**Introduction**

- The project is based on the ISBI 2012 Challenge and aims to perform segmentation of cell images.
- There are initially 30 512x512 images both in the training and testing sets.
- The metric of success is accuracy of the classifier.

**Data Augmentation**

- Used Image Data Generator in Keras to generate new training images.
- Since the training set has a generated infinite size, the number of steps per epoch is fixed to 2000.

**Models**

- U-Net:
  ![U-Net Diagram](image)
- SegNet:
  ![SegNet Diagram](image)

**Results**

<table>
<thead>
<tr>
<th>Model</th>
<th>Optimizer</th>
<th>Learning Rate</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-Net</td>
<td>SGD</td>
<td>0.0001</td>
<td>0.885</td>
</tr>
<tr>
<td>U-Net</td>
<td>Adagrad</td>
<td>0.0001</td>
<td>0.878</td>
</tr>
<tr>
<td>U-Net</td>
<td>Adam</td>
<td>0.0001</td>
<td>0.967</td>
</tr>
<tr>
<td>U-Net</td>
<td>Adam</td>
<td>0.001</td>
<td>0.958</td>
</tr>
<tr>
<td>SegNet</td>
<td>SGD</td>
<td>0.0001</td>
<td>0.782</td>
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<tr>
<td>SegNet</td>
<td>Adam</td>
<td>0.0001</td>
<td>0.810</td>
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<tr>
<td>SegNet</td>
<td>Adam</td>
<td>0.001</td>
<td>0.814</td>
</tr>
</tbody>
</table>

Predictions: Left (U-Net), Right (SegNet)

**Discussion**

- Best score for a U-Net with Adam and a learning rate of 0.0001.
- Data augmentation is essential, otherwise scores are very low.
- SegNet misses the finer details, unlike U-Net, especially at the boundaries.
- U-Net is not very efficient when one class is present in abundance and there is some random noise.
- Future works:
  - Transfer Learning
  - Tiramisu
  - U-SegNet (combination of U-Net and SegNet).

**References**

- Badrinarayanan, Kendall, Cipolla: SegNet, a deep convolutional encoder decoder architecture for image segmentation.
- Ciresan, Gambardella: Deep neural networks segment neuronal membranes.