SeaAlert

Classifying Maritime Distress Messages with LLM-Generated Data

Presenter:
Tomer Atia, Ilana Estrin

Motivation and Use Case

This project addresses the challenge of assigning urgency levels to noisy, non-standard maritime distress text messages at rescue centers.

PROJECT GOALS

• Automatically assign a distress level to every incoming maritime message

•Use synthetic data to cover rare, life-threatening cases that have no public transcripts

LIMITATIONS OF CURRENT DATASETS

• No public corpus of maritime distress messages with **GMDSS**-style labels.

• Real MAYDAY calls are rare, sensitive and often classified.

NOVELTY

- No real maritime distress texts exist due to confidentiality and rarity.
- Create synthetic maritime messages with LLM to fill this missing data.
- Support emergencies described **without** any MAYDAY/PAN PAN/SECURITE keyword.
    - Skippers under stress forget formal distress phrasing.
    - Other vessels just report what they see.
    - many skippers don’t really know the formal MAYDAY/PAN PAN phrases.

ML Task Definition and Objectives

The project performs a four-class text classification task to determine the severity of maritime distress messages from short text transcripts.

INPUT& OUTPUT

- **Input**: Short text transcript of a maritime communication
- **Output**: 4-class label:
  - **0** = ROUTINE – regular operational message
  - **1** = SAFETY – navigation or weather warning
  - **2** = URGENCY – serious problem, no immediate life danger.
  - **3** = DISTRESS – grave and imminent danger to life or vessel

Classification Model

- **Model A**
  - Bag-of-Words + Logistic Regression
- **Model B** :
  - Transformer model- **DistilBERT**

Training Method

- Train both models on the same synthetic 4-class dataset
- **For DistilBERT**: replace head → 4 classes and fine-tune

Dataset & Synthetic Data

DATASET

- No real labelled dataset of maritime distress texts is available
- **Main dataset**: fully synthetic, generated from structured scenarios.
- **Optional-** small set (dozens) of hand-written examples **used for testing**

GENAI PIPELINE

• **Scenario Generator -** samples vessel type, problem, sea state, and communication flags.

• **Rule-Based Labeling -** assigns DISTRESS / URGENCY / SAFETY / ROUTINE using GMDSS rules.

- LLM Message Generation - produces both standard calls (MAYDAY/PAN PAN/SECURITE) and messy real-life texts.

End-to-End Synthetic Sample

Step 1 - Scenario (structured input):


```
{
  "vessel_type": "sailing boat",
  "problem_type": "taking on water",
  "people_on_board": 4,
  "sea_state": "rough",
  "distance": "5 nm",
  "declared_prefix": "MAYDAY",
  "immediate_life_danger": true
}
```


Step 2 - label

Codeword table:

- MAYDAY → DISTRESS
- PAN PAN → URGENCY
- SECURITE → SAFETY
- No danger → ROUTINE

Applied to this scenario:
declared_prefix = "MAYDAY" → label = DISTRESS

Step 3 - message

"MAYDAY MAYDAY, water rushing in, we can't stay afloat, four people on board"

Step 4 - Final training example used by the models


```
{
  "text": "MAYDAY MAYDAY, water rushing in, we can't stay afloat, four people on board",
  "label": "DISTRESS"
}
```

Evaluation and Metrics for Model Performance

TESTING FOCUS

Models are evaluated on one test set containing a mix of routine, safety, urgency, and distress messages

This shows how well each model identifies the correct severity level

EVALUATION METRICS

Key metrics:

- **Accuracy**
- **Recall**
- **Precision**
- **F1 score**

Limitations & Future Work

- Models are currently trained only on synthetic distress messages; no public real-world logs are available.
- Test on real logs or expert-labelled calls to reduce the “sim-to-real” gap.