Iceberg Classifier.

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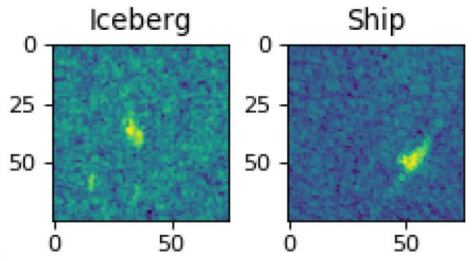
1. Introduction

Using deeplearning and image recognition, we have a unique opportunity to achieve higher levels of worker safety in remote and dangerous locations, as is evident in the threat that drifting icebergs present to commercial activities in our arctic regions. Leveraging a challenge presented by kaggle.com I have developed an algorithm to identify a remotely sensed target as a ship or iceberg, using satellite imagery. The result is to improve safety conditions with a solution to assess the risks from icebergs. Kaggle Competition: (**https://www.kaggle.com/c/statoil-iceberg-classifier-challenge**)

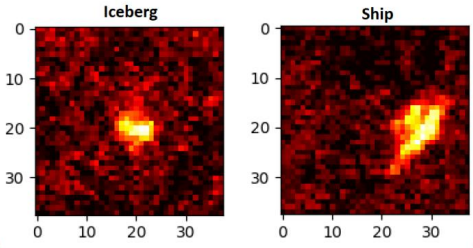
2. Data

All the images are presented in 2 bands of flattened image data with 75x75 pixel values, at 5625 element in total. Each band is characterized by radar backscatter produced from different polarizations at a particular incidence angle, or the angle at which the image was taken. The labels used in training and validation are provided by human experts and geographic knowledge on the target.



3. Features

The data set provides 3 key features for prediction, across the 2 bands of image data and the angle of incidence. Given the data set is relatively small at 1103 images, across training and dev sets I have used augmentation to expand this to 16,545 images. The augmentation techniques include; rotation, flipping, horizontal and vertical shift, zooming and translation along a positive and negative diagonal. During feature analysis saliency mapping was used to help understand the impact of the features.



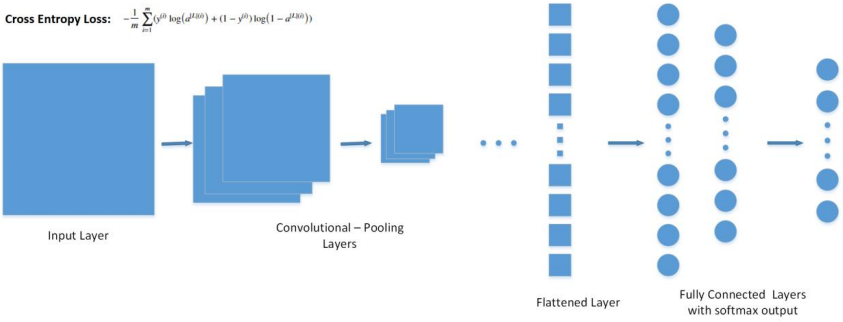
7. References

Iceberg Classifier Challenge [Online]. Available: https://www.kaggle.com/c/statoil-iceberg-classifier-challenge

Yuzhen Lu, "Food Image Recognition by Using Convolutional Neural Networks (CNNs)" Department of Biosystems and Agricultural Engineering, Michigan State University, East Lansing, MI 48824, USA Feb. 2004.

4. Models

A total of four models were used, based on the architecture framework illustrated below. The configurations consistent to each model were as follows: Conv Filter size 3x3 and a max pool filter size of 2x2, Stride of 1, and padding of 'SAME'. Cross entropy was used as the loss function and softmax on the output layer.



Unique model was configurations were limited to: Number of hidden layers and neurons, and drop out regularization. The primary motivation was, as more neurons were added, dropout regularization was increased.

	Dropout	Convolutional Layers						FC Layers	
Model 1	0.2	64	128	128	256	128	64	512	256
Model 2	0.7	64	128	256	512	128	64	512	256
Model 3	0.2	64	128	128	256	0	0	256	128
Model 4	0.7	64	128	128	256	0	0	256	128

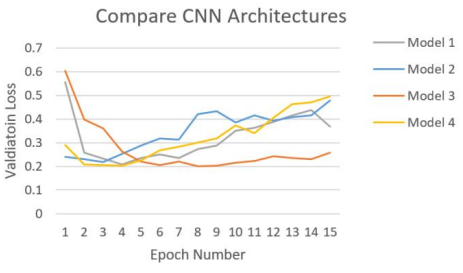
5. Discussion and Results

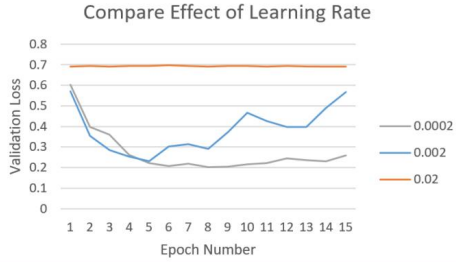
Using 4 models and the key metric of test error, I validated each model using 15 epochs of the data set to produce the results below. Model 3 had the best overall score and was used for the final submission to the kaggle.com competition. The final result was produced using 50 epochs and generated a training error of 0.1860 and test error of 0.2005. My final place on the leader board progressed from a starting position of 1519 to 1145 with a final public score of 0.1657. The competition had 3343 entrants.

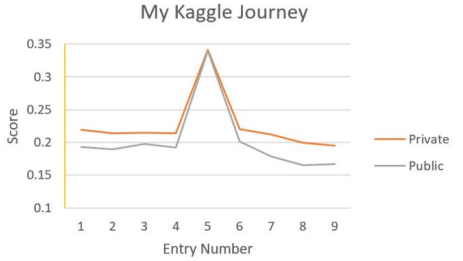
Test error was used as the success metric and the values below record the most successful iteration of each model during the model validation phase of development.

Training Samples: 16,545
Test Samples: 368

	Training Error	Test Error
Model 1	0.2828	0.2083
Model 2	0.1088	0.2183
Model 3	0.2001	0.2013
Model 4	0.2184	0.2031







6. Future

The competition winner identified the critical role that the angle of incidence played in the data set, and used clustering techniques to arrive at an accurate prediction. Given another 6 months I would develop a better understanding of the data and explore the suggested clustering algorithms.

The poster presentation can be located on youtube at the following unlisted video.
Poster Presentation
https://youtu.be/CC1iYS-18Kc