1. Chapter 1

**Topic:**

Provide an introduction to the thesis and the army data.

1. Introduction to thesis:
2. What research questions will be answered?
3. Introduction to the army data:
4. What is the goal for landmine detection?
5. How is the data formatted/provided?
   1. What is a lane?
   2. What is a grid?
6. What are the different types of landmines?
   1. High metal
   2. Low metal
7. How was the data collected?
   1. Collection site
   2. Date collected
8. Hypothesis:
   1. Provide hypothesis and formal thesis statement
9. Chapter 2

**Topic:**

Studying the 3 variations of multi target MIACE: greedy approach, thresholding approach, clustering approach.

**Research Questions to be answered:**

Between the 3 variations of the multi-target MIACE algorithm: greedy approach, thresholding approach, and clustering approach, is there a variation that is able to choose the underlying EMI target signatures? If so, which method performs the best considering ability and efficiency?

1. Background Literature Review:
2. MIACE
3. Proposed Algorithms Explanations:
4. Multi target MIACE Greedy Approach
5. Multi target MIACE Thresholding Approach
6. Multi target MIACE Clustering Approach
7. Experiments:

Ability:

1. ROC curves on High metal
2. ROC curves on Low metal

Efficiency:

1. Run time comparison
2. Space comparison
3. Data awareness comparison (How much do you need to know about the different classes within the data before running the algorithms)
4. Conclusions:
5. Chapter 3

**Topic:**

Studying what clustering approach for multi-target MIACE is the best out of three different approaches.

**Research Question to be answered:**

Using a clustering initialization approach to the multi-target MIACE algorithm, which of these three clustering methods (clustering1, clustering2, and clustering3) performs the best, considering ability and efficiency?

1. Background Literature Review:
2. Clustering for dictionary learning
3. Clustering Method 1
4. Clustering Method 2
5. Clustering Method 3
6. Proposed Algorithms Explanations:
7. Clustering Method 1
8. Clustering Method 2
9. Clustering Method 3
10. Experiments:

Ability:

1. Confusion matrix
2. ?

Efficiency:

1. Run time comparison
2. Space comparison
3. Data awareness comparison (How much do you need to know about the different classes within the data before running the algorithms)
4. Conclusions:
5. Chapter 4

**Topic:**

Studying if any of the 3 variations of multi target MIACE are better than Global ACE and MIACE on individual target classes, considering ability and efficiency than.

**Research Question to be answered:**

Are any of the three types of multi-target MIACE algorithms defined below better, considering ability and efficiency, than a single MIACE algorithm on individual target type classes and/or Global ACE using a generated Discrete Spectrum of Relaxation Frequencies (DSRF)?

1. Background Literature Review:
2. Global ACE
   1. Discrete Spectrum of Relaxation Frequencies (DSRF)
3. MIACE
4. Proposed Algorithms Explanations:
5. Global ACE
   1. Discrete Spectrum of Relaxation Frequencies (DSRF)
6. MIACE
7. Experiments:

Ability:

1. ROC curves on High metal
2. ROC curves on Low metal

Efficiency:

1. Run time comparison
2. Space comparison
3. Data awareness comparison (How much do you need to know about the different classes within the data before running the algorithms)
4. Conclusions: