FLATIRON MODULE 4 PROJECT: AUTOMATION OF PNEUMONIA DIAGNOSIS IN CHEST X-RAYS

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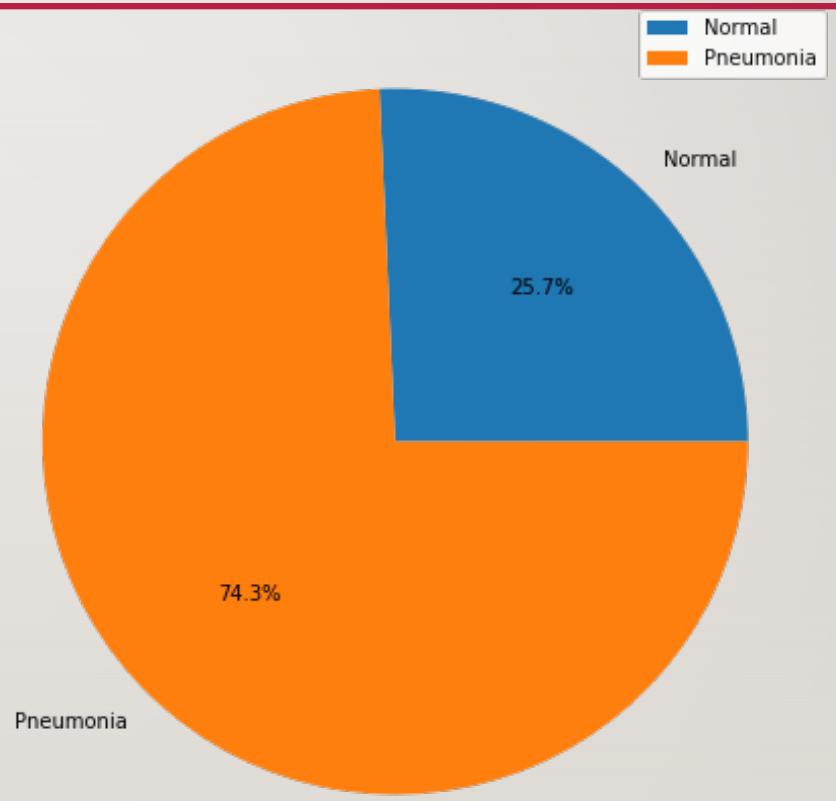
HELLO!

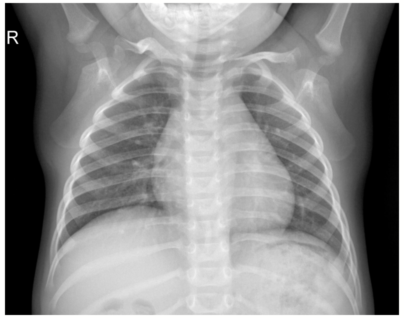
- My name is Kiarash Ahmadi. I'm an aspiring Data Scientist and I am pursuing a Master's in Computational Science & Engineering and Aerospace Engineering at Georgia Tech
- My field of work is in the building energy modeling industry
- Discussion today will be about the use of convolutional neural networks to classify chest X-rays

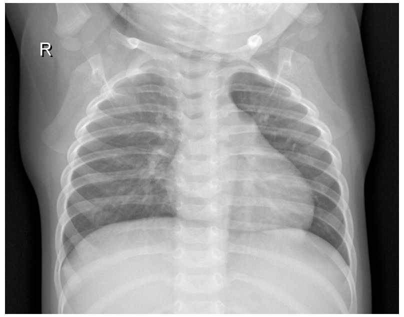
PROJECT BACKGROUND

- Given 5,856 chest X-rays
- The X-rays are labeled as:
  - Pneumonia: 4273 images
  - Normal: 1583 images
- From there a series of models are trained using 5126 images and assessed in order to classify an X-ray as normal or pneumonia as accurately as possible
- Models are created via convolutional neural networks

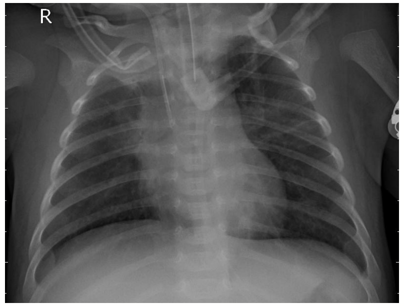


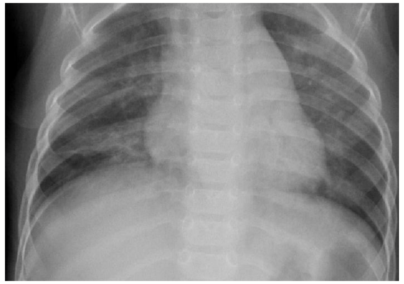
Diagnosed as Normal





Diagnosed as Pneumonia

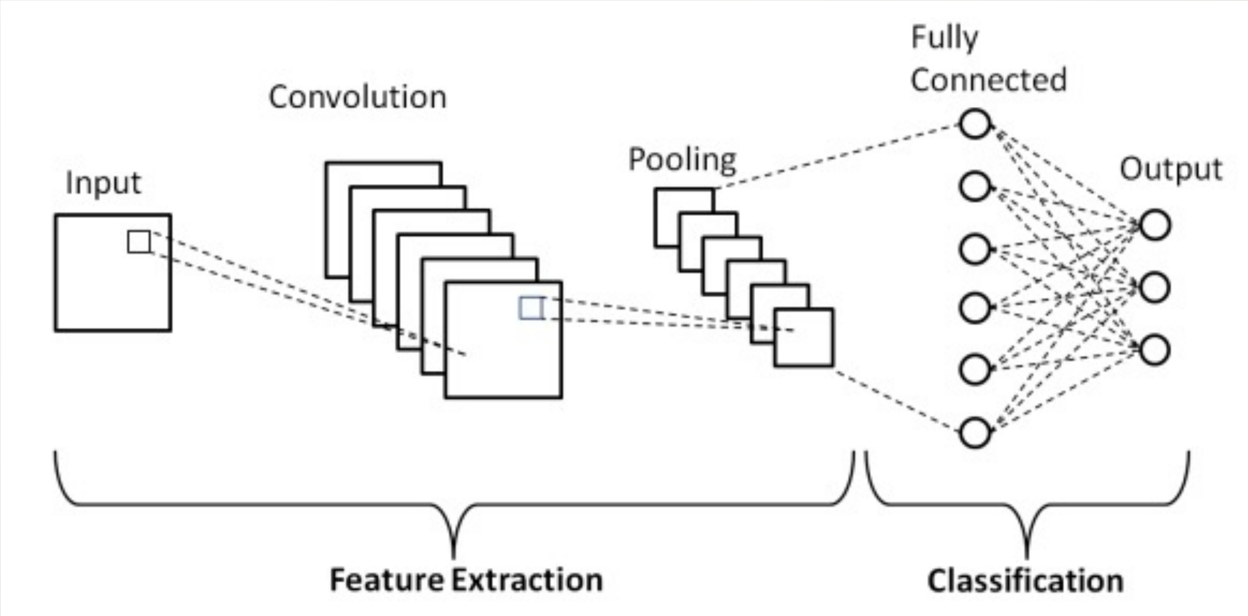




EXAMPLE X-RAYS FROM TRAINING SET

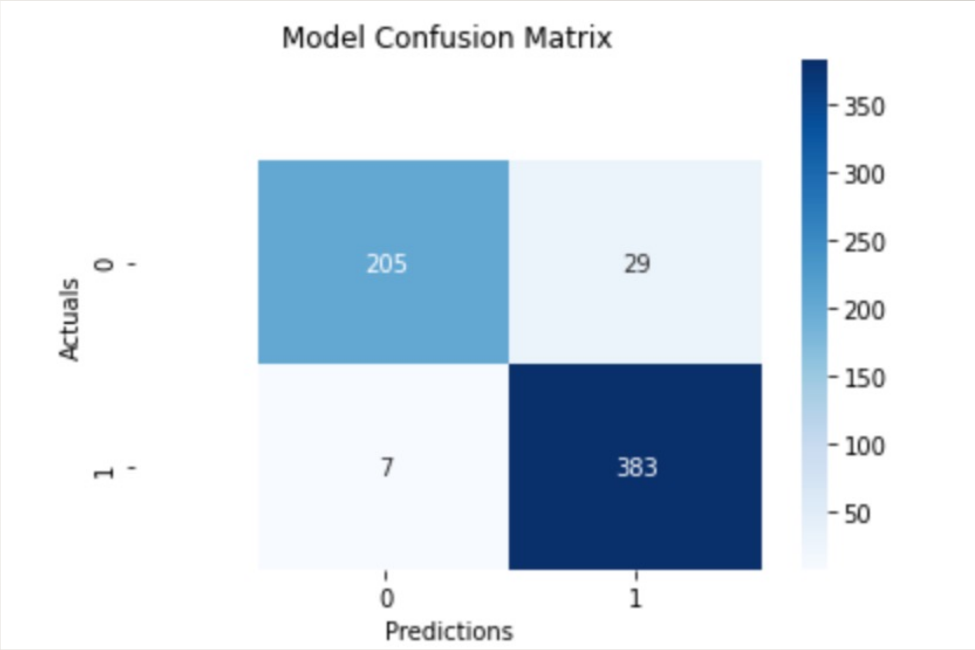
WHAT IS A CONVOLUTIONAL NEURAL NETWORK?

- Convolutional Neural Networks are often used for image classification
- This is because they can transform the data in ways to highlight edges and features
- The architecture is like the connectivity pattern of neurons in a human brain drawing inspiration from the organization of the visual cortex



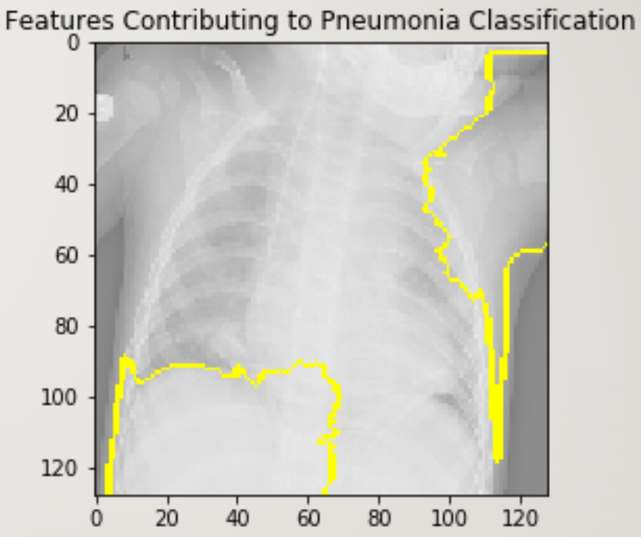
BEST PERFORMING CONVOLUTIONAL NEURAL NETWORK

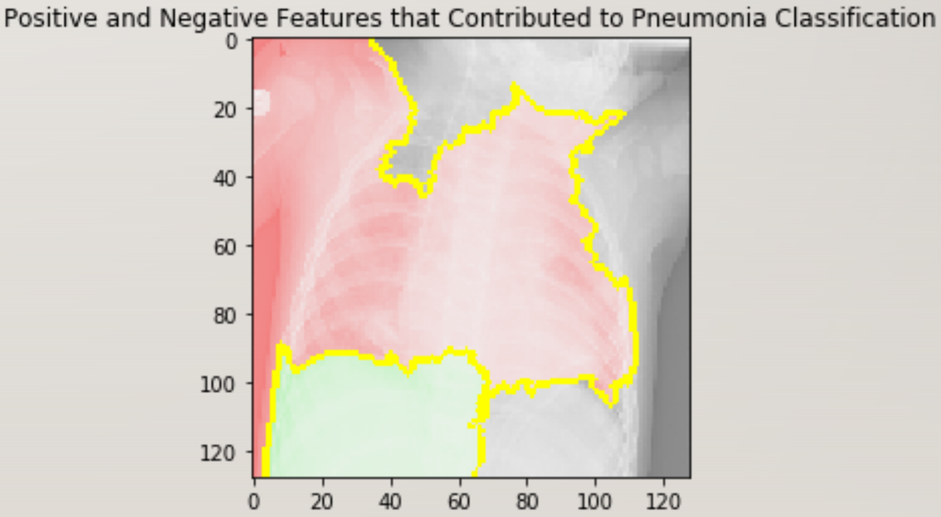
- Multiple iterations of different CNN's with varying architectures and hyperparameters were performed
- The best model has:
  - A testing accuracy of 94.23%
  - 93% precision when predicting chest X-rays with pneumonia
  - 97% precision when predicting normal chest X-rays
  - 98% recall when predicting chest X-rays with pneumonia
  - 88% recall when predicting normal chest X-rays



BEHIND THE SCENES OF MODEL CLASSIFICATION

- Classification of a chest X-ray comes from distinguishing features in the image
- These features have a positive or negative impact in affect the classification decision
- Model abstracts the data enough to have the minimize noise and focus on features that define the diagnosis of a given X-ray





SUMMARY AND OUTLOOK

- Recommendations:
  - Reduce the image size in order to decrease the noise in the images and focus more on the distinguishing features
  - Continue to add images to the pool of X-rays that consist of training, testing, and validation sets
  - Increase the validation set size while maintain the training set size
  - Use CNN models as one of many tools when diagnosing a chest X-ray
- Future work:
  - Try more architectures and investigate different filter sizes, stride lengths, and input shapes
  - Implement more pretrained CNN's and building different architectures around them
  - Perform hyperparameter tuning via GridSearch
  - Use augmented data on other CNN models
  - Perform various iterations on the same type of model and average results

THANKS!

Any questions?

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