Iceberg Detection and Analysis

Sania Bandekar and Victoria Le
Department of Computer Science, San Jose State University, California

I. Introduction

DATA regarding icebergs can be very crucial to monitoring climate change as well as sea levels. Using SAR imaging combined with despeckling techniques can provide ways to examine these icebergs more closely, and obtain the necessary information required to make predictions on the effects of climate change as well as the effects of the icebergs themselves on the ecosystem.

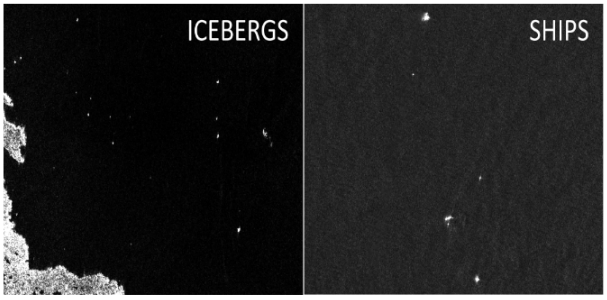
II. Progress

A. Research

Many researchers have utilized machine learning in order to detect icebergs and analyze them as they have a significant influence on oceanic properties [1]. Recent advancements in deep learning, convolutional neural networks (CNNs) and U-Net in particular, have been very helpful in enhancing the accuracy of iceberg detection from satellite images and computing iceberg shape and size.

B. Data Preparation

Data preparation involved preprocessing in order to enhance important features for iceberg detection. This process included normalizing the image data and despeckling to reduce noise. The use of an existing dataset from Kaggle was needed due to the limited availability of suitable SAR images [3]. It was loaded from JSON files and images were reshaped and converted into NumPy attays for model input.

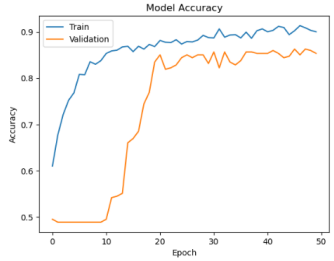


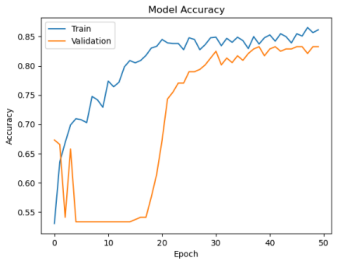
C. Convolutional Neural Network

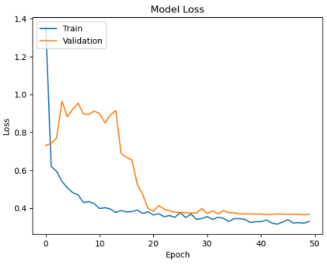
We are currently working to implement a CNN architecture consisting of convolutional layers and pooling layers with increasing depth to look for features from the images in the dataset. This is followed by batch normaliation and ReLU activation. The max pooling layers help reduce spatial dimensions and enchance the features while maintaining all the important information. We chose CNN as it is most ideal for image classification.

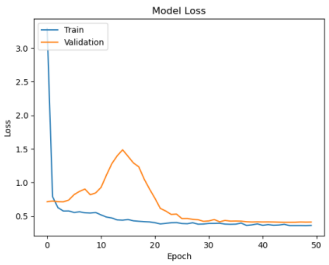
D. Training

A portion will be used for validation. The loss function used will be binary cross-entropy, which is suitable for our binary classification problem – Does the photo contain an iceberg or a ship. Training includes optimization using Adam optimizer and ReduceLROnPlateau callback. [2].









E. Development of User Interface

The front-end design is focused on providing an intuitive user experience for visualizing iceberg detection results. We are developing a desktop application using Python that allows users to upload images and view detection results, along with metrics that indicate the confidence of each prediction. The

design is responsive and we aim to present information in way that is easily accessible and clear.

III. Challenges

A. Data Preparation

It was difficult to find the satellite imaging we needed for the project, especially one that was large enough to get an accurate and precise model. Thus, we had to resort to using an already existing dataset from Kaggle [3].

IV. Next Tasks to Complete

A. Metrics

Determining best model accuracy and loss by average.

B. Application Deployment

The back-end will need to be integrated with the front-end user interface to provide users with an efficient a simple way to upload images and get results.

C. Iceberg Size Calculation and U-Net

We plan to look into adding an additional feature to our application where users can upload a higher quality image of an iceberg [4].

References

[1] David Hogg Anne Braakmann-Folgmann, Andrew Shepherd and Ella Redmond. Mapping the extent of giant antarctic icebergs with deep learning, 2023.
[2] HankyuJang. Statoil-c-core-iceberg-classifier-challenge, 2017.
[3] Kaggle. Statoil/c-core iceberg classifier challenge, 2017.
[4] University of Leeds. Ai can map the outline and area of giant icebergs, November 9 2023.