Pneumonia Detection

with Chest X-Ray images

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Pneumonia

Pneumonia is an inflammation of lung tissue and can cause fluid to build up in the chest

Symptoms include:
- cough
- fever
- chest pain
- loss of appetite
    - Rarely: coughing up blood

Those at increased risk include:
- babies and very young children
- the elderly
- people who smoke

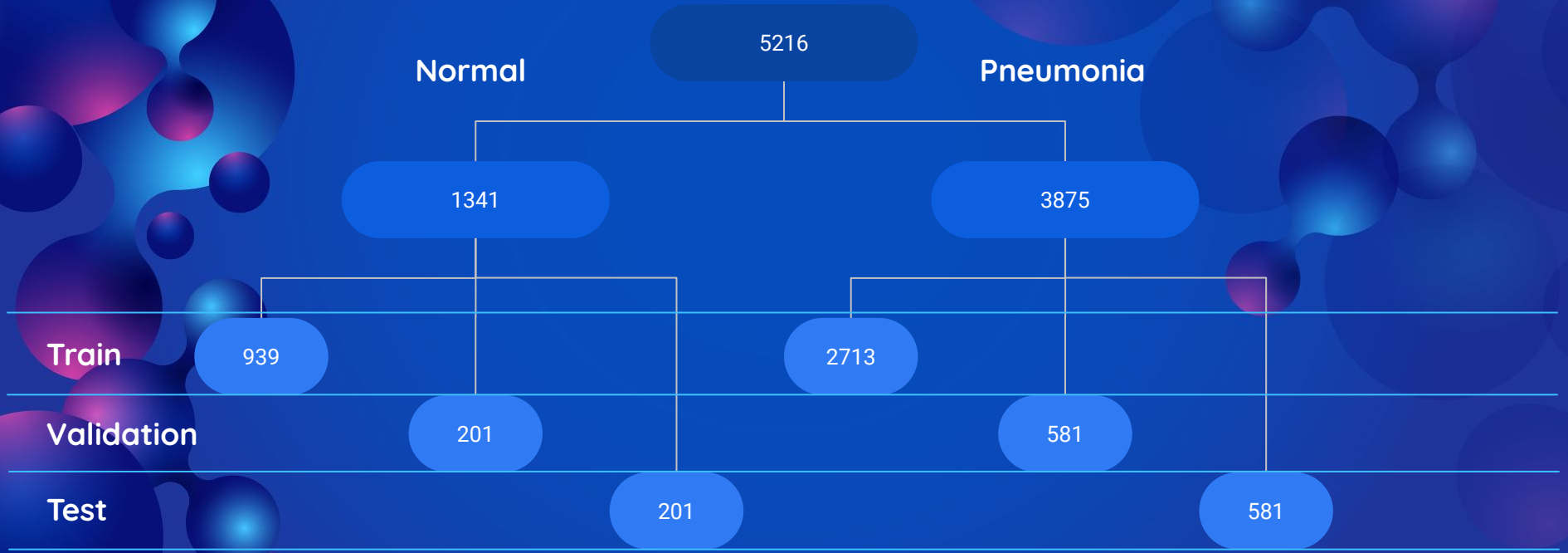
Severe cases of pneumonia can lead to:
- pleurisy
- a lung abscess
- blood poisoning

Can be fatal

Pneumonia can be detected either from blood tests or X-Rays

Data

Source: https://www.kaggle.com/paultimothymooney/chest-xray-pneumonia



Chest X-Ray Images

Normal

Pneumonia

Resolution: 128x128

How to work with pictures?

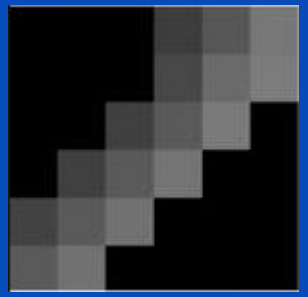
Resolution: 128x128

> 16384 pixels arranged in a square grid

What is a pixel?

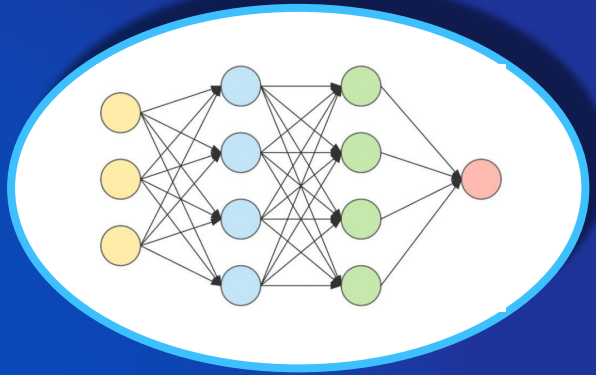
> greyscale: a number, 0-255,
> rgb: 3 numbers, 0-255

Each number denotes the brightness:
> 0 - Black
> 255 - White



0	0	0	61	87	120
0	0	0	72	106	123
0	0	64	90	122	0
0	64	89	117	0	0
68	89	114	0	0	0
89	114	0	0	0	

Dense Neural Network



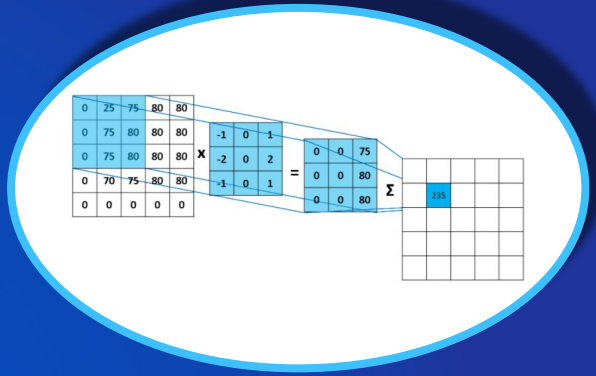
01 Consist of layers of nodes

02 Each node is a calculation performed on the input

03 Every input goes to every node in the layer

04 Every node's output is an input for every node in the next layer

Convolutional Neural Network (CNN)



Consist of layers of kernels

01

02

Each kernel is a grid of values which represent a certain pattern

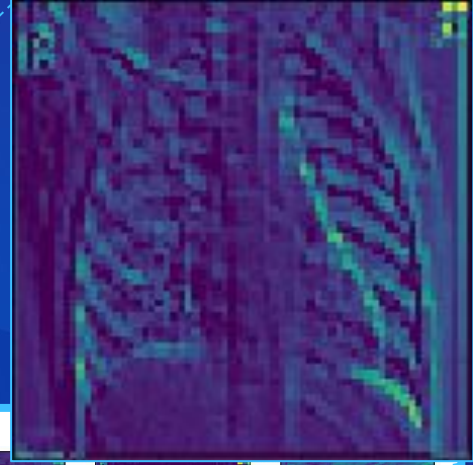
These “images” are then the inputs for the next layer

04

03

They scan across the image, creating a new “image” where each pixel shows how strongly the original pixels match the kernel’s pattern

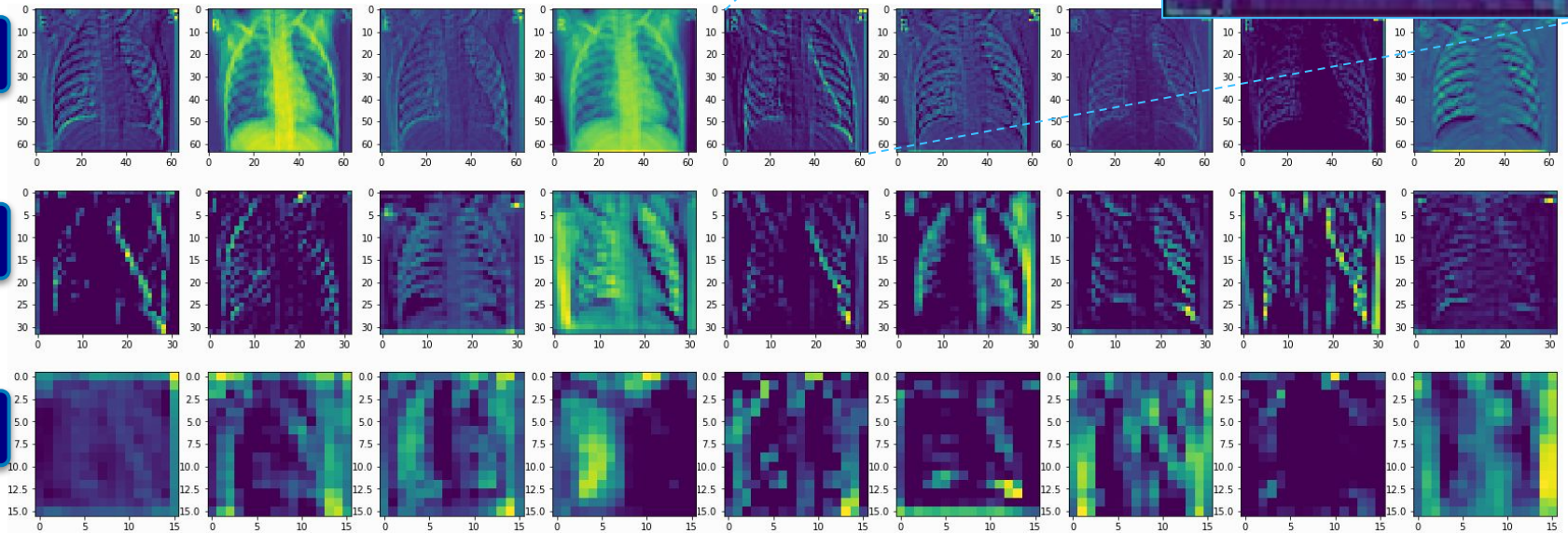
Kernel outputs, Layers



Layer 1

Layer 2

Layer 3



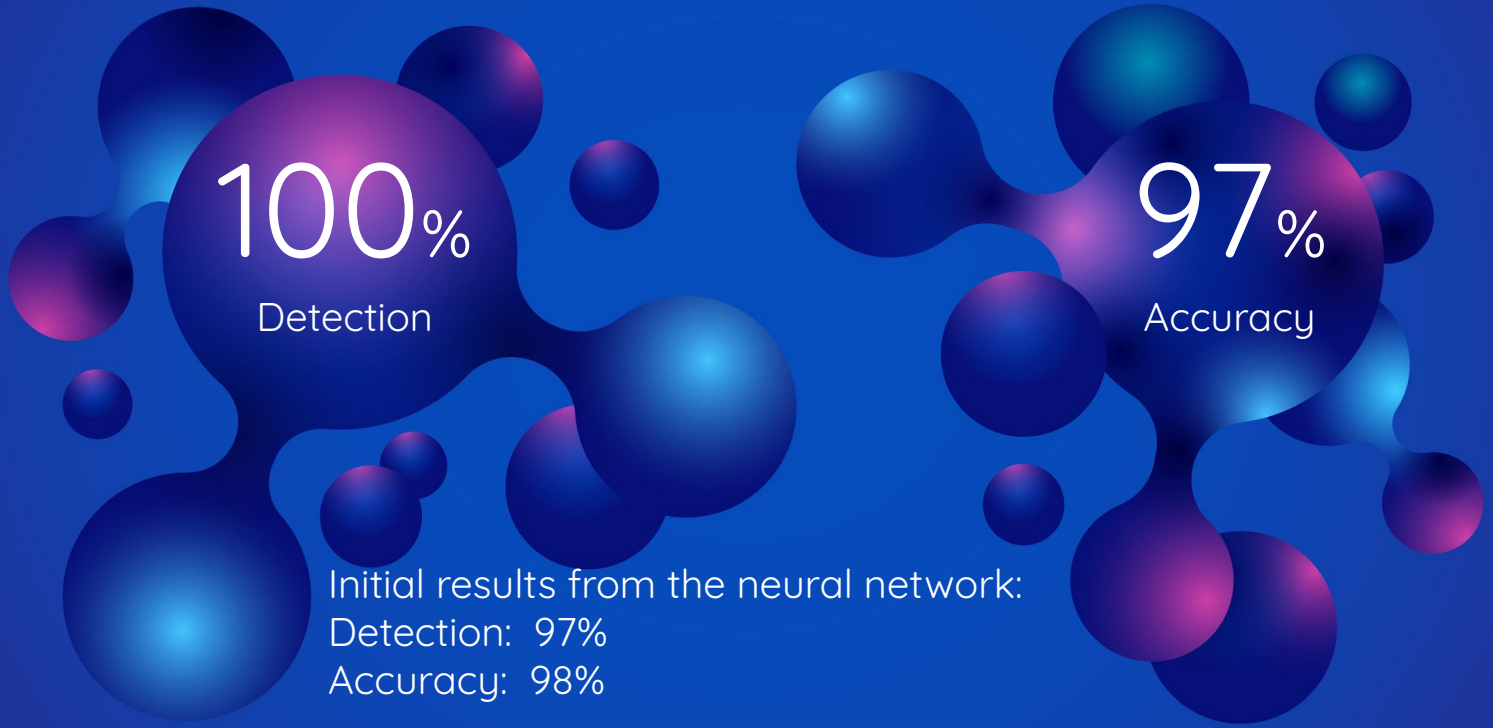
Transfer Learning

Models can often be improved with:

- More time
- More layers
- More kernels
- More data

Shortcut:
- Use a large pretrained neural network as a base
- Add an appropriate head for the model you want
- Only the train the small head and a few of the top layers

Results (Test Set)



Initial results from the neural network:
Detection: 97%
Accuracy: 98%

Traded accuracy for Detection

Future work

- Try higher resolution images
- Try a different base model
- Train for a longer time (more epochs)
- Try GlobalAveragePooling
- Try scheduling a learning rate decay

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Github: https://github.com/Maltanno/Phase4_Project