Motivation

- Kaggie "Airbus Ship Detection Challenge" [1]
- Interesting problem with real world application and available data due to the Kaggie competition
- No specific papers published on this dataset due to ongoing Kaggie competition

Dataset

The Kaggie dataset has 192,555 images that were labeled with Masks for ships if they are present. The dataset is very unbalanced with 78% of the images having no ships. As you can see, small and some have many ships on one image. Here are some examples of the data:

Satellite Photos from Dataset

<table>
<thead>
<tr>
<th>Images</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Ships</td>
<td>150,000</td>
<td>78%</td>
</tr>
<tr>
<td>Ships</td>
<td>42,555</td>
<td>22%</td>
</tr>
</tbody>
</table>

Same Satellite Photos with Masks Overlaid

The data was randomly divided into 172,555 training images, 10,000 development images and 10,000 test images.

Model Structure: Divide Into Two Parts

As you can see in the chart below we divide the problem into two parts because of the unbalanced data. We first classify images as ship or no ship using Inception3. Then we use a U-Net model for those images classified as ship to generate a mask and for those classified as no ship we output an empty mask.

Inception3 Model

Original

Truth Mask

Projected

U-Net Example Results: Val Data

Dice Coefficient

I used the Dice Coefficient to evaluate the mask results.

\[
DC = \frac{2TP}{2TP + FP + FN}
\]

Where P is the predicted mask and T is the true mask. Values range from 0 to 1, with 1 being the best match. I used the negative of the Dice Coefficient as the loss to train the U-Net Model.

<table>
<thead>
<tr>
<th>Epochs</th>
<th>Train Dice Coef</th>
<th>Val Dice Coef</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>91.5%</td>
<td>89.9%</td>
</tr>
<tr>
<td>100</td>
<td>95.6%</td>
<td>94.1%</td>
</tr>
<tr>
<td>150</td>
<td>97.2%</td>
<td>95.2%</td>
</tr>
</tbody>
</table>

LR = Model Learning Rate

Contributions from Others

I had originally partnered with Suren Talla, another SCPD student in CS230. We worked together through the Milestone. Since the Milestone he had significant family issues and ultimately had to drop from the project. He contributed in choosing this project, the initial research and ideas discussed in the Milestone. All the modeling done here is all my work and has been done since the Milestone.

Link to YouTube Video Presentation

https://youtu.be/uHAMBrHsMDk

Combined Results

I did not have time to run combined results of these best two scenarios for this poster but I will include these combined results in the final paper.

Future Work

- Try Different Classification Models for the first model other than Inception V3 to see if we get better results
- Explore more U-Net structures
- Try other pretrained mask models such as MASK R-CNN as an alternative to U-Net
- Test if data augmentation will improve the results of either model.