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# Image Segmentation - Update 1

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Project Guides:

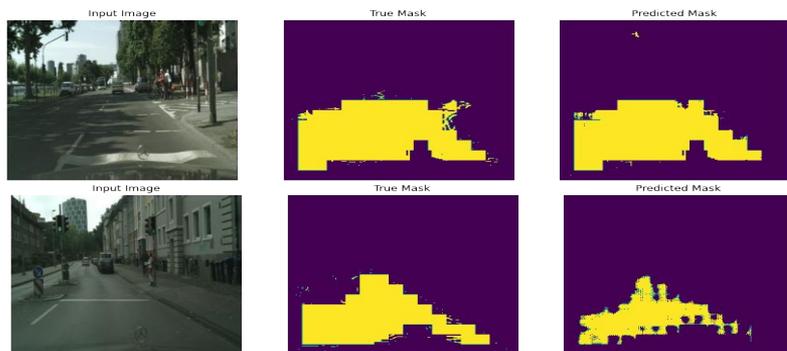
J. Hays and L. Milward

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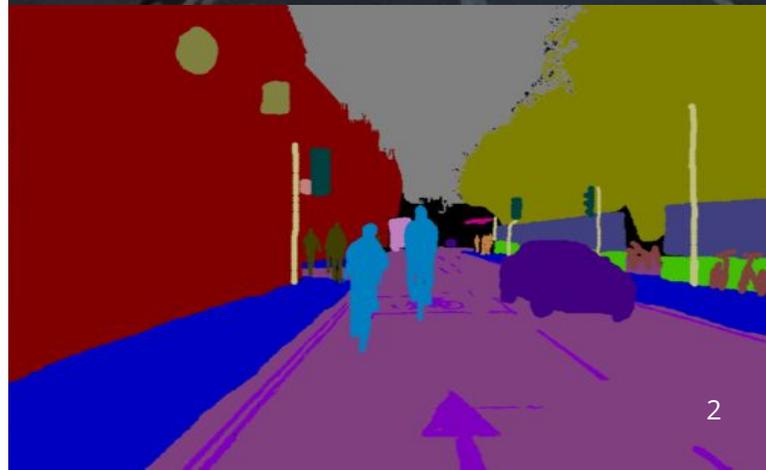
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# Fully Convolutional Network (FCN)

- **Fully Convolutional Networks** (FCNs) are named due to their architecture, which is built only from connected layers, such as **convolution**, pooling and upsampling.
- Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as image objects).
- My project is to construct a fully convolutional neural network (FCN) which can perform image segmentation.
- Image segmentation of foil images for HIP etch-pits using FCN will help us to determine the exact pixels in an image where etch-pits are located.

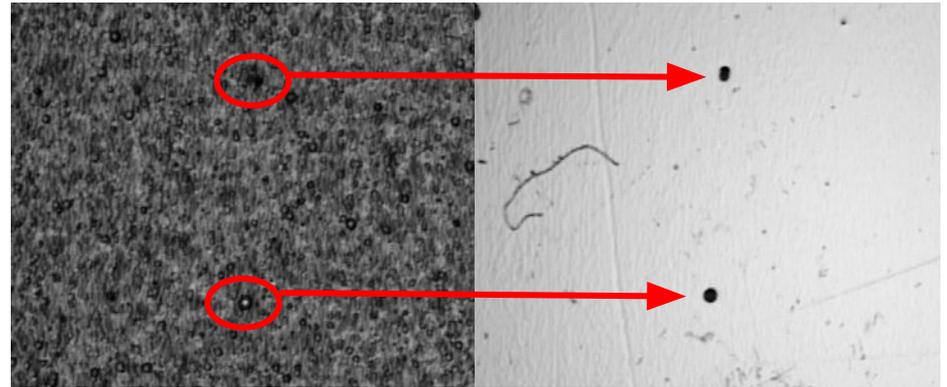
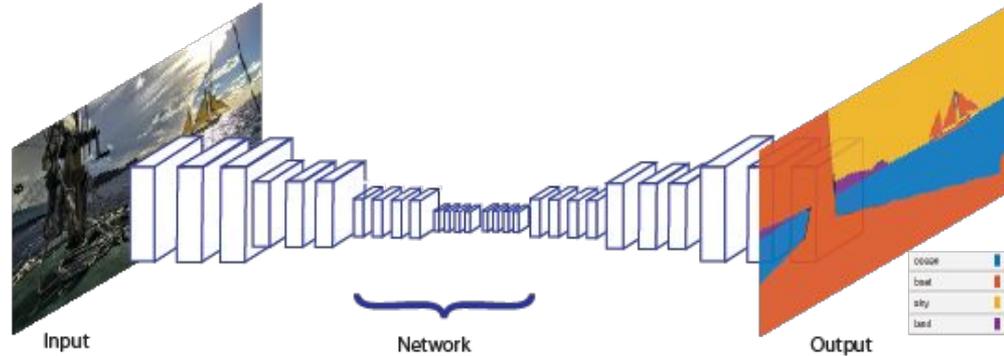


Source : [O.R.V. Dataset](#)



# FCN Architecture

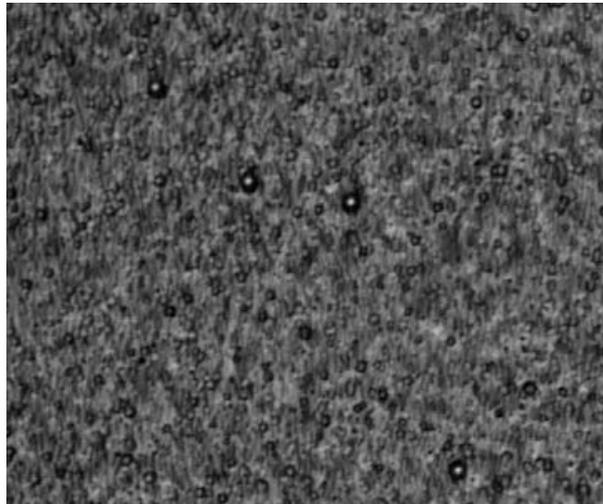
- A convolutional neural network (CNN) algorithm, extracts the feature map from an input image using convolution and pooling layers.
- This feature map is flattened to a vector which is used in images recognition and images classifications.
- An FCN does not flatten the feature maps but use it to upsample the image to original dimensions.
- As the HIP etch-pits are the only objects common to both images this should be the only feature that NN should learn and contribute to the final image.



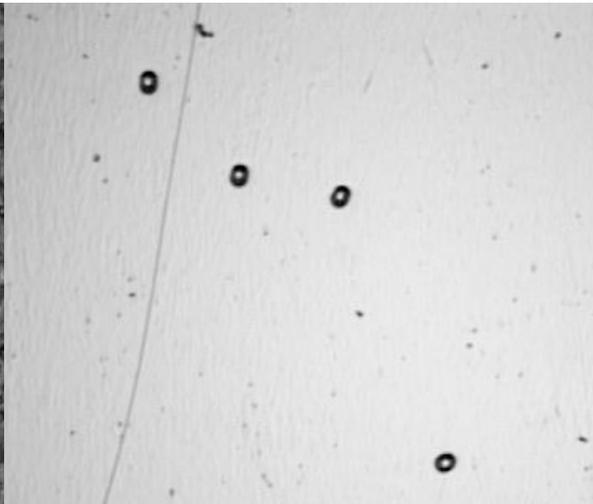


# Data

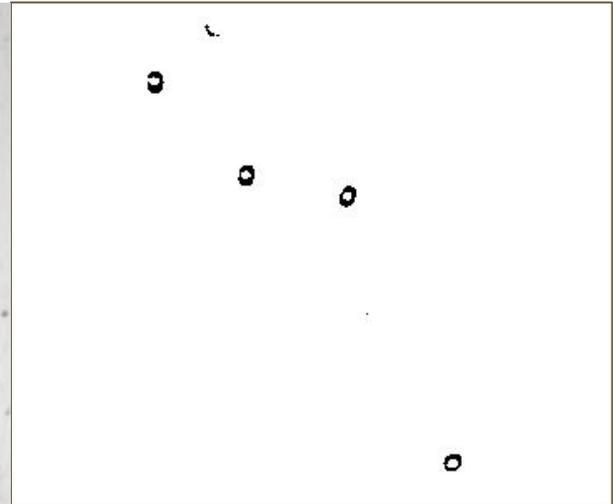
- $^{148}\text{Pb}$  ion exposed aligned foil images from the backlit channel were used for training and validation of the FCN.
- For validation two types of dataset were constructed one with clean foil one with binary image ( $\sim 30\%$  threshold was used) of the clean foil to compare their performance.



Dirty Image



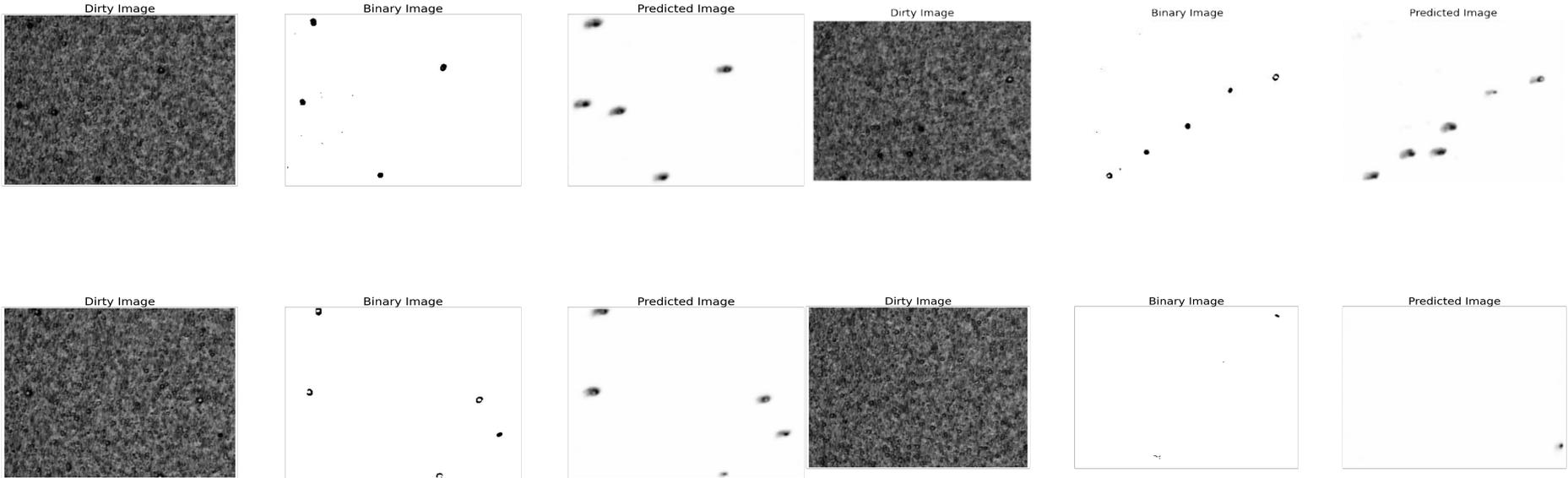
Clean Image



Binary Image

# Results

Some preliminary work using binary images from clean images.



# Summary

- Constructed an FCN using UNET architecture.
- Running network on backlit channel.
- The ability to detect HIP etch pits is shown in the results.

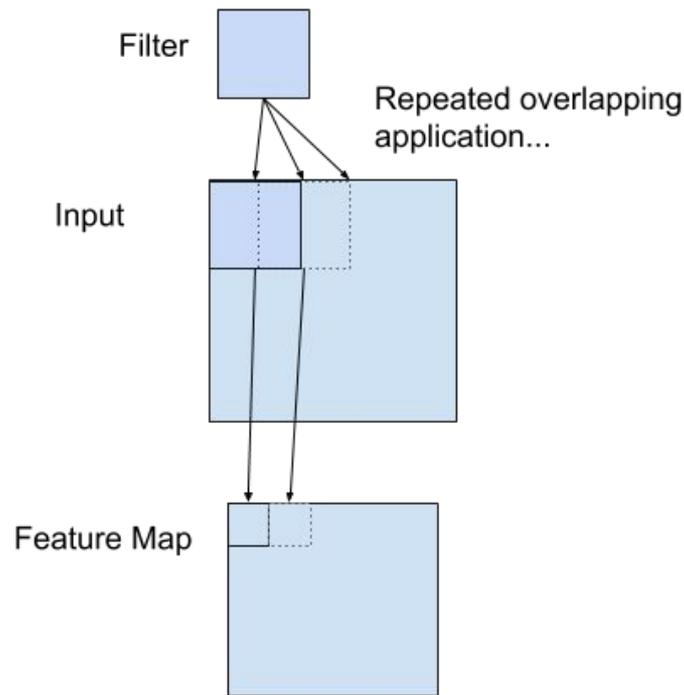
# Outlook

- Try to measure and increase the accuracy of the segmented image.
- Work on non binary clear image.
- Incorporate other channels in the dataset.

# Backup

# Convolutional, max pooling and transpose convolutional layers

- Unlike traditional hidden layers in neural networks, a convolutional layer, multiplies a set of weights on a kernel or filter with the input. The kernel is smaller than the input.
- Pooling also uses a kernel but it will always reduce the size of the image. Max pooling passes the maximum value of the filter.
- Transposed convolutional layer is used to generate an output feature map which has a spatial dimension greater than that of the input feature map. First zeroes are added between rows and columns according to the required output, and the normal convolution is performed.



# Clean foil results

