Problem Description

There are not enough tools that help people track their mental health and analyze trends over time. We sought to build a journaling app that would allow users to log entries, then use text analysis to identify emotions in their writing. We sought to provide additional analysis tools such as charts aggregating emotions over time and suggestions for addressing concerns raised by the user in their journal. We sought to equip the app with features that made it intuitive and easy-to-use, such as a search function for entries, a calendar displaying the user's history, and standard authentication and account functionality. Finally, we wanted to make this app available on iOS and Android to ensure everyone could use it.

Motivation

There are several gaps in available mental health tools concerning emotion tracking. Firstly, people with mental health problems often do not have access to people who can listen to their problems. Professional therapists and psychiatrists can charge 250-500 CAD per hour in Ontario[1]. Beyond the fact that this is a high cost for an average person to pay, many mentally ill people struggle to work consistently as a result of their symptoms. Secondly, stigma often stops people from reaching out to friends, families, and therapists--even if therapy is financially and logistically accessible to them. Finally, there are not enough labelled tracking tools for mentally ill people recording their feelings and thoughts. Therapists often recommend journaling and self-monitoring to their patients. While this can be done with a paper and a pen, it is often overwhelming for people who are already struggling to attempt to analyze dozens or hundreds of entries to notice useful trends. We understand that self-analysis can be useful and is arguably more effective than machine analysis. However, self-analysis is not useful to people who lack the energy, motivation, and time; these people are currently likely to do no analysis at all. Mental illness is an extremely important problem: it takes and ruins people's lives. We were motivated to make this project because we wanted to improve, if only slightly, ordinary people's capacity to take the first steps to addressing their problems.

Concerning datasets, there are a number of reasons why current emotion-related data is lacking. Firstly, it is difficult to find organic labelled data to train models on. When people write about their emotions, they often adhere to a set of habits that are understandable but inconvenient for research. They tend to write about their emotions privately, meaning that it is difficult to get good data by trawling the internet. When people do write about their emotions publically (which happens most commonly on social media), it is difficult to extract accurate labels for the text. Emotion is extremely subjective and personal. People are also often insincere and sarcastic online, and the short nature of most social media posts means that it is difficult for machines to discern the context necessary to determine which emotion a user genuinely feels when they right a tweet or a Reddit comment.

Data Description

BERT (Bidirectional Encoder Representations from Transformers) represents a significant advancement in natural language processing (NLP) developed by Google researchers in 2018.

Unlike previous language models that processed text in a unidirectional manner, BERT implements bidirectional context understanding. This means the model can analyze and understand words in relation to their surrounding context from both left and right directions, which more closely mimics human language comprehension.

The model is pre-trained on two primary tasks: masked language modeling and next sentence prediction. In masked language modeling, some percentage of input tokens are randomly masked, and the model must predict those masked words based on their context. Next sentence prediction involves the model determining whether two given sentences are consecutive in the original text.

BERT's architecture is built on the Transformer neural network architecture, utilizing self-attention mechanisms that allow the model to weigh the importance of different words in a sentence when generating representations. There are two primary versions: BERT-base (with 110 million parameters) and BERT-large (with 340 million parameters).

bert-43-multilabel-emotion-detection (which will be referred to from now on as bert-43) is a pre-fine-tuned version of BERT. It was trained by Boris Atayan, who uploaded it to Hugging Face under the account borsin70. bert-43 was trained on three primary datasets: Tweet Emotions, GoEmotions, and synthetic data. We were unable to obtain information on the synthetic data used to train bert-43.

GoEmotions is a dataset developed by Google. It contains 58 009 Reddit comments from 2005-2019 labelled by humans with emotions. The labelset includes 27 emotions, which are organized according to a taxonomy that considers their valence. Crucially, this dataset is quite unbalanced.

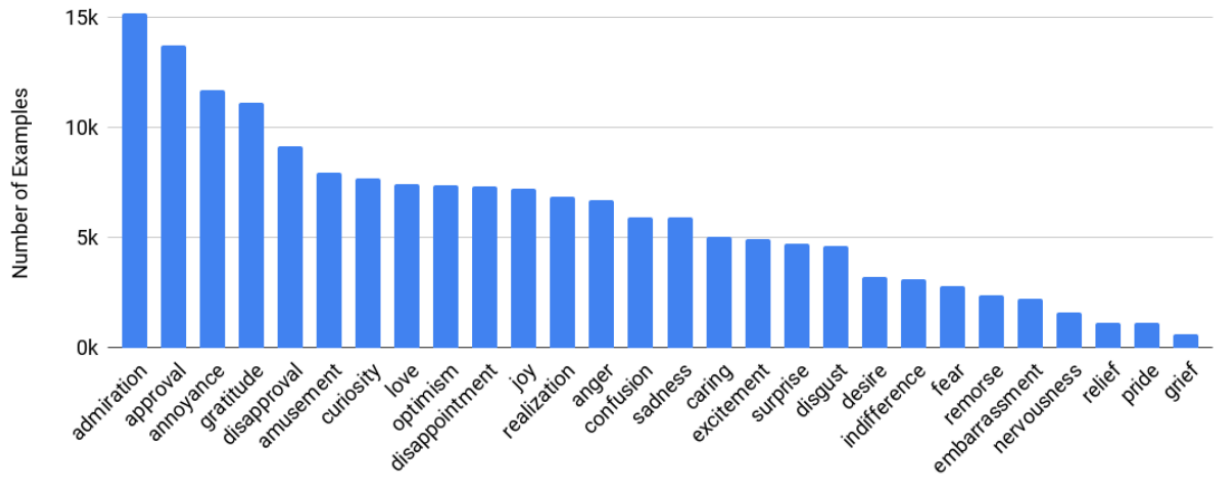

Figure 1. A chart showing the distribution of emotions found in the GoEmotions dataset[2]

Tweet Emotions is a dataset comprised of roughly 40 000 tweets with corresponding emotion labels. It was published by Pashupati Gupta on Kaggle. It contains a set of 13 emotion labels.

bert-43 uses a combination of the labelsets of these two datasets. Further exploration should be performed on the exact breakdown of the influence of each dataset on the model. From preliminary testing of 100 journal samples, we determined that some of the labels found exclusively in Tweet Emotions appeared at a much higher rate than the rest (especially the “neutral” label). However, aside from the overrepresentation of neutral, our test set of journal entries were labelled by bert-43 with emotions that we generally considered to be accurate and correctly identified. This motivated our decision to stick with bert-43 instead of training a new model for our application.

Methodology

In addition to bert-43-multilabel-emotion-detection, we used several technologies to create our app.

Figma

We used Figma to design the user interface. We set out to design a homepage, a journal entry screen, an analysis screen, an insights screen, a settings screen, and a calendar screen. We ensured that each screen was aesthetically calming by using softer colours, intuitive buttons, and relaxing images. We followed this method because our target demographic includes people who are stressed out and/or unwell.

React Native

React Native is an open-source development framework started by Facebook (now Meta). We used it to write an app that would be functional on both iOS and Android. We wrote most of the code in Javascript, with HTML and CSS mixed in to structure pages and style components respectively.

Most of the structuring of the code and the app layout was done in React Native. We knew we wanted most screens to be easily accessible from a navigation bar, but not all screens. For example, it would be impractical to allow the user to directly navigate to any journal entry from the bar--there would potentially be hundreds to display and choose from, and that is not feasible with the limited space provided by a phone screen. We solved this problem by using nested navigators. In terms of the structure of the code, we divided it into several sections. The screens folder holds files with code for the screens. The utils folder holds most of the ancillary functions needed to run the app. This includes the interface with the API that is used to send and retrieve information to the analysis models, the functions that aggregate and filter data for the insights page, and maps of emotions to colours and images that are used to represent them

throughout the app (for example, dates on the calendar page are coloured according to a formula that produces a colour from the set of top emotions for the entry on that day (if an entry exists)).

We had a number of difficulties with React Native. Firstly, despite the fact that it allows apps to be built for both Android and iOS, it does not handle all differences between the platforms. We discovered that we had to be mindful about which libraries we used (especially for styling) because some worked for Android but not iOS and vice versa. Secondly, many tools designed for React are ambiguous about their compatibility with React Native. We initially tried to utilize NLP models via web workers in order to efficiently distribute computing power. Unfortunately, web workers are incompatible with React Native, and they only produce errors down the line, which made it difficult to identify the problem. We also struggled to find libraries that would help us design charts that aggregated the journal entry analyses for the insights screen. react-native-chart-kit seemed promising, but it lacked the flexibility we needed (it does not allow developers to manually set the scale for line charts)

Results

The app is functional and produces effective analysis. Qualitative testing shows that the app produces acceptable insights into journal entries regardless of length, subject, writing style, and tone. Below is a series of images showing the completed screens of the app captioned with explanations of their functions.

Login & Sign Up Page

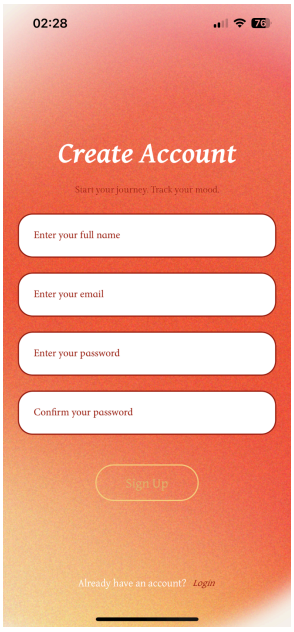

Figure 1

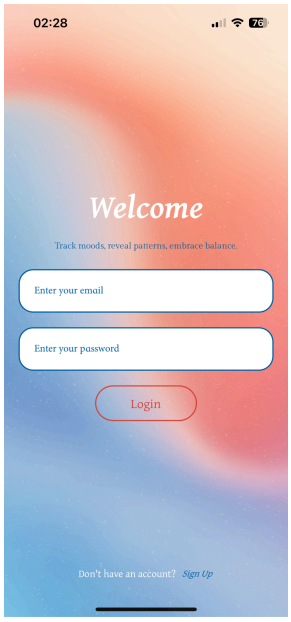

Figure 2

Figure 1 : The MoodLight login screen with email and password fields on a calming gradient background.

Figure 2: The sign-up screen for creating an account with name, email, and password fields.

Home Page

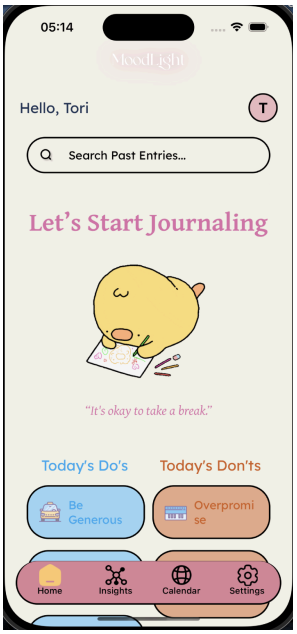

Figure 3

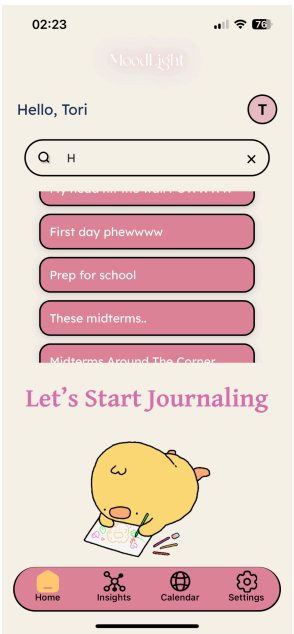

Figure 4

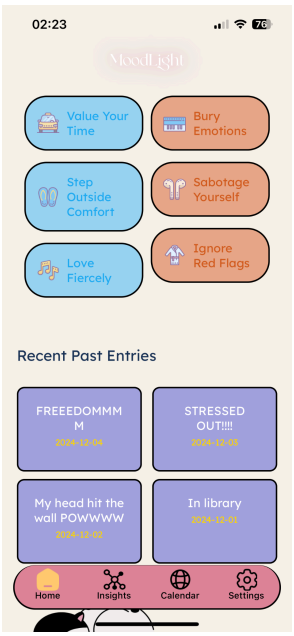

Figure 5

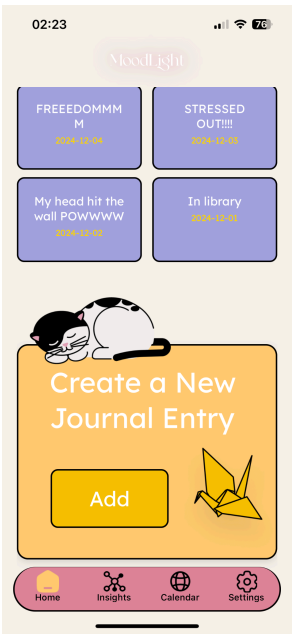

Figure 6

Figure 3: The **MoodLight** homepage features a welcoming message, a daily motivational quote, and a playful image to encourage users to begin journaling.

Figure 4: The interactive homepage includes a **search bar** to filter and find past journal entries quickly.

Figure 5: The insights page provides daily **"Do's"** and **"Don'ts"** suggestions alongside recent journal entries that are clickable!

Figure 6: The home screen displays recent journal entries with a clear **"Create a New Journal Entry"** button, encouraging users to add new reflections seamlessly.

Create a New Entry

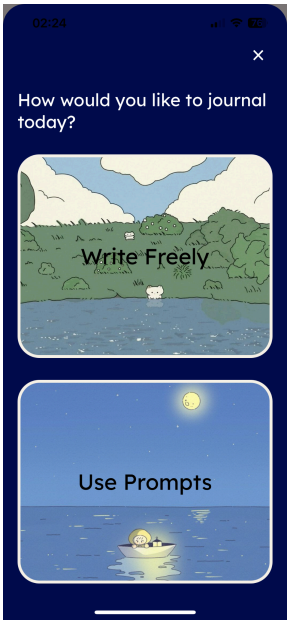

Figure 7

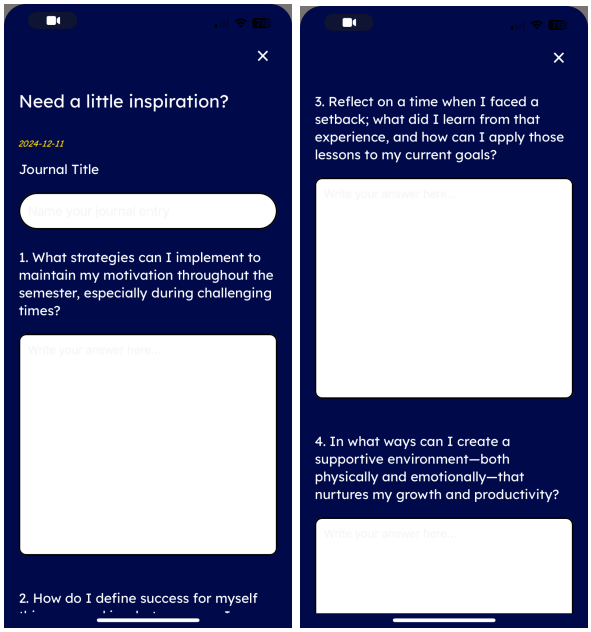

Figure 8

Figure 9

Figure 7: The journal entry mode selection screen offers two options: **“Write Freely”** for unstructured journaling and **“Use Prompts”** for guided inspiration.

Figure 8: The page offers mood-based prompts that guide users to reflect on past journal entries, encouraging thoughtful responses such as strategies for maintaining motivation during challenges.

Figure 9: The “Dear diary…” page allows users to freely create and save their journal entries with a title and open-ended input field.

Calendar

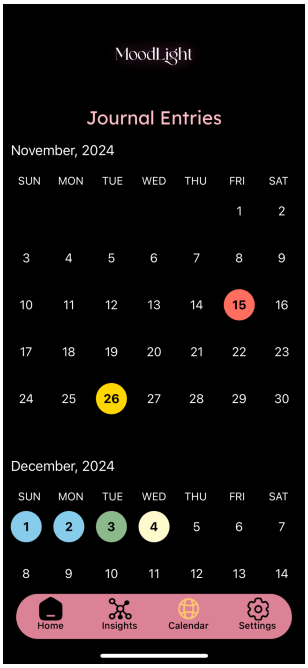

Figure 10

Figure 10: The **Calendar** allows users to create new entries by clicking on empty days or view existing ones by selecting the **colored circles**. Each color represents a recorded mood for that day. Filling in entries daily transforms the calendar into a vibrant visual of emotions over time.

View/Edit/Delete Entry

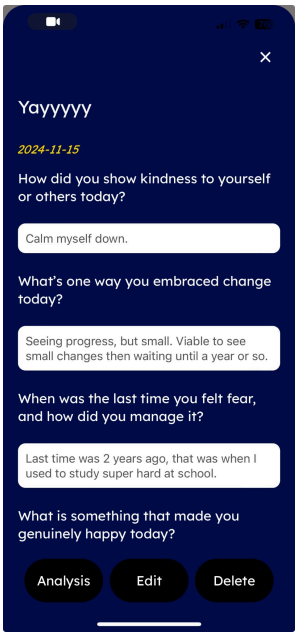

Figure 11

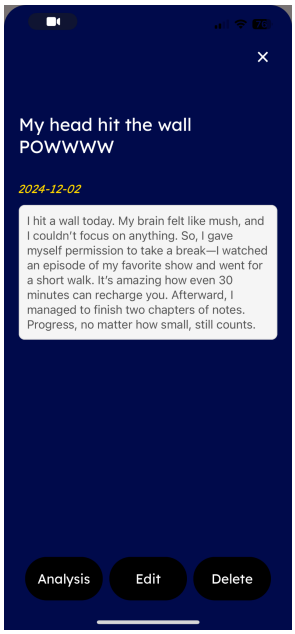

Figure 12

Figure 11: This journal entry, created using the **“Use Prompts”** option, allows users to reflect on guided questions, such as kindness and change. Opened from the **homepage** or **calendar**, it includes options to **Edit**, **Delete**, or view the **mood analysis**.

Figure 12: A different journal entry, saved using the **“Write Freely”** option, provides space for unstructured thoughts. Accessed the same way as Figure 11, it also offers options to Edit, Delete, or analyze the entry.

Analysis Page

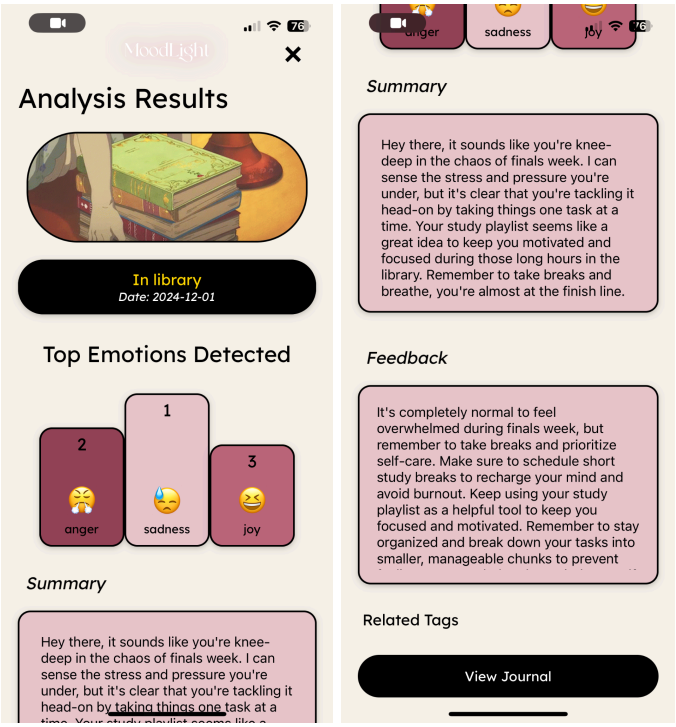

Figure 13

Figure 14: The **Analysis Results** page is accessed by clicking **Analysis** after viewing a journal entry. It displays the **top three detected emotions** with visual rankings, a personalized **Summary** reflecting the entry, and actionable **Feedback** for self-care and motivation. Users can also revisit the original entry via the **View Journal** button and sometimes view **Related Tags.**

Insights

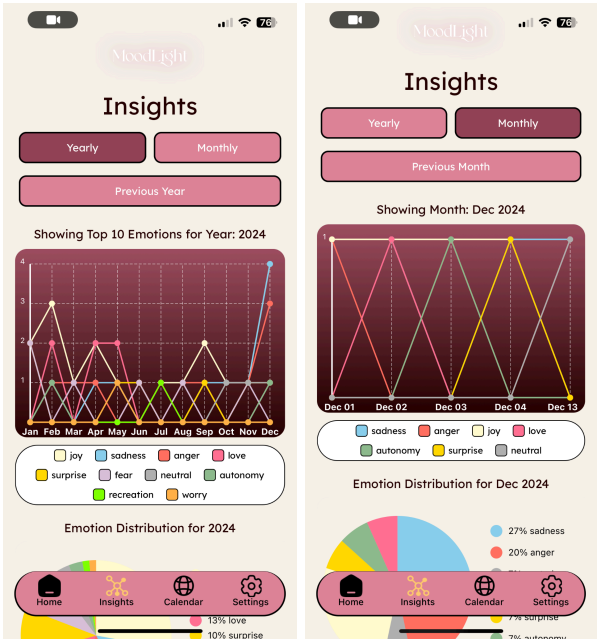

Figure 14

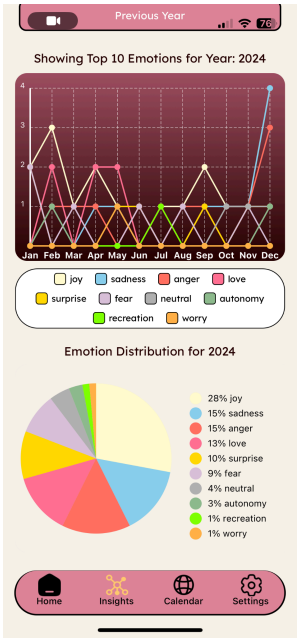

Figure 15

Figure 14: The insights page features **line charts** for both yearly and monthly views, tracking the **top 10 emotions** over time. The yearly chart shows trends across the entire year, while the monthly chart focuses on day-to-day changes for a selected month, such as December 2024.

Figure 15: This screenshot highlights the **emotion distribution** for the year, visualized as a **pie chart**. It provides a breakdown of emotions by %, summarizing the overall emotional patterns for 2024.

Settings

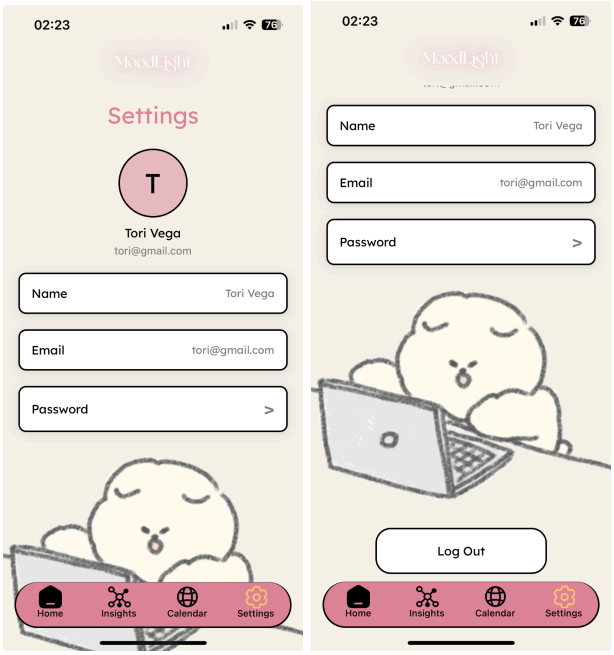

Figure 16

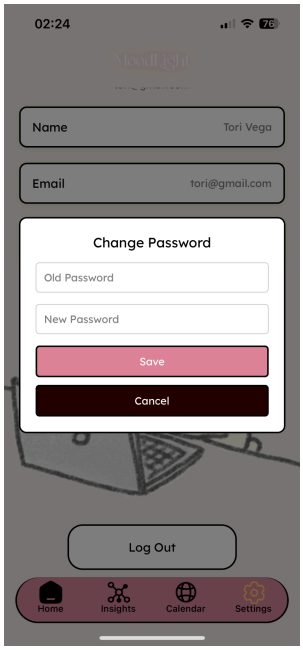

Figure 17

Figure 16: The settings page allows users to view and update their profile details, including name, email, and password. Users can log out using the button at the bottom for account management.

Figure 17: This change password modal, accessed from the settings page, enables users to update their password.

Discussion

This application could be useful to help people practice identifying and labeling emotions, especially for those who are autistic. There are some disorders that make it kind of extremely hard to learn and be comfortable with labels that other people use, including emotional labels. Even if the app is not a perfect substitute for a human, it is good to give people a tool that helps them describe what is happening in their life and identify labels for those experiences that they can use going forward when communicating with other people. We think that this makes it easier for people with these kinds of disorders to seek help and that interaction with other real people; they may have more confidence that they have the ability to effectively convey their experiences. Additionally, this tool could be useful for monitoring abnormal dips in emotion for people who are experiencing bullying or difficult periods in their lives.

GitHub Repo

Check out more of our contributions and the application on github!
https://github.com/ShannonNoah/CSI-4900-Honours-Project

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