Deep Learning

Naval Mine Detector Case Study

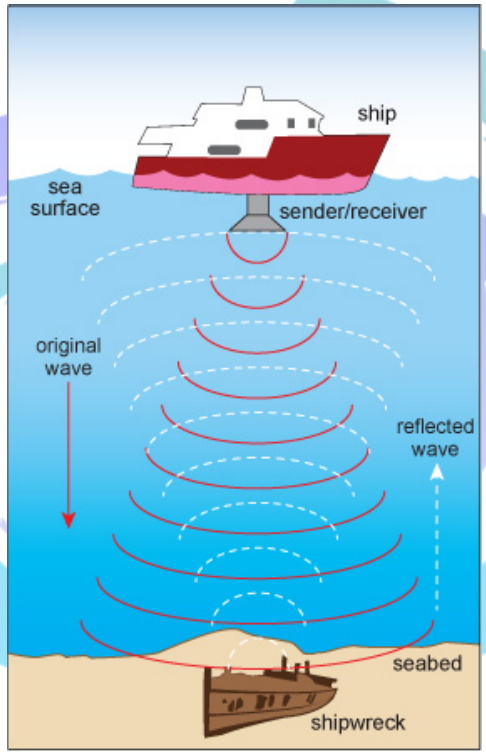
Abstract :

- Mine detection and classification using side scan sonar imagery is a challenging problem.
- As opposed to the majority of techniques, several Neural-network-based methods for the detection and classification of mines and mine like objects have been proposed.
- Detection and classification of underwater objects in sonar imagery is a complicated problem, due to various factors such as variations in operating and environmental conditions, presence of spatially varying clutter, variations in target shapes, compositions and orientation.
- Moreover, bottom features such as coral reefs, sand formations, and the attenuation of the sonar signal in the water column can totally obscure a mine-like object.
- Side scan sonar is a proven tool for detection of underwater objects.

- In order to overcome such complicated problems detection and classification system is needed.
- This method is able to extrapolate beyond the training data and successfully classify mine-like objects (MLOs).
- Five basic components of detection and classification techniques are considered namely data preprocessing, segmentation, feature extraction, detection and classification.

Introduction :

An underwater mine is a self-contained explosive device placed in water to destroy ships or submarines.
Ocean mines have been a major threat to the safety of vessels and human lives for many years.
Identification of mine-like objects is a pressing need for military, and other ocean meets.
In mine, countermeasures operations, side scan sonar are used to detect and classify mine- like objects if their sonar signatures are similar to known signatures of mines.
The detection and classification of underwater mines is an important task, with strong implications for the safety and security of ports, harbors and the open sea.
Mine warfare, including the detection and classification of undersea mines, has become extremely important to the U.S. Navy.



Sophisticated sea mines can be deployed at a relatively insignificant cost to cause huge problems for a battle group because of the difficulties associated with their detection and classification.
Moreover, in certain scenarios, mine countermeasures operations must be performed rapidly to allow naval platforms to reach their destinations in a timely manner.
Although the task of finding mine like objects has received recent attention, little has been published on the problem of discriminating between mine-like objects (MLO) and non-mine objects of similar size and shape.

Data Set :

- In this use case, we are going to use SONAR data set which contains the data about 208 patterns obtained by bouncing sonar signals off a metal cylinder (naval mine) and a rock at various angles and under various conditions.
- Now, as we know, a naval mine is a self-contained explosive device placed in water to damage or destroy surface ships or submarines.
- So, our goal is to build a model that can predict whether the object is a naval mine or rock based on our data set.

This dataset contains 61 columns and 208 rows.
From 61 dataset first 60 are features and last column contains label as R or M.