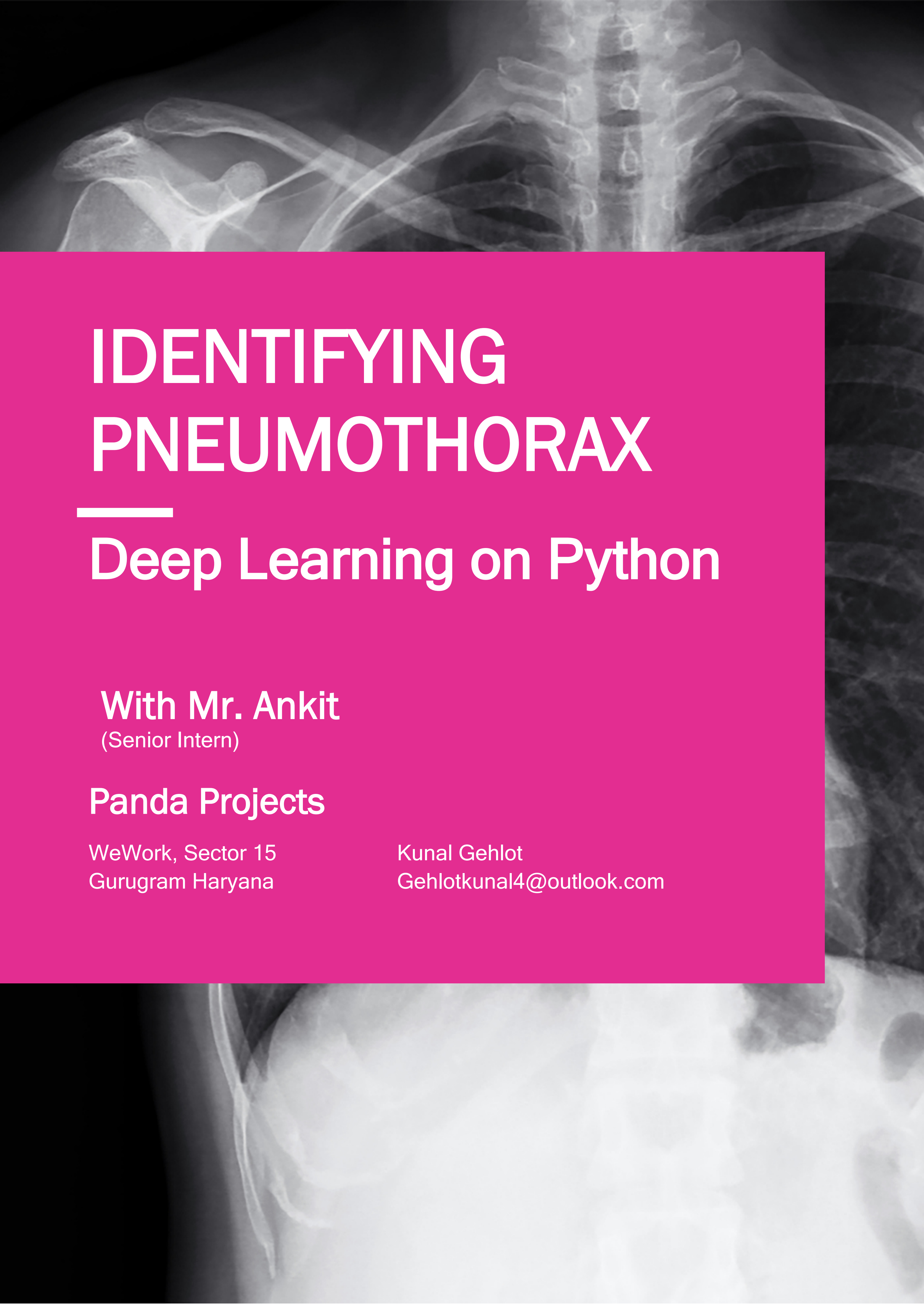

IDENTIFYING PNEUMOTHORAX

Deep Learning on Python

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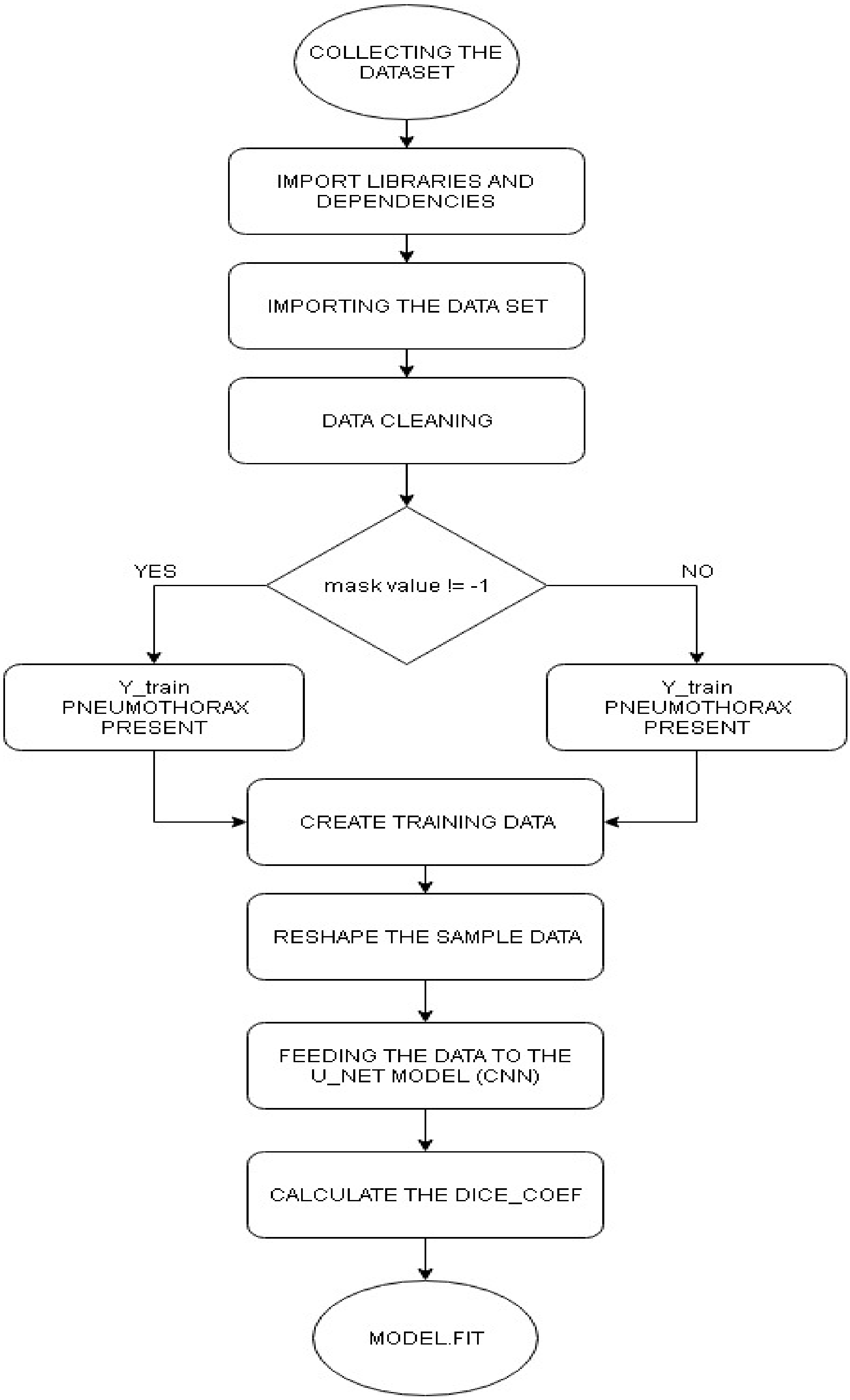
Flow Chart of Training Process



Collecting the Database

The data base for the problem contains images and annotations. The data set was made available for the purpose of early recognition of **pneumothorax**.
A sample submission file was also provided as to classify what will be the data stored within the **submission.csv** file. The data is comprised of images in **DICOM** format and annotations in the form of image **IDs** and **run-length-encoded (RLE)** masks. Some of the images contain instances of **pneumothorax**, which are indicated by encoded masks in the annotations.
Information stored in a **DICOM** file

```
Filename.........: ../input/siim-acr-pneumothorax-segmentation/sample images/1.2.276.
0.7230010.3.1.4.8323329.1000.1517875165.878027.dcm
Storage type.....: 1.2.840.10008.5.1.4.1.1.7

Patient's name......: 17d405a3-a0d2-4901-b33a-63906aa48d9f,
Patient id..........: 17d405a3-a0d2-4901-b33a-63906aa48d9f
Patient's Age.......: 38
Patient's Sex.......: M
Modality............: CR
Body Part Examined..: CHEST
View Position.......: PA
Image size.......: 1024 x 1024, 130476 bytes
Pixel spacing....: ['0.168', '0.168']
```

This files also contains the **RLE** values which are used to find the presence of pneumothorax. If the value of **RLE** is **-1** then **pneumothorax** is not present but if the value of **RLE** is not **-1** and is an **array of pixels** then **pneumothorax** is present. The **pixel array** is used to find the location of the area in which **pneumothorax** is present and with that we can create a mask to better display the affected area.

Import and Cleaning the Data

The data contains **dicom-images-train**, **dicom-images-test, train-rle.csv** and **train-rle-sample.csv** which is used for the prediction. The total number of **files** in the training dataset are 10712 and the number of **files** in test data set are 1377 which will be used for making the predictions.
The imported data set is then sorted. We will **read train-rle.csv** file. This file contains the **RLE** for the respected file. The number of entries in the **train-rle file** are 11582.

We have 10712 number of **files** and 11582 number of **RLEs** for the files. The **RLE** values is then stored inside a list. The next step is finding that how many of the images are annotated.

The process of data cleaning involves removing the duplicate **files**. In the data set some files doesn't have any **RLE** values which were also dropped in the data cleaning process. After the data cleaning process two data are created **ds1** and **ds2** which stores values of **RLE** and **indices (contains ImageId and EncodedPixels)** respectively.

This data cleaning process is performed for improving the overall accuracy of the model and improve the prediction.

A small part of the data set is printed to visualize the format of the dataset. Next step is checking the **RLE** and printing the images of the lungs without **pneumothorax** images which have **pneumothorax** overplayed with mask.

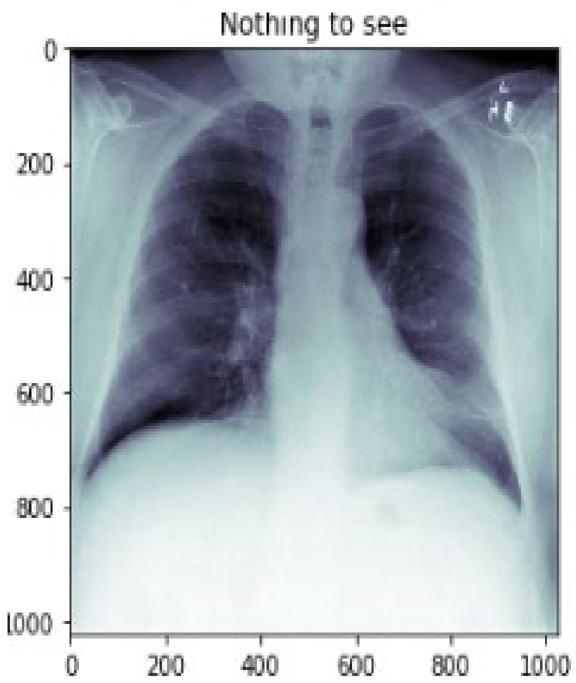
RESHAPE THE SAMPLE DATA

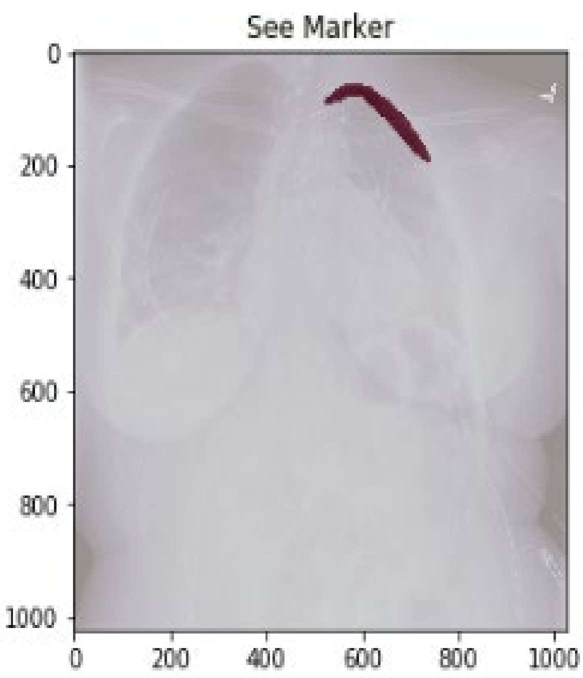
The **X_train** and **Y_train** dataset is then reshaped for better processing and change the size of the training and validation samples.

Create Training Data

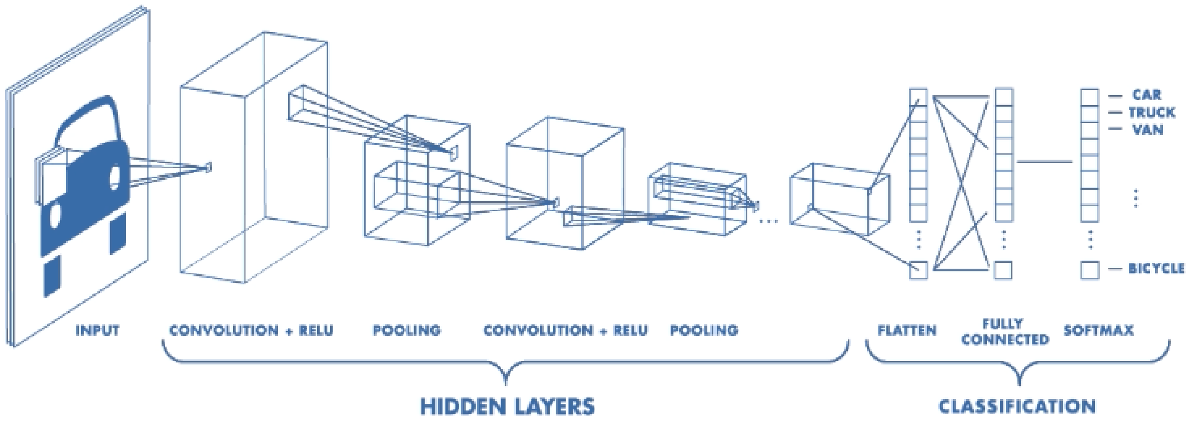
The imported files from the data base will be used for training the model. **X_train** and **Y_train** two files will be trained in this process which will then be used for predicting the loss and the **dice_coeff** of the images in the dataset. **X_train** is produced using the pixel array of the files in the data set. **Y_train** is also produced which will store the information of the **RLEs** of the files. The **RLE** of the file contains two types of value. The first value represents the healthy lungs or (lungs with no **pneumothorax**) and the second value defines the affected area (in which **pneumothorax** is present). For that we will call **rle2mask** function which will convert the **RLE** files and to **mask** and will overlap them on the images.

The images that doesn't have **pneumothorax** have a **RLE** value of -1 and if the **RLE** is in the form of **pixel array** then the lungs contains **pneumothorax** disease.





Creating the Convolution Neural Network (CNN)



The above image shows a **Convolution Neural Network**. It is divided into three layers **Input layer**, **Hidden layer**, **Classification layer**. The hidden layer is the layer which involves the processing part. The **hidden layer** in a **CNN** contains **multiple convolution** and **pooling layers**. Then the images is send to **classification layer**. The number of layers of **CNN** can be increased or decreased to change the total no of parameters on which to train. These parameters are then fed to the model for calculation the loss percentage. The **dice_coeff** is also calculated in this process.

Formula for calculating the **dice_coeff**

$$dice\_coeff = 2 * \frac{|x \cap y| + smooth}{|x| + |y| + smooth}$$

The smooth in the above formula is used for smoothing the predicted value. The activation function used is **RELU** and padding is also used for maintaining the original size of the image. The loss is calculated using **binary_crossentropy.**
The model take **inputs** and **outputs** variables as inputs for training.

The last step in Training process is training the model. The trained model is saved as **model.h5** and will be used in testing phase.