ChillPills:

A Mental Health Support Chatbot

**Objective:**  
The project aims to create a mental health support chatbot, ChillPills, which integrates meditative techniques and responds to emotional states such as anxiety, stress, and sadness. The chatbot will function as a compassionate tool to provide users with emotional support through conversation and mindfulness practices.

**Step 1: Understanding the Theory of Emotions**

To ensure that ChillPills can effectively address and respond to a variety of emotional states, we started by exploring foundational theories of emotions. One of the most influential frameworks for understanding human emotions is the **Theory of Emotions** proposed by Paul Ekman.

**Paul Ekman’s Theory of Emotions**

Paul Ekman, a pioneering psychologist, developed a model based on the idea that certain emotions are universal across human cultures. According to Ekman, these primary emotions are biologically programmed and have adaptive functions that aid in human survival and social interaction. Understanding these emotions and their expressions will allow ChillPills to identify and respond appropriately to the emotional states of users.

**Primary Emotions**

Ekman identified a set of **primary emotions** that are universally recognized across cultures. These include:

1. **Anger**
2. **Fear**
3. **Sadness**
4. **Joy**
5. **Surprise**
6. **Disgust**

**Secondary Emotions**

In addition to these primary emotions, Ekman noted the presence of **secondary emotions**, which are more complex and often result from the interplay of primary emotions, personal experiences, and social context. Examples include:

* **Anxiety**: Often a combination of fear and sadness, rooted in the anticipation of negative outcomes.
* **Jealousy**: A mixture of fear and anger, related to insecurity about relationships.
* **Shame**: A secondary emotion stemming from an internal conflict between personal standards and perceived social acceptance.
* **Hope**: A positive emotional state linked to aspirations, often involving the anticipation of joy or success.
* **Remorse**: The combination of sadness and guilt, usually following a mistake or moral misstep.

These secondary emotions reflect a deeper emotional complexity and may require nuanced responses that ChillPills can be trained to identify and address.

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**Step 2: Incorporating Ekman’s Framework into ChillPills Chatbot Design**

Given the insights from Ekman’s Theory, the chatbot will be designed to identify and categorize user emotions based on their textual input. By leveraging natural language processing (NLP) techniques and sentiment analysis, ChillPills will analyze the sentiment behind each user message to detect primary and secondary emotions.

* **Emotion Detection**: The chatbot will use NLP algorithms to identify keywords and patterns in the user’s input. For example, phrases like “I feel frustrated” or “I can’t take this anymore” would trigger the detection of **anger**, while phrases like “I feel overwhelmed” or “I just want to give up” might indicate **sadness** or **anxiety**.
* **Response Generation**: Based on the detected emotion, the chatbot will provide personalized responses. If a user expresses **anger**, the chatbot may offer calming techniques such as deep breathing or mindfulness practices. For users expressing **sadness** or **anxiety**, the chatbot could suggest meditative techniques or offer empathetic, reassuring responses.

Immagine che contiene Policromia, cerchio

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[https://atlasofemotions.org/#continents/disgust](https://atlasofemotions.org/" \l "continents/disgust)

**CHILL PILLS’S FLOW CHART**

Immagine che contiene testo, diagramma, schermata, Piano

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1. **Default Start Flow**:
2. **Personal Information**:  
   The first phase of the process involves gathering personal information. This section is crucial for collecting initial data.
3. **Basic Primary Research**:  
   After obtaining personal information, the primary emotions of the user are collected and examined. These emotions are essential because they provide a direct understanding of the user's initial emotional state and perceived risk.
4. **Advanced Secondary Research**:  
   Next, secondary emotions are explored, which are more complex and reflective emotions that build upon the primary emotions.
5. **Risk Decision (Advice 0 / Advice 1)**:  
   After examining the primary and secondary emotions, a risk assessment is made, which determines the advice to provide to the user:

* **Advice 0 (Low Risk)**: If the risk assessment indicates low perceived risk, appropriate advice is given for low-risk situations.
* **Advice 1 (High Risk)**: If the risk assessment indicates high perceived risk, advice is provided for dealing with high-risk situations.

1. **Confirmation**:  
   After giving the advice, the user's response is checked:

* **Yes**: If the user confirms, the process proceeds to the next phase.
* **No**: If the user does not confirm, the flow returns to a previous phase for further evaluations or modifications.

1. **Something Else**:  
   In this step, the user approaches the end of the session, either accepting the final advice or starting a new session, if necessary.
2. **End Session**.

**Step 3: Synonym’ Generation**

The next step is to create a dataset that helps the chatbot better understand the language variations related to each emotion.

Each emotion has been associated with a sequence of synonyms divided into categories (nouns, verbs, adjectives, adverbs). For example, for anger emotion we could include synonyms like furious (adjective), irritated (verb), rage (noun), and angrily (adverb).

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Descrizione generata automaticamente

In our implementation of DialogFlow CX, we have added Primary Emotion and Secondary Emotion as custom [Entity Types](https://cloud.google.com/dialogflow/cx/docs/concept/entity) to better capture and understand the emotional state of users during interactions.  
Entities represent categories of objects, concepts, or values within a conversation that the system can identify to better understand the user's intent and personalize the response.

After generating the synonyms for each emotion, we organized them into JSON files, which were then uploaded to the DialogFlow CX platform.

**Step 4: Dataset Creation**

The next step was to create at least 30 sentences for each emotion.

The sentences were generated by ChatGPT, which used different synonyms and formulations for each emotion

These phrases have been organized based on primary and secondary emotions, creating a variety of expressions to train the chatbot. Each emotion has a set of phrases that the chatbot will use to recognize users' emotional states and respond appropriately.

Immagine che contiene testo, schermata, Carattere, software

Descrizione generata automaticamente

After creating the dataset in CSV format, we integrated it into the [**intents**](https://cloud.google.com/dialogflow/cx/docs/concept/intent). Each intent is an object that associates a group of example phrases, known as "training phrases", with a specific response from the system. When the user provides input, DialogFlow CX analyzes the phrase and attempts to match it to the most relevant intent, determining the most appropriate response based on natural language analysis. This process allows the system to understand the user's intent and respond in a accurate manner.

**Step 4: Future Integration of Meditative Techniques**

To support users through their emotional challenges, ChillPills will integrate a range of **meditative techniques** that can help reduce stress, anxiety, and negative emotions:

* **Breathing Exercises**: Guided breathing practices to help calm the nervous system and reduce anxiety.
* **Mindfulness Meditation**: Techniques that encourage present-moment awareness to combat stress and rumination.
* **Progressive Muscle Relaxation**: A method to release physical tension and promote relaxation.
* **Visualization Techniques**: Guided imagery to help users feel more grounded and relaxed.

Each technique will be introduced based on the user’s emotional state, helping to restore balance and emotional well-being.

**CURIOUS LIMITATION:**

1. **Limit in the Analysis of Sentiment**

In the context of the implementation of DialogFlow CX, we found a problem related to the analysis of sentiment, due to the polysemy of the term, for example "upset".

In many situations "upset" is associated with emotions such as disgust or fear, so it has nuances that can represent more than one emotion.

* Disgust: In some cases, "upset" can be used to express a reaction of disgust or repulsion, such as when someone reacts negatively to something unpleasant or repugnant.

Example: "The idea of eating that spoiled food really upset me." (In this case, "upset" is related to a negative reaction similar to disgust.)

* Fear: In other cases, "upset" may describe an emotional reaction of concern, anxiety or fear in the face of a situation perceived as threatening or disturbing.

Example: "She was upset after hearing the news of the accident." (In this case, "upset" may reflect an emotional reaction of fear, anxiety or concern.)

DialogFlow CX struggles when a term has multiple emotional connotations. "Upset" is an example of a term that can express two contrasting emotions (disgust and fear), but the system is designed to detect only one type of emotion per word, thus unable to distinguish all the emotional nuances.

This limitation means that in some contexts, DialogFlow CX could incorrectly classify a conversation or user response. The platform might mistakenly associate a response with just one emotion (e.g., only disgust or only fear), whereas the user may actually be experiencing a combination of emotions or a more complex emotional response.

1. **Complexity of secondary emotions**

Secondary emotions, which are mixtures of primary emotions (e.g. anxiety from fear and sadness, or jealousy from fear and anger), can be difficult to identify for ChatGPT. Although the model is able to recognize primary emotions such as anger or sadness, interaction between different emotions can confuse the model and lead to inaccurate responses.

For example: Anxiety, which is a combination of fear and sadness, may be difficult to detect if the sentences do not contain direct expressions of these emotions.

In addiction, ChatGPT has difficulty recognizing complex or subtle emotions, such as ambivalence (feeling happy and sad at the same time) or mixed emotions.

A sentence like "I’m glad I finished, but I also feel sad that it’s finished" might be difficult to analyze properly, since the model could detect only one predominant emotion, without grasping the emotional conflict.

1. **Insufficient documentation**

Another significant limitation in the implementation of DialogFlow CX is the unclear documentation and the lack of available support material. Although Google Cloud provides official documentation, it can be incomplete, insufficiently detailed, or difficult to follow in some critical aspects, especially for beginners or complex projects.

1. **Failure to Synchronize Collaborative Work**

An additional limitation encountered when using DialogFlow CX concerns real-time collaboration between multiple developers. When two users work simultaneously on the same project, changes saved by one user may not be immediately visible to the other.

This issue appears to be related to the browser’s cache and cookie management. DialogFlow CX uses cookies and locally stored data to optimize the interface loading process. However, in a collaborative context, this mechanism can cause synchronization issues, as changes made by one user are not updated in real time on the other user’s interface.

As a result, developers need to manually clear browser cookies and cache every time to see updates, slowing down the workflow and reducing collaboration efficiency.

1. **Manual Deletion of Terms in JSON File**

Another issue encountered during the implementation of DialogFlow CX concerns the management of terms associated with emotions when deleting a word from the platform’s user interface. When a term is manually removed from the interface to simplify emotion mapping (for example, to keep a word associated with only one emotion), one would expect this change to be automatically reflected in the JSON file generated by the platform.

However, DialogFlow CX does not automatically delete the term from the JSON file when it is removed from the interface. The term deleted from the interface remains defined in the JSON file, causing the system to continue recognizing it, which may lead to incorrect classifications during sentiment analysis. This behavior creates a discrepancy between the user interface and the exported JSON file content, potentially resulting in misconfigurations and unexpected behavior in the system.

**Conclusion**

After an in-depth analysis of the implementation process for the ChillPills mental health support chatbot, we identified several critical limitations that hinder its development and long-term viability. Key issues include **ambiguities in sentiment analysis**, **difficulty managing complex emotional nuances**, **insufficient documentation**, **real-time collaboration challenges**, and **manual synchronization issues** related to the management of emotional terms in JSON files.

These limitations significantly impact the chatbot’s ability to provide accurate emotional recognition, seamless collaboration, and efficient project maintenance. Given the sensitive nature of mental health support, where precision and responsiveness are essential, these constraints pose **substantial risks** to the reliability and effectiveness of the final product.

Considering these factors, we have decided to **halt the development of the ChillPills project**. We believe that moving forward would require additional platform enhancements or the adoption of a more suitable technology capable of managing complex emotional models and real-time collaboration efficiently. This decision reflects our commitment to ensuring that any mental health support tool we develop meets the highest standards of accuracy, reliability, and user safety.

WordNet:

A Study of Sentiment Analysis

**Objective**:

Emotions play a crucial role in human communication and language understanding.

The goal of this project is to create a specialized WordNet tailored for sentiment analysis in the Italian language.

This semantic network covers the entire spectrum of emotions, mapping their interconnections and relationships. This structure allows the NLP models to improve their ability to recognize, classify and interpret emotions with greater precision and depth.

**Step 1**: **Identification of Emotions**

The first step is to identify the emotions that will be included in WordNet. These emotions must cover the entire emotional spectrum, from primary to more complex emotions.

**2. Identification of Relationships between Emotions**

The second step is to identify semantic relationships between identified emotions. Key relationships to map include:

* **Synonyms**: They represent words that express the same or similar emotional meaning. This is useful for identifying different expressions for the same emotion. Example: "happiness", "joy", "euphoria" are synonyms of "joy", indicating different ways to describe a state of intense happiness.
* **Antonyms**: They indicate emotions that are opposite, that is, that express opposing feelings. Example: "joy" has as its antonym "sadness", which represents a negative emotion contrary to happiness.
* **Hyponyms**: More specific emotions fall under a more general category. In other words, a hyponym is a more specific type of emotion than a broader one. Example: "satisfaction", "enthusiasm", "serenity" and "gratitude" are all hypopuns of "joy" as they represent emotions that derive from or are specific manifestations of joy.
* **Hypernyms**: They indicate more general emotions that contain a set of more specific emotions. These serve to place an emotion within a broader category. Example: "joy" is a hyponym of "positive emotion," which is a category that includes all emotions with a positive connotation.
* **Related**: More nuanced relationships between emotions that, although not synonymous or antonyms, are nevertheless connected. These emotions can be perceived as often experienced together or as part of a more complex emotional experience.

We also added section:

* **Details**: A brief description of the emotion that offers a more precise and contextualized definition of the emotion. This can be useful to provide additional information about the emotional state."

**Step 3: Development of the Emotion Network Visualization Application**

Once the emotions and their relationships were identified and structured in a JSON format, the next step involved the development of an interactive application to visualize and explore these emotional connections. This application was designed using Python, leveraging PyQt5 for the graphical interface and PyVis for network visualization. The primary objective of the application is to allow users to load a custom JSON-based WordNet, explore different emotions, and view their relationships in a dynamic network.

We added key Features:

* **Splash Screen**: Provides options to load a custom JSON file, view app info, and start the visualization.
* **Emotion Selection**: Users select emotions from a list to explore their relationships.
* **Network Visualization**: The app generates a network graph where emotions are represented as nodes, and relationships (synonyms, antonyms, etc.) are shown as edges.
* **Emotion Details**: Displays information about each selected emotion and its relationships.
* **Serch**: search for specific emotions.
* **Legend**: Color-coded to distinguish different types of relationships in the network.

Immagine che contiene software, schermata, testo, Software multimediale

Descrizione generata automaticamente

The app displays a selected emotion along with its related network visualization.

It is also possible to select all emotions at once and generate a complete WordNet, visualizing the full network of emotional relationships.

Immagine che contiene visualizzazione

Descrizione generata automaticamente con attendibilità bassa

The complete network

**Limitations:**

**Leaf long Process**: The process of analyzing and identifying for each "leaf" (emotion) all the relative interconnections is long. It requires detailed analysis of emotions, their nuances, and semantic relationships, a task that becomes exponentially more difficult as the network expands.

**Conclusion**:

The WordNet project for sentiment analysis in Italian has been an important initiative to improve the understanding and processing of emotions in the context of natural language. Through the identification and mapping of emotions, as well as their semantic relations, such as synonyms, antonyms, hyponyms, hypernames and more complex connections, We have succeeded in creating a network that accurately represents the richness and variety of human emotional experience.

The implementation of the interactive application, which allows you to visually explore these emotional connections, provides users with a tool to understand how emotions are interconnected and how they can be more accurately recognized and analysed by natural language processing models.

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