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CaffeineOverFlow

★ Best Medical Image Visualization

★ Best Classification

Covid Detection through Chest X-rays

By CaffeineOverFlow (Team 26)

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About Us

Martin Gallois

BS Physics

McGill University

Karim Jabbour

BS Computer Science

Concordia University

Yinan Wang

MSc Electrical Engineering

Computer vision and image processing

McGill University

Yichen Wu

BS Software Engineering

McGill University

Siqi Zhang

BS Computer Science

University of Toronto

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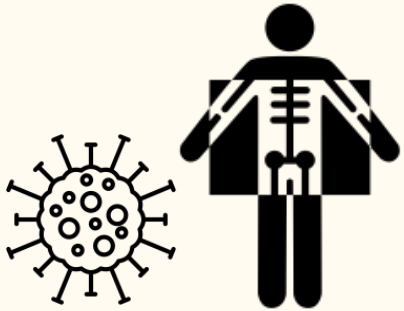
Introduction

- +500 000 daily infections.
- Common detection method: PCR tests
- Disadvantage: not enough trained professionals, equipment and facilities
- Team project: detect Covid-19 through chest X-rays (CXR) by training a Convolutional Neural Network.

Benefits:

- Minimize transportation of patients
- Less invasive
- Lower costs
- Faster diagnosis with a well trained model



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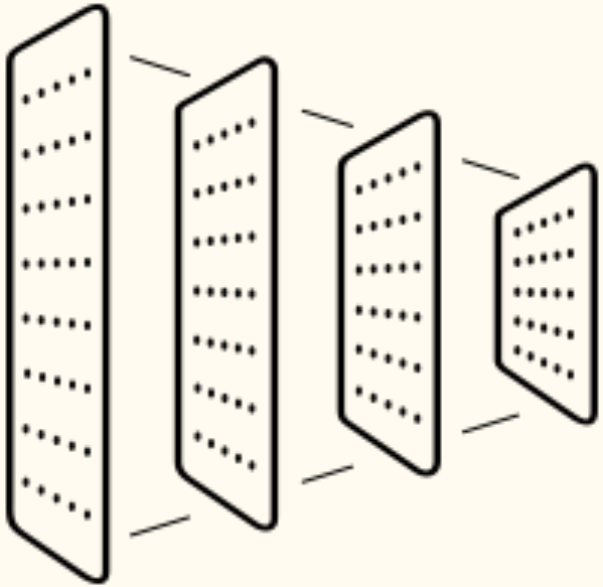
Our Project

Our project consisted of two parts:

- CNN model:
  - Train
  - Validate
  - Test

- Feature Maps



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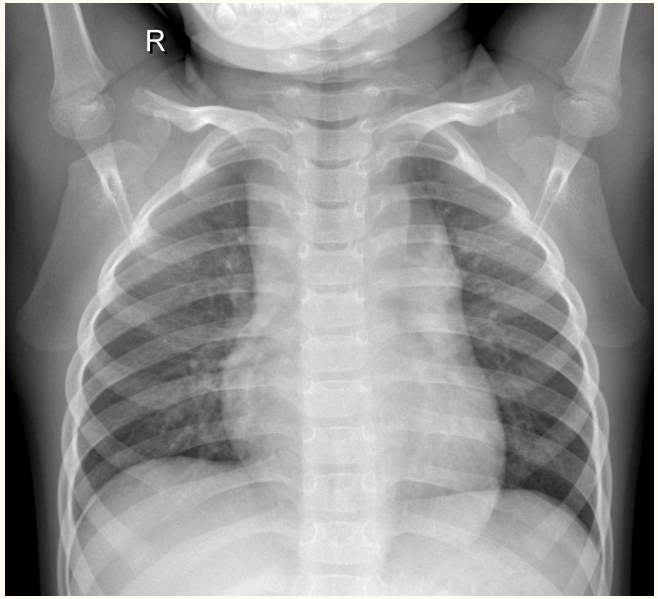
Visual Introduction: Can you tell?



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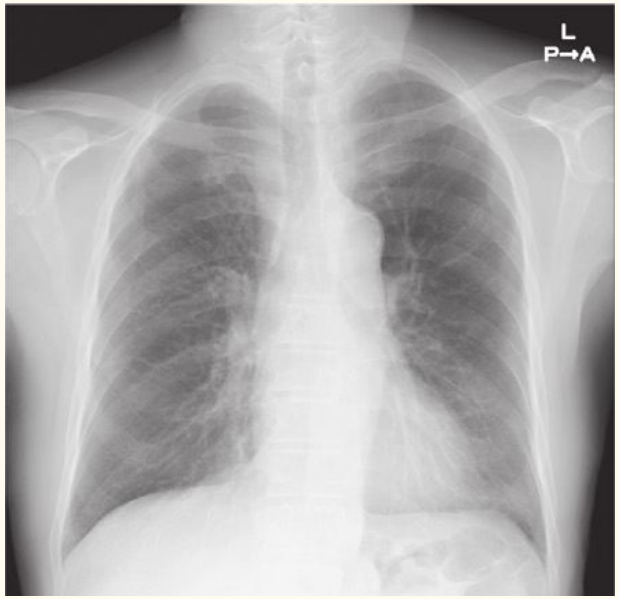

Covid -ve

Covid +ve

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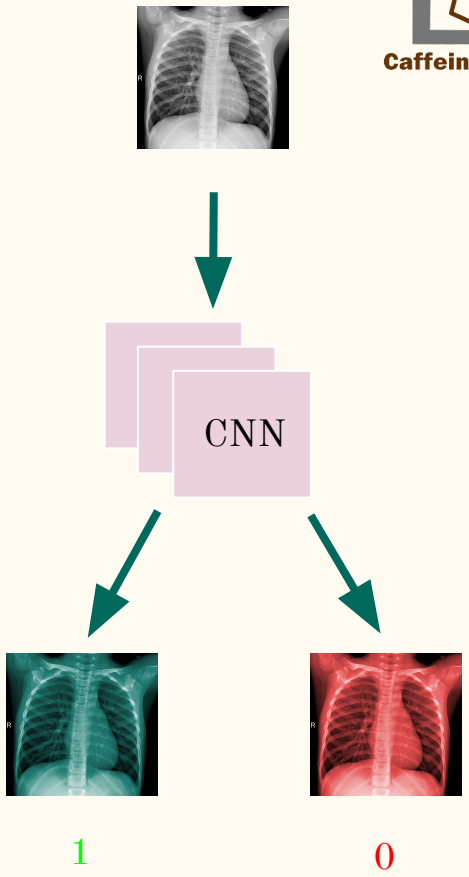
The CNN and Data

- Keras → CNN: 4 layers
- Dropout layers: preventing it from overfitting
  ReLU layers: after each convolution layer to make the model learn faster.
- training set: 196 CXRs
  validation set: 196 CXRs
- Output Indices:
  - Covid +ve = 0
  - Covid -ve = 1



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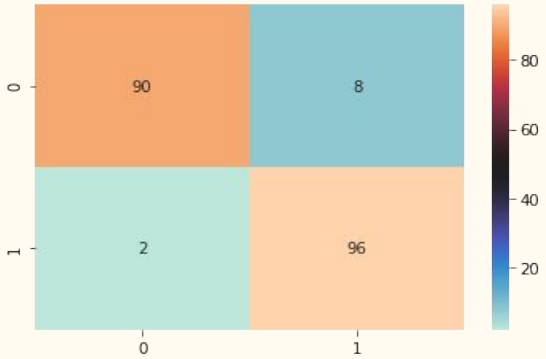
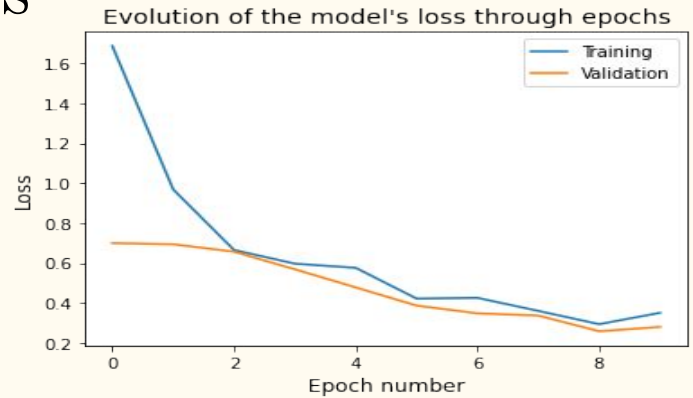
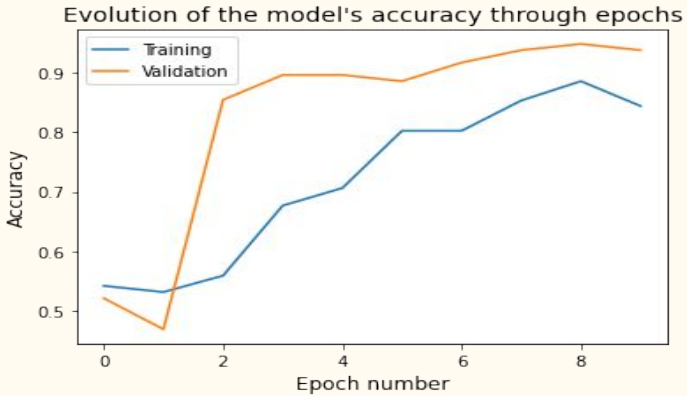
Results and Future Enhancements

- Validation accuracy: 90%
- Validation error: 28%

- Future enhancement:
  -improve with larger sets of data
  -train to differentiate pneumonia and other lung infections from Covid-19.







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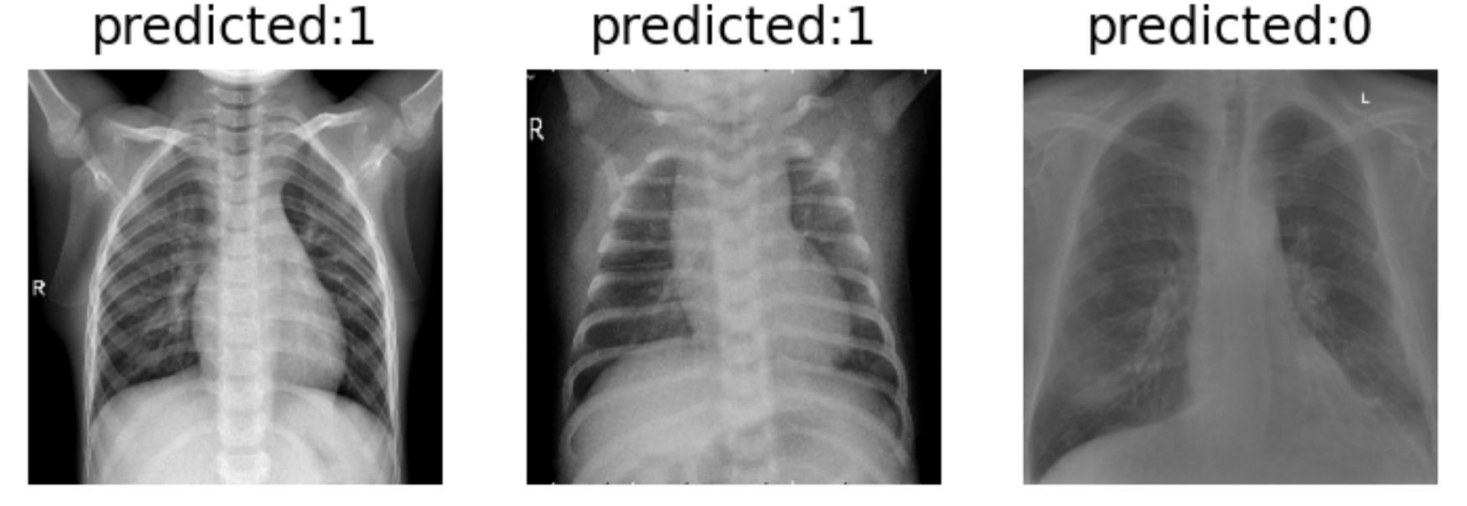
Prediction Results



Covid - ve = 1

Covid +ve = 0

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Our website: Dash Plotly

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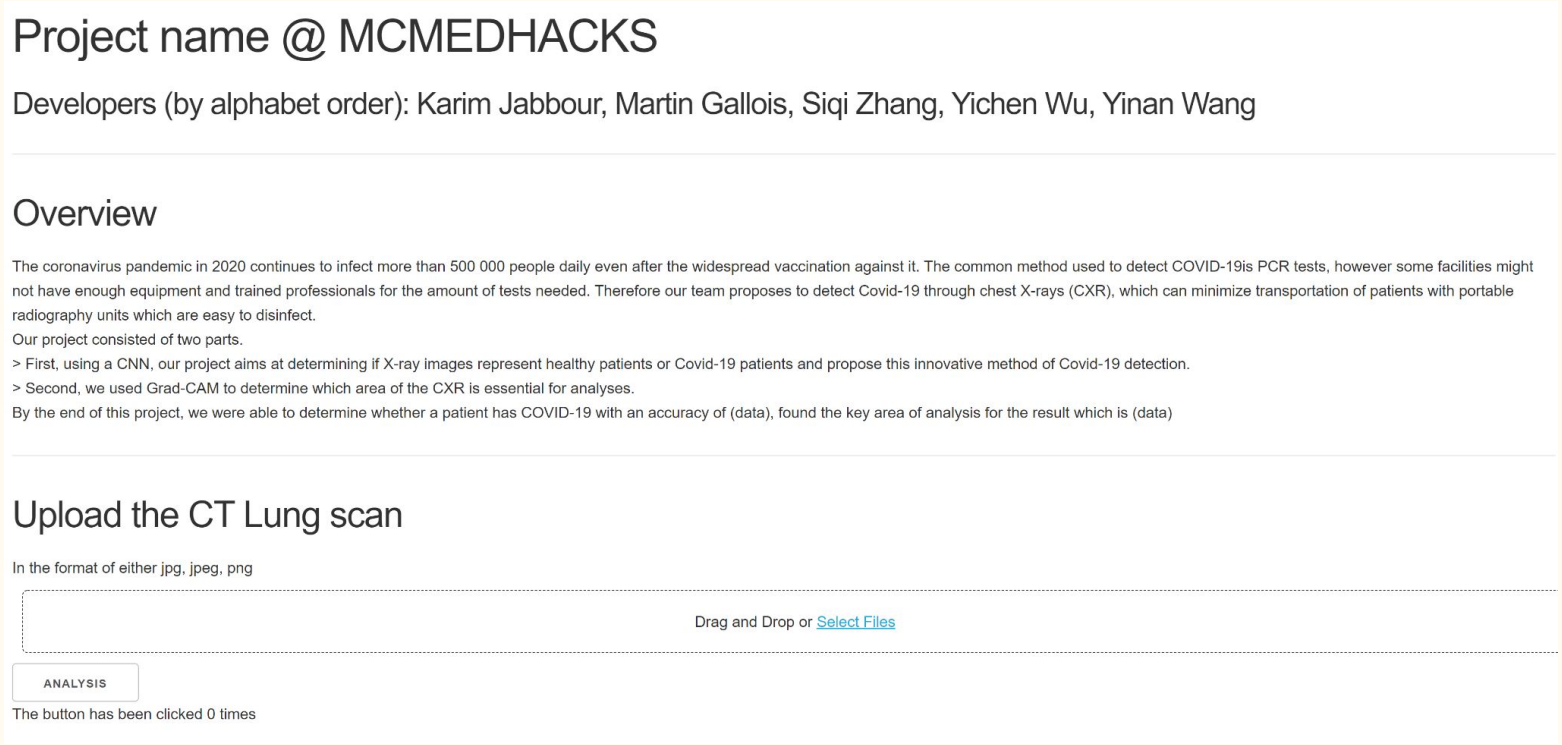

COVID detection website

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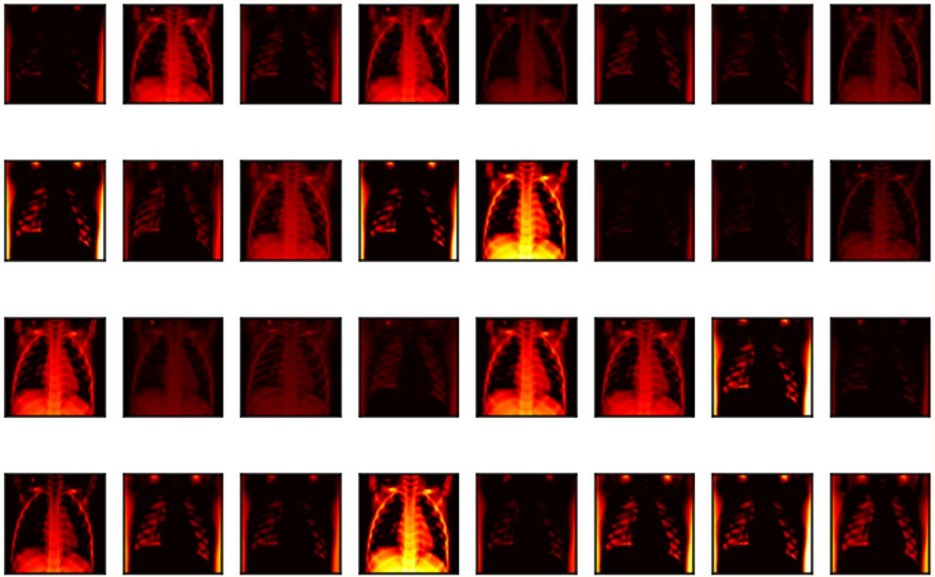
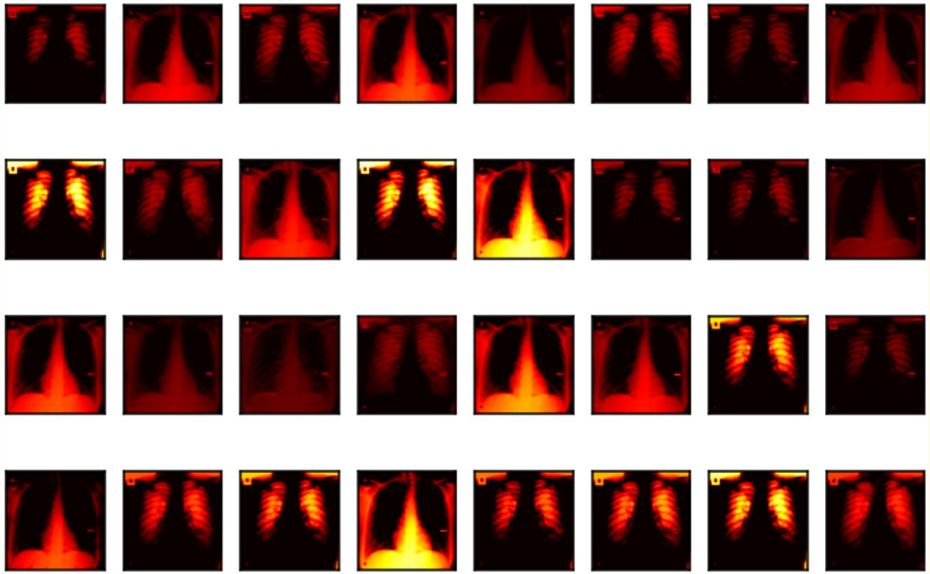
Visualization



Covid -ve



Covid +ve

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Thank you so much for listening! Are there any questions?

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Detection of Covid-19 using Convolutional Neural Networks and Chest X-Rays

Karim Jabbour, Martin Gallois, Siqi Zhang, Yichen Wu, Yinan Wang

Keywords - COVID-19, CNN, Classification, Visualization, Machine Learning, Feature Map

Abstract. The coronavirus, also known as COVID-19, continues to infect more than 500,000 people daily even after the widespread vaccination against it. The common method used to detect COVID-19 is PCR tests, however some facilities might not have enough equipment and trained professionals for the amount of tests needed. Therefore our team proposes to detect COVID-19 through chest X-rays (CXR), which can minimize transportation of patients with portable radiography units which are easy to disinfect. Our project consisted of two parts. First, using a Convolutional Neural Networks (CNN), our project aims at determining if X-ray images represent healthy patients or COVID-19 patients and propose this innovative method of COVID-19 detection. Second, we tried to implement a Web-App for easy UI. By the end of this project, we were able to determine whether a patient has COVID-19 with an accuracy of 90% and have made a website for better user experience.

1. Introduction

COVID-19 is an infectious disease that causes patients to experience respiratory illnesses such as coughing or difficulties breathing. Being highly infectious as it is, COVID-19 has infected and continues to infect millions of people worldwide. The common method used to diagnose COVID-19 is PCR tests, which are invasive and might not be accessible at every facility. Under such circumstances, our team recognizes the value of diagnosing COVID-19 through CXR because COVID infection results in distinct radiographic visual characteristics in CXRs. With a well trained model, diagnoses can be made in a shorter period of time with this less invasive method.

2. Methodology

The following methods are segmented into three key areas:

1. Acquiring of data and implementation of the Convolutional Neural Network

2. Design and building of the Application/Website to allow for easy user-experience.

In order to compare the difference between the Covid positive and negative cases, we also generated the convoluted images for both cases.

3. Result

Due to the nature of the neural networks and the randomization of images within our data in sampling, results may vary slightly within each run. Nevertheless, below is a solid set of results that demonstrate what one build results in.

3.1 Confusion Matrix

The matrix demonstrates in Fig. 2 that using a 196 set of images, we have 90 true positives, 96 true negatives, 8 false negatives, and 2 false positives. This result (Fig. 2) indicates little error in prediction using our datasets.

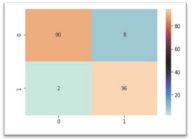

Fig. 2 Confusion Matrix where that 0 represents COVID-19 positive and 1 represents COVID-19 negative

3.2 Accuracy[7]

The below accuracy plot (Fig. 3) shows increasing accuracy as the model builds through the CNN layers with each epoch over time. Final accuracy is around 90%, which is great.

Both lines slow-down in growth towards the end which indicates that we are on the verge of "over-fitting".

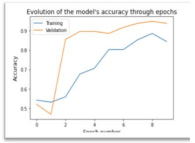

Figure 3. Accuracy for the training and validation sets for each epoch

3.3 Entropy Loss

The below loss plot (Fig. 4) shows decreasing loss with each epoch, which is expected. The lines do not separate which is a good sign that over-fitting is not taking place.

Sample Pages From Abstract