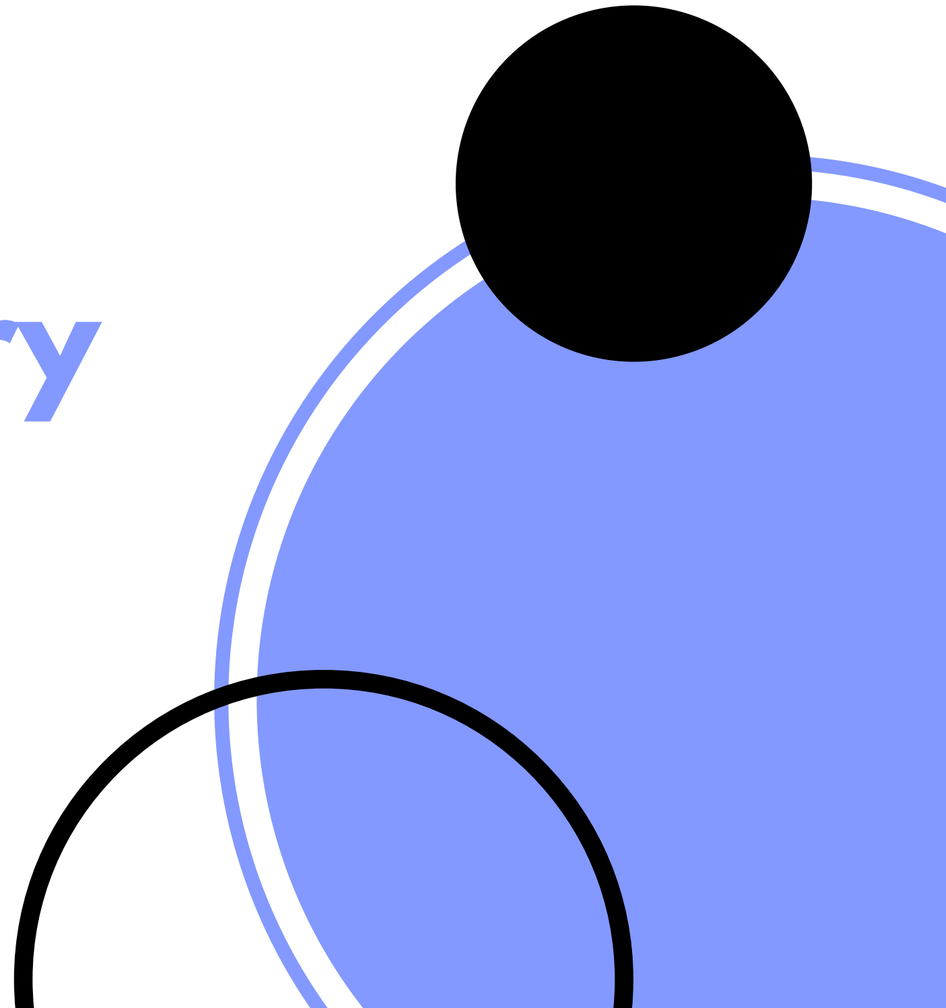
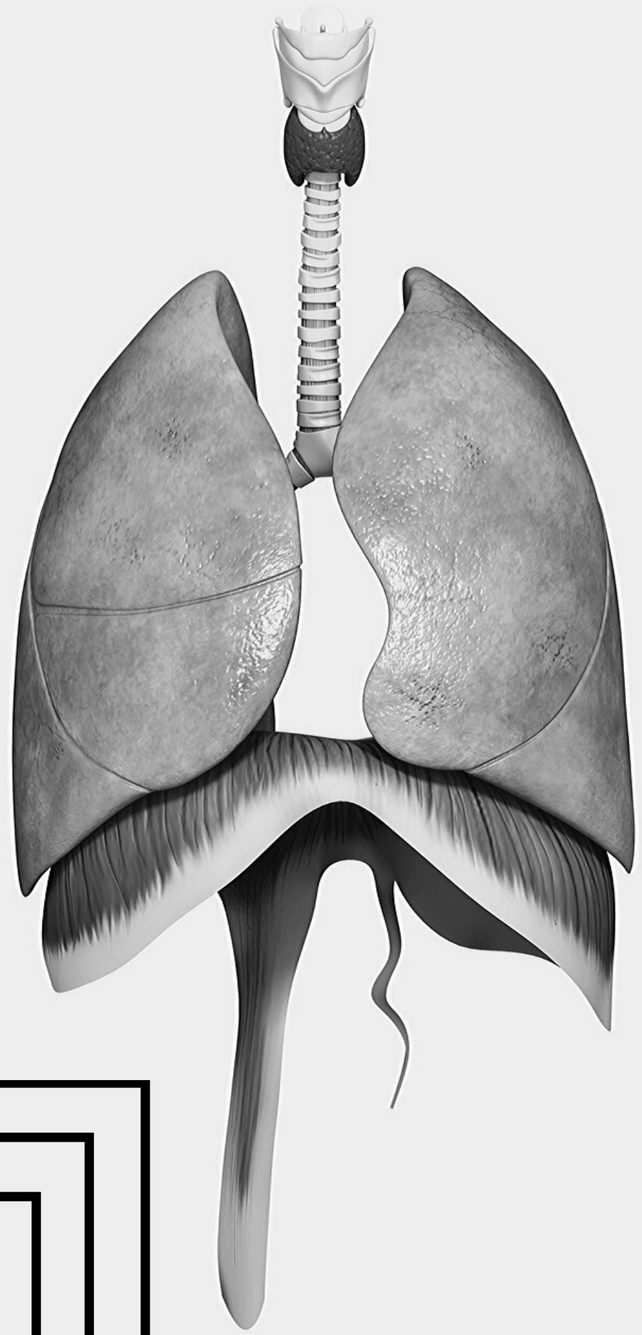
CAPSTONE UPDATE

Diagnosing Respiratory Disease with Deep Learning

By Dana Nicolas

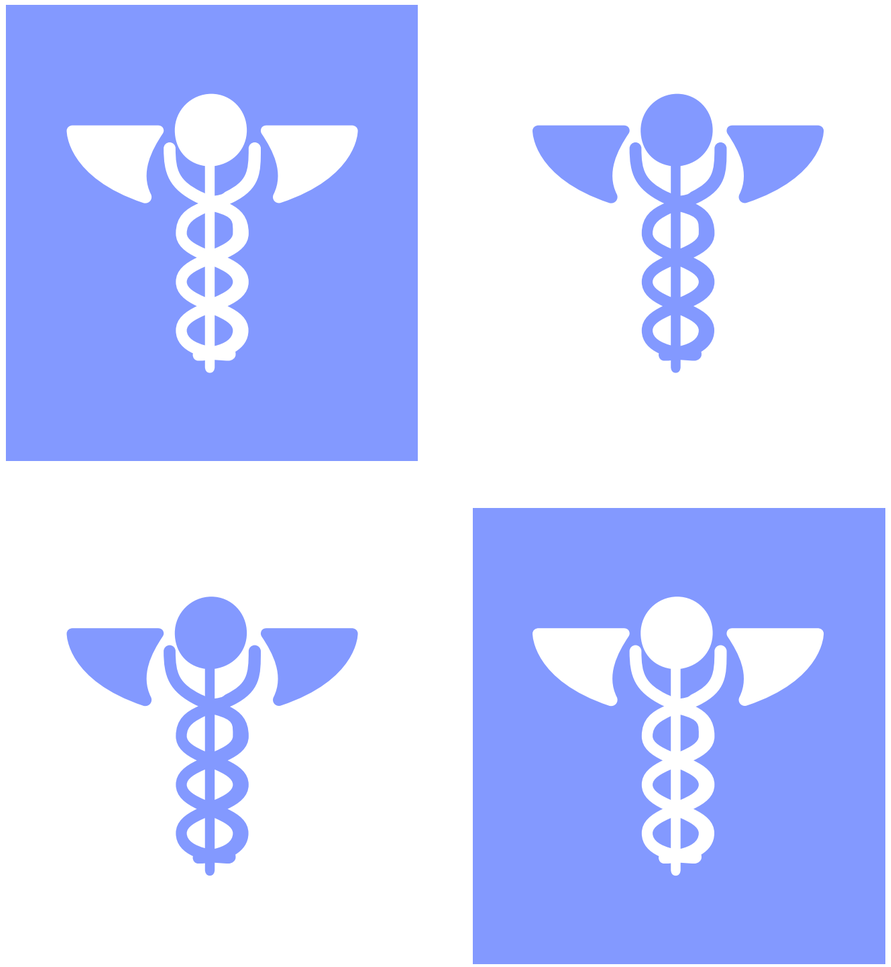




PRESENTATION OUTLINE

TOPICS TO BE COVERED

Opportunity Areas
Potential Impact
Dataset
Current Status
Strategies for Improvement
Summary
References



OPPORTUNITY AREAS

MODERNISING HEALTHCARE

- Healthcare has lagged behind in terms of IoT integration compared to other industries.
- Using AI to improve and modernise how doctors do diagnosis.
- Much more accurate and uniform way of diagnosing.
- A starting point for IoT integration in the health industry.

2017-18 DOCTOR DISTRIBUTION IN AUSTRALIA

Table 2. FSE* GPs per 100,000 people across each State/Territory

	NSW	VIC	QLD	WA	SA	TAS	ACT	NT	AUS
Major cities	104.7	99.9	113.9	94.8	109	NA***	77.1	NA***	103.5
Inner regional	107.1	103.3	109.8	101.4	78.2	97.9	NP**	NA***	104.2
Outer regional, remote and very remote	NP**	NP**	96.8	77.9	85	84.2	NA***	54.9	89.9

*1 FSE is a 37.5 hour working week

**NP not published

***NA not available

Reference: Australian Medical Association -- https://ama.com.au/article/general-practice-facts

Potential Impact

- **INCREASE SPEED OF DIAGNOSIS.**
- **IMPROVE ACCURACY OF DIAGNOSIS.**
- **CAN ATTEND TO MORE PATIENTS AT A TIME.**
- **WIDEN ACCESS OF HEALTHCARE.**

DATA SET

RESPIRATORY AUDIO SOUNDS

- The Respiratory Sound Database was created by two research teams in Portugal and Greece.
- It includes **920 annotated recordings** of varying length - 10s to 90s. There are a **total of 5.5 hours** of recordings containing 6898 respiratory cycles - 1864 contain crackles, 886 contain wheezes and 506 contain both crackles and wheezes.
- These recordings were taken from **126 patients including diagnosis**.
- The data includes both clean respiratory sounds as well as noisy recordings that simulate real life conditions.
- The patients span all age groups - **children, adults and the elderly**.

CURRENT STATUS

CLASSIFICATION PROBLEM

8 Categories:
(1) Asthma; (2) Bronchiectasis; (3) Bronchiolitis; (4) COPD;
(5) Healthy; (6) LRTI; (7) Pneumonia; (8) URTI

GENERATE IMAGES FROM AUDIO FILES

Librosa Library to create spectogram images of each file.
This will be fed to the Deep Learning model later on.

USING BASIC CNN TO CREATE BASELINE METRICS

Using VGG16 and ImageNet for its pre-trained weights.
Optimiser used is Adam with learning rate of 0.0001

91.88%

VALIDATION ACCURACY

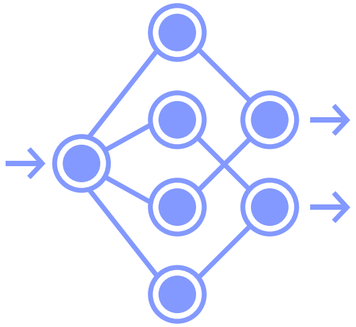
0.3316

VALIDATION LOSS

STRATEGIES FOR IMPROVEMENT

FINE TUNING DATA AND MODEL

Humans have a different way of perceiving sounds.



Gammatone Filtering in preparing audio data before converting to image.

Compare baseline results with new results.

SUMMARY

- Pre-process dataset using Gammatone and explore other ways of extracting features to mimic how humans perceive sound.
- Fit and fine tune models to improve accuracy.

REFERENCES

DATASET AND TOOLS

https://www.kaggle.com/vbookshelf/respiratory-sound-database
https://bhichallenge.med.auth.gr/ICBHI_2017_Challenge

STATE OF HEALTHCARE IN AUSTRALIA

https://ama.com.au/article/general-practice-facts

Thank you

Questions?