

# CXResnet

*Image classification for COVID-19 diagnosis*

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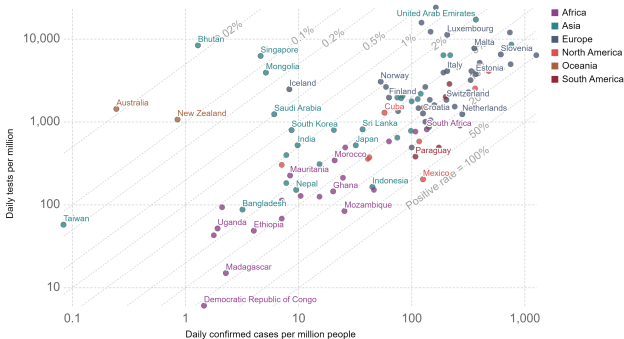
January 31, 2021

# Motivating the problem

## COVID-19: Daily tests vs. Daily new confirmed cases per million

The figures are given as a rolling 7-day average.

Our World  
in Data



Source: Testing data from official sources collated by Our World in Data, confirmed cases from Johns Hopkins University CSSE

Note: Comparisons of testing data across countries are affected by differences in the way the data are reported. Daily data is interpolated for countries not reporting testing data on a daily basis. Details can be found at our Testing Dataset page.

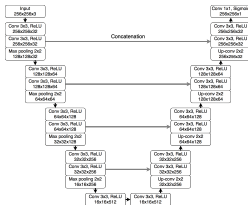
OurWorldInData.org/coronavirus • CC BY

Source: Our World in Data

# Neural Networks and Computer Vision

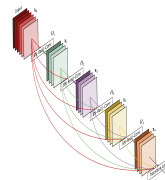
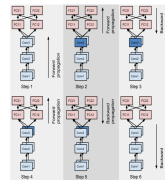


ResNet



U-Net

AlexNet

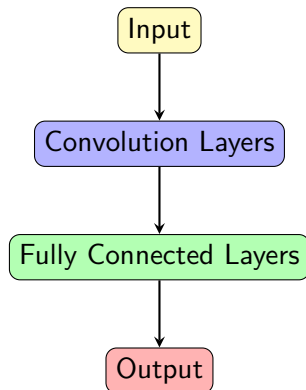


DenseNet

## Creating the Blueprint for a New Architecture

### I First consider a simple CNN architecture

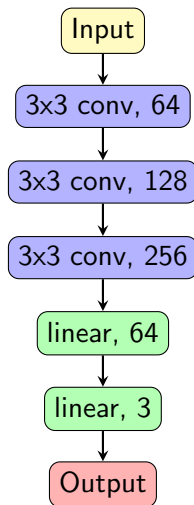
1. Several stacked convolution layers with structure:
  - i) 2d Convolution filter
  - ii) ReLU activation function
  - iii) Pooling layer
  - iv) Batch Normalization
2. Fully connected Linear layers
  - i) Sequence of linear layer, ReLU activation, and batch normalizations
  - ii) Final linear layer returns model output



## Create the Blueprint for a New Architecture

II Next, consider how this network can be expanded

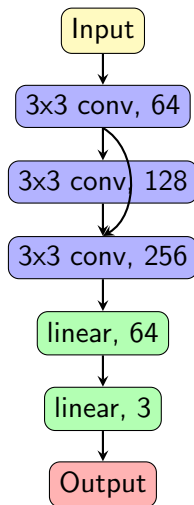
1. Increase the depth
  - Add more convolution and/or linear layers.
  - How many of each type of layer should be used?
2. Increase the width
  - Increase the number of convolutions



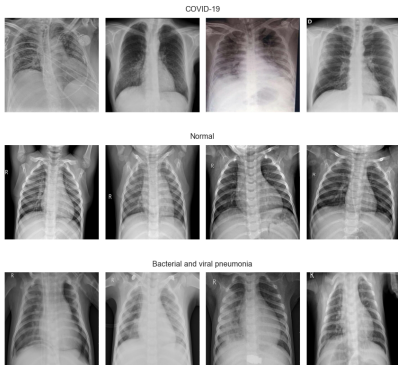
## Create the Blueprint for a New Architecture

### III Introduce residual connections between layers

1. Avoid encountering vanishing or exploding gradients
2. Effectively allows unneeded layers to be ignored



# Examining the Dataset

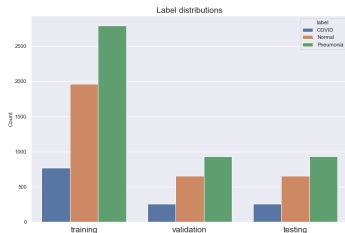


Dataset contains...

- 1281 COVID-19 X-rays
- 3270 Normal X-rays
- 4657 Pneumonia X-rays

Sample dataset images for each class

# Splitting the Dataset



Distribution of image labels for each split

Dataset is split into 3 disjoint sets...

- 60% training
- 20% validation
- 20% testing