Defect segmentation on Textured Surfaces

In this project, you will be developing a model to detect defects by Industrial Optical Inspection on Textured Surfaces. This problem can be modelled as an Image Segmentation task where you will have to find the pixels where the defect occurs in a given image.

The dataset we will be using is described here:

https://hci.iwr.uni-heidelberg.de/node/3616

You do not have to download it. We will provide a compressed version.

There are many ways to solve this problem. We will attempt to solve this using deep learning and the approach we will follow is based on the paper on U-Net: Convolutional Networks for Biomedical Image Segmentation.

Reference Material

Here are some links that might help you to get familiar with the tools and techniques that you might need to finish the project. [OPTIONAL]

1. Introduction to CNNs – Jianxin Wu
2. Keras tutorial
    a. https://keras.io
    b. https://keras.io/getting-started/sequential-model-guide/
3. U-Net paper
4. Dice Coefficient

Project Setup

The project will be done using a high-level library Keras. Although Keras is not very flexible and hence not the preferred choice for most people, it is easy to understand. Since the project requires training deep networks, you will be requiring a GPU. To facilitate this, the project will be done using Google Colab. Google Colab provides free GPU runtime and can be synced with Google Drive to transfer/load data.

Steps:
1. Save the dataset in your Google Drive.
   Go to this link and click the "Add to My Drive" button on the top right.
   The dataset will be visible in the root folder of your Google drive after a few seconds.
2. Go to http://colab.research.google.com/ and upload the .ipynb file provided in this project.
3. Set the Runtime to GPU from the menu on the top left.
4. Follow the instructions in the notebook.

Deliverables

Do not modify any code other than the places where it is clearly specified.
You need to submit the .ipynb file and the corresponding .html file.

You are encouraged to experiment with different hyperparameters/models/loss functions, but please do that in the last part of the notebook without changing the code of the template. This will ensure that you do not lose any points during grading.

Model
Below is a picture of the model (from U-net paper) we will be creating to solve the segmentation task.