

Chapter 1

Introduction

Crisis Text Line (CTL) is an organization that provides counseling services to young people in crisis through texting. The goal of this thesis is to supply CTL counselors with assistive tools in order to offer their clients the best possible service. This section explains the motivation behind this research project, the problems we want to solve, the approaches to implement and evaluate, and the contributions made.

1.1 Motivations for Mental Health Visualizations

The main motivating factor for this thesis is to help people with mental health crises. Many people suffer from depression, suicidal thoughts, and emotional stress every day. Crisis Text Line provides an outlet for clients to discuss their issues and ask for support. However, there is a shortage of counselors compared to the countless number of people seeking aid. Each counselor may have to manage various conversations continuously for several hours. Many of these counselors are also volunteers who undergo a short period of training as preparation. These constraints motivate us to maximize the amount of time and brainpower counselors spend on client support. Time is a particularly critical factor in mental health situations because clients may be at risk of suicide or physical harm.

Fortunately, the unique thing about a texting hotline is that the use of written communication allows computer programs to analyze and extract meaningful data

from the text. Topic modeling is a machine learning technique that discovers abstract topics occurring in a set of documents. It can be useful for summarizing large amounts of text. Counselors may benefit from summaries of their various conversations with clients, but topic modeling is a complex and advanced artificial intelligence concept. Therefore, we would like to provide counselors with an easy method of understanding the data through visualizations. Visualization is a powerful approach for presenting data that most people are familiar with.

1.2 Problem Definition

As mentioned in the motivation section, some main difficulties with Crisis Text Line are that there are not enough counselors to talk with all of the clients in crisis, the counselors are usually context switching between multiple different client texts at a time, and they need to be properly trained. Since it is more difficult to control external factors such as the number of available counselors, our approach to these issues consist of tackling four specific problems:

1. Reduce the amount of time counselors spend not talking to clients.
2. Reduce the cognitive load of counselors so they can concentrate on clients.
3. Improve the quality of counselor training.
4. Improve the quality of client service.

1.3 Hypotheses

We believe a variety of topic model visualizations will offer assistance in solving the proposed problems. Using topic models, mental health conversations may be summarized by a combination of topics, such as job-related issues, family troubles, relationship difficulties, or self-injurious behavior, to name a few. Topic models also provide indexing information, which tells us where each specific topic can be found in the conversation text.

1.3.1 Context Switching

As the medium of texting usually involves gaps in response time during a conversation, counselors often switch context between talking to different clients. When a counselor returns to a previous conversation after a client response, he or she may have to spend time recalling what that particular conversation was about. However, if the counselor was given a visual summary of the conversation, with the option of quickly reading through chat details, less time may be spent recognizing the conversation topics. This approach can minimize both the time a counselor spends not talking to a client and the cognitive load that context switching has on the counselor.

1.3.2 Shift Changes

Counselors usually handle incoming client texts in shifts. A shift change may occur in the middle of conversations, in which case the leaving counselor gives the incoming counselor a brief summary of the talking points so he or she can take over. However, this summary is general and transient, and the incoming counselor would have to take time scanning through the existing conversation text for details. We suspect that a permanent visual summary computed using topic models would be more helpful for the incoming counselor. The visualizations can provide different levels of detail depending on what the counselor needs to know about the conversation history. Visual indexing can quickly point him or her to the parts of the conversation related to a certain topic. This technique minimizes the amount of time necessary to search through the text for details and potentially improves the quality of client service by better preparing the new counselor for the interaction.

1.3.3 Counselor Training

One potentially significant contributor to quality counseling, especially for new counselors, is the initial training that they receive. As many counselors are simply volunteers with little professional background in mental health, it can be important to show them the right way to respond to certain situations or test how they would reply

to a real client message. I think topic models are a great resource for finding real and relevant training examples. Managers or supervisors can utilize the visual indexing aspect of the topic model visualizations to find helpful instances of client messages related to specific topics. Then a counselor can be easily trained for a specific area, such as crises involving jobs or family. This method may enhance the quality of counselor training and therefore client service, while decreasing the amount of time spent searching for or fabricating relevant samples.

1.3.4 Conversation Trends

As previously mentioned, counselors must keep track of multiple conversations at a time. These conversations may also contain gaps of time due to the use of texting. In order to aid the counselor's memory, we believe that displaying topic trends over time for each conversation could be useful. Showing trends, including where topics appear in the course of a conversation and how they accumulate, may potentially improve the quality of client service. A chart of topic trends could alert the counselor to important focus points. For example, if the topic of self-injurious behavior is on the rise, the counselor might want to react in a certain way to prevent escalation of injury. Conversation trends may also be useful for organization leaders to detect patterns that might be of use in supporting clients.

1.4 Contributions

Based on a topic model developed from a collection of real mental health conversations, I designed and implemented a website prototype for Crisis Text Line with four visualizations. These visualizations were designed based on four different levels of granularity, so the counselor can choose the amount of detail he or she wants.

The **Topic List** visualization lists the topics discovered in a conversation that are above a certain threshold. Topics are ordered from highest to lowest percentage detected in the conversation. This visualization is a quick, glance-able summary of the conversation topics.

The **Donut Chart** visualization adds a small level of detail by displaying the topic proportions in a pie chart variation to show the parts of the whole relationship. User interaction by hovering over the chart or the legend provides the topic percentages for quantitative information.

The **Line Chart** visualization reaches finer granularity by revealing topic proportions at the message level, where each client message in the conversation is analyzed for topics. A line exists for each topic above a certain threshold that shows the trend of that topic throughout the conversation timeline. There is also the option of viewing the accumulation of topic proportions across the conversation. When the user clicks on a topic, points are displayed to reveal the client messages in the conversation that contain the topic.

The **Scatter Plot** visualization is the deepest detail level, allowing the user to click on the topic instances that occur throughout the conversation. The conversation text then automatically scrolls to the appropriate message. The size of the scatter plot points represent the proportion of that topic in the corresponding message.

1.5 Thesis Outline

Chapter two presents related work, consisting of topic models, visualizations of topic models for other fields, and general visualization techniques.

Chapter three discusses the design of the four visualizations contributed in this thesis: a topic list, a donut chart, a multi-series line chart, and a scatter plot.

Chapter four explains how the system was implemented and lists the existing technologies that were used.

Chapter five evaluates the visualizations based on the user test results.

Chapter six explores ideas for future work, some of which could not be completed due to time, resource, and technological constraints.

Finally, chapter seven discusses the main contributions presented in this thesis.