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DenseNet121

DenesetNet121 is a convolutional neural network (CNN), which each layers are connect to all other layers which are deeper in the network. It focuses to improve learning by going deeper on the layers as well as trying to get more efficient training by keeping by using shorter connections between the layers. The principle is i^{th} layer is connected to the $i+1^{th}$, $i+2^{th}$…. layers. An example of densenet with a A 5-layer dense block with a growth rate of k = 4 and each layer takes all preceding feature-maps as input:
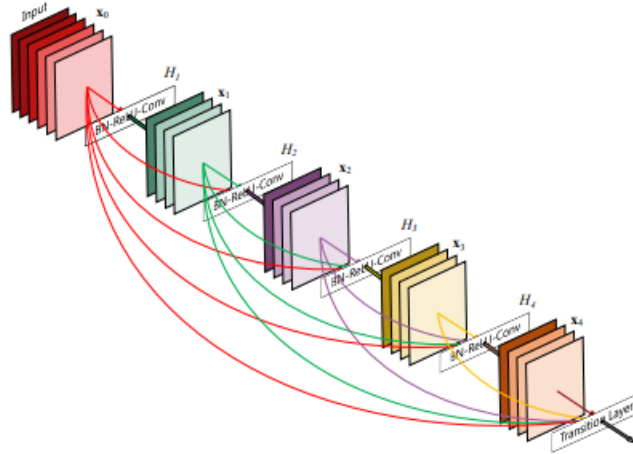

Figure 3 A 5-layer dense block with a growth rate of k = 4. Each layer takes all preceding feature-maps as input.[1]

To apply denseNet121 algorithm first data are separated to distinguish classes and images are **labeled.** Then the **pre-processing** applied to the image data. For the pre-processing first **standardization** applied the image data. Since the pre-trained data uses 3 channel inputs, the images transformed to gray scale for three channel formats by repeating the pixel values in the images across all the channels. As almost all other medical data class imbalance occurs also in our data sample. To solve **class imbalance** problem the loss function applied on the weights using binary cross entropy loss function. More explanation given below in modeling. Then to establish train model, **include_top** option of DenseNet121 is set to false in order to change the input and output layers according to our data. Also, since the number of examples required to train medical models for diagnosis are typically between 10.000 and 100.000, the **DenseNet121**'s already pre-trained data weights are used. So, as a **weight** option this pre-trained library used. Then to the model, for the pooling **global spatial average pooling** added. Then for the output layer dense **activation** layer with unit:1 and activation: "sigmoid". For the loss function **Binary Cross Entropy Loss** function applied (we have only 0 and 1 normal or Pneumonia classes). Then the model trained using model fit with 5 epoch 100 steps in per epoch with 2 validations step using already given validation data. The resultant accuracy for test %74.68, for validation %87.5 for train %93.9 which are quite height, but accuracy is not only metric for training performance and reliability. From the classification report recall (sensitivity) for Pneumonia found as %98 while for normal case %35. It can conclude that the result of the algorithm can be reliable for the Pneumonia diagnosis, but it cannot be exactly saying that you are not Pneumonia. In other words, it is reliable for positivity but not reliable for negativity.

	precision	recall	F1-score	support
Normal	0.92	0.35	0.51	234
Pneumonia	0.72	0.98	0.83	390
Accuracy			0.75	624
Macro avg	0.82	0.67	0.67	624
Weighted avg	0.79	0.75	0.71	624