COVID-EXP

Pipeline for X-ray Examination of COVID

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With support from Dr. Parthiv Mehta and team
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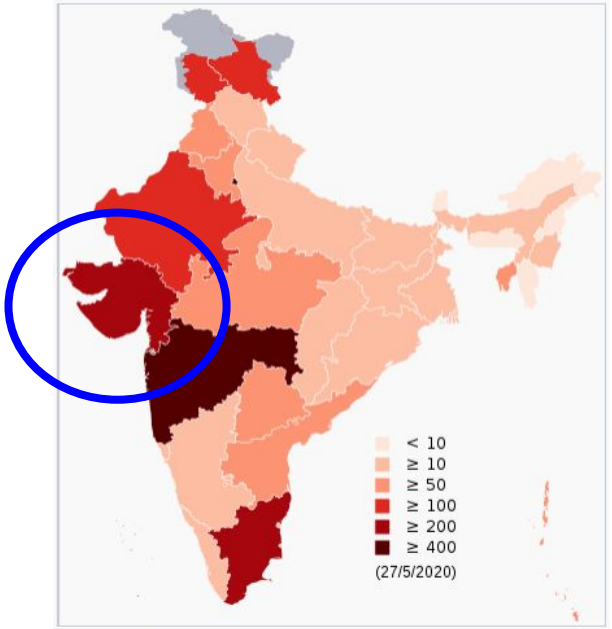
Project background and motivation

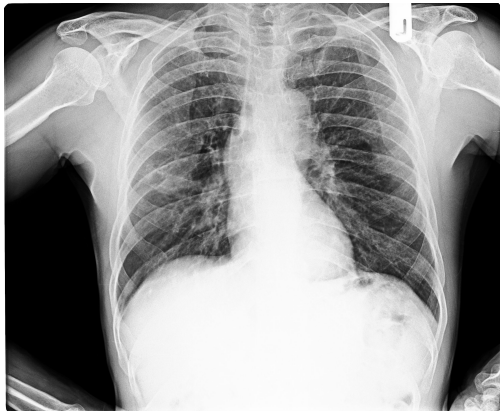
- India is hit particularly hard by the pandemic. At time of start, India only had 3% of cases with 17% of population
- Healthcare system under strenuous pressure; opportunity to introduce machine learning to assist diagnosis of COVID-like symptoms
- Results to be interpreted and used by trained radiologists, in connection with other COVID-19 tests



Map of COVID-19 cases per million population in India by state and union territory (As of 27 May 2020)

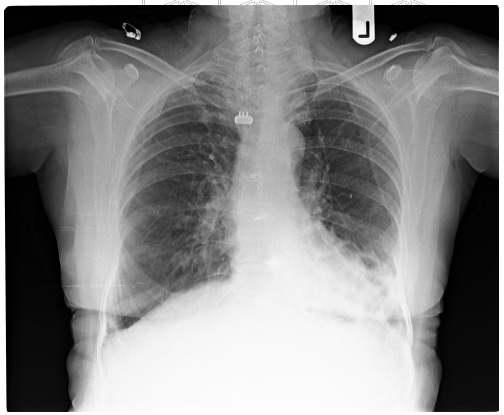
Source: Wikipedia

Typical

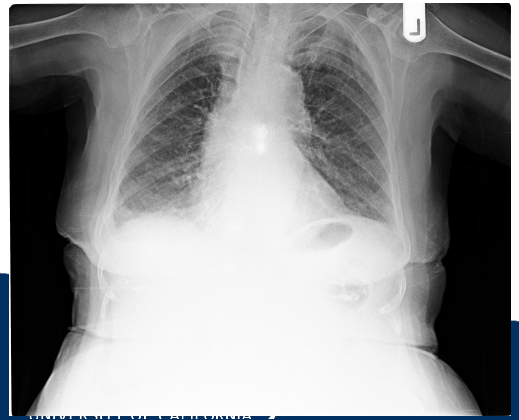


Other

ARDS

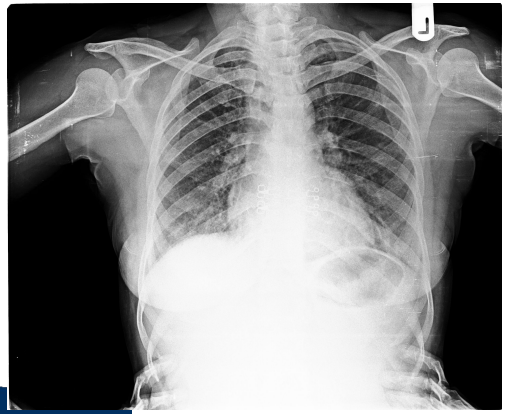


TB



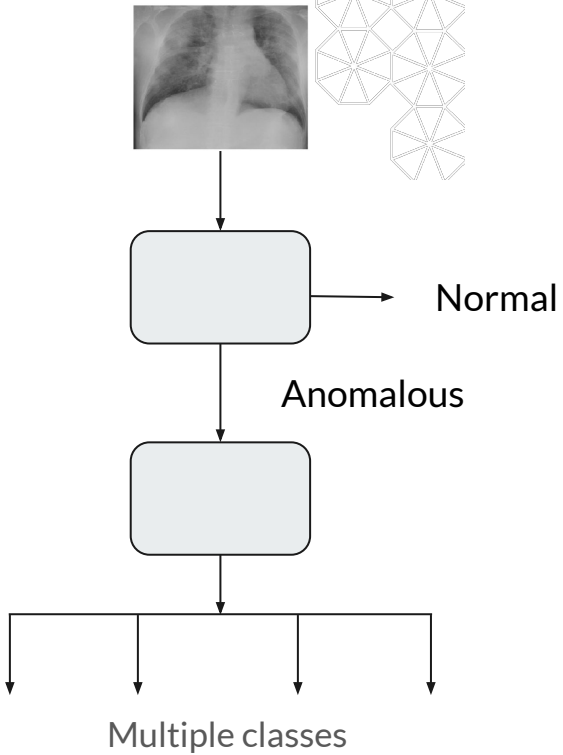
Normal

Atypical (COVID-19 is subset)



Inference pipeline

- Two staged inference pipeline:
  - First stage: binary classification, normal versus anomalous
  - Second stage: multiclass classification, one of six possible conditions

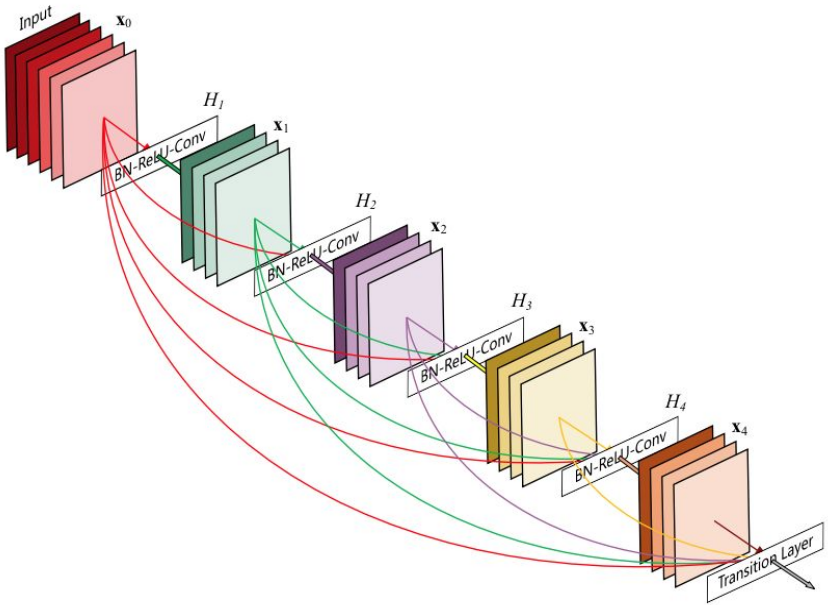


Models overview

First stage - binary	MobileNet	MobileNet2	VGG	DenseNet	UCSF
Accuracy	0.84	0.88	0.82	**0.88**	0.78
AUC	0.87	0.88	0.87	**0.93**	0.86

Second stage - multiclass	DenseNet
Accuracy	**0.90**
AUC	**0.90**

DenseNet(*) architecture

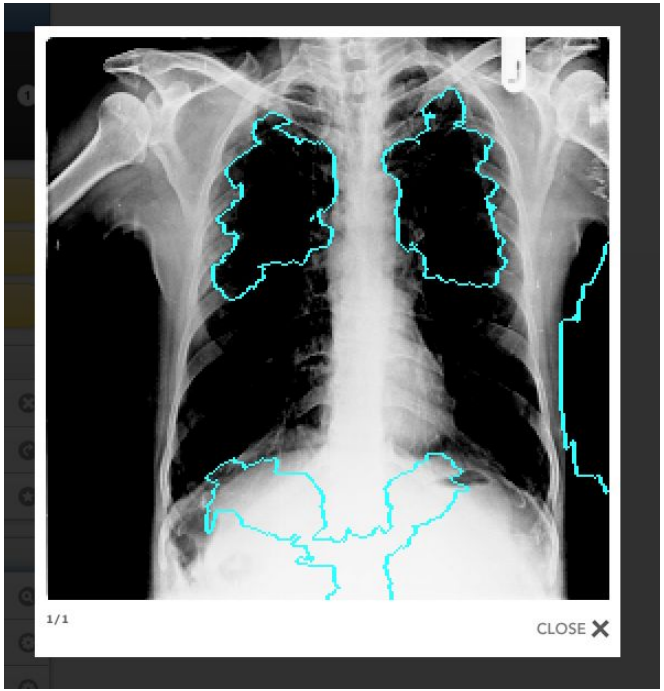


Preprocessing and model parameters

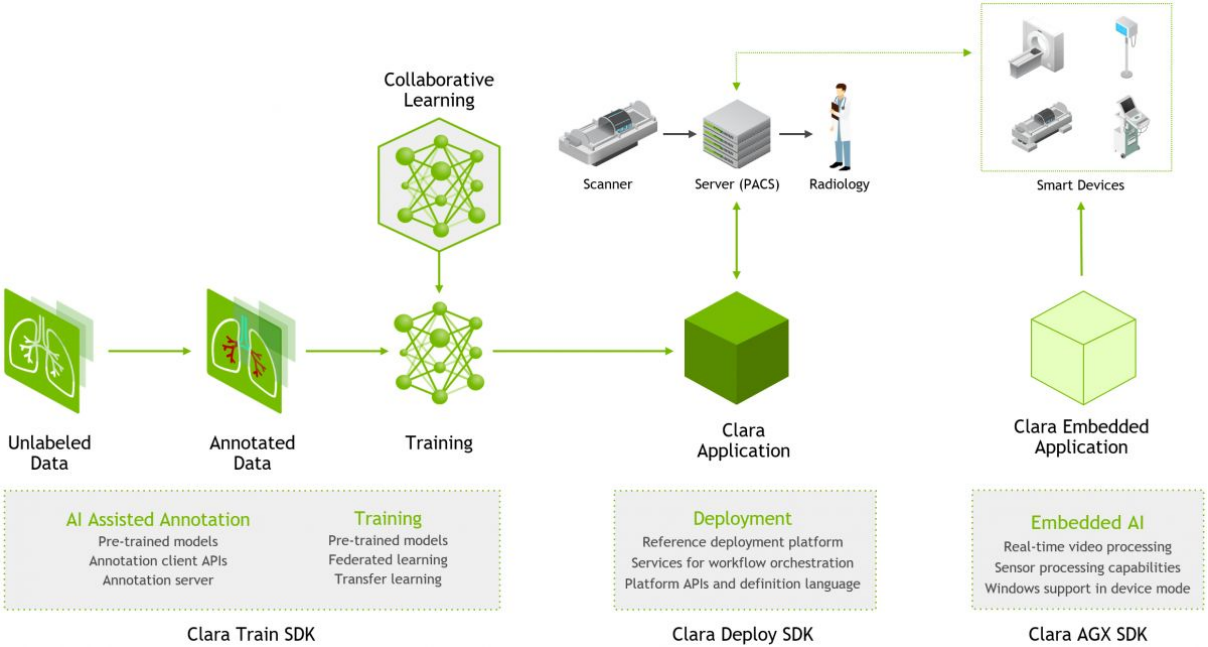
- 256x256x3 input image size
- Weight decay: 1E-5
- Random rotations/crops
- Optimizer: Adam
- Learning rate: 2.0E-4
- Loss: Cross Entropy

(*) Huang, Gao, et al. "Densely connected convolutional networks." *Proceedings of the IEEE conference on computer vision and pattern recognition*. 2017.

LIME



CLARA demo


Collaborative Learning
Scanner
Server (PACS)
Radiology
Smart Devices
Unlabeled Data
Annotated Data
Training
Clara Application
Clara Embedded Application
AI Assisted Annotation
Pre-trained models
Annotation client APIs
Annotation server
Training
Pre-trained models
Federated learning
Transfer learning
Deployment
Reference deployment platform
Services for workflow orchestration
Platform APIs and definition language
Embedded AI
Real-time video processing
Sensor processing capabilities
Windows support in device mode
Clara Train SDK
Clara Deploy SDK
Clara AGX SDK

Rollout/Impact

- Full pipeline access to 1,800 healthcare professionals in India
- Will supplement doctor's decision making process - help prioritize which images to look at first
- Spearheaded by Dr. Parthiv Mehta
- No cost to doctors

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