Defining Research Questions

**Research on Chest X-rays to deduct various respiratory infections:**

After having above idea in my mind I just want to do research on available X-Rays to know the severity of the disease and level of infection inside the body so that public can alert and have a chance to consult or ask doctor for remedy for the damage and doctors can easily identify and give proper medication to the patient. I thought to explore X-ray images as doctors frequently use X-rays and CT scans to diagnose pneumonia, lung inflammation, abscesses, and enlarged lymph nodes. Since COVID-19 attacks the epithelial cells that line our respiratory tract, we can use X-rays to analyse the health of a patient’s lungs. Given that nearly all hospitals have X-ray imaging machines, it could be possible to use X-rays to test for COVID-19 without the dedicated test kits.

A drawback is that X-ray analysis requires a radiology expert and takes significant time which is precious when people are sick around the world. Therefore developing an automated analysis system is required to save medical professionals valuable time.

**Research Questions:**

**RQ1: Removing or adding noisy data** as a radiographer, your goal from day to day, from patient to patient, is to complete an imaging exam that provides sufficient information for an accurate clinical diagnosis. The patient’s anatomy has created variations in the X-ray intensity that the imaging system uses to create the image. But overlaying this image “signal” is the inherent statistical “noise” associated with the X-ray production process. As you will see, there are two main challenges. One is that the X-ray process is governed by fundamental laws of nature that we cannot alter and whose characteristics introduce unavoidable “noise”. The second is that the multiple processes in the X-ray image capture process also generate noise, but they are amenable to optimization through careful detector design. In an chest X-ray test where only a small amount of radiation has been used to create the image (low exposure), the distracting visual appearance of the statistical noise (sometimes known as “salt and pepper” noise) relative to the size of the signal variations generated by the patient’s anatomy, can reduce the visibility of subtle, clinically important features. This can lower the radiologist’s diagnostic confidence.

**RQ2: Detecting COVID-19 severity using chest X-rays** novel coronavirus disease (COVID-19) is the most challenging problem for the world. The disease is caused by severe acute respiratory syndrome coronavirus-2 (SARS-COV-2), leading to high morbidity and mortality worldwide. The COVID-19 test is typically done on respiratory samples obtained by a nasopharyngeal swab. However, a nasal swab or sputum sample may also be used. Results are generally available within hours based on the test type. Chest X-rays scans may be helpful to diagnose COVID-19 in individuals with a high clinical suspicion of infection. Radiology experts will have possibility to detect the COVID-19 virus using chest X-rays. For this detecting we have to analyse the negative chest X-rays along with normal or positive X-rays to identify whether the two lungs are effected or not.

People with these symptoms may have COVID-19:

* Fever or chills
* Cough
* Shortness of breath or difficulty breathing
* Fatigue
* Muscle or body aches
* Headache
* New loss of taste or smell
* Sore throat
* Congestion or runny nose
* Nausea or vomiting
* Diarrhea

**RQ3: Detecting Pneumonia using chest X-rays** Pneumonia is an infection that causes inflammation in one or both of the lungs. It can be caused by a virus, bacteria, fungi or other germs. The infection is usually acquired when a person breathes in air carrying germs. Your doctor may conduct a physical exam and use chest x-ray, chest CT, chest ultrasound, or needle biopsy of the lung to help diagnose your condition. Your doctor may further evaluate your condition and lung function using thoracentesis, chest tube placement or image-guided abscess drainage.Most at risk for developing pneumonia are young children or people over the age of 65.An x-ray exam will allow your doctor to see your lungs, heart and blood vessels to help determine if you have pneumonia. When interpreting the x-ray, the radiologist will look for white spots in the lungs (called infiltrates) that identify an infection. This exam will also help determine if you have any complications related to pneumonia such as abscesses or pleural effusions (fluid surrounding the lungs). Pneumonia can sometimes lead to serious complications, such as respiratory system failure, spread of infections, fluid surrounding the lungs, abscesses or uncontrolled inflammation throughout the body (sepsis). The condition can also be fatal, so it is important to seek immediate medical attention if you are experiencing these symptoms.

Patients with pneumonia could have the following symptoms:

* cough that produces phlegm or sometimes blood
* fever
* shortness of breath or difficulty breathing
* chills or shaking
* fatigue
* sweating
* chest or muscle pain

**RQ4: Improving the efficiency of the training datasets** Over the last years, end-to-end trained convolutional neural networks (CNNs) have shown drastically superior performance on a multitude of image analysis challenges when compared to more classical hand-crafted algorithms or even other machine learning approaches such as support vector machines, in particular when the challenge can be sufficiently well characterized by abundant labelled training data. The use of deep learning on chest X-Rays has attracted some attention due to the cheapness of this imaging technique, the abundance of data and the similarity to natural images, which allows the transfer of models to medical tasks. With my approach I want to reduce the computational and memory requirement significantly, without sacrificing the classification performance.