**Comparing AND ANALYSING Sentiment Analysis of Apple Products on Social Media and E-Commerce Platforms**

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ABSTRACT

This research paper presents a case study focused on analysing public perceptions of Elon Musk after his latest decision to rebrand Twitter to X. Leveraging a dataset comprising 2000 Reddit comments, the study delves into five primary discussion topics and employs three distinct sentiment analysis methods to gain comprehensive insights. The findings shed light on the sentiment surrounding the businessman’s portrayal and offer valuable implications for understanding general reception in society.

**Keywords:** Elon Musk, Twitter, Reddit comments, Sentiment analysis, Topic modelling.

# Background & the problem domain:

In today's digitally interconnected world, the proliferation of social media and e-commerce platforms has revolutionized the way businesses engage with their customers. Companies now have the unprecedented opportunity to directly interact with their customers and gain insights into their preferences, opinions, and sentiments. This paradigm shift has brought forth the importance of sentiment analysis, a vital tool in understanding and leveraging customer sentiments for strategic decision-making.

Within this context, analyzing and comparing sentiment analysis of products on social media and e-commerce platforms holds immense significance. Because, in this way, it is possible to examine, analyze and compare the impressions of the users who buy the product and the general audience, which is unknown whether they buy the product or not. Apple Inc., a global technology leader renowned for its innovative products, has an extensive customer base that actively engages with the brand across various online platforms. Understanding the sentiments expressed by customers about Apple products on social media and e-commerce platforms is crucial for Apple's continued success in a highly competitive market.

The academic relevance of this project lies in its utilization of advanced data science techniques to extract meaningful insights from large volumes of unstructured textual data. Sentiment analysis, a subfield of natural language processing (NLP), presents an exciting opportunity to bridge the gap between qualitative customer opinions and quantitative analytics. By applying sentiment analysis methodologies, this project seeks to contribute to the field of sentiment analysis and NLP, demonstrating how these techniques can be employed to decipher complex customer sentiments in real-world scenarios.

From an industrial standpoint, this project has direct implications for enhancing business strategies and decision-making processes. Businesses are increasingly recognizing the significance of harnessing customer sentiments to drive product innovation, refine marketing strategies, and bolster customer satisfaction. The project aims to address a real-world challenge faced by businesses: deciphering the multifaceted sentiments customers express across diverse platforms, from casual social media discussions to structured e-commerce reviews.

The key problem domain the project addresses is twofold: the first one is the challenge of comprehensively understanding customer sentiments in an era of data deluge and the second one is the need to compare sentiments across different platforms to extract nuanced insights. Existing sentiment analysis techniques often fall short in capturing the intricacies of sentiment expression, especially when applied to diverse sources like social media posts and e-commerce reviews. Moreover, the disparity between sentiment expressions on social media platforms and those on e-commerce sites can obscure the true sentiment landscape.

By meticulously collecting and preprocessing data from social media platforms (YouTube and Reddit) and e-commerce platforms (Amazon and eBay), and employing sophisticated sentiment analysis methods, the project aims to shed light on the subtle variations in customer sentiment expression on distinct platforms. Additionally, through the aggregation of sentiment data over time and the identification of recurring themes and products, the project intends to unveil valuable patterns that can guide Apple's strategic decision-making processes.

The proposed project not only contributes to the academic field of sentiment analysis and NLP but also offers practical insights that can shape business strategies for companies like Apple. Through the holistic analysis of sentiments expressed on social media and e-commerce platforms, the project seeks to empower businesses with the tools to translate customer opinions into informed actions, ultimately elevating customer satisfaction and driving innovation in the competitive landscape.

As the field of sentiment analysis garners universal importance and continued development, numerous studies and projects have materialized. While Dupinder Kaur was trying to explain the sentiment analysis of tweets about Apple with machine learning via the Naive Bayes classifier, he found that positive sentiment predominates among tweets (<https://www.researchgate.net/publication/353072253_Sentimental_Analysis_on_Apple_Tweets_with_Machine_Learning_Technique> accessed on 10 August 2023). Jasmina Smailović et al. explored the use of sentiment analysis on Twitter data to determine significant events and forecast stock price changes, demonstrating success in predicting Apple stock movements based on tweet volume and sentiment polarity (<https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=ba53a72840a5e9dd5787235007a873984d3a4f3d> accessed on 10 August 2023). Hassan Saif et al. paper discussed using sentiment analysis on Twitter to monitor public sentiments towards organizations including Apple, introducing a novel approach of incorporating semantic concepts as additional features for sentiment prediction, leading to improved accuracy in identifying both negative and positive sentiments compared to traditional methods (<https://link.springer.com/chapter/10.1007/978-3-642-35176-1_32> accessed on 10 August 2023). Rubi Gupta et al. explored using sentiment expressed on StockTwits, a microblogging platform, to enhance stock price prediction by analyzing tweet contents and studying the correlation between aggregated daily sentiment and daily stock price movement for companies including Apple (<https://ieeexplore.ieee.org/abstract/document/9175549> accessed on 10 August 2023). Elly Indrayuni et al. examined Apple product reviews to classify sentiments using the Support Vector Machine algorithm and genetic algorithms for optimization, resulting in accuracy improvements from 70.00% to 85.76% and AUC enhancements from 0.924 to 0.945 compared to the SVM model without optimization. As can be seen, although there are studies focusing on different areas related to sentiment analysis specific to Apple, there has been no direct study comparing sentiment analysis in e-commerce and social media platforms. Thus, with this project, it was aimed to do what has not been done before. However, despite these endeavors, a direct study comparing sentiment analysis outcomes within e-commerce and social media platforms has remained elusive. This project seeks to bridge this gap and undertake a novel endeavor, aiming to fill a distinct niche that has thus far remained unexplored. Through meticulous data collection, rigorous preprocessing, and advanced sentiment analysis techniques, the project intends to carve a path of exploration that contributes not only to academic discourse but also to the strategic endeavors of companies operating within dynamic digital ecosystems.

# objectıves

The primary goal of this MSc project is to conduct a comprehensive comparative sentiment analysis of discussions related to Apple products on both social media and e-commerce platforms. The intention is to bridge the existing gap in knowledge by investigating the subtleties of sentiment expressions within these distinct digital landscapes. This research endeavours will employ advanced data science techniques to extract meaningful insights from unstructured textual data, making contributions to both the academic field of sentiment analysis and the practical world of business decision-making.

To begin, the project aims to assemble and curate a substantial dataset sourced from diverse platforms, encompassing social media outlets such as YouTube and Reddit, as well as e-commerce giants Amazon and eBay. This data will undergo meticulous preprocessing procedures to ensure its cleanliness and suitability for subsequent sentiment analysis.

The project will delve into the realm of sentiment analysis methodologies, investigating state-of-the-art techniques tailored to the specific characteristics of textual data extracted from social media and e-commerce platforms. The objective here is to adapt existing models or devise novel ones capable of accurately capturing the intricate nuances of sentiment expression.

An integral facet of the project is the in-depth comparative analysis of sentiment expressions between the distinct worlds of social media and e-commerce. The research will highlight notable similarities and discrepancies in sentiment trends, considering factors such as platform dynamics, user demographics, and the nature of the products under scrutiny.

Through the application of data aggregation techniques, the project aims to uncover recurrent sentiment patterns that emerge over time within these digital realms. By identifying prevalent themes, significant keywords, and recurring topics, the project intends to elucidate the drivers behind positive and negative sentiments for Apple products across both social media and e-commerce platforms.

The project's broader scope extends to the strategic implications these sentiment analysis outcomes hold for business decision-making. This involves interpreting the tangible impact on crucial aspects like product innovation, marketing strategies, and the enhancement of overall customer satisfaction. The project's aspiration is to offer actionable insights capable of steering companies like Apple toward refined strategies rooted in an astute understanding of customer sentiments.

While the primary focus remains on the practical applications of sentiment analysis, the project concurrently strives to enhance existing methodologies within the academic domain. By bolstering the discourse surrounding sentiment analysis and natural language processing, the project seeks to provide empirical evidence that illuminates sentiment variations across distinct digital platforms.

An essential component of the project is knowledge enrichment. The research endeavours to deepen understanding in the realm of advanced data science techniques and sentiment analysis, especially when applied in the real-world context of dynamic digital ecosystems. This aspect of the project is geared toward equipping the researcher with insights into the challenges and opportunities embedded in sentiment analysis across various online platforms.

Dissemination of the project's findings stands as another significant objective. The research aims to present its outcomes with Apple and the University of Westminster through academic papers, presentations, thus contributing to the broader research community's comprehension of challenges and solutions within the field of sentiment analysis.

Lastly, the project underscores its practical applicability and relevance within the industry. By showcasing how sentiment analysis can be harnessed to refine business strategies, particularly within the technology sector epitomized by Apple, the research endeavors to highlight the capacity of sentiment insights to guide companies through the dynamic evolution of the digital landscape.

The proposed objectives encompass a well-balanced synthesis of theoretical exploration, technical execution, and pragmatic implications. Through the systematic pursuit of these objectives, the project aims to fill a critical void in existing literature and present fresh insights that can enrich both academic discourse and industry practices. The temporal framework of the project has been meticulously designed to ensure the successful attainment of these objectives, all within the constraints of the designated MSc project duration.

# Project

The proposed MSc project aims to conduct a comprehensive comparative sentiment analysis of discussions related to Apple products on both social media and e-commerce platforms. This section outlines the methods and techniques to be employed to achieve the project's objectives, while also discussing possible alternatives and outlining a manageable project plan.

## Data Collection and Preprocessing

The project will begin by collecting data from various platforms, including YouTube, Reddit, Amazon, and eBay. This will involve utilizing web scraping techniques to extract user-generated content such as comments, reviews, and posts relevant to Apple products. Additionally, metadata like timestamps, user profiles, and platform-specific features will be collected to provide context for the subsequent sentiment analysis.

## Sentiment Analysis Techniques

To address the complexity of sentiment expression within diverse platforms, a combination of existing sentiment analysis methods will be explored and adapted. These techniques may include lexicon-based approaches, where sentiment scores are assigned to individual words and phrases using sentiment dictionaries. Machine learning models, such as Naive Bayes, Support Vector Machines (SVM), or deep learning models like Recurrent Neural Networks (RNN) or Transformer-based models like BERT, will also be tried to develop. LexMo will be applied to conduct a respective emotion analysis.

## Comparative Analysis and Insights

The core of the project involves a detailed comparative analysis of sentiment expressions across social media and e-commerce platforms. This will be achieved by comparing sentiment trends over time, investigating potential variations, and performing an aspect-based comparison to understand differences in sentiment expression.

## Output and Project Management

The project's outcomes will encompass sentiment analysis models trained to accurately assess sentiments within Apple-related discussions on various platforms. Additionally, the project will produce insightful visualizations depicting sentiment trends, comparisons, and patterns to facilitate interpretation. The research findings and methodologies will be documented in a research paper and presentations for sharing with the University of Westminster and potential collaboration with Apple.

The project's management will be organized through a series of milestones. The initial phase involves data collection and preprocessing, spanning Weeks 1 to 4. This phase aims to collect and clean data from different platforms, ensuring data compatibility and quality.

The subsequent phase, spanning Weeks 5 to 6, focuses on sentiment analysis model development. During this period, the project will experiment with various sentiment analysis techniques, refine the models, and ensure their robust performance on both social media and e-commerce data.

The third phase, Weeks 7 to 10, involves comparative analysis and pattern recognition. This stage is dedicated to conducting a detailed comparative analysis, identifying sentiment patterns, and extracting valuable insights from the sentiment data.

The final phase, Weeks 11 to 12, centers on documentation and dissemination. During this period, the project will compile research findings, create visualizations, draft the research paper, and prepare presentations to share outcomes with relevant stakeholders.

## Alternative Approaches and Likelihood of Success

While the proposed approach focuses on adapting and combining existing sentiment analysis techniques, it's important to acknowledge potential alternatives. If discerning meaningful insights from the contrast in sentiment analysis between social media and e-commerce platforms proves to be ineffective, or if the existing data is deemed inadequate, supplementary data reinforcement can be procured via a meticulously designed survey. Furthermore, in cases where the sentiment analysis methodologies aforementioned fall short, supplementary techniques and approaches will be employed. This is particularly pertinent during the data acquisition phase, wherein a diversified spectrum of scraping and API mechanisms will be leveraged to enrich the data collection process while simultaneously mitigating potential issues.

The project's likelihood of success is bolstered by the availability of relevant data sources and established sentiment analysis techniques. The comprehensive milestone-based project plan ensures steady progress and manageable execution within the defined 12 weeks, aligning with the scope of an MSc level project. This project's approach leverages a multi-faceted sentiment analysis technique and a well-defined project plan to achieve its objectives of comparative sentiment analysis between social media and e-commerce platforms. The project aims to contribute to both academic understanding and practical business insights. Gant chart ekle.

# resources

To ensure the successful execution of this project, a variety of resources will be required, each serving a specific purpose in achieving the project's objectives.

## Hardware Resources:

A high-performance personal computer will serve as the backbone for various project tasks, including data preprocessing, model development, and analysis. Additionally, ample storage space is essential to accommodate the extensive datasets, preprocessed files, trained models, and intermediate results that will be generated throughout the project.

## Software Resources:

The project heavily relies on software tools and libraries that enable efficient development and analysis processes. The Python programming language will be the foundation for various tasks such as data processing, sentiment analysis, and model implementation. Web scraping tools, such as Praw, Google API Client, BeautifulSoup and Selenium, will be essential for data collection from platforms like YouTube, Reddit, Amazon, and eBay. Machine learning libraries like scikit-learn, TensorFlow, and PyTorch will facilitate the creation and experimentation of sentiment analysis models. Natural Language Processing (NLP) libraries like NLTK and spaCy will support text preprocessing and linguistic analysis. To implement sentiment analysis, prebuilt tools like VADER for lexicon-based analysis and Hugging Face Transformers for advanced models like BERT will be utilized. Data visualization tools, including Matplotlib and Seaborn, will be employed to convey sentiment trends visually. Version control through Git and platforms like GitHub will aid in collaborative development. An Integrated Development Environment (IDE) like Jupyter Notebook or Visual Studio Code will be used for code development and experimentation.

## Library and Research Resources:

Access to academic journals, papers, and online resources is crucial to stay informed about the latest sentiment analysis techniques and methodologies. Platforms like arXiv, IEEE Xplore, and ResearchGate will provide valuable research materials. Moreover, platforms such as Medium, Kaggle, and Towards Data Science, which serve as hubs for knowledge dissemination within the realm of data science, will be harnessed for comprehensive resource exploration and meticulous methodology analysis. These resources will guide the project's decisions, ensuring alignment with best practices and innovation in the field.

## Data Resources:

Data collection is fundamental to this project's success. To gather data from social media and e-commerce platforms, access to relevant APIs is necessary. Social media APIs from platforms like YouTube and Reddit will be used for scraping data from user-generated content. Similarly, e-commerce APIs from platforms like Amazon and eBay will provide access to product reviews and descriptions. For platforms without APIs, custom web scraping scripts will be developed to extract the required textual data.

## Stakeholder Collaboration:

Collaboration with stakeholders is vital for gaining domain-specific insights and refining the project's outcomes. Potential collaboration with Apple Inc. could offer invaluable insights and enhance the practical implications of the research findings. Additionally, the University of Westminster's resources, including research facilities, libraries, and academic expertise, will provide guidance and feedback, enriching the project's overall quality.

## Project Timeline:

To ensure a well-paced progress, a carefully designed timeline is essential. Allocating sufficient time to each project phase, including data collection, preprocessing, model development, analysis, and documentation, will enable a thorough and successful execution. Regular monitoring against predefined milestones will facilitate timely completion and provide room for adjustments as needed.

In summary, these combined hardware, software, library, data, stakeholder collaboration, and timeline resources will work in tandem to support the accomplishment of the project's goals. The strategic utilization of these resources will contribute to generating valuable insights that bridge the gap between academic understanding and practical applications in the dynamic landscape of sentiment analysis and digital ecosystems.

A graph with numbers and a line

Description automatically generated

**Figure 2** *This is a screenshot of the Total Market Revenue line graph from Power BI.*

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