**Asklytics**  
***An LLM for Website Analytics with Sentiment Analysis of Google Analytics 4 (GA-4) & Google Maps Reviews Data***

**Course: COMP 4495**

**Applied Research Project**

**Section: 001**

**Team Lead**

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**Team Members**

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**Date of Submission:**  
26.01.2025

Table of Contents

[Introduction 1](#_Toc188790766)

[Domain 1](#_Toc188790767)

[Background & Context 1](#_Toc188790768)

[Problems to Solve 1](#_Toc188790769)

[Existing Tools 1](#_Toc188790770)

[Hypothesis, Assumptions & Benefits 2](#_Toc188790771)

[Proposed Research Project 2](#_Toc188790772)

[Research Design and Objectives: 2](#_Toc188790773)

[Methodology and Justification: 2](#_Toc188790774)

[Data Collection: 3](#_Toc188790775)

[Technologies: 3](#_Toc188790776)

[Expected Results: 3](#_Toc188790777)

[Riipen External Partners or Affiliates 4](#_Toc188790778)

[Project Planning and Timeline 4](#_Toc188790779)

[Project Contract 6](#_Toc188790780)

[Work Date/Hours Logs 7](#_Toc188790781)

[Closing and References 7](#_Toc188790782)

# Introduction

### Domain

In the modern era of data-driven decision-making, organizations increasingly rely on web analytics to understand user behavior, optimize website performance, and enhance customer satisfaction. Google Analytics 4 (GA4) serves as a powerful tool for gathering web traffic data, offering insights into metrics such as bounce rates, user sessions, and engagement patterns. However, despite its utility, interpreting this data can be overwhelming for non-technical users, limiting its accessibility and practical application.

### Background & Context

This project addresses the challenge of making website analytics user-friendly by developing an AI-powered chatbot capable of answering natural language queries. Beyond the standard analytical insights, the chatbot will also integrate sentiment analysis capabilities to classify customer feedback into positive, neutral, or negative sentiments. This dual approach not only simplifies data interpretation but also provides actionable insights for businesses to improve their offerings and customer engagement strategies.

### Problems to Solve

The key problems this project aims to solve include:

1. The steep learning curve associated with understanding and using GA4 data.
2. The absence of conversational interfaces in current analytics tools.
3. The lack of integrated sentiment analysis in interpreting user feedback along with the real time impact on user interest in business’s website.

### Existing Tools

Existing research and tools focus heavily on data visualization and automated reporting but rarely incorporate natural language interfaces tailored to specific analytics questions. By leveraging Natural Language Processing (NLP) models, sentiment analysis techniques, and predictive analytics, this project fills a critical gap in website performance analysis and feedback interpretation.

### Hypothesis, Assumptions & Benefits

Our hypothesis is that an intuitive, AI-driven chatbot combined with sentiment analysis will empower users to derive meaningful insights without requiring technical expertise. This project has the potential to enhance decision-making, reduce the time spent on manual analysis, and improve customer-centric strategies for organizations.

# Proposed Research Project

Research Design and Objectives:  
The overarching goal of this project is to create an interactive chatbot that simplifies website analytics and enhances customer feedback analysis. The specific objectives include:

1. Implementing a natural language interface to process and respond to queries about website performance metrics.
2. Visualizing GA4 data in an accessible and interactive format.
3. Classifying user feedback into sentiment categories (positive, neutral, and negative).
4. Providing predictive insights for future website performance and detecting anomalies in traffic patterns.

### Methodology and Justification:

* Natural Language Understanding (NLU): The chatbot will be powered by a fine-tuned transformer-based model such as BERT, tailored to analytics-related queries. BERT's ability to understand context and semantics ensures accurate responses to user questions.
* Sentiment Analysis: User feedback will be analyzed using pre-trained sentiment analysis models such as VADER or en\_core\_web\_lg. These models have proven effective in classifying text sentiments, particularly for reviews and social media data.
* Predictive Analytics: To forecast website traffic trends, models like ARIMA and Prophet will be used. Anomaly detection will be implemented with Isolation Forest or DBSCAN to identify unusual patterns in the data.
* Visualization: Data visualization will be achieved using Chart.js and Plotly to ensure clarity and interactivity, enabling users to explore metrics like traffic sources, engagement rates, and bounce rates.

### Data Collection:

1. GA4 Data: Metrics such as user sessions, bounce rates, and page views will be retrieved using the Google Analytics Data API.
2. Google BigQuery: Google Merchandise Ecommerce Store publicly available data will be used as training dataset.
3. User Feedback: Publicly available datasets containing user reviews will be preprocessed and used for sentiment analysis.

### Technologies:

* Operating System/Platform: Linux (Ubuntu 24.04 LTS).
* Programming Languages: Python for backend and machine learning tasks, JavaScript for frontend development.
* Frameworks: Django (backend) and React.js (frontend).
* Database: PostgreSQL for managing user sessions, interaction logs, and derived insights.

Expected Results:  
The expected outcomes of this project are:

1. A conversational AI-powered chatbot that responds accurately to user queries about website analytics.
2. Interactive visualizations that make data exploration intuitive and user-friendly.
3. Sentiment classification of user reviews, identifying patterns and trends in feedback.
4. Predictive models that provide insights into future website performance and flag anomalies in real-time.

Riipen External Partners or Affiliates  
This project does not involve any Riipen external partners or affiliates.

# Project Planning and Timeline

**Timeline and Milestones:**

| **Phase** | **Milestone** | **Deliverables** | **Deadline** |
| --- | --- | --- | --- |
| 1 | Topic Research, Projects & Repo Setup | Proposal Submission | Jan 26, 2025 |
| 2 | **Analytics:**   * NLP Pipeline Implementation,   **Development:**   * Chat Interface Complete (React) * User Mood Meter Complete (React) * REST API design (Partial) | Fine-tuned BERT model for natural language queries | Feb 14, 2025 |
| 3 | **Analytics:**   * Sentiment Analysis   **Development:**   * OAuth2 flow (Complete) * Implement RESTAPI endpoints with mock data except OAuth2 (complete) | Sentiment classification module for user feedback | Feb 28, 2025 |
| 4 | **Analytics:**   * Data Visualization   **Development:**   * Integrating RESTAPI with Frontend (Complete). * Adding Plots/Charts generation in React (Partial) | Integrated Chart.js and Plotly components | Mar 14, 2025 |
| 5 | **Analytics:**   * Predictive Analytics   **Development:**   * Adding Plots/Charts generation in React (Complete) | Traffic forecasting and anomaly detection models | Mar 28, 2025 |
| 6 | Integration & Testing | Fully functional system with end-to-end testing | Apr 10, 2025 |
| 7 | Final Submission | Complete documentation and video demonstration | Apr 15, 2025 |

**Team Responsibilities:**

* **Mohamed Nuskhan Niyas:** Responsible for leading the LLM training, testing, improving & creating NLP pipeline implementation.
* **Tamoor Haider Aslam:** As a Teamlead, Tamoor will be responsible for project management, communication, giving direction, removing blockers etc. Also he will take part in LLM testing, frontend and backend architecture design and development.

**Project Management Chart:**  
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# Project Contract

We, the undersigned, accept & agree with the scope, milestones, and timelines outlined in this proposal. Regular meetings and progress updates will be conducted to ensure the project is completed successfully.

**Digital Signatures:**  
**Mohamed Nuskhan Niyas**: \_\_\_\_*Mohamed Niyas Mohamed Nuskhan*\_\_\_\_\_\_\_\_\_\_

**Tamoor Haider Aslam**: \_\_\_\_*Tamoor Haider Aslam* \_\_\_\_\_\_\_\_\_\_

# Work Date/Hours Logs

| **Student Name** | **Date** | **Hours** | **Description of Work Done** |
| --- | --- | --- | --- |
| Tamoor Aslam | Jan 18, 2025 | 3 | Research on Project Ideas   * Audio to sign language avatar video |
| Mohamed Nuskhan | Jan 20, 2025 | 3 | Researched GA4 API documentation and integration methods. |
| Tamoor Aslam | Jan 25, 2025 | 2 | Set up repos, worked on proposal doc. |
| Tamoor Aslam | Jan 26, 2025 | 2 | Formatting, proofreading & referencing. Setup React & Django projects |
| Mohamed Nuskhan | Jan 22, 2025 | 1.5 | Implemented initial prototype for natural language queries. |

# Closing and References

**Acknowledgments:**  
Special thanks to Douglas College for providing access to resources, tools, and guidance essential for this project.

**References:**

1. Devlin, J., et al. (2018). *BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding.*
2. Google Developers. (2025). *Google Analytics Data API Documentation.* Retrieved from <https://developers.google.com/analytics/devguides/reporting/data/v1>.
3. Hutto, C., & Gilbert, E. (2014). *VADER: A Parsimonious Rule-Based Model for Sentiment Analysis of Social Media Text.*