# OBJECT DETECTION

# PROJECT GOAL
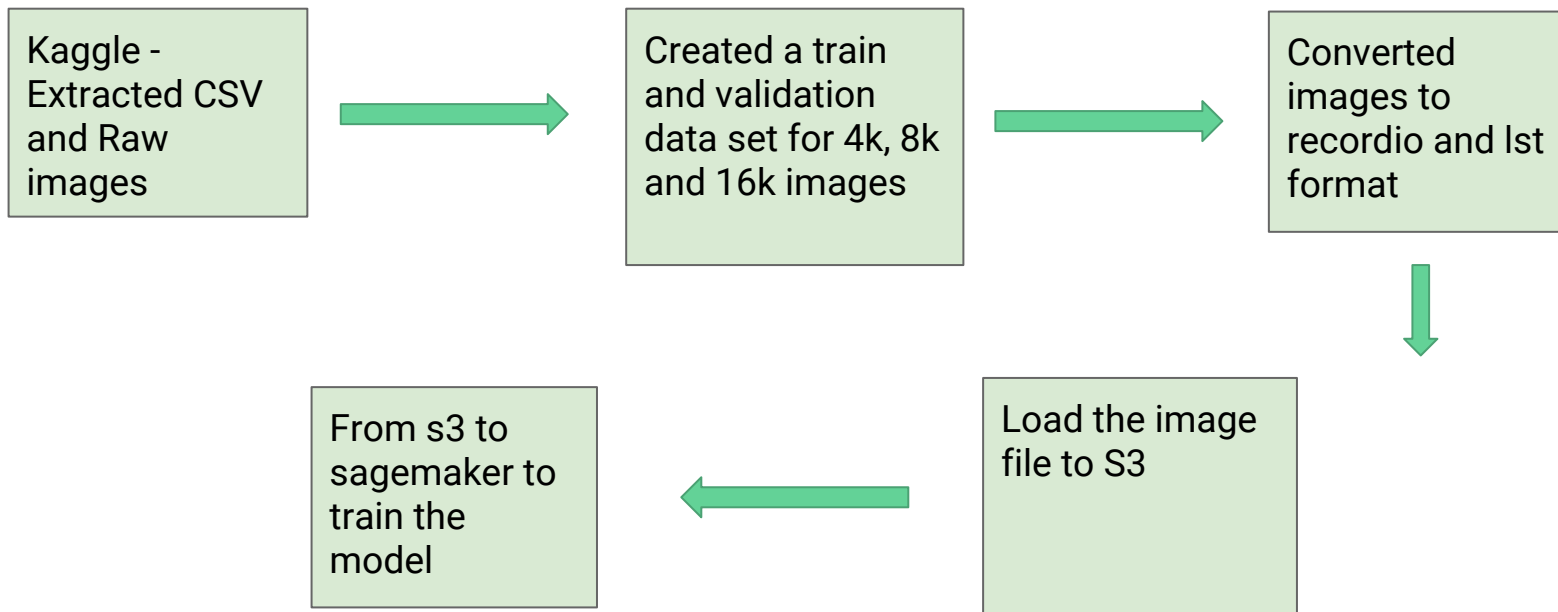
## GOAL

Identifying ships from the satellite images with high precision.

**USE CASES**

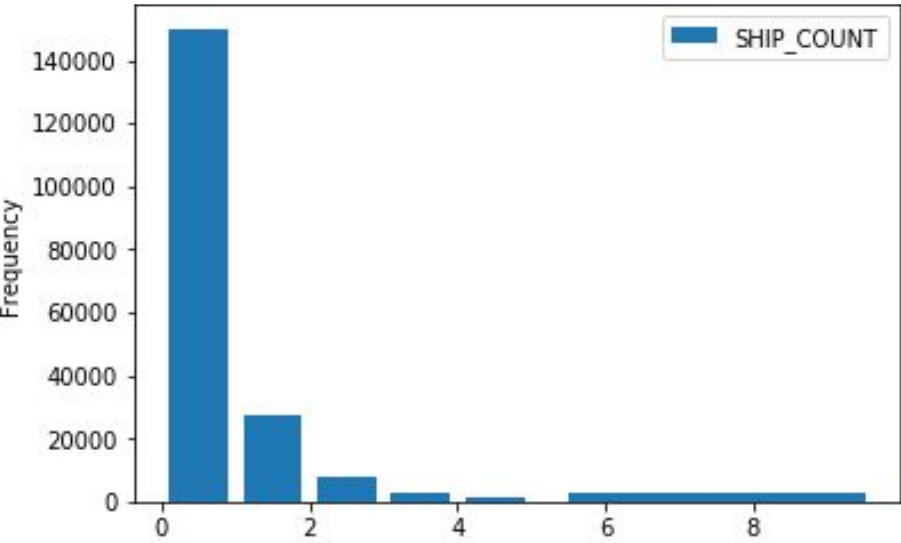This solution will help in improving our response to environmental disasters, piracy, illegal cargo movement, etc...

# ETL STRATEGY

Kaggle - Extracted CSV and Raw images → Created a train and validation data set for 4k, 8k and 16k images → Converted images to recordio and lst format → Load the image file to S3 → From s3 to sagemaker to train the model

# DESCRIPTIVE ANALYTICS

Total number of rows in raw file - 231,723
Number of rows with image - 192,556
Number of images contain one or more ships - 42,556 (22%)
Number of images with no ship - 150,000 (78%)

Raw Data from Train Data Set

# MODELING STRATEGY

- **Image classification problem**
  - We used Sagemaker's image classification built-in algorithm to solve this problem.
  - Transfer learning using pre-trained ResNet-18 architecture
  - Two-class softmax classification: **SHIP or NO SHIP**

- Hyperparameters:
  - **Training set size: 4K, 8K, 16K**
  - Number of layers: 18
  - Mini-batch size: 10
  - Learning rate: 1e-2

- Interpreted accuracy with epochs and confusion matrix

# EPOCHS and ACCURACY

**Data Set : 4000 Images**
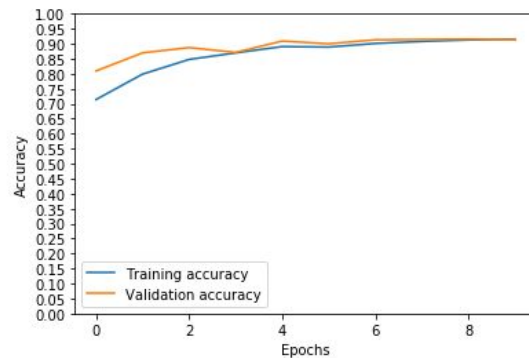
Maximum validation accuracy: 0.904000
<Figure size 432x288 with 0 Axes>
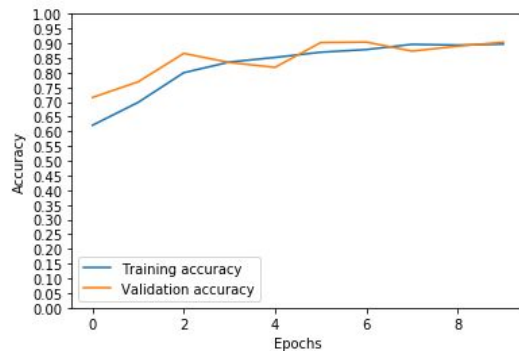


**Data Set : 8000 Images**

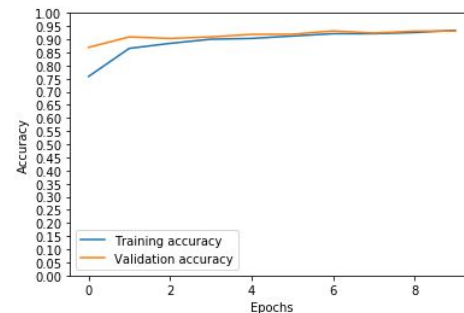Maximum validation accuracy: 0.915750
<Figure size 432x288 with 0 Axes>



**Data Set : 16000 Images**

Maximum validation accuracy: 0.931750
<Figure size 432x288 with 0 Axes>

# CONFUSION MATRIX

| | |
|---|---|
| **True Positive**<br><br>898 | **False Positive**<br><br>57 |
| **False Negative**<br><br>102 | **True Negative**<br><br>943 |

**False Negative** : Ship was not identified.
For example, Drug trafficking and piracy would potentially result in loss of life.

**False Positive** : Ship identified falsely. Increase in cost and lost in time.
For example, false leads will be provided to search and rescue teams resulting in lost time and efforts.
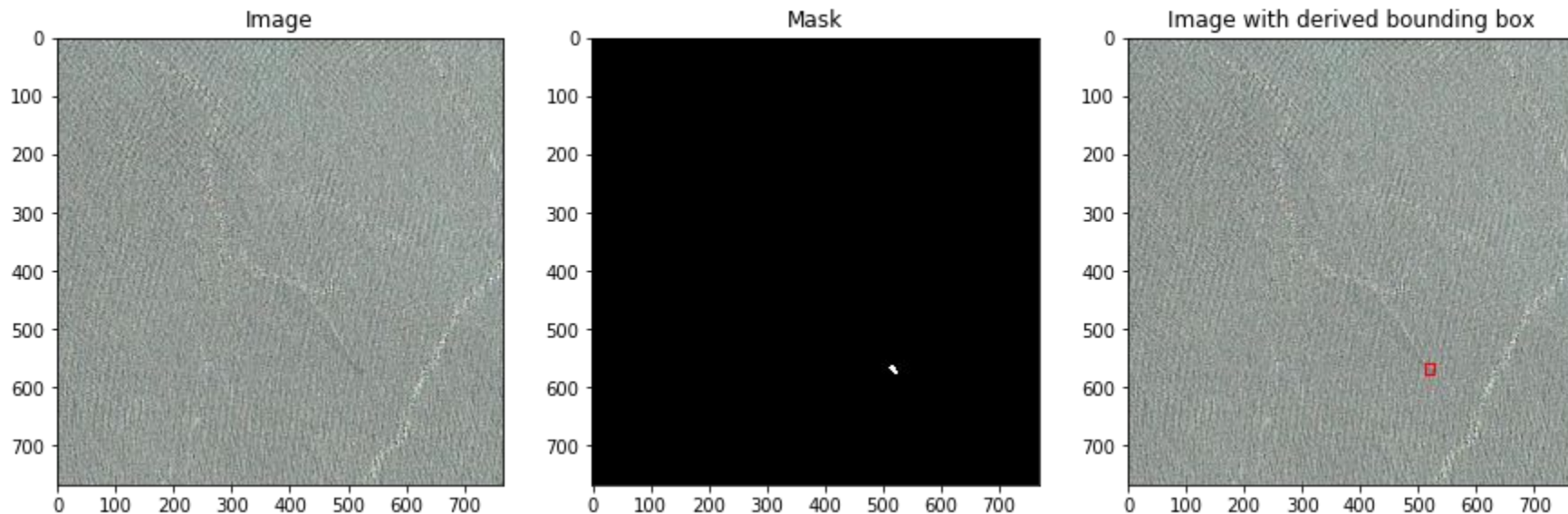
**Recall:**     94.3%
**Precision:** 90.2%

# ERROR MODES : Missed Ships (FNs)
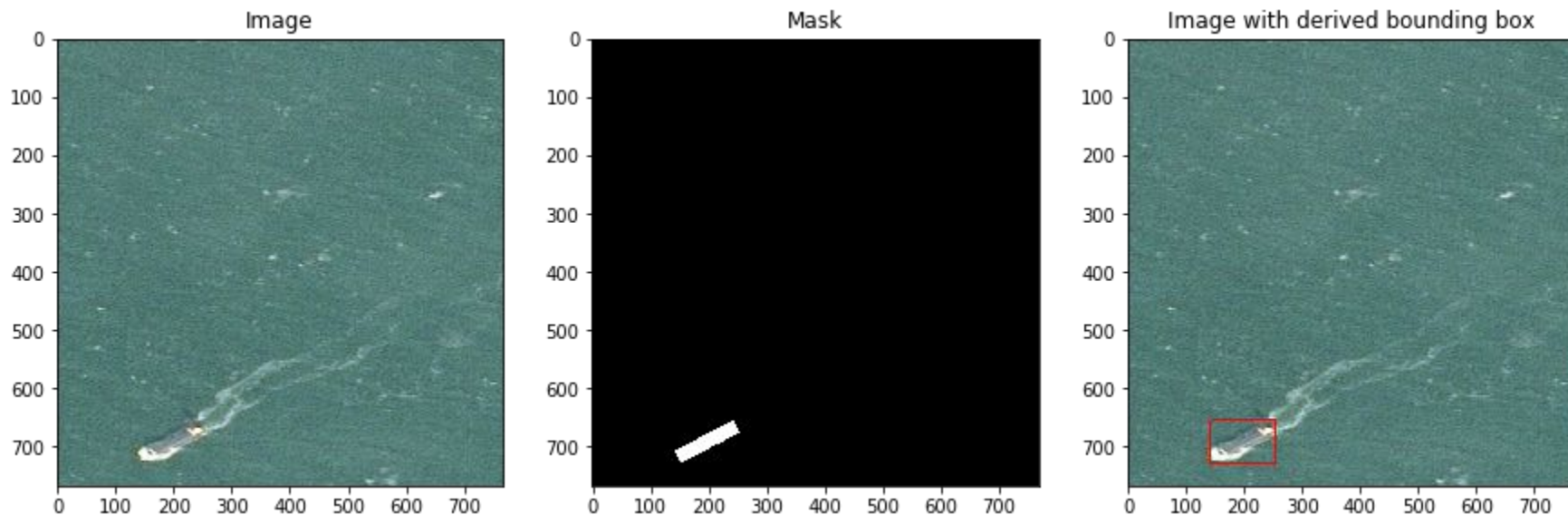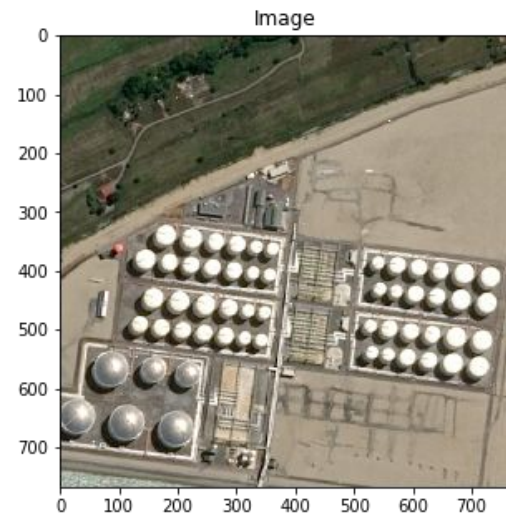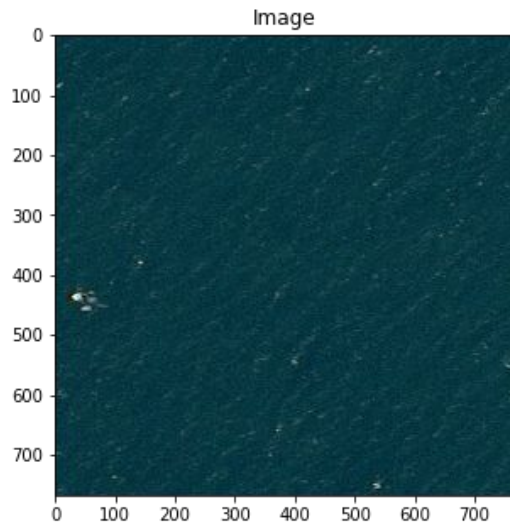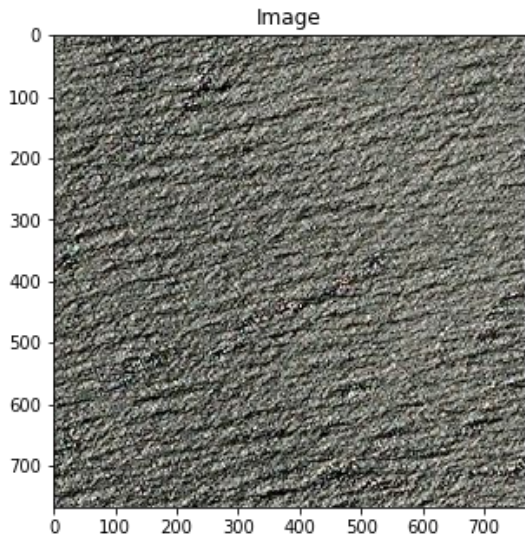


Image

Mask

Image with derived bounding box
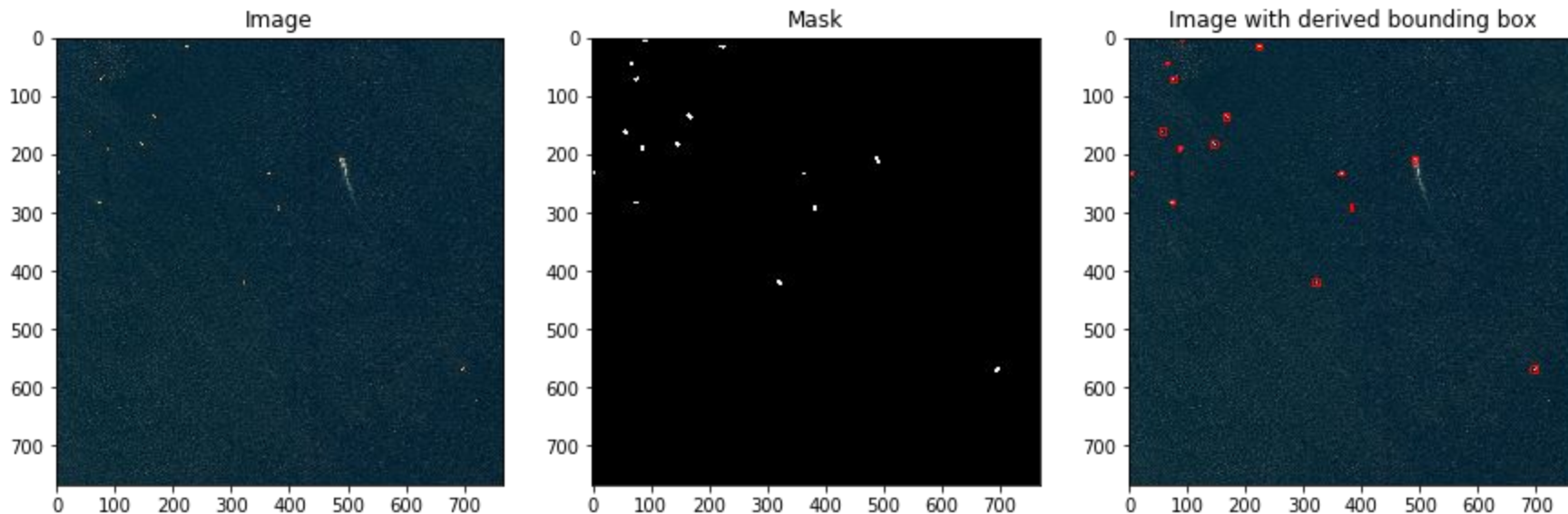
# ERROR MODES : Missed Ships (FNs)

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# ERROR MODES : Imagined Ships (FPs)

# NEXT STEPS

**Assuming continued free access to amazing AWS/SageMaker:**

- Scale the training set (and validation)
- Increase capacity of the network (e.g., larger/more FC layers)
- Tune additional hyperparameters (learning rate, batch size, epochs, etc.)
- Extend error analysis to identify edge cases
- Move to object localization (bounding boxes or pixel-level segmentation)