VRIJE UNIVERSITEIT AMSTERDAM

DEPARTMENT OF MATHEMATICS

# Automated Behavioral Coding to Enhance the Effectiveness of Motivational Interviewing in a Chat-Based Suicide Prevention Helpline


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# Background

# Motivational Interviewing

## What is MI?

Motivational interviewing is a collaborative, goal-oriented conversation style with special attention to change language.

It is designed to enhance personal motivation and commitment to a particular goal by eliciting and exploring one's own reasons for change in an atmosphere of acceptance and compassion.

*Miller & Rollnick (2013)*

# Research motivation

## Practical situation

- MI is a challenging skill to learn and requires substantial expertise to apply effectively.
- Counselors at 113 applied MI techniques consistently during chat conversations but could not strategically deploy MI techniques to elicit enough change talk from clients to change their behavior intrinsically (Janssen et al., 2022).
- By increasing their behavior awareness, counselors can significantly reduce cognitive effort and reflect on MI insights.

# Research goals

## Goals

1) Investigate the performance of AI models in classifying MI behavior.
2) Investigate the feasibility of using these models in helplines as an automated support tool for counselors in clinical practice.

## Contributions

- Combining AI and MI focusing on suicide prevention
- Support crisis chat counselors in their practical challenges
- We describe our AI approach in detail following the best AI practices

# Methodology

# Data

| Message | Code |
| --- | --- |
| Hi, welkom bij 113. Ik lees even terug wat je met mijn collega hebt besproken, goed? | Structure |
| Is goed. | Follow / Neutral |
| Ik lees dat je ruzie hebt. | Reflectie - |
| Ja, mijn ouders snappen mij niet. Ik heb het gevoel dat ik met niemand kan praten. | Sustain talk |
| Je wil graag dat je ouders je begrijpen. | Reflectie + |
| Dat gaat nooit gebeuren. | Sustain talk |
| Mijn vader wordt altijd boos. | Sustain talk |
| Ik heb vertrouwen in jou. | Support |

- 17 codes for counselor messages
- 4 codes for client messages

- 2 codes for **MI-consistent / MI-inconsistent** counselor language
- 2 codes for **evocative / non-evocative** counselor language

| Dataset Statistics |
| --- |
| 253 chat conversations |
| 23,982 total messages |
| 12,125 counselor messages |
| 11,857 client messages |

# Procedure

| DATA PRE-PROCESSING | INFORMATION EXTRACTION | MODELING | EVALUATION | PRACTICAL IMPLICATIONS |
| --- | --- | --- | --- | --- |
| *Make the data ready to analyze* | *Informative features* | *Behavior classification* | *Performance and Explainability* | *Output* |

# Textual information

Word usage

TF-IDF

Named entities

Parts of Speech

Bag of Words

Sentiment

Dependencies

Word embeddings

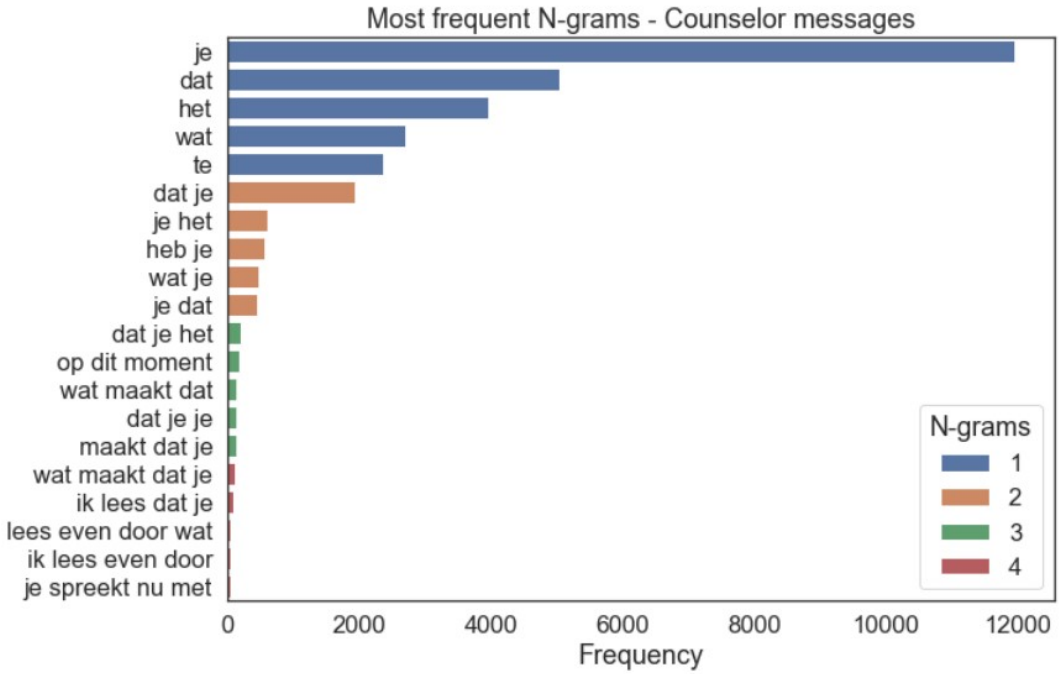
Topics

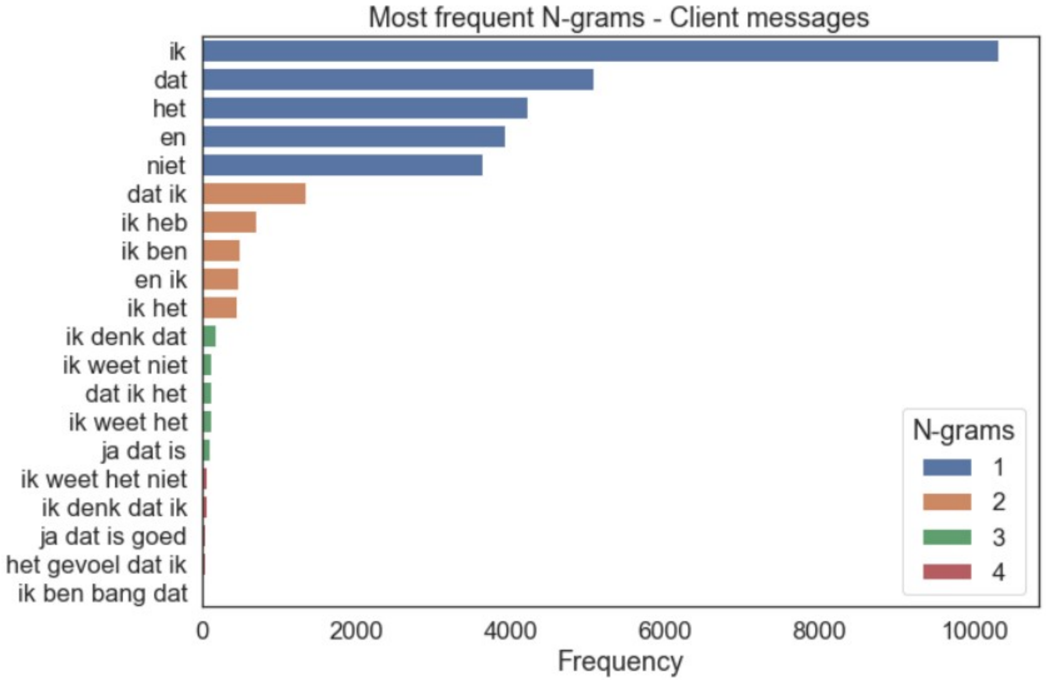
Temporal patterns

Cognitive distortions

5850 features in total

# Language insights



# Client – counselor interactions

## Temporal patterns

1. Using Closed Questions, Non-Evocative language and Negative Reflections lead to Sustain Talk by clients.

2. Using Positive Open Questions and Evocative language lead to Change Talk by clients.

# Classification performance

# AI algorithms

**Machine learning**

- Decision Tree
- K-nearest neighbours
- Random Forest
- SVM

**Explainability:** High

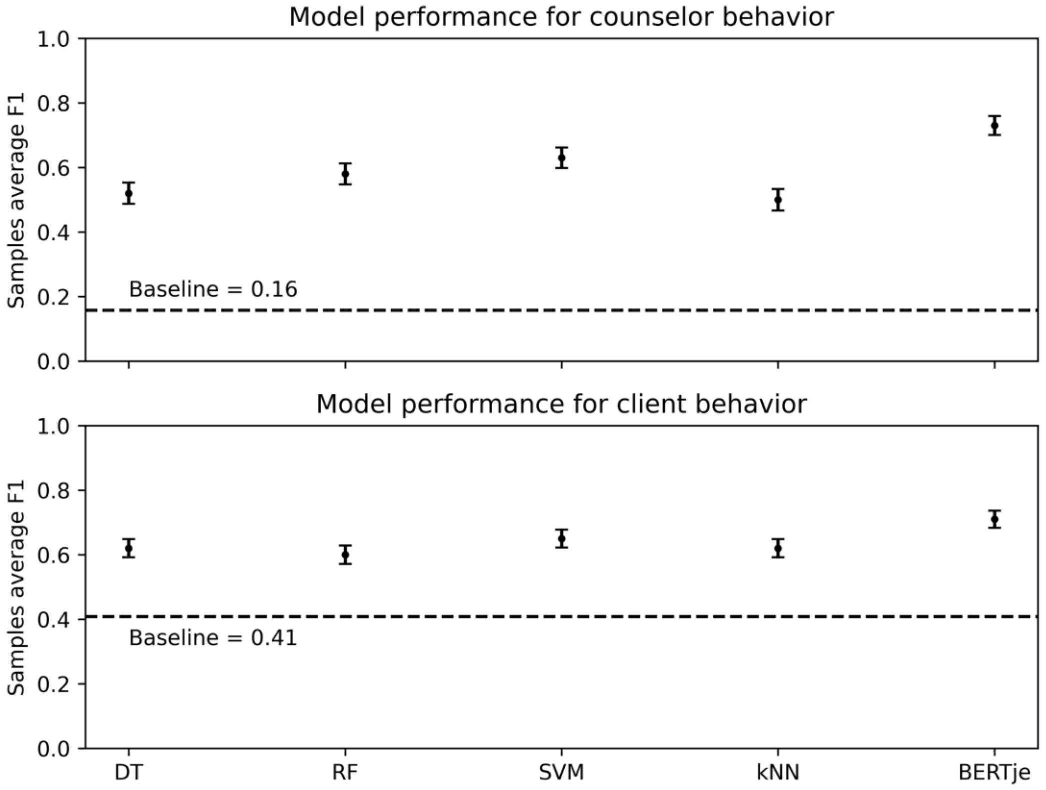
**Transfer learning**

BERT (Devlin et al., 2018) by Google

- Captures **context** of words
- Pre-trained on millions on messages

**Explainability:** Medium

# Classification performance




**Note.** The standard deviation (SD) for the results yields 0.015 for counselor behavior and 0.013 for client behavior. Confidence intervals for the results are given by performance value ± 2 × SD.

## Model comparison

- All models significantly performed above the baseline.
- **BERTje** significantly outperformed the machine learning models.

**Let's dive into BERTje!**

# Classification performance (BERTje)

## Counselor behavior

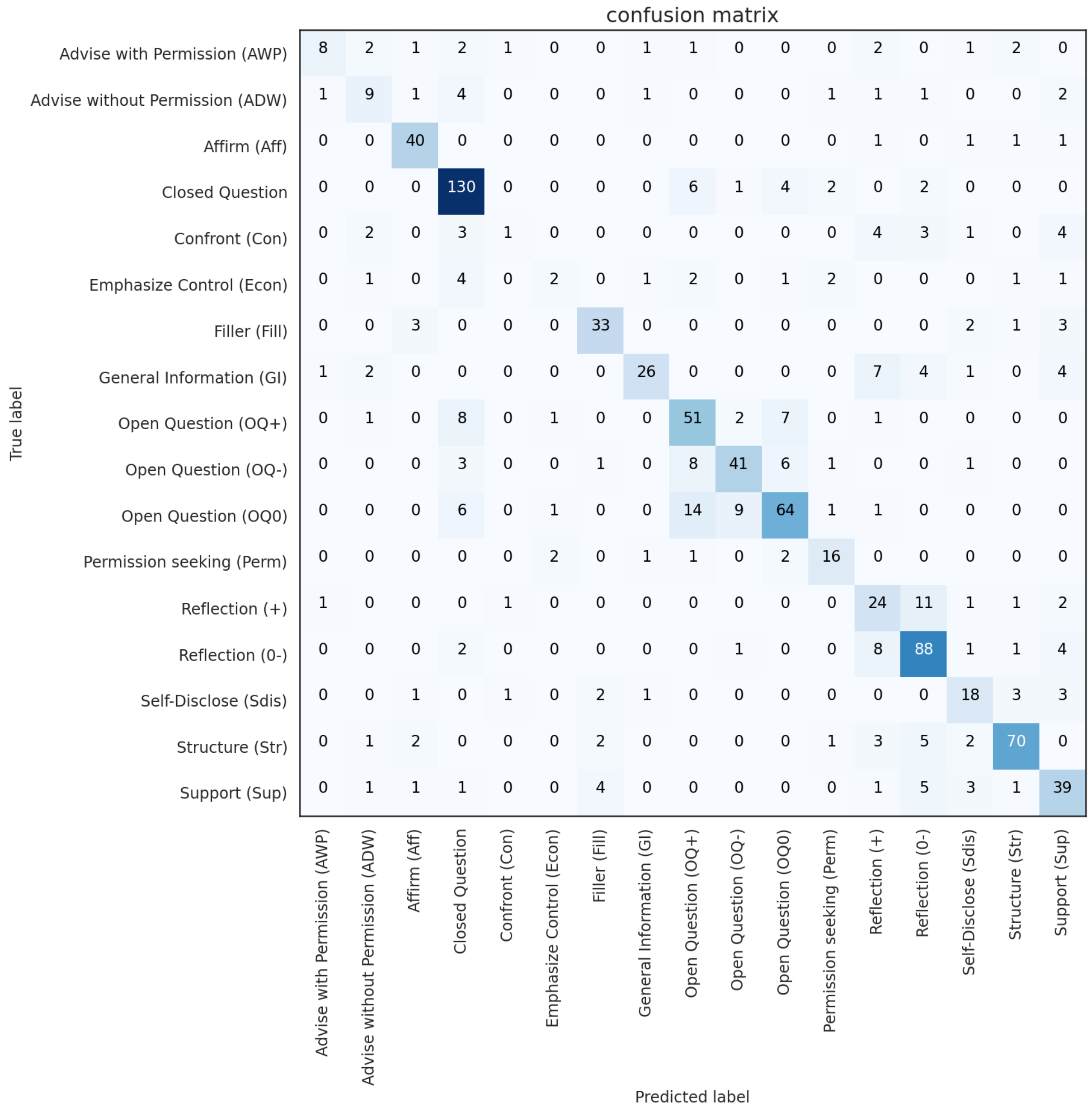
**Fine-grained predictions**
Accuracy = 0.72, Kappa = 0.69
AUC range: 0.89 – 0.99

**MI-congruency**
Accuracy = 0.87, Kappa = 0.65
AUC = 0.92

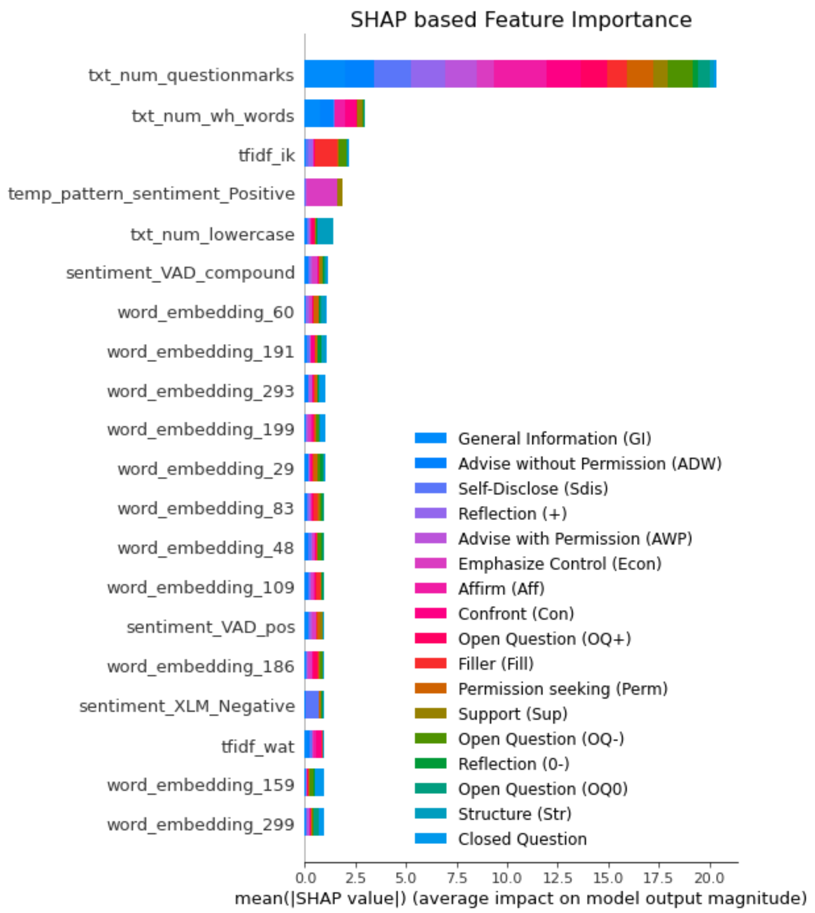
**Evocative language**
Accuracy = 0.90, Kappa = 0.65
AUC = 0.92

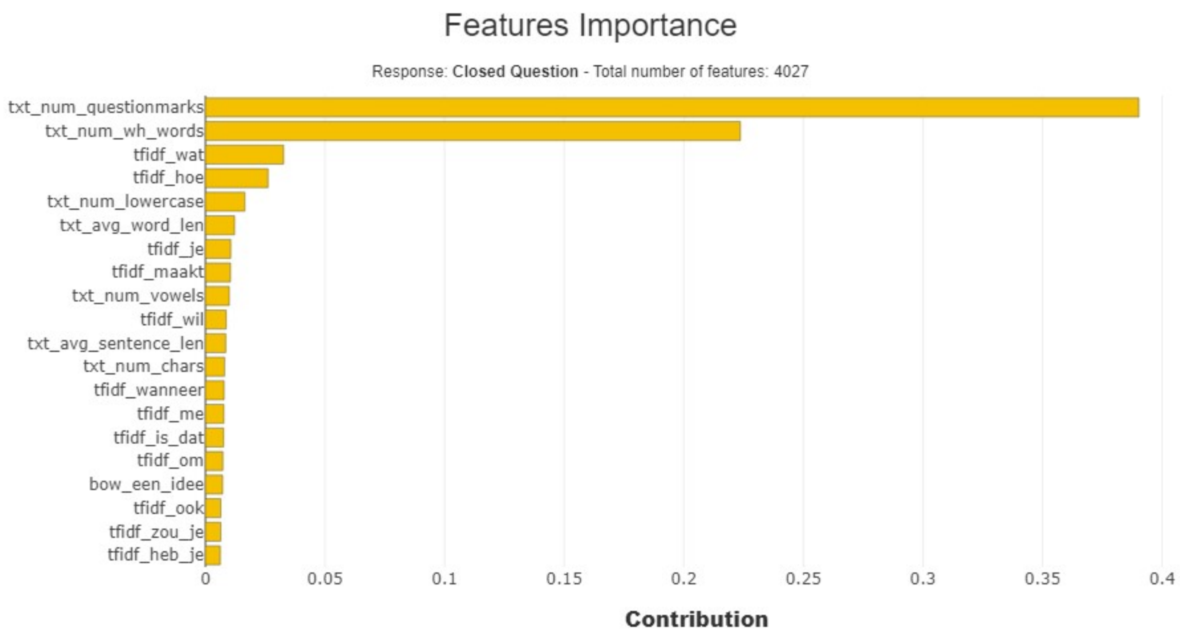
## Client behavior

**Fine-grained predictions**
Accuracy = 0.70, Kappa = 0.50
AUC range: 0.81 – 0.99



# Explainability



# Conclusions

# Answers to the research questions

This study demonstrated the potential of AI models, particularly the transformer model BERTje, in classifying MI behavior in online mental health helplines.

Although the lower performance of the ML models, their high explainability adds value for gaining a deeper understanding of language use concerning specific MI behaviors.

The interpretable model predictions discerned client change- and sustain talk, counselor affirmations, and reflection types - the effective ingredients of MI - facilitating valuable counselor feedback.

# Implications for clinical practice

### Leveraging AI Models for Clinical Support

**Generalizable**

Integrate AI models into chat-based counseling platforms.

Offer post-session feedback and training to counselors.

Use AI models to monitor and evaluate the qualit counseling services

Reduce the *time-to-proficiency.*

### Evaluating the Effectiveness of AI Models

Conduct pilot studies or RCT's analyzing changes in conversation outcomes over time.

Counselors could provide

### Next Steps to Take

Collect data.

Connect with other clinicians and researchers in the field.

### Future Directions

Simulation tool.

Evaluate the performance of these models on larger datasets.

A classification model must become sensitive to the processes of MI.

Apply the methods used in this study to other languages and institutions.

**Practical and scalable solution to improve the MI proficiency of counselors.**

**Leading to higher-quality interactions and potentially better health outcomes for individuals seeking help.**

## Take-aways

1. AI is there to support you
2. Broader impact than just suicide prevention

**The Impact of Artificial Intelligence**

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# Thanks for your attention!

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