

# Uncertainty-Aware COVID-19 Detection from Imbalanced Sound Data

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CAMBRIDGE**

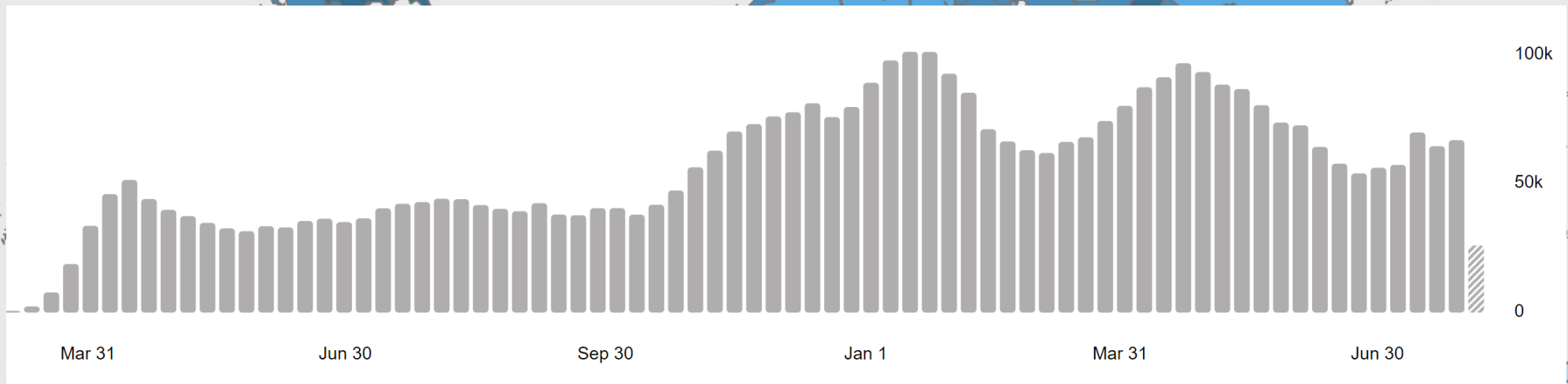


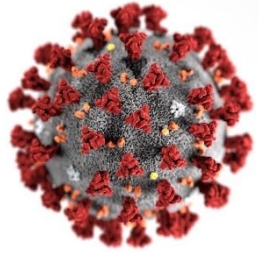
# WHO Coronavirus (COVID-19) Dashboard

[Overview](#)

[Data Table](#)

[Explore](#)





- ***Invasive***
- ***Expensive***

## POLYMERASE CHAIN REACTION (PCR) TESTING

PROS: Most accurate  
CONS: Longer processing time

## ANTIGEN TESTING

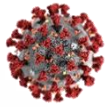
PROS: Rapid and inexpensive  
CONS: Accuracy problems

## ANTIBODY (SEROLOGY) TESTING

PROS: Rapid, detects disease spread  
CONS: False positives/negatives

# COVID-19 Testing





Upper respiratory tract

Nasal cavity

Pharynx

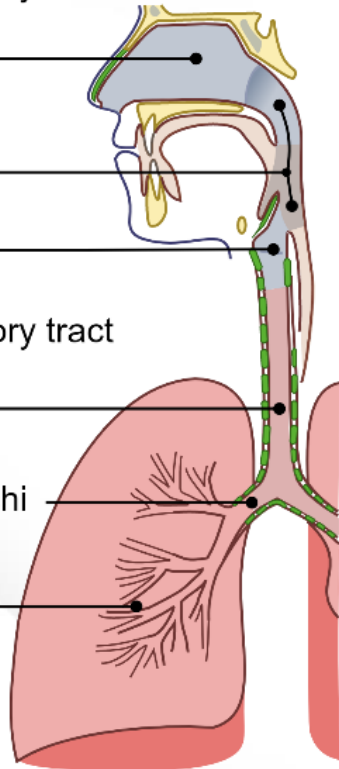
Larynx

Lower respiratory tract

Trachea

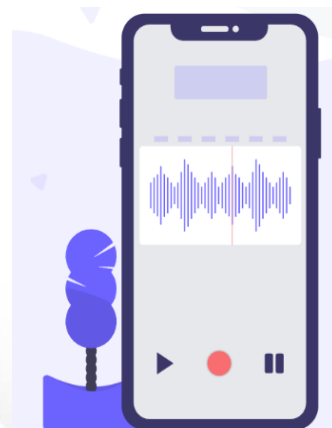
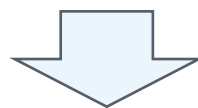
Primary bronchi

Lungs



## ***Automatic COVID-19 Screening from sounds***

- *COVID-19 Artificial Intelligence Diagnosis using only Cough Recordings, MIT*
- *COVID-19 Sounds, the University of Cambridge*
- *Coswara, Indian Institute of Science (IISc) Bangalore, etc.*

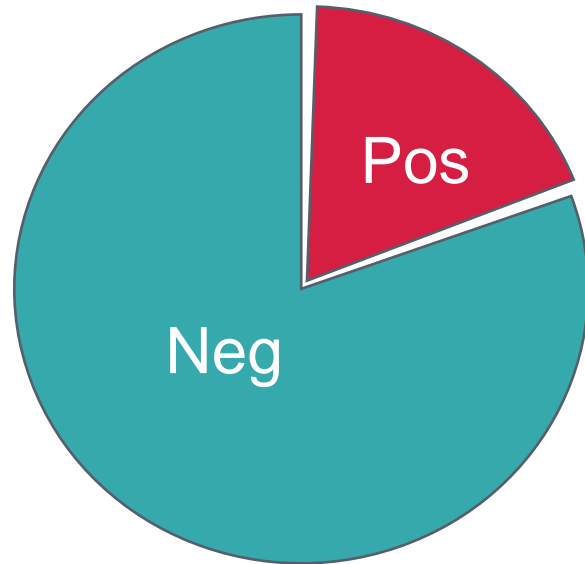


- Affordable
- Non-invasive
- Timely
- Ubiquitous

# Unsolved challenges of sound-based COVID-19 detection

## Challenge I:

Sparse and imbalanced audio data



469 tested positive samples  
1,526 tested negative samples

## Challenge II:

Lack of confidence estimation



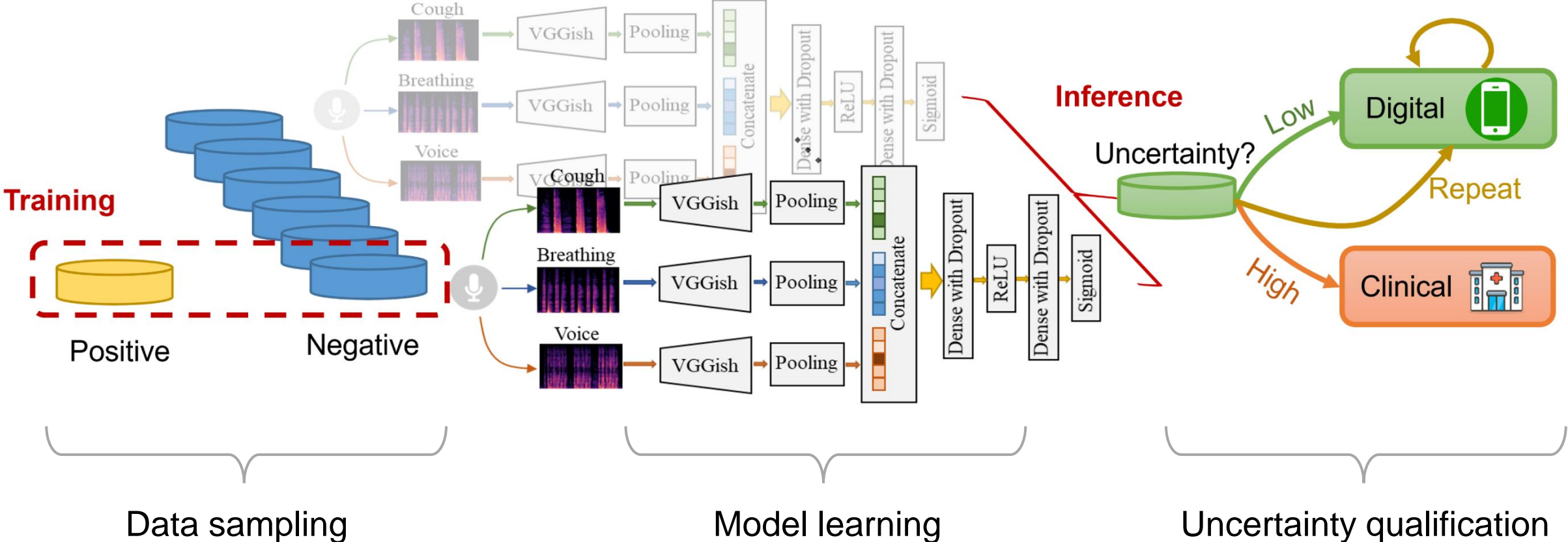
*Over-confident*



*Difficult diagnosis*

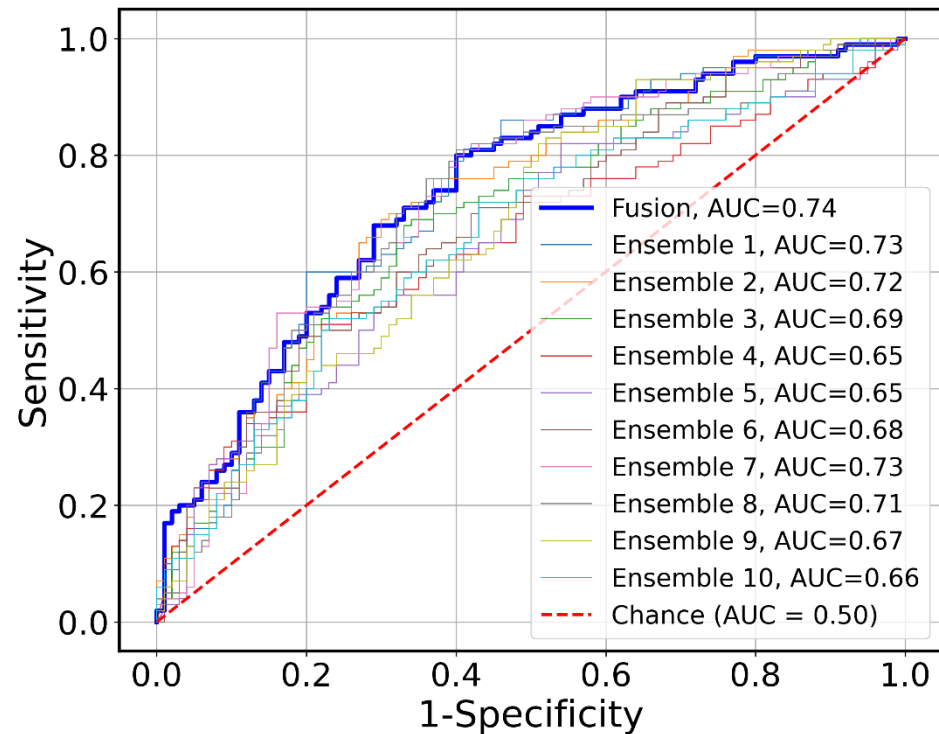
Measuring uncertainty

# Ensemble framework

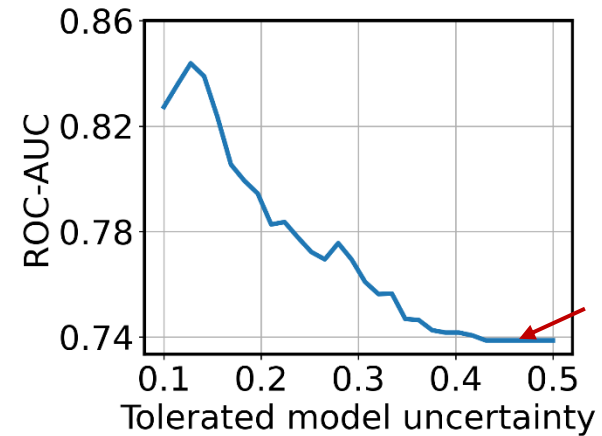
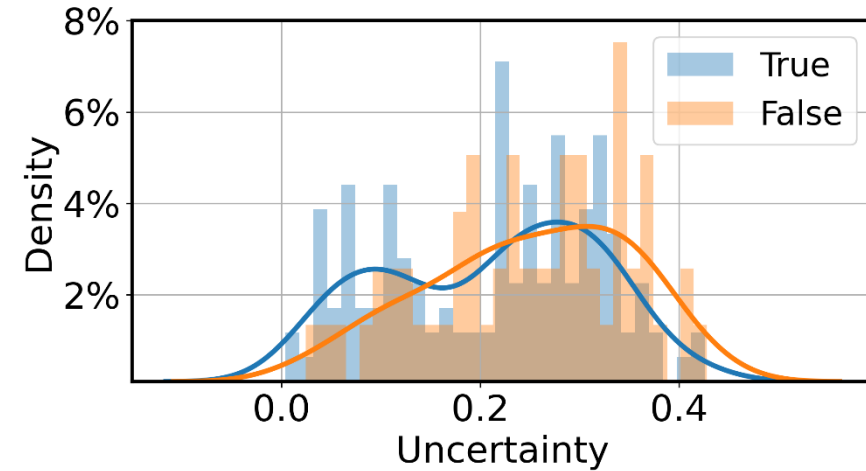


# Uncertainty-aware COVID-19 detection from sounds

		ROC-AUC	Sensitivity	Specificity
Ensemble model	SVM	0.66(0.04)	0.63(0.05)	0.62(0.04)
	CNN	<b>0.74(0.03)</b>	<b>0.68(0.05)</b>	0.69(0.06)



*Ensemble fusion outperforms single unit.*



*Reject the least confident predictions.*



# Welcome to use our COVID-19 Sounds App !

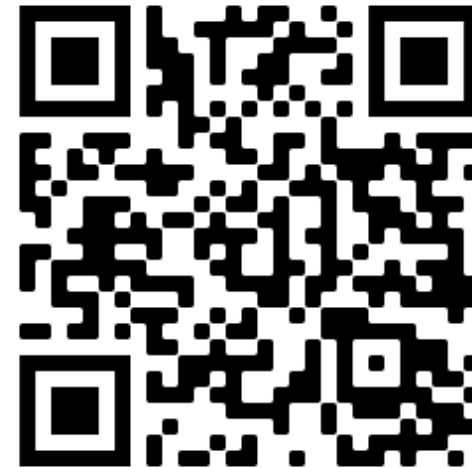


## COVID-19 Sounds App

Upload short recordings of cough and breathing and report symptoms to help researchers from the University of Cambridge detect if a person is suffering from COVID-19. Healthy and *non-healthy* participants welcome.



or use the online form



Contact: [tx229@cam.ac.uk](mailto:tx229@cam.ac.uk)

## Paper session:

**Thu-M-V-1 Thursday, September 2, 11:00-13:00 Virtual: Assessment of pathological speech and language II**

- 11:00 **Thu-M-V-1-9** 1320 *Uncertainty-Aware COVID-19 Detection from Imbalanced Sound Data*