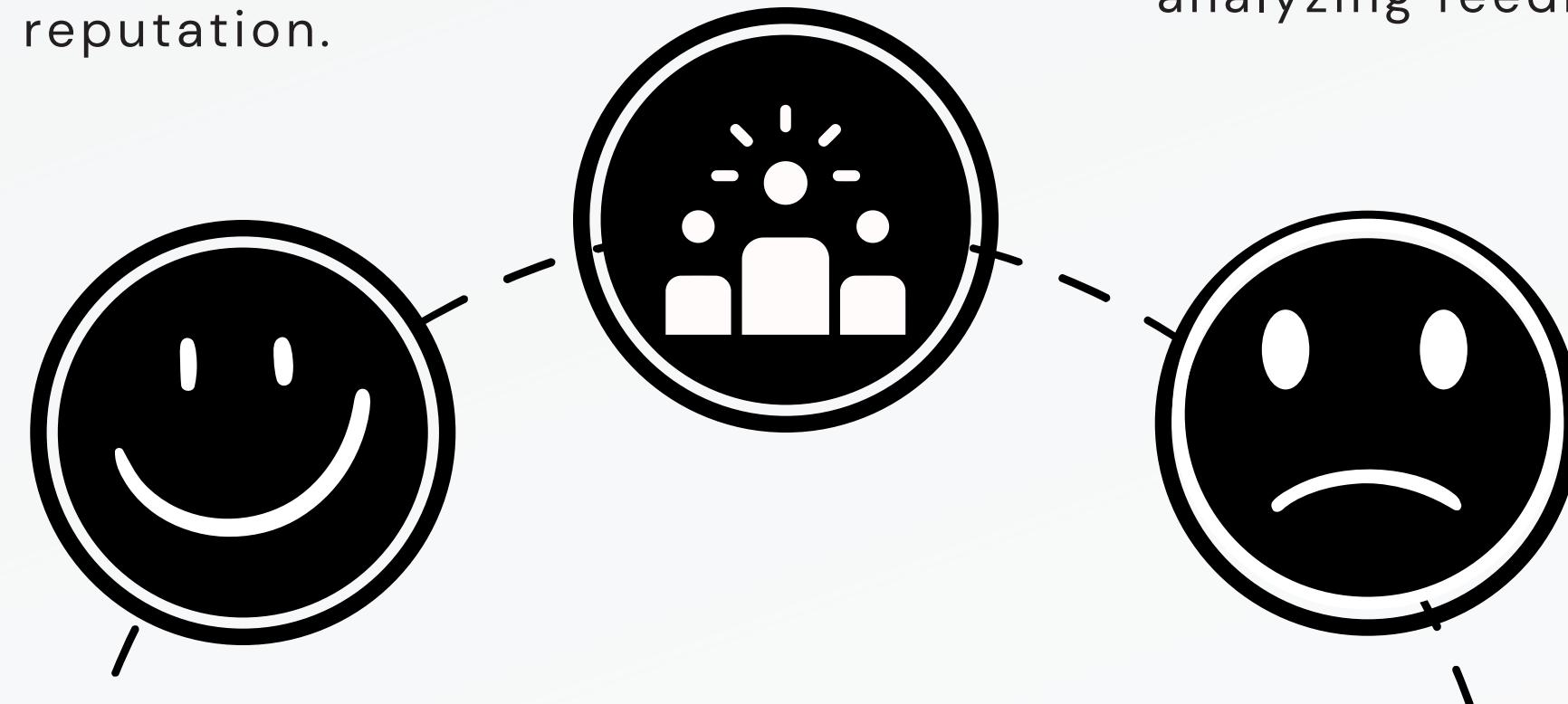
JAVASCRIPT

FLASK

SCOPE OF THE PROJECT

ANALYZE CUSTOMER SENTIMENTS

Increases potential customers by targeting on the positive sentiments and manages reputation.



ASPECT-BASED SENTIMENT ANALYSIS

Aspect-based sentiments helps in efficiently categorizing and analyzing feedback.

INPUT

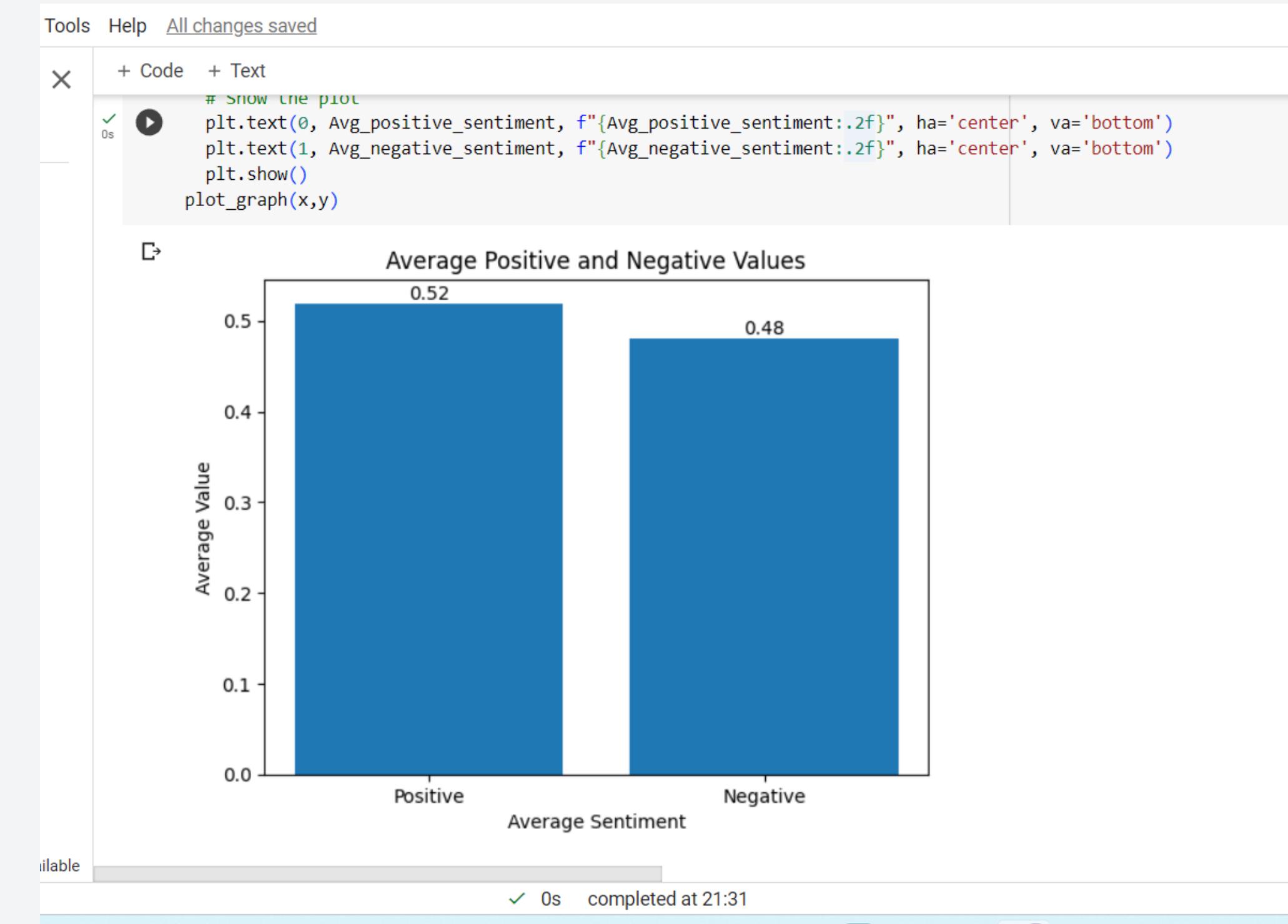
- URL of the product is given as input.
- BeautifulSoup library is used as web scraping tool for extracting real-time reviews from the amazon website.

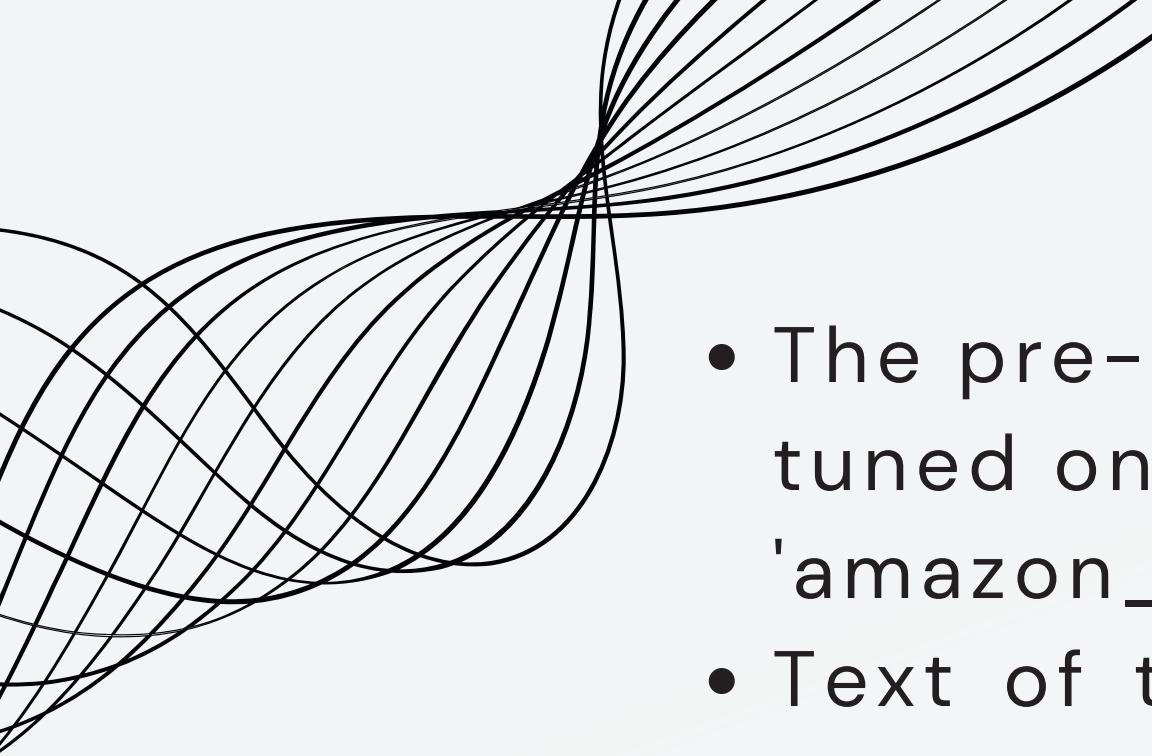
```
[ ] url='https://www.amazon.in/boAt-Immortal-121-Wireless-Signature/product-reviews/B0BKZFKQ3G/ref=cm_cr_arp_d_viewopt_srt?ie=UTF8&reviewerType=all_reviews&sortBy=recent&pageNumber=1'
```

	Reviews
0	I'm totally unsatisfied!!! Literally, looks is...
1	Amazing Amazon What i want i gotted
2	Boat immortal 121 Black The media could not be...
3	Got broken earpods Worst product
4	Only after few days of using this product left...
5	A great product but difficult to take earbuds ...
6	Wrost fiting It has wrost fiting and recieved ...
7	Look wise not good yet It sounds good and easy...
8	It's not worth purchasing They are very dedica...
9	Good product Good product but maintain some im...

OUTPUT

- The result is visualized as bar graph with positive and negative labels.
- The average value of positive and negative sentiment is displayed on the top of respective bar.





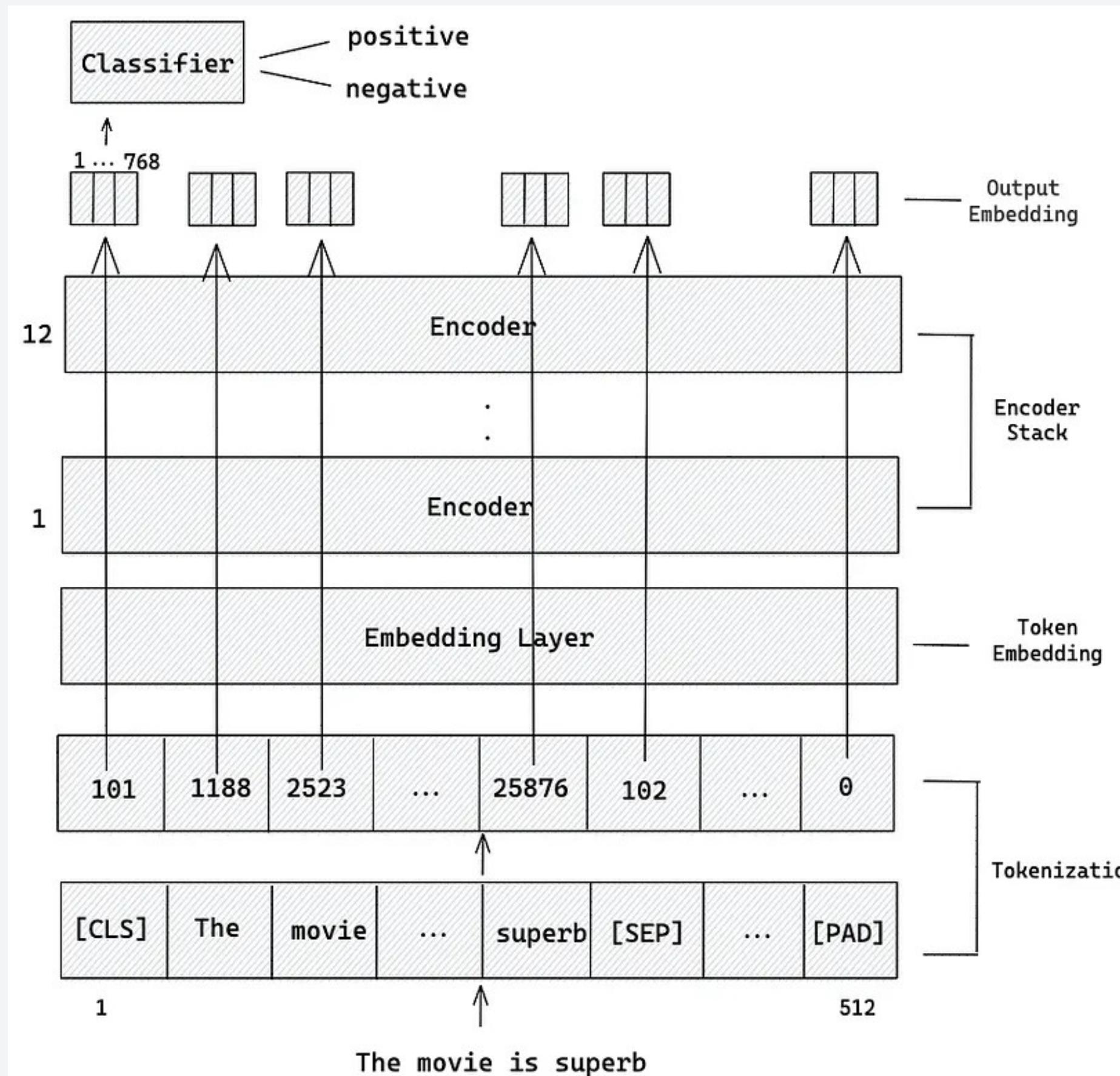
MODEL

- The pre-trained bert-base-uncased model is imported and fine-tuned on tensorflow 'amazon_us_reviews/Mobile_Electronics_v1_00' dataset
- Text of the review is tokenized and encoded into input_ids and attention_mask,mapped to label and given to the model.
- The output of the model is the percentage score for each label (negative , positive).

	Review	Sentiment
0	Does not work	0
1	This is a great wiring kit i used it to set up...	1
2	It works great so much faster than USB charger...	1
3	This product was purchased to hold a monitor o...	1
4	it works but it has really bad sound quality. ...	1

Model: "model"			
Layer (type)	Output Shape	Param #	Connected to
input_ids (InputLayer)	[None, 512]	0	[]
attention_mask (InputLayer)	[None, 512]	0	[]
bert (TFBertMainLayer)	TFBaseModelOutputWithPoolingAndCrossAttentions(last_hidden_state=None, 512, 768), pooler_output=None, 768), past_key_values=None, hidden_states=None, attentions=None, cross_attentions=None)	109482240	['input_ids[0][0]', 'attention_mask[0][0]']
dense (Dense)	(None, 1024)	787456	['bert[0][1]']
outputs (Dense)	(None, 2)	2050	['dense[0][0]']

WORKING OF MODEL



ASPECT-BASED SENTIMENTAL ANALYSIS

- It is performed using PyABSA framework.
- Aspects of the input product are identified from the reviews and their sentiments are classified into positive, negative and neutral.

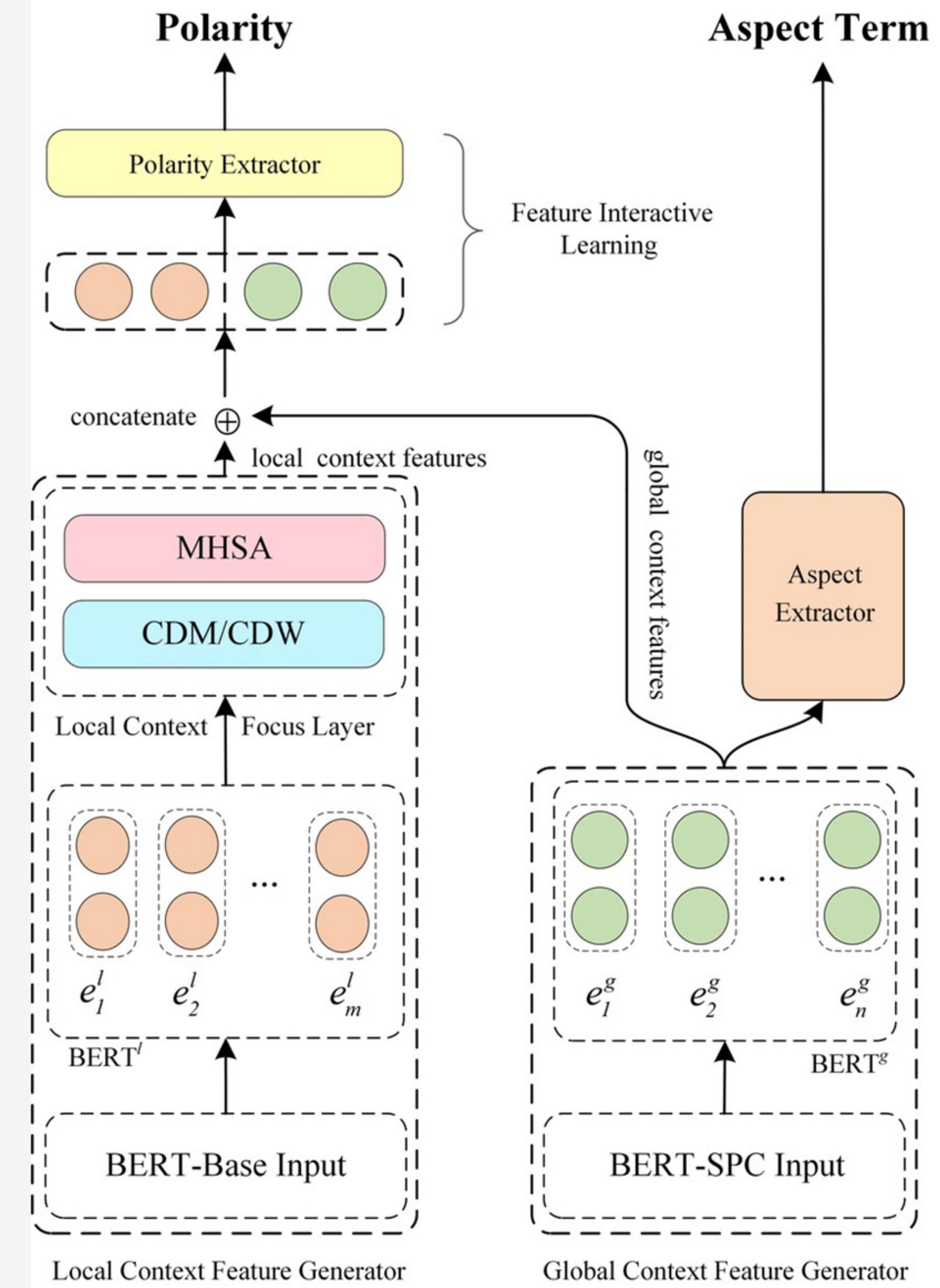
The screenshot shows a Jupyter Notebook cell with the following code:

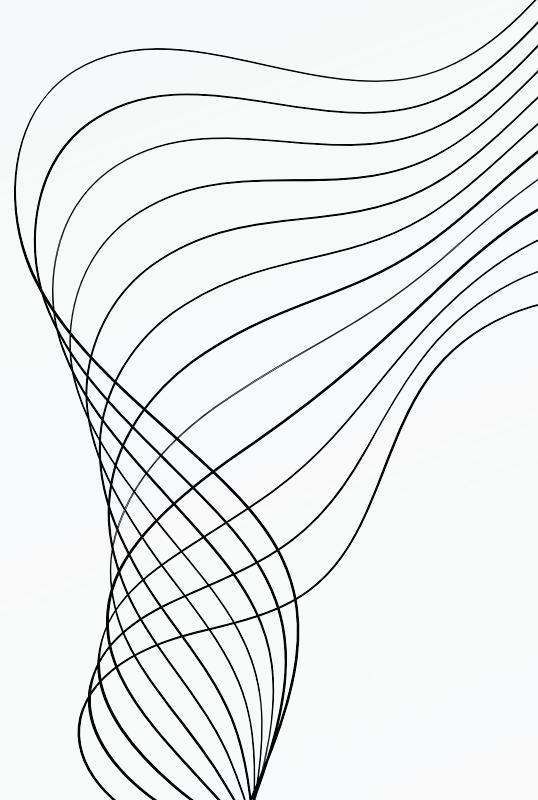
```
+ Code + Text  
✓ [36] print(ta)  
{'Amazon': 'Positive', 'immortal': 'Neutral', 'earpods': 'Negative', 'left ear pod': 'Negative', 'fiting': 'Negative', 'Look': 'Negative'}  
✓ [37] negative_asp=[]  
positive_asp=[]  
neutral_asp=[]  
for i in ta:  
    if ta[i]=='Negative':  
        negative_asp.append(i)  
    elif ta[i]=='Positive':  
        positive_asp.append(i)  
    else:  
        neutral_asp.append(i)  
  
✓ [38] print(positive_asp)  
print(negative_asp)  
print(neutral_asp)  
['Amazon', 'sounds', 'light']  
['earpods', 'left ear pod', 'fiting', 'Look', 'look', 'feel', 'mic quality']  
['immortal']  
✓ 0s completed at 21:45
```

The code defines a list `ta` containing product aspects and their sentiments. It then creates three empty lists `negative_asp`, `positive_asp`, and `neutral_asp`. A loop iterates over the items in `ta`, appending each item to the appropriate sentiment list based on its value. Finally, it prints the contents of all three lists.

ABSA MODEL ARCHITECTURE

- Aspect based sentiment analysis involves two tasks:
 - a. Aspect Term Extraction
 - b. Aspect Polarity Classification
- The ATEPC model uses BERT embeddings to extract aspects.
- Sentiment polarity classification is done for these aspects based on their context within review.



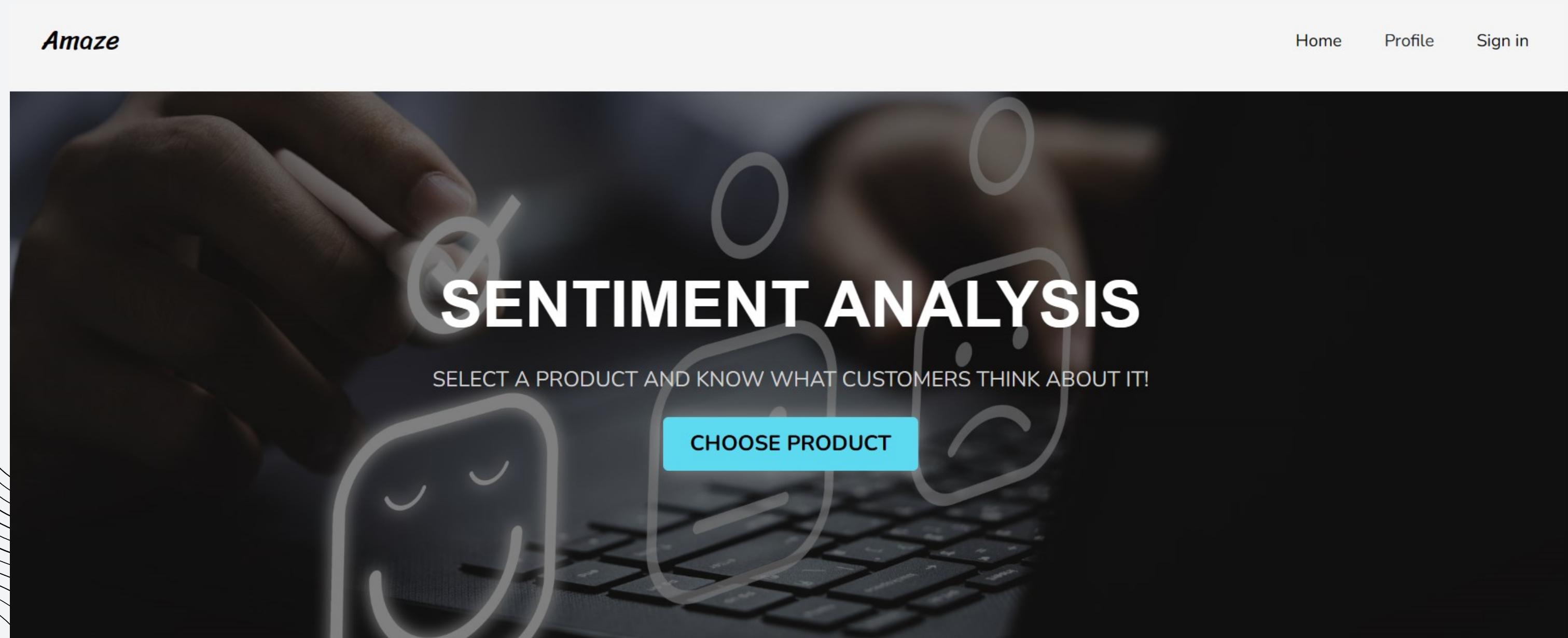


PROJECT AS WEBSITE



Landing page of website

- The home page of the website is shown as below, and if the user tries to choose the product before logging in an error "Login to continue" will be displayed.



SENTIMENT ANALYSIS

Find out how your product is being received by the public!

ASPECT-BASED SENTIMENT ANALYSIS

Find out what the customers like best in your product!

Signup page

- User need to be signed up to access the website.

Let's get you signed up!

Sign Up

Name *

This Field must be filled.

Surname *

This Field must be filled.

Email address *

Password *

SIGN UP

Already a member? Sign in: **SIGN IN**



Login page

- Firebase authentication is used.
- When the user enters credentials, the firebase verifies the data and redirects the user to home page.

Firebase Authentication

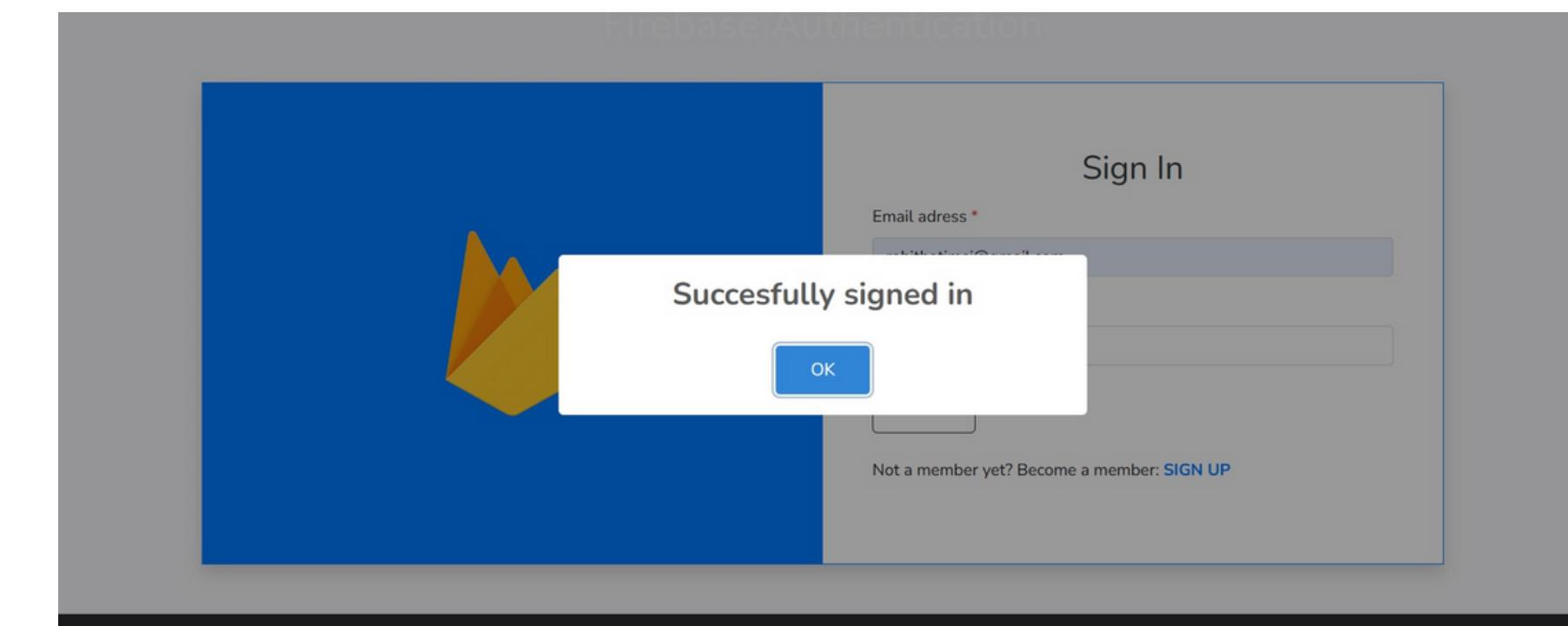
Sign In

Email address *

Password *

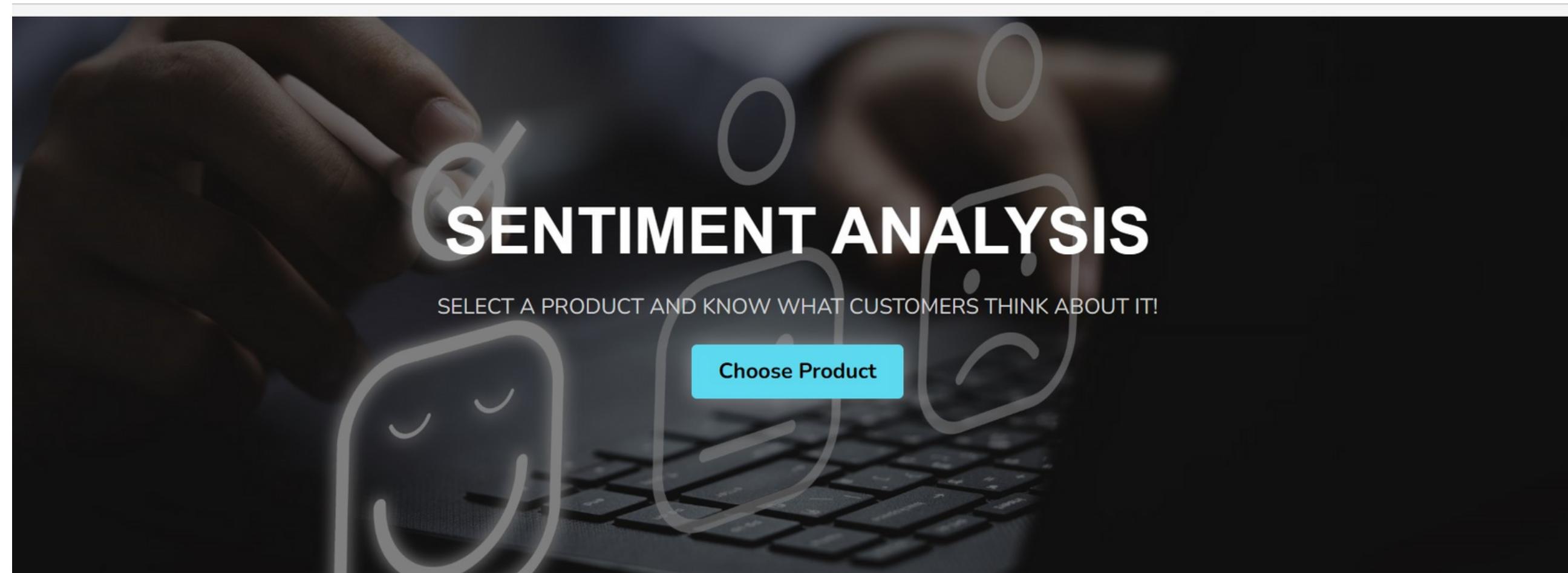
SIGN IN

Not a member yet? Become a member: [SIGN UP](#)



Home Page

- There are two buttons which redirects the user to either sentiment analysis or aspect-based sentiment analysis based on their choice.



SENTIMENT ANALYSIS

Go

Find out how your product is being received by the public!

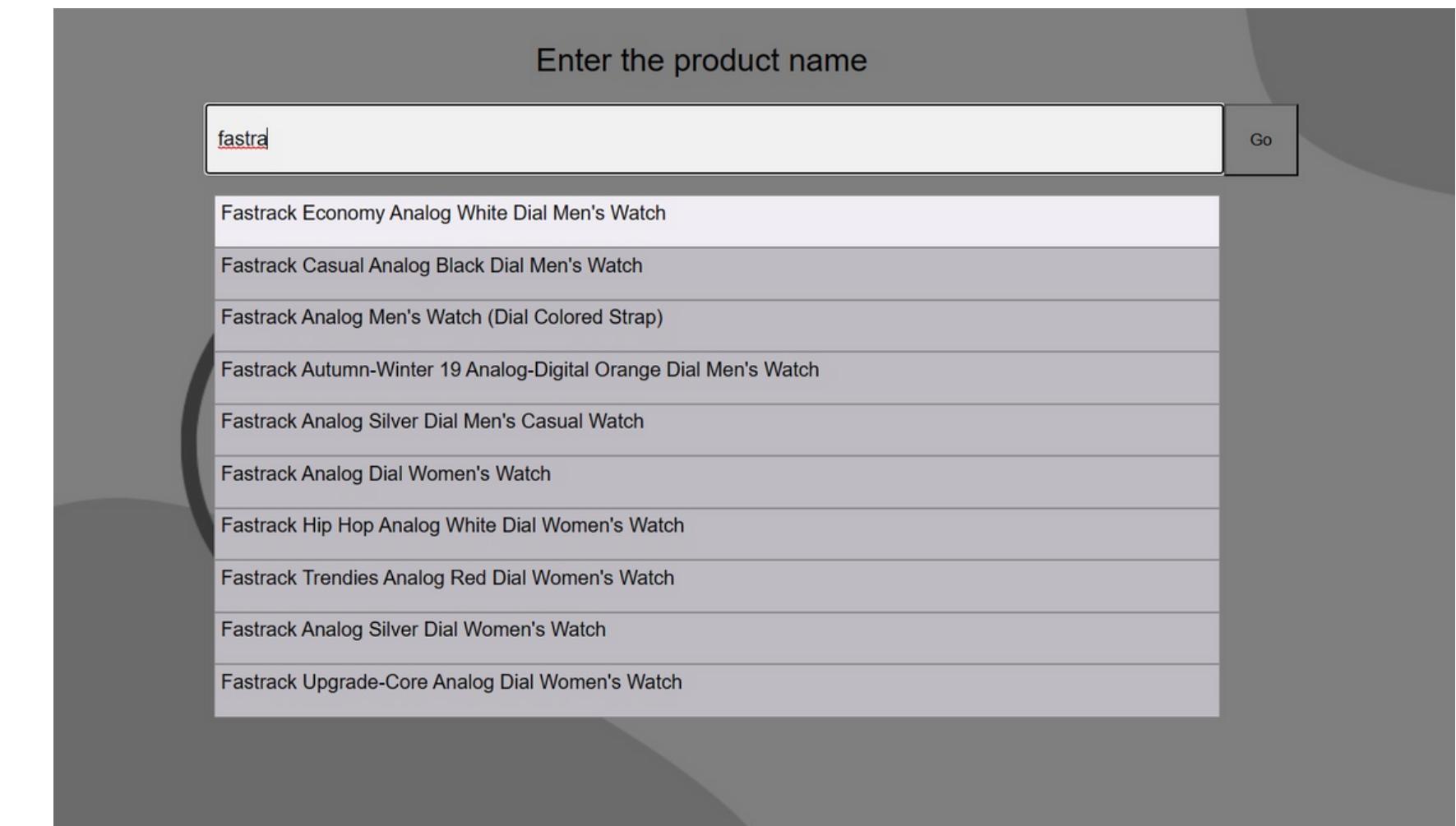
ASPECT-BASED SENTIMENT ANALYSIS

Go

Find out what the customers like best in your product!

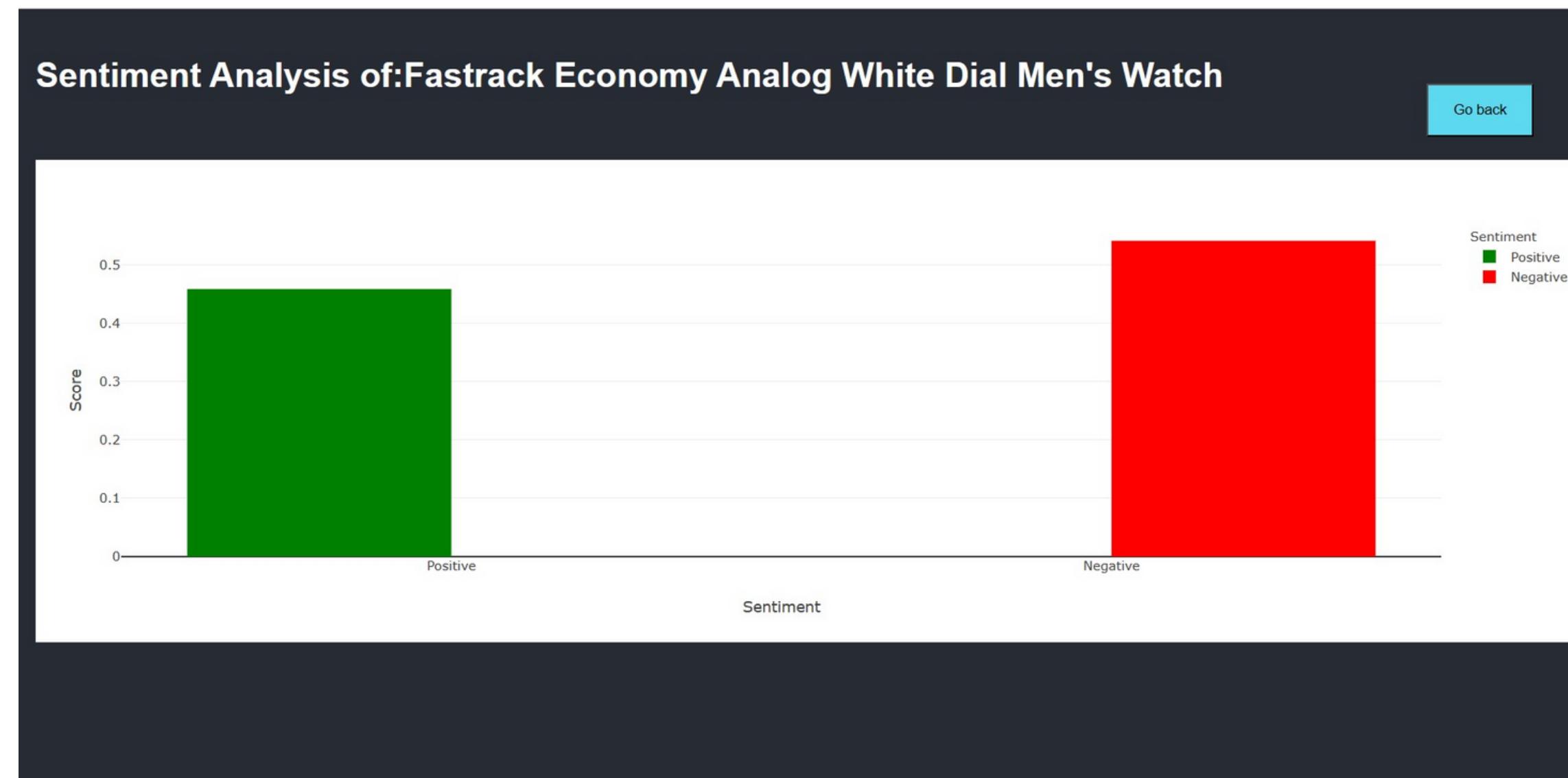
Choose Product

- The user has to select a product name.
- For this project, 90 products from amazon site are taken and mapped with their ASIN code.
- When the user selects a product, the ASIN of the product is retrieved and recent reviews from the amazon website are scraped.



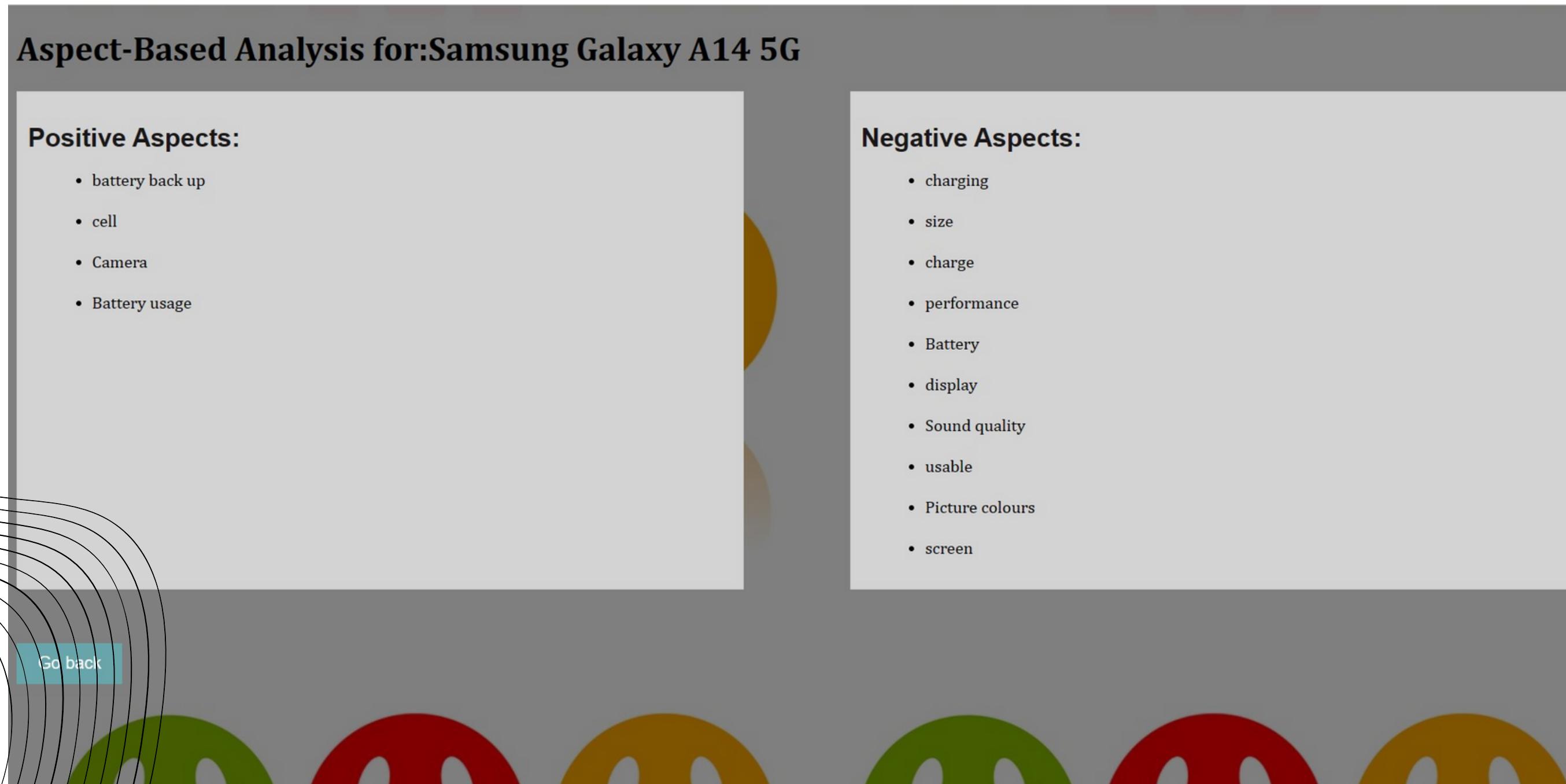
Result of Sentiment Analysis

- BERT model classifies the reviews into positive and negative and predicts their sentiment score.
- Average positive sentiment and average negative sentiment is calculated for the selected product
- The result is visualized as a bar graph.



Result of Aspect-based Sentiment Analysis

- Aspects are identified from the reviews and are classified into positive and negative aspects based on their polarity.



Process of Aspect-based Sentiment Analysis

Product Name: Samsung Galaxy A14 5G

Example 0: I bought this phone from physical store . The phone is advertised as having fast <charging:Negative Confidence:0.9609836339950562> capability . However , it only shows fast <charging:Negative Confidence:0.9609836339950562> indication momentarily on connecting to samsung original charger and cable . After that , it reverts to normal charging . I am using 20W charger . It takes more than 2 . 5 hours to reach 80 percent . Apparently , samsung has fooled the customers .

Example 1: Bulky is <size:Negative Confidence:0.9995181560516357> . Bit costly

Example 2: Worst phone I have purchased in my life . Your staff was saying that it has good battery back up and charging but it ' s taking 150 min to full <charge:Negative Confidence:0.99772709608078> and <battery back up:Positive Confidence:0.7420028448104858> is only last long 8 - 9 hours . I have purached phone on 19 Jun 23 and the <performance:Negative Confidence:0.9998435974121094> is very very lowest range . 0 out of 100 . Plz don ' t buy this phone

Example 3: The Samsung Galaxy A14 5G is a budget - friendly smartphone that offers a decent mix of features and performance . It has a 6 . 6 - inch 1080p LCD display with a 90Hz refresh rate , a MediaTek Dimensity 700 processor , 4GB of RAM , 64GB of storage , a 50MP rear camera , a 13MP front camera , and a 5 , 000mAh battery . The Galaxy A14 5G is a good choice for people who are looking for a basic smartphone with 5G connectivity . It ' s not the fastest phone on the market , but it ' s fast enough for most tasks . The display is sharp and vibrant , and the 90Hz refresh rate makes scrolling and animations feel smooth . The battery life is also excellent , and the phone can easily last a full day on a single charge . The camera is one of the weaker points of the Galaxy A14 5G . The main camera takes decent photos in good lighting , but the quality drops off significantly in low light . The front camera is also a bit underwhelming . Overall , the Samsung Galaxy A14 5G is a good budget - friendly smartphone with 5G connectivity . It ' s not the best phone on the market , but it offers a good value for the price . Here are some of the pros and cons of the Samsung Galaxy A14 5G : Pros : 5G connectivitySharp and vibrant display90Hz refresh rateLong battery lifeAffordable priceCons : Camera is not great in low lightFront camera is a bit

Example 4: Phone Nehi dabba hai yehh . <Battery:Negative Confidence:0.9997919201850891> is bad , <display:Negative Confidence:0.9998034834861755> is very bad , lags always , . <Sound quality:Negative Confidence:0.99981290102005> is very bad . I don ' t like it .

Example 5: One of the 3rd class mobile i have ever seen very disappointed go with oppo even they don ' t provide <charging:Negative Confidence:0.9998422861099243> adapter ..

Example 6: The phone is not easy <usable:Negative Confidence:0.9995518326759338> . <Picture colours:Negative Confidence:0.9996997117996216> and clarity are not good . Unnecessary , unwanted disturbing occurring in the <screen:Negative Confidence:0.9997795224189758> . Rectifications are needed .

Example 7: Good <cell:Positive Confidence:0.9997274279594421> . <Camera:Positive Confidence:0.999774158000946> clarity is good

Example 8: I thought Samsung had rectified there phones overheating issue , but it still the same . Within 2 days it started over heating on a normal use . Thanks to Amazon for there 7 days return policy

Example 9: Overall good . <Battery usage:Positive Confidence:0.9988691210746765> is according to how we use cellphone

THANK YOU

