

Sentiment Analysis for Sexual Assault Call Center

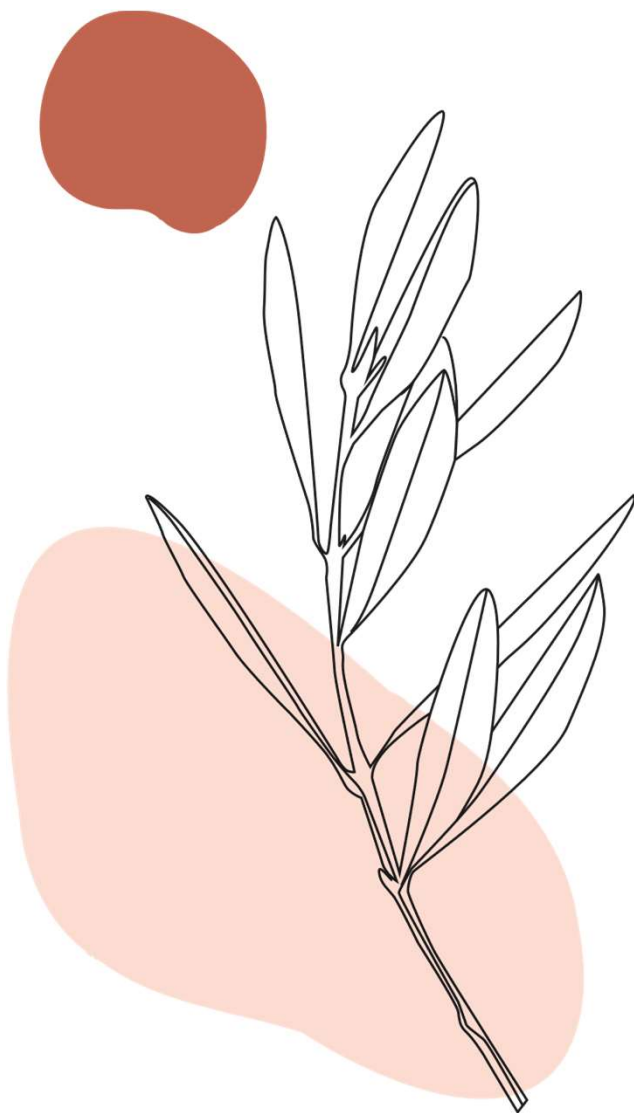
About Us



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Introduction

The Challenge:

- Each contact with a sexual assault support line is urgent, but pinpointing calls that demand immediate intervention remains a complex task.
- Our initiative utilizes advanced sentiment analysis to enhance this process, aiming to deliver swift and more nuanced assistance, ensuring individuals affected by sexual assault receive the promptest response possible.

The Solution:

- By evaluating the emotional tone within conversations, our system distinguishes the criticality of each call.
- This empowers support staff to prioritize and customize their assistance effectively, offering a more refined response to those in dire need.



Project Goals

Developing an NLP Model

- Our primary goal is to create a natural language processing (NLP) model that can accurately classify the urgency and emotional undertones in calls, enabling precise prioritization.

Categorizing Support

- We strive to systematize the classification of conversations—whether they require legal advice, counseling, or immediate action—to bolster the decision-making process and provide targeted support.

Creating an Intuitive Interface

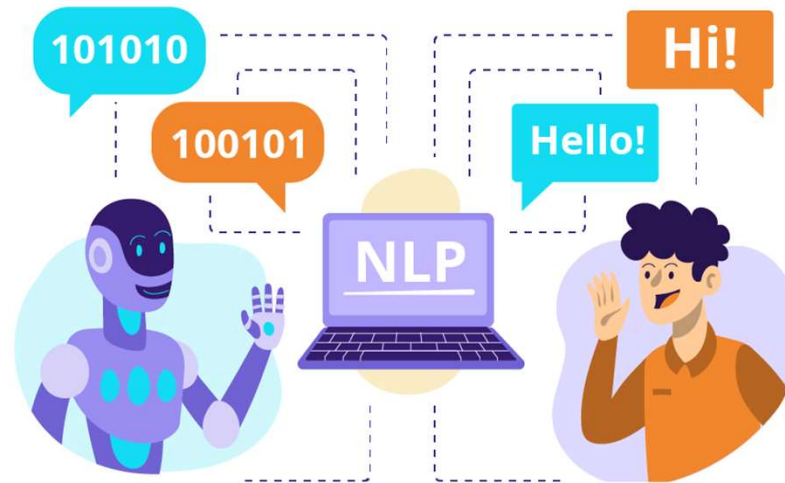
- We aim to design a user-friendly interface that simplifies the process of analyzing calls for non-technical staff, ensuring that technology enhances, rather than hinders, their workflow.



What is NLP?

Natural Language Processing (NLP) is a subset of the Artificial Intelligence (AI) domain that enables computers to understand, interpret, and use human language.

It is a tool that helps us build intelligence and drive insights from human language (most commonly text data).



Sentiment Analysis



Sentiment analysis is a branch of natural language processing (NLP) that analyzes text data to determine the emotional tone expressed within the text.

- The primary objective of sentiment analysis is to automatically classify a given text into predefined categories representing different sentiments or emotions.
- The process is composed of :
 - Text Input: Sentiment analysis begins with inputting a piece of text, ranging from short sentences to longer documents.
 - Text Preprocessing: The text often undergoes preprocessing steps to clean and prepare the data before analyzing sentiment.
 - Sentiment Classification: The core of sentiment analysis involves classifying the sentiment of the text into one or more predefined categories.

Literature review

Innovative Approaches to Support Systems

- #MeTooMaastricht Chatbot (Baue et al., 2019): Developed to assist survivors by categorizing harassment types and extracting details through machine learning. Demonstrates the potential of NLP in enhancing survivor support.
- LAW-U AI Chatbot (Socatiyanurak, 2021): Offers legal guidance to sexual violence survivors, showing the application of NLP in providing accessible legal information.

NLP in Mental Health Detection

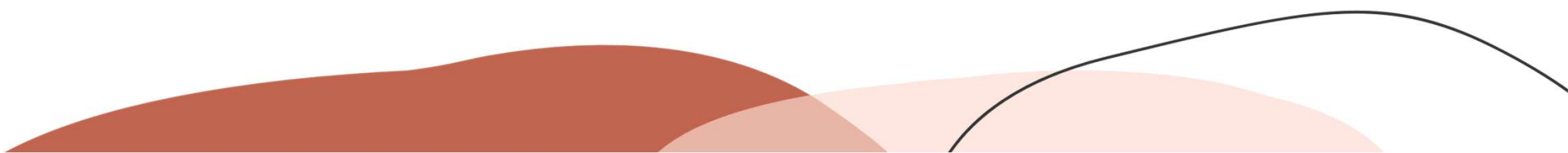
- Detecting Mental Illness via Sentiment Analysis (Yadav, 2022): Explores sentiment analysis for identifying mental health issues from social media posts, highlighting NLP's role in early detection.
- Supervised Machine Learning for Depression Analysis (Obagbuwa et al., 2023): Compares various machine learning models for predicting depression, relevant for understanding emotional states in support center calls.
- Suicide Risk Detection with SR-BERT (Izmaylov et al., 2023): Integrates psychological theories with NLP for improved suicide risk detection, emphasizing the importance of nuanced language understanding.



Market Search

Solution	Overview	Key Features	Geographic Availability
Woebot	Provides accessible support for anxiety and depression using NLP and CBT research.	<ul style="list-style-type: none">- Addresses on-demand mental health support.- Mitigates shortcomings of traditional care.	United States only.
Wysa	AI Coach for emotional well-being, integrating CBT, DBT, meditation, and more.	<ul style="list-style-type: none">- Growing mental health awareness.- Complementary support to traditional therapy.	International reach (30+ countries).
rAlnbow	A chatbot for domestic violence survivors, offering a confidential and safe environment.	<ul style="list-style-type: none">- Accessibility via Facebook Messenger.- Provides information and education on domestic abuse.	Initially launched in South Africa, accessible globally.





Metrics


Accuracy Goal

- Aim for a minimum accuracy rate of 80% in classifying calls as urgent or non-urgent.
- This ensures the model's reliability in identifying the sentiment and urgency accurately.

Precision and Recall Goal

- Strive for at least 75% precision and recall in differentiating between support needs (legal, counseling, emergency).
- This minimizes the risk of misclassification and guarantees that survivors are directed toward the appropriate support channels.

Usability Score

- Target a user satisfaction score of at least 4 out of 5 in UI usability tests.
 - Key Features to Test: Ease of use, intuitiveness, and effectiveness in analysis.
- 

Methodology

Leveraging Sentiment Analysis:

- Our approach utilizes machine learning algorithms and NLP techniques to analyze call transcriptions, focusing on identifying key emotional indicators and urgency signals.

Ethical Considerations in Data Treatment:

- Given the sensitive nature of the calls, we need to implement data protection and anonymization to ensure all information is handled with the utmost respect and confidentiality.

Real-Time Intervention Capabilities:

- By integrating real-time sentiment analysis, we can immediately identify and flag high-risk calls, empowering support staff to quickly prioritize and respond to urgent situations.



Stakeholders

Stakeholders in this project are:

- Survivors of sexual assault.
- Support center staff.
- System administrator.
- Legal and counseling professionals.
- Developers.



Functional requirements

Requirements from the NLP Model

- The NLP model should accurately classify the urgency of calls by analyzing sentiment, ensuring high reliability in distinguishing urgent from non-urgent conversations by these classifications - legal assistance, counseling, or emergency intervention.
- The model will continuously learn and improve its accuracy by training on new data collected from text conversations.

System Requirements

- Ensure seamless communication between the server hosting the NLP model and the user interface, facilitating real-time analysis and classification of text conversations.
- To minimize the computational load on the end user's device, all NLP model training, text analysis, and classification processes are performed on the server.
- The system must efficiently store and retrieve classified conversation data, including urgency status and sentiment analysis results, in a database.





Functional requirements

Requirements from the User Interface (UI)

- The UI will present a clear and intuitive dashboard for users to input new text conversations and view analysis results.
- Display detailed sentiment analysis results, including the urgency classification for each conversation.



Non-functional Requirements

Design Requirements

- The interface should be user-friendly, allowing users with no technical background to navigate and utilize the system effectively from their first interaction.
- Adopt a minimalist design approach to ensure clarity and prevent user overwhelm, facilitating a straightforward analysis process.

Performance Requirements

- The UI should deliver analysis results promptly, with specific benchmarks for response times to be determined based on testing.



Non-functional Requirements

Maintenance Requirements

- Design the system for easy updates and compatibility with future versions, ensuring long-term sustainability.
- Implement a scalable database architecture capable of handling growing data volumes without performance impact.

Reliability Requirements

- Ensure system stability and reliability, maintaining high availability for users to access and use the application as needed.

Privacy Requirements

- Wherever possible, data will be anonymized to protect the identity of survivors.
- The data collected will only be data that is strictly necessary for the classification and analysis of calls.



Use cases

Use Case 1: User Authentication

- Actors: Support center staff
- Preconditions: The user has been registered in the system with appropriate credentials.
- Basic Flow:
 - The user navigates to the login page.
 - The user enters their username and password.
 - The system authenticates the user and grants access based on their role.

Postconditions: The user can access the system functionalities relevant to their role.

- Alternate Flows:
 - Invalid credentials: The system displays an error message and prompts the user to try again.



Use cases

Use Case 2: Conversation Input and Analysis

- Actors: Support center staff
- Preconditions: The user is logged in and can input new conversations.
- Basic Flow:
 - The user inputs a new text conversation.
 - The system processes and analyzes the conversation to determine its sentiment and urgency.
 - The system categorizes the conversation as urgent or non-urgent and displays the results to the user.
- Postconditions: The conversation is categorized.
- Alternate Flows:
 - Analysis error: If the system cannot analyze the conversation, it prompts the user to try again.



Use cases

Use Case 3: Continuous Learning and Model Improvement

- Actors: Developers
- Preconditions: New data from analyzed conversations is available for training.
- Basic Flow:
 - Developers collect and prepare new training data from recent conversations.
 - The NLP model is retrained with the updated dataset to improve accuracy.
 - The updated model is deployed, enhancing future sentiment analysis and urgency detection
- Postconditions: Based on the latest conversational data, the system's ability to accurately identify urgent messages is improved



System Architecture and Technology Stack

Client-Server Architecture

- Implement a client-server setup where the server hosts the NLP model.
- The UI communicates with the server exclusively through a well-defined API for processing and analysis.

Backend Development

- Utilize Flask or Django in conjunction with Python for server-side operations, ensuring a stable and efficient backend environment.
- Python will also be the language of choice for developing and training the NLP model, leveraging its libraries for machine learning.

Frontend Development

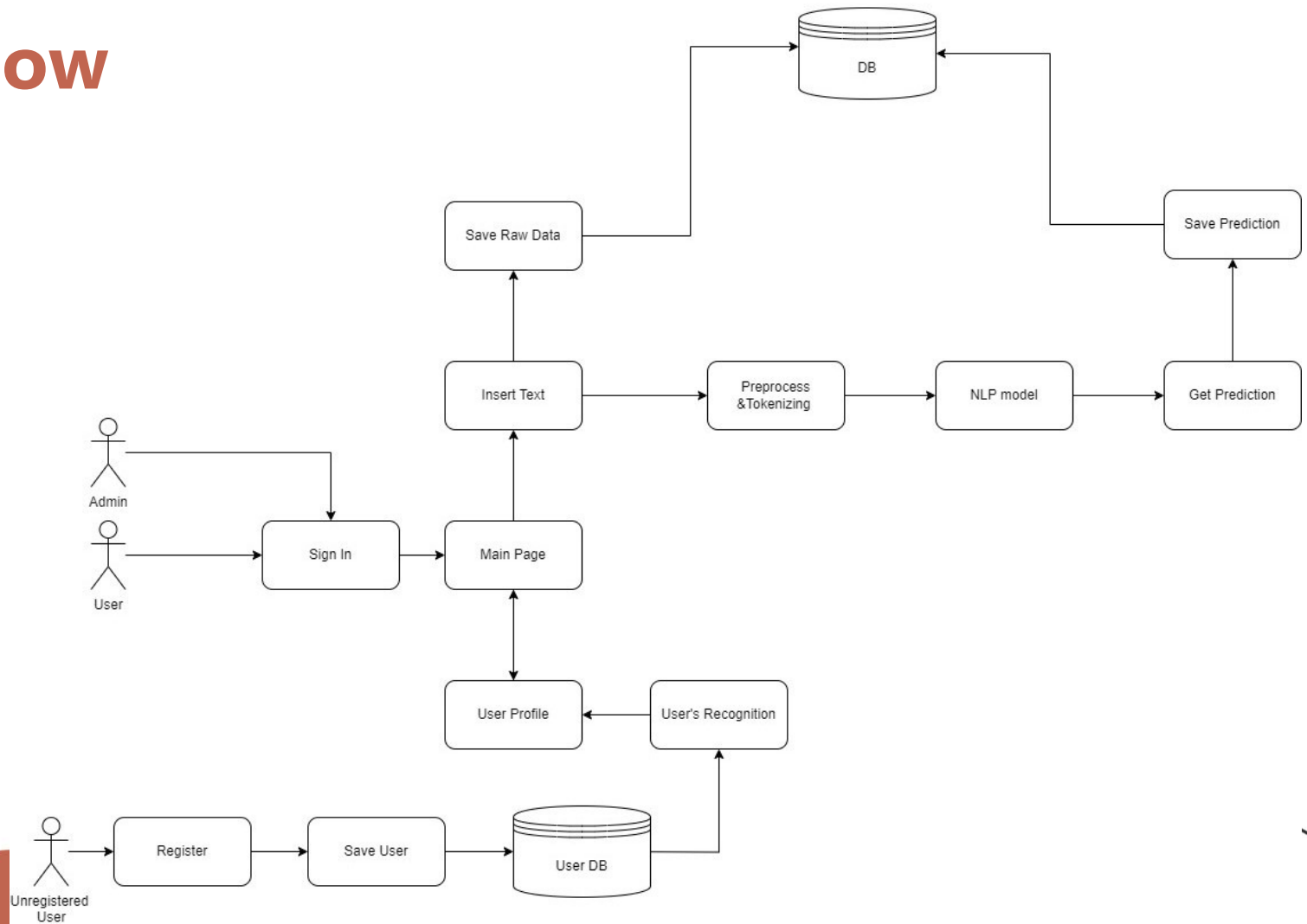
- Employ React for building a responsive UI, allowing for an interactive user experience that adapts to various devices and workflows.

Database Management:

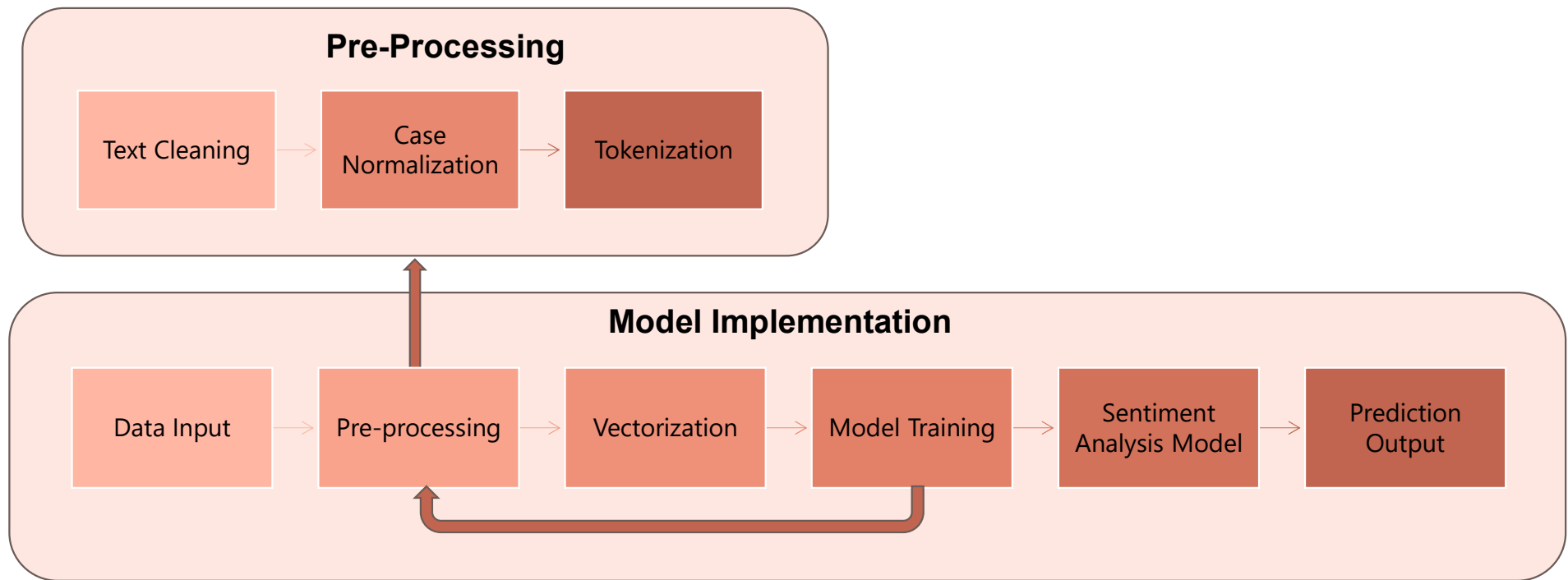
- Integrate PostgreSQL to manage diverse datasets, including user information, raw call data and model predictions.



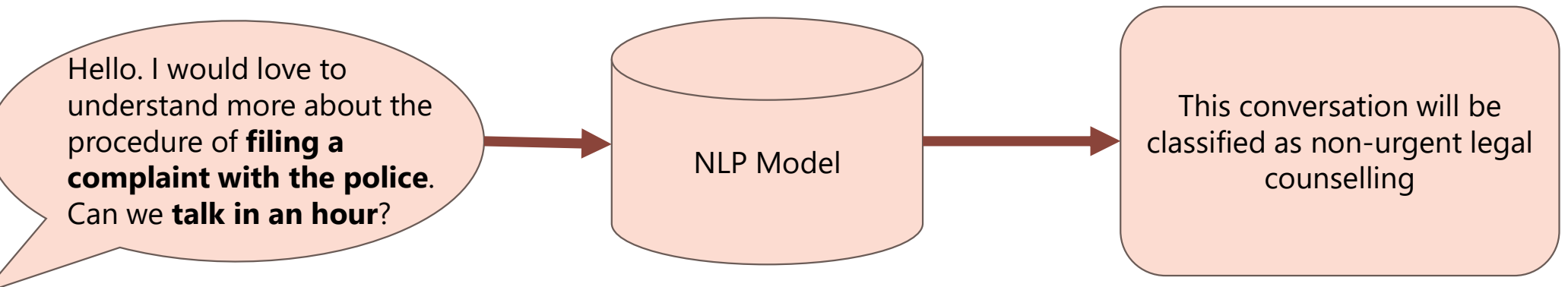
System Flow



NLP Model

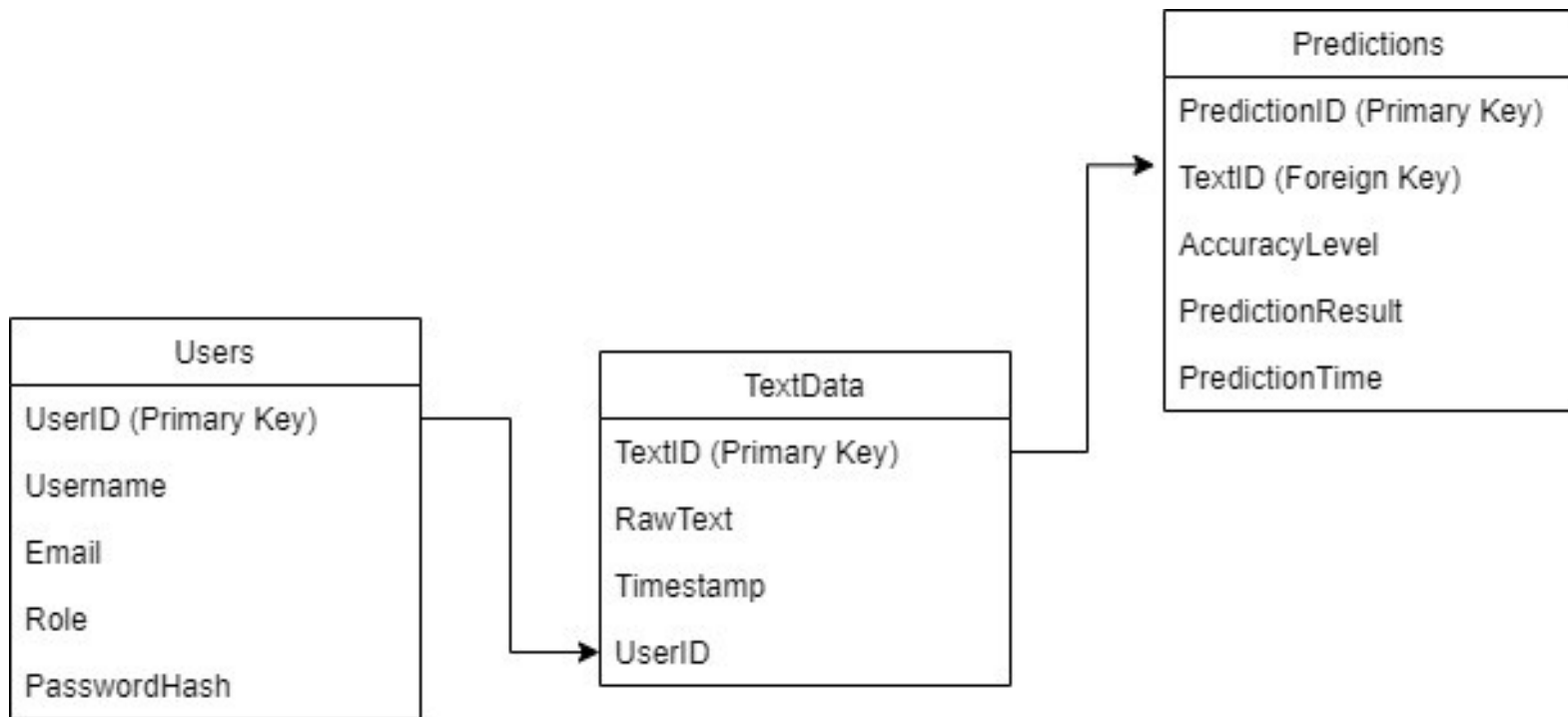


NLP Model



- The phrase "**understand more about the procedure of filing a complaint with the police**" indicates that the user seeks information that aligns with legal counseling.
- The request "**Can we talk in an hour?**" suggests that the situation does not require immediate attention, classifying it as non-urgent.

DB Scheme



UI Mockups

The user enters a text conversation

[Home](#) | [Get Analysis](#) | [Settings](#) [Logout](#)


Get Analysis

Please enter the text conversation

Type here

Send

Clear



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UI Mockups

The user waits for the model


[Home](#) | [Get Analysis](#) | [Settings](#) [Logout](#)

Get Analysis

Please enter the text conversation

Type here

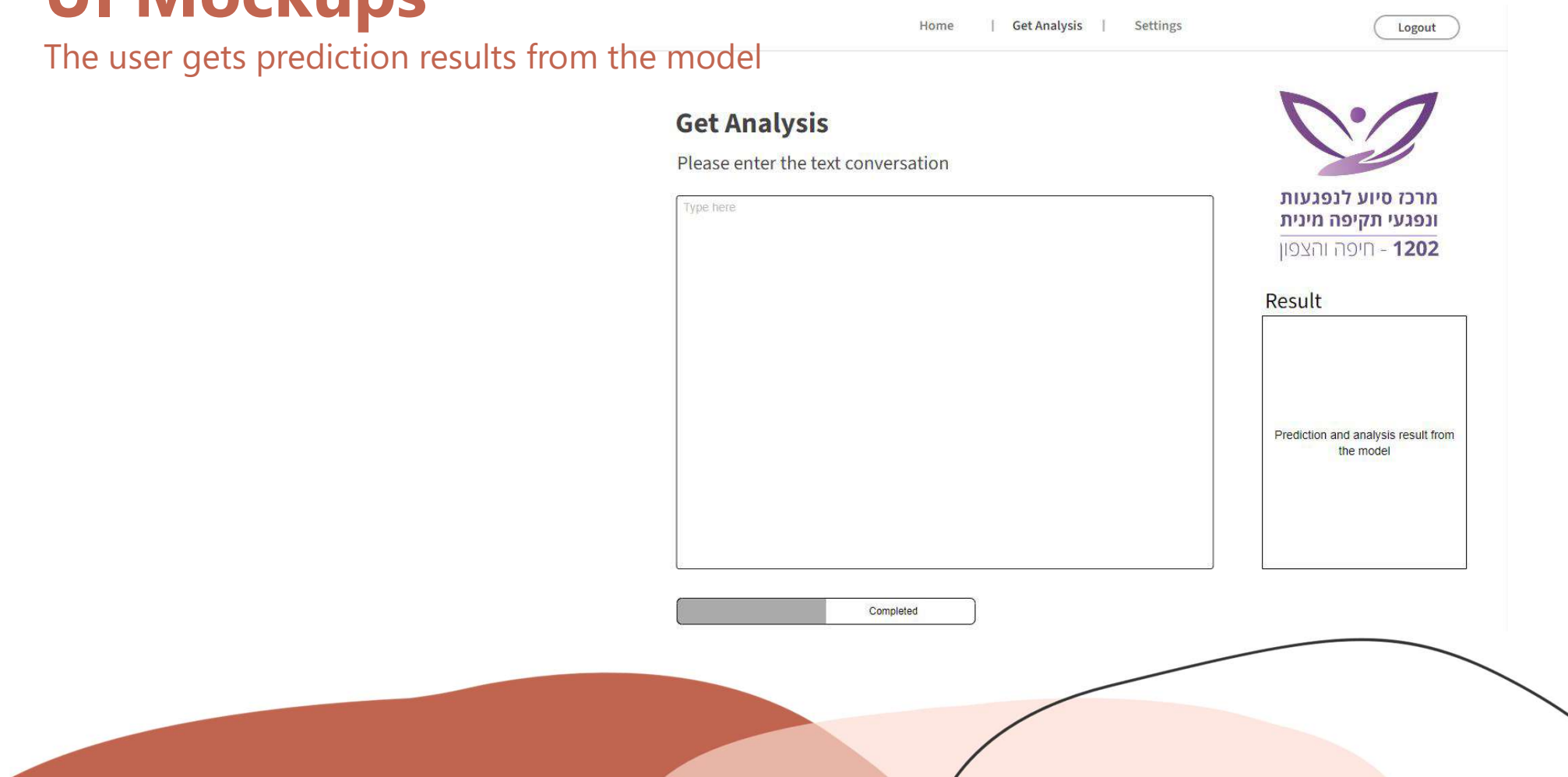
80% Progress

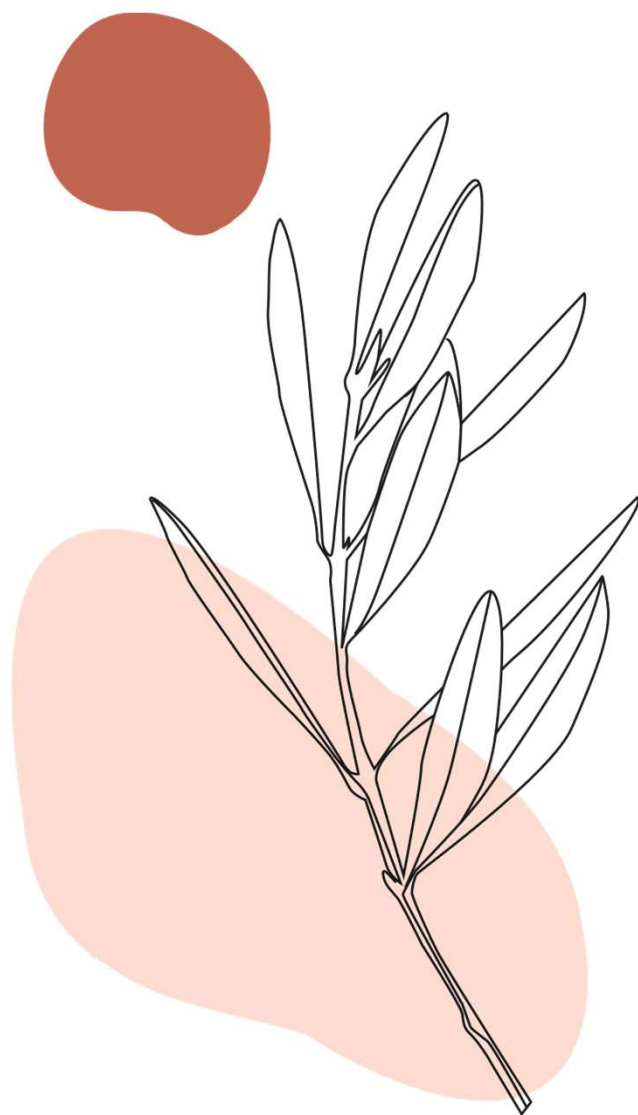


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UI Mockups

The user gets prediction results from the model

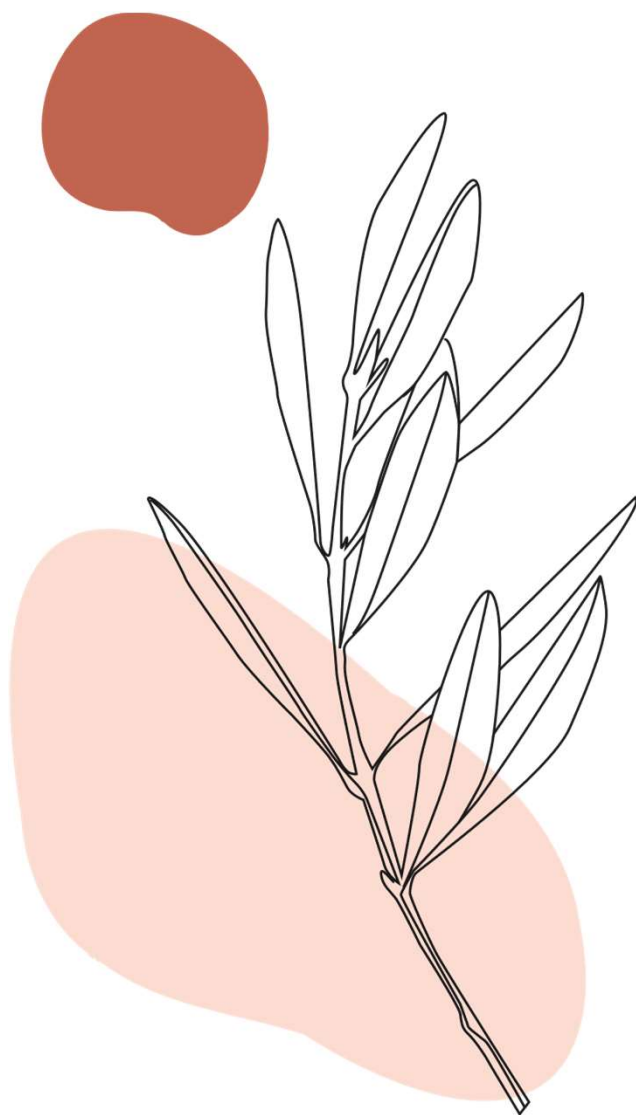




The project was done by Gal Druker and Liron Golan, under the supervision of Dr. Sharon Yalov Handzel.

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Questions?