# AI For Search and Rescue


Machine Learning Team

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## Background

- Search and Rescue (SAR) incidents involve locating a missing person
- We analyze historical missing person data to uncover patterns that can guide future search efforts
- This will help us make predictions about the status or location of future missing individuals
- We use various machine learning models on large datasets such as ISRID to identify trends and make real-time predictions that support field operations

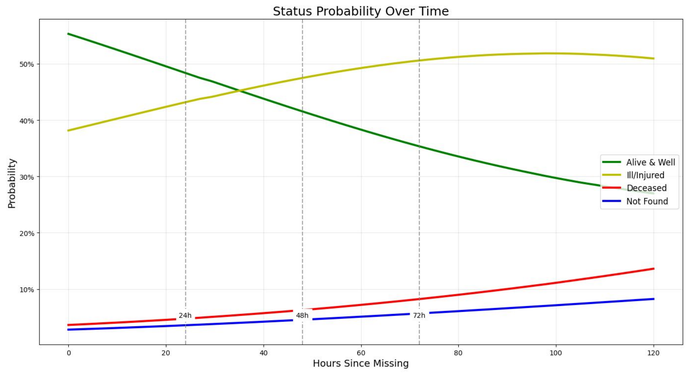
## Goal/Motivation

- Our main goal is to improve the overall efficiency of an incident.
  - Improve the overall effectiveness and efficiency of search and rescue operations
  - Deliver relevant, real-time information to support search teams in the field
  - Direct responders to areas with the highest probability of locating the missing person
  - Reduce both time and financial costs associated with search efforts through data-driven insights

## Machine Learning Models Used

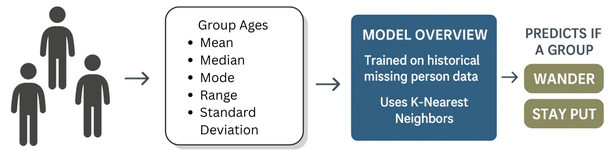
- K-nearest-neighbors/K-Prototypes Clustering: Groups similar missing-person cases to find cluster patterns
- Logistic Regression Model: Predicts survival outcomes to prioritize urgent rescue missions
- Stacking Model: Combines multiple models for higher accuracy and reliable rescue predictions
- Additional models: Random Forest, Decision Trees, Support Vector Machine (SVM) Regression

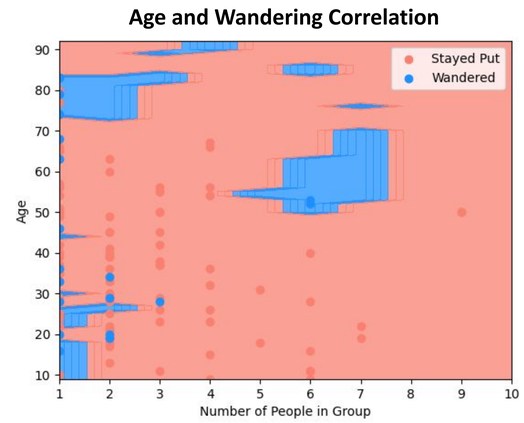
## Machine Learning Models

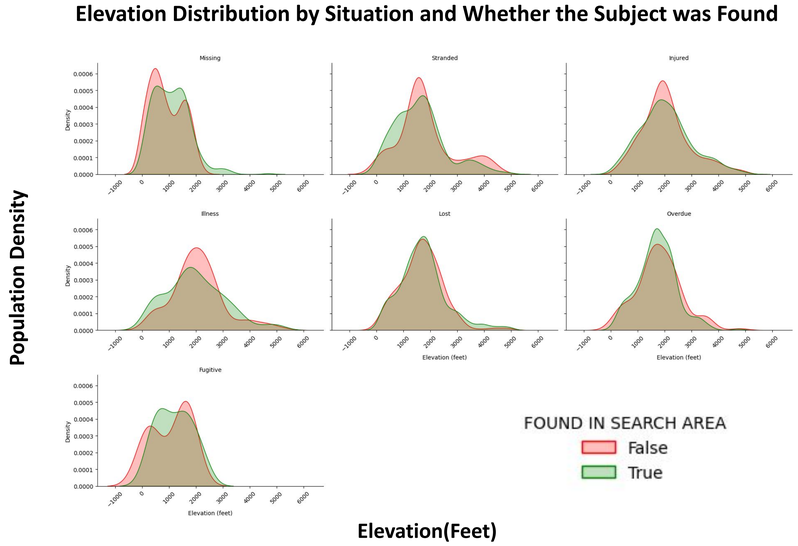



Status prediction over time for a 35-year-old subject with good physical fitness, outdoor experience, and lost in a forest environment

Correlation between age, number of people in group, and wandering habits




Elevation affects probability of finding a missing person in a search area

Situations analyzed: Fugitive, Illness, Injured, Lost, Missing, Overdue, Stranded

## Results

- Key Behavioral Trends Identified
  - Confirms Koester's findings and expert insights regarding dementia as a prevalent mental condition among missing persons.
  - Subjects aged 50–60 are more likely to remain missing for extended periods
  - Identifies patterns linking elevation, subject situation, and rescue success
  - Highlights correlation between duration missing and final rescue outcome
  - Reveals strong predictive patterns related to age and gender
- Key Insights
  - Estimates survival risk using a priority scoring model informed by past cases — offering a more nuanced approach than standard checklists alone
  - Continuously learns from real-world SAR outcomes and updates with new data to improve accuracy over time

## Future Work

- Model Integration: Combine separate prediction models (e.g., subject status, likelihood of being found, wandering behavior) into a single, cohesive system to provide rescuers with unified, actionable insights
- Real-Time Prediction: Enable live updates to model predictions as new data is collected during the mission, allowing searchers to adjust strategies dynamically
- Explainable AI (XAI): Incorporate interpretability methods so rescuers can understand the reasoning behind predictions, increasing trust and usability in the field

## Acknowledgements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