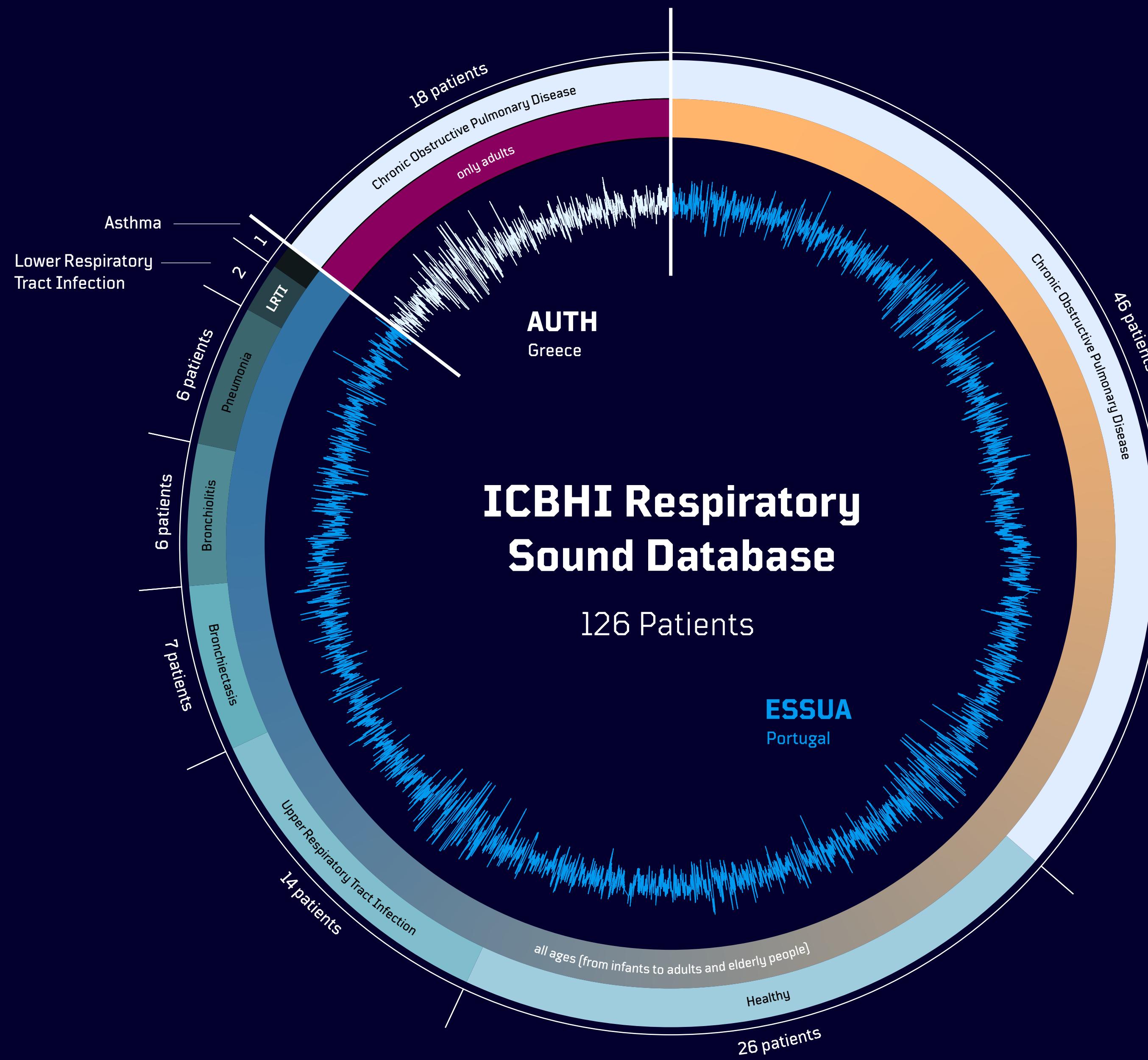


# Machine Learned Stethoscope

Respiratory Sound - Auscultation of the Lung



## AUTH

Papanikolaou General Hospital, Thessaloniki  
General Hospital of Imathia, Greece  
(Health Unit of Naousa)

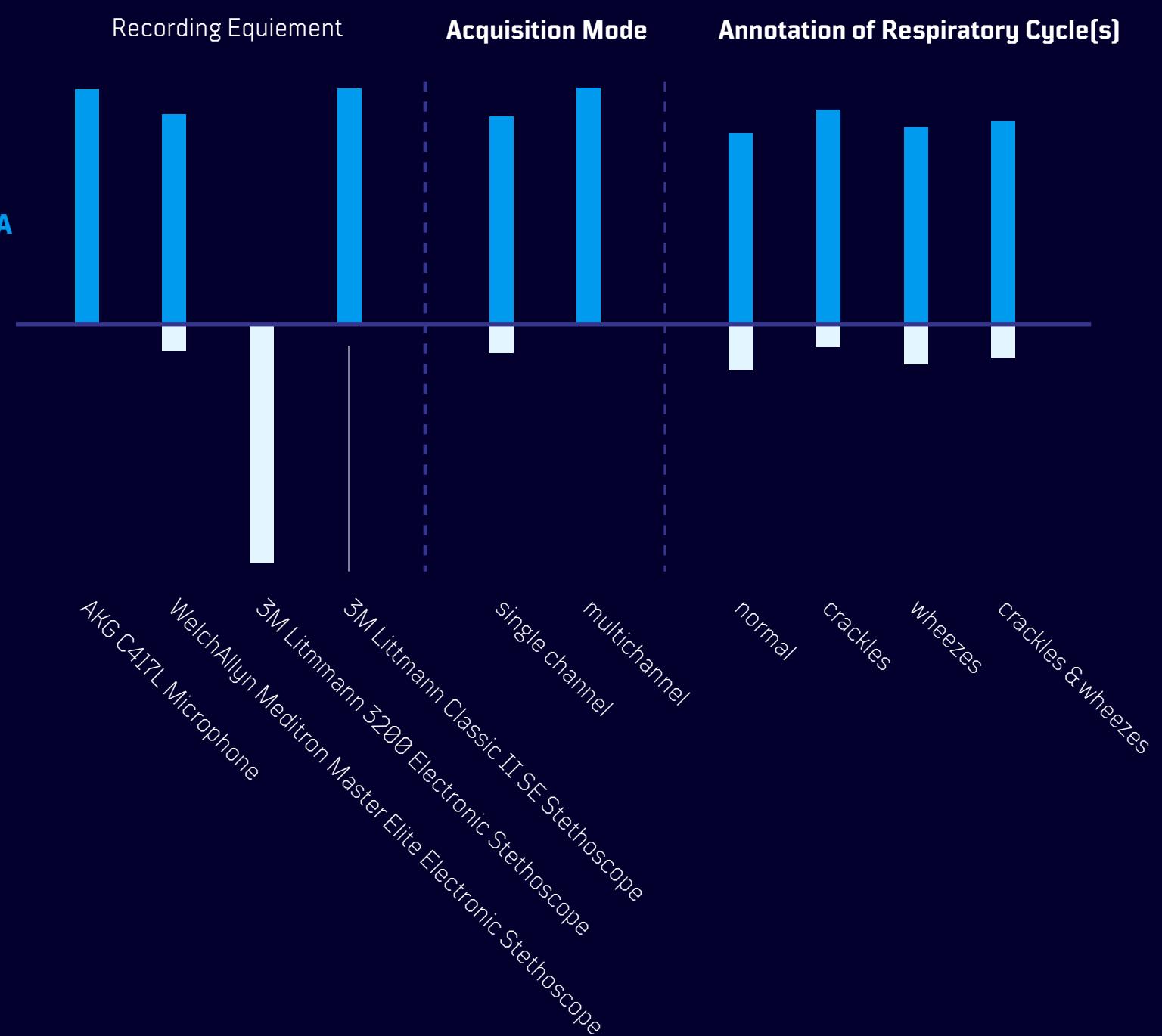
Aristotle University of Thessaloniki (AUTH)  
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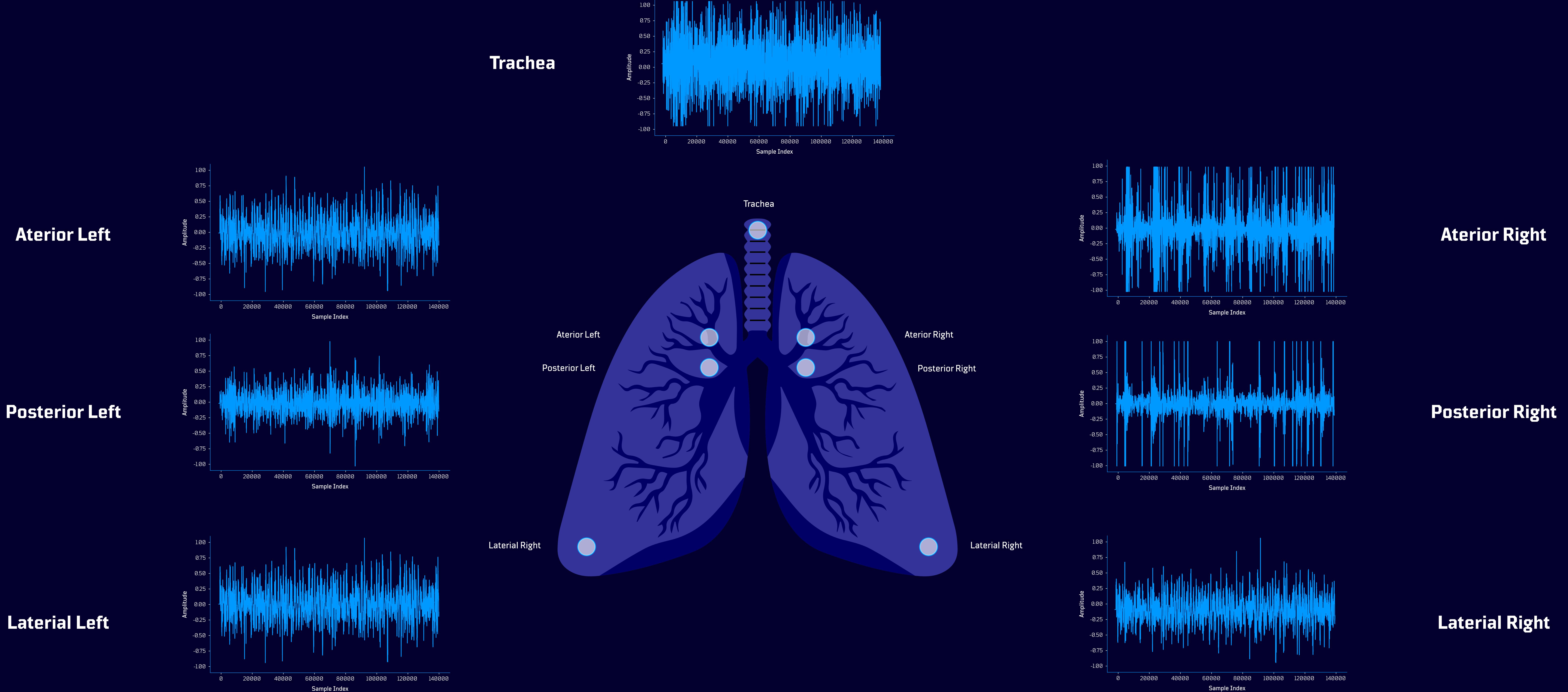
## ESSUA

Respiratory Research and Rehabilitation Laboratory (Lab3R)  
Hospital Infante D. Pedro, Aveiro, Portugal

School of Health Sciences, University of Aveiro (ESSUA)

## Technical Details





135\_2b3\_Pr\_mc\_LittC2SE

Male

Age 70

BMI 21

Recording Asciulation

Annotation

**Recorded File**

Resampling

Denoising

Banpass Filter

**Filtered File**

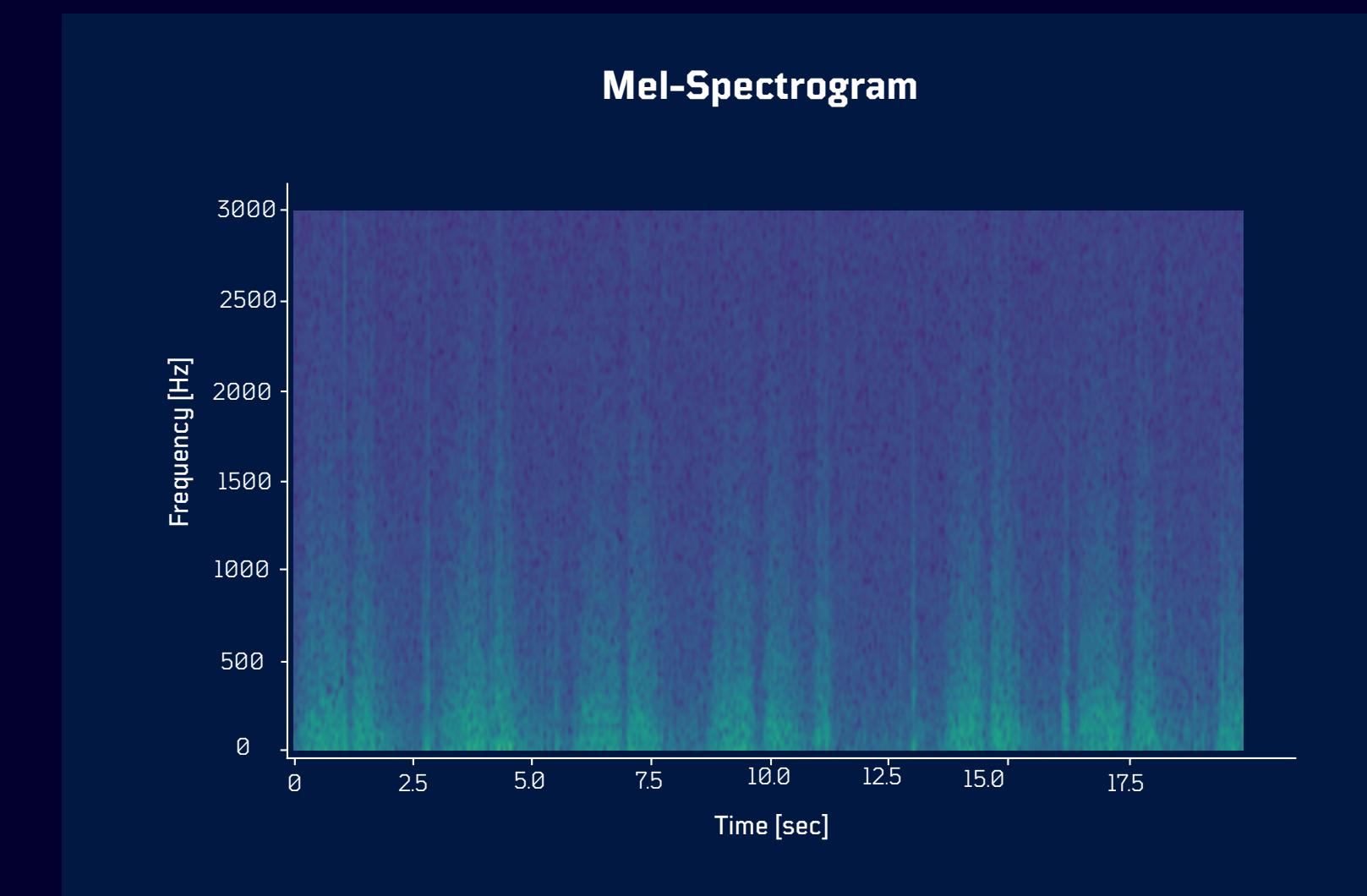
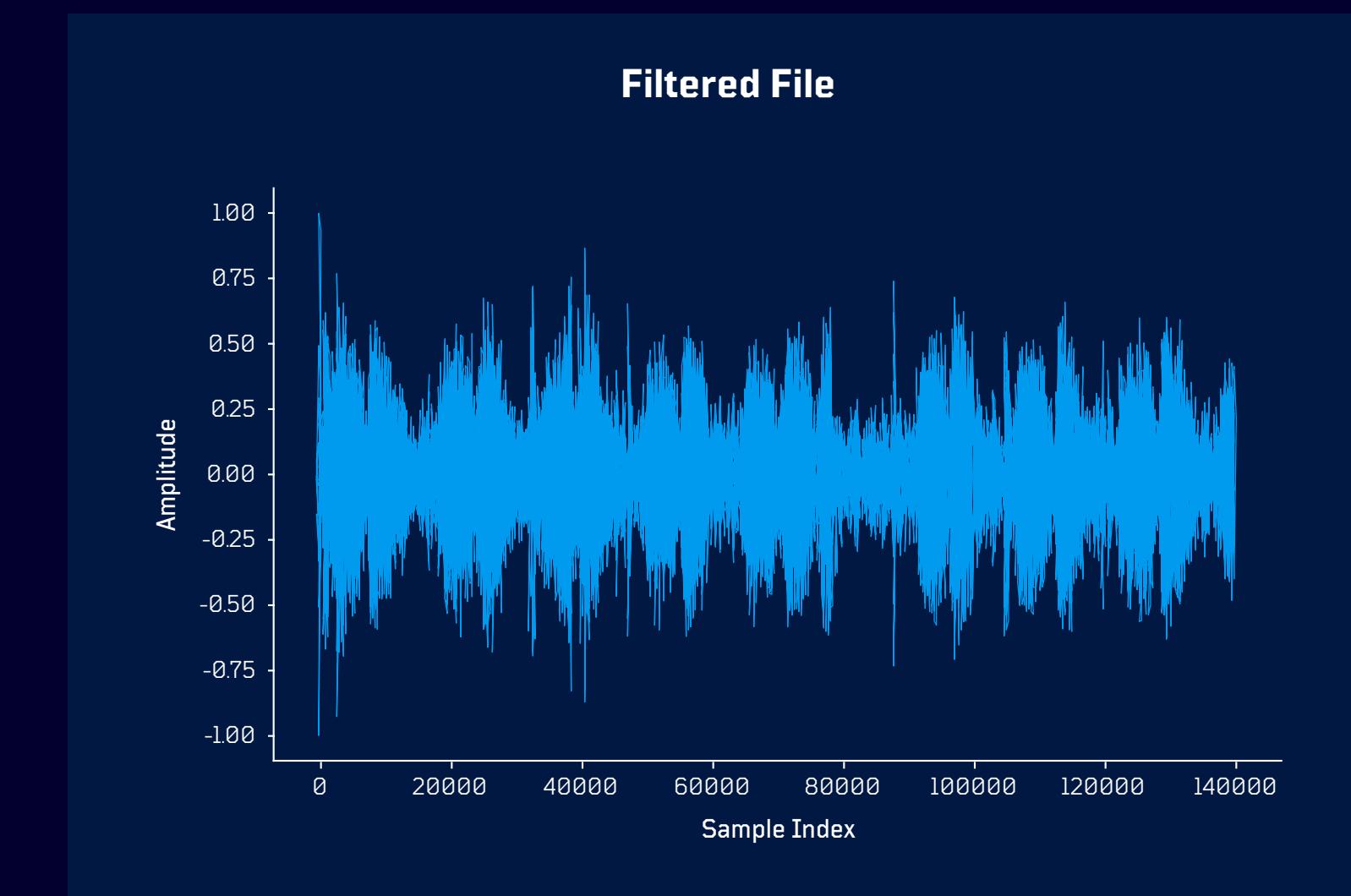
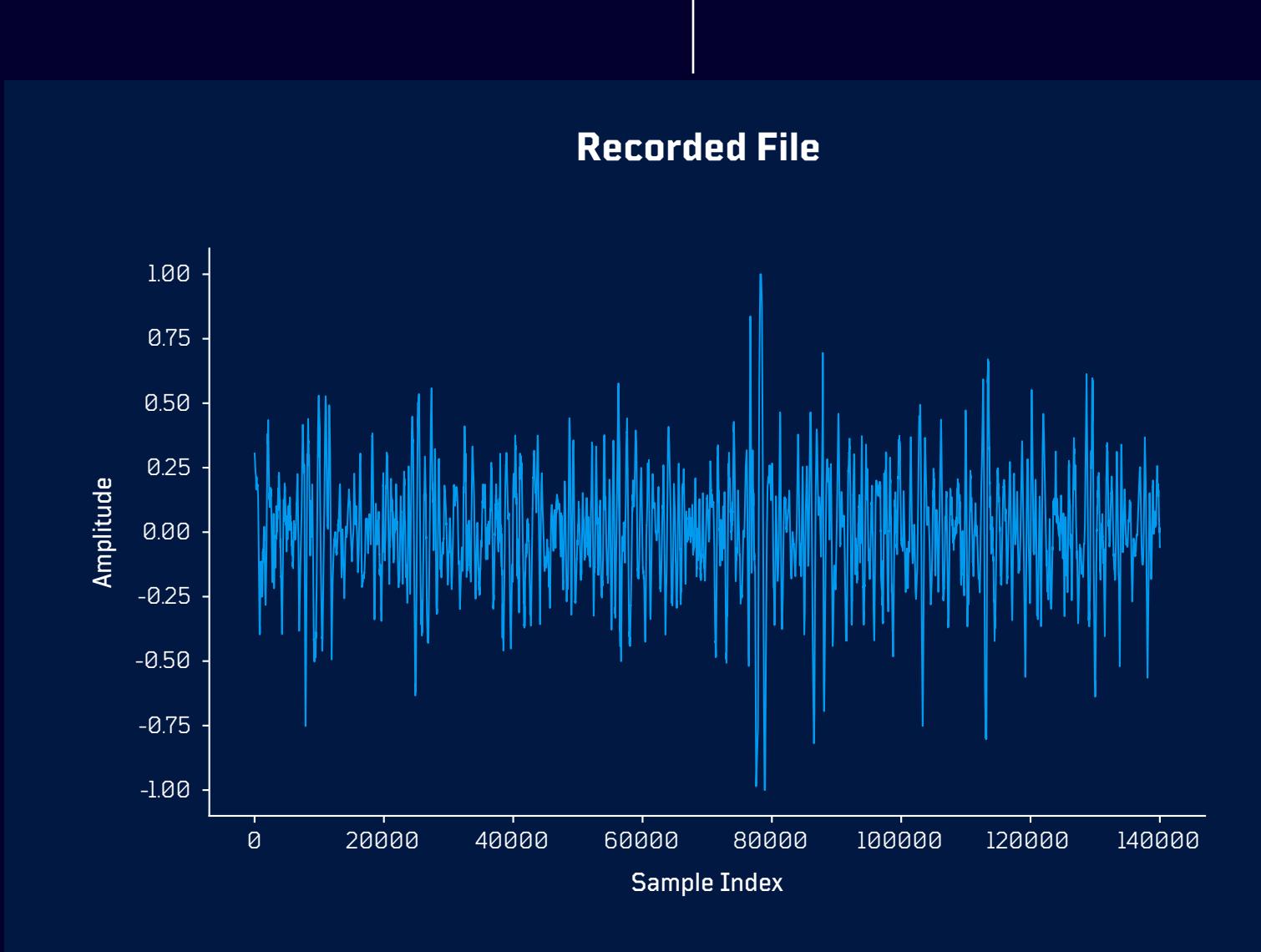
Transform Signal to Array

Fast Fournier Transform

VLTP- Algorithm

Mel Frequency Cepstral Coefficients

**Mel-Spectrogram**



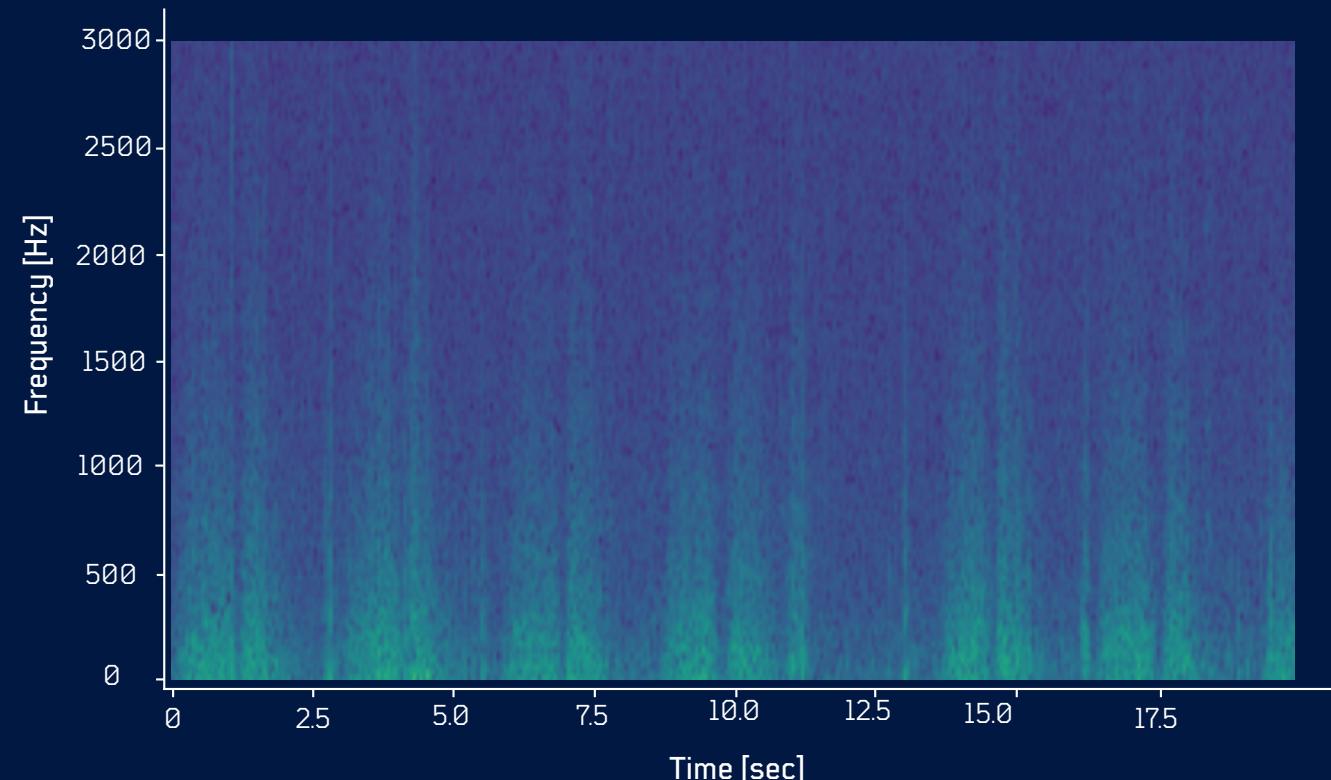
Mel Frequency Cepstral Coefficients

### Mel-Spectrogram

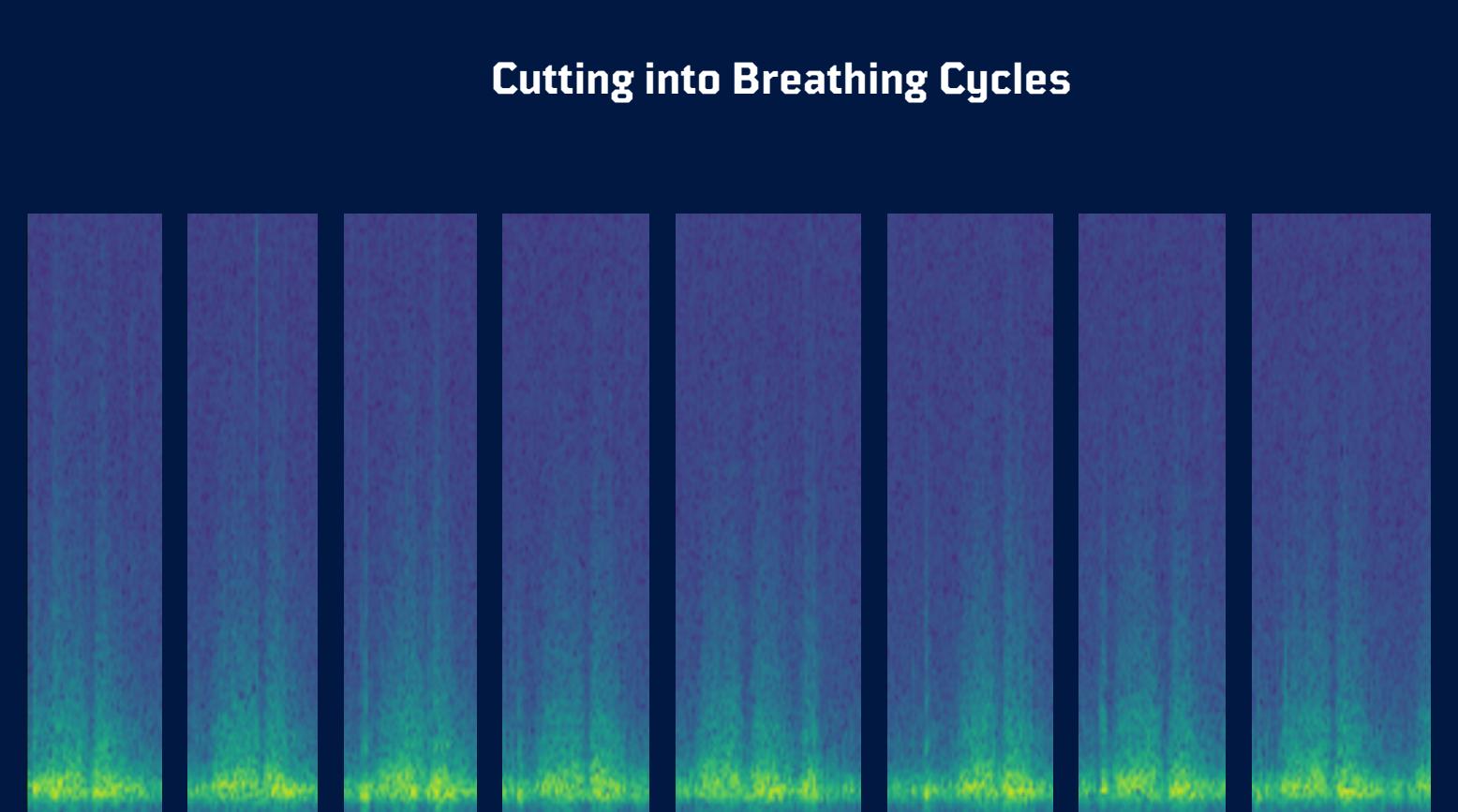
### Cutting into Breathing Cycles

### Data Augmentation

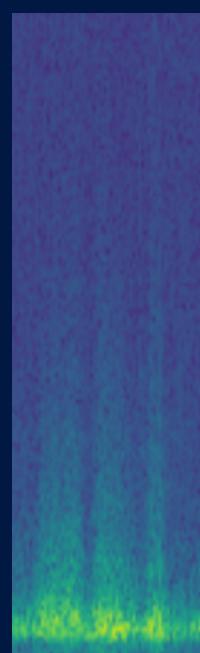
#### Mel-Spectrogram



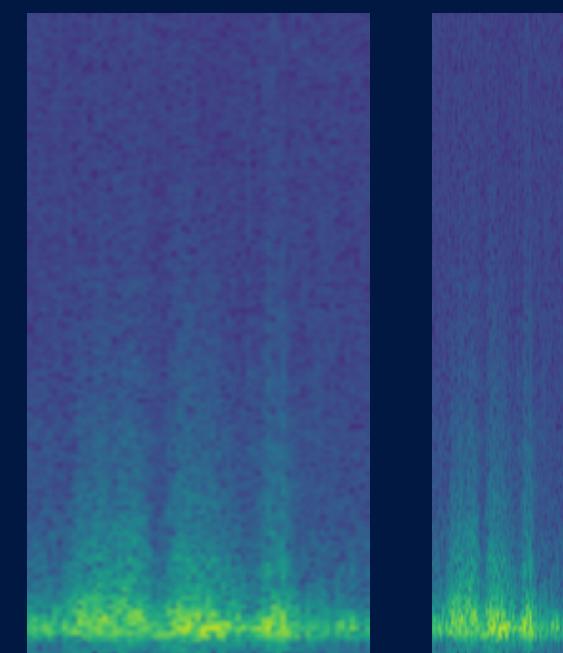
#### Cutting into Breathing Cycles



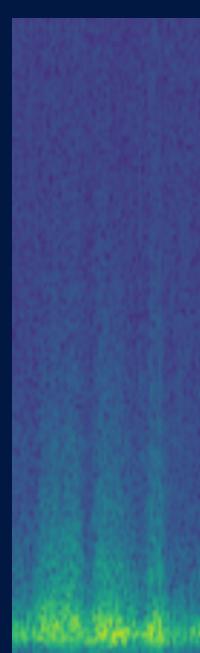
Original



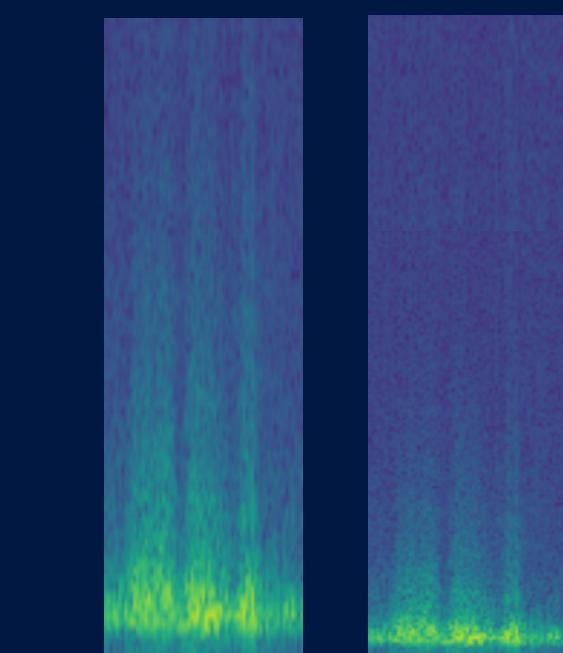
#### Data Augmentation



stretching/contracting

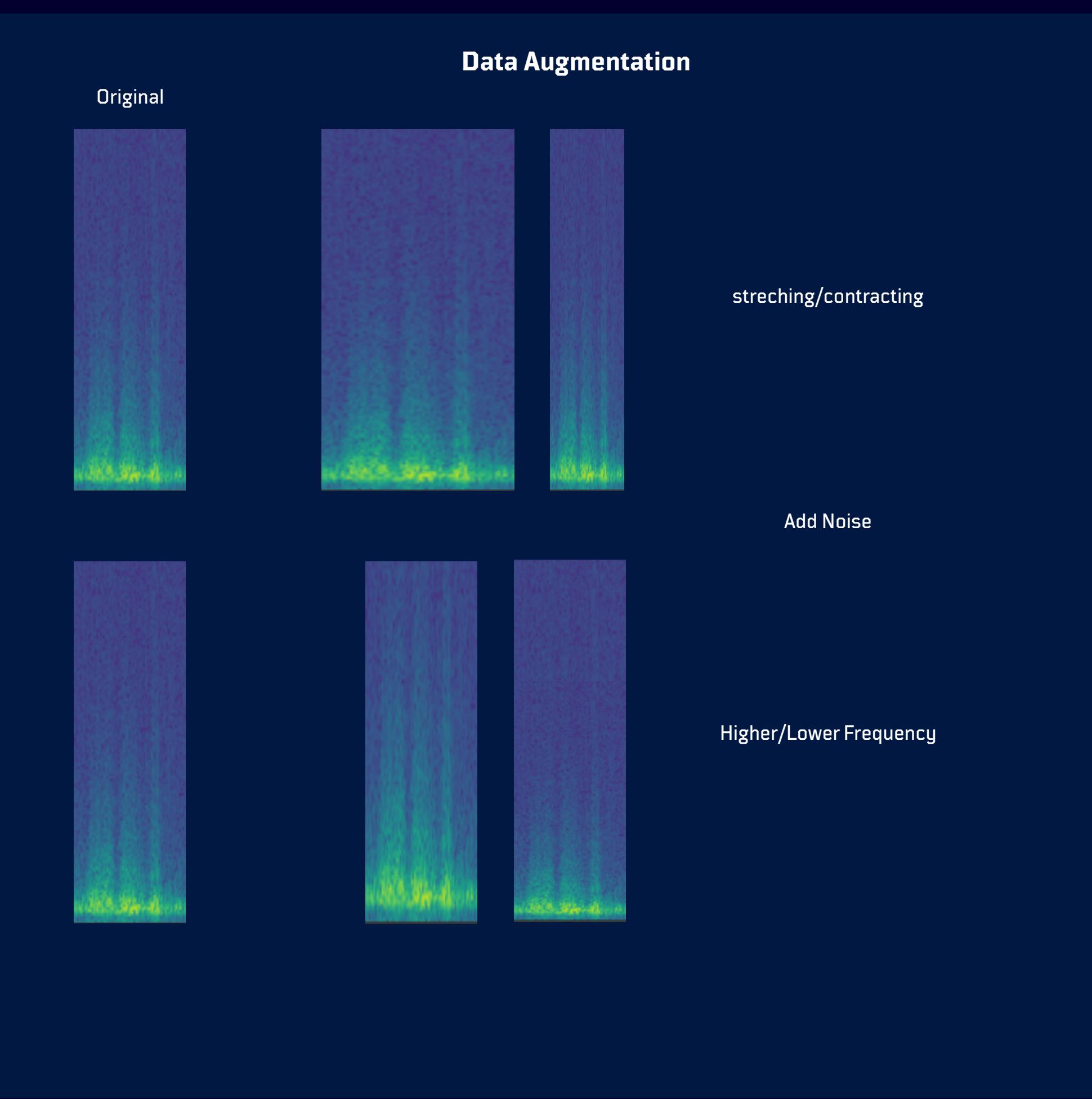


Add Noise

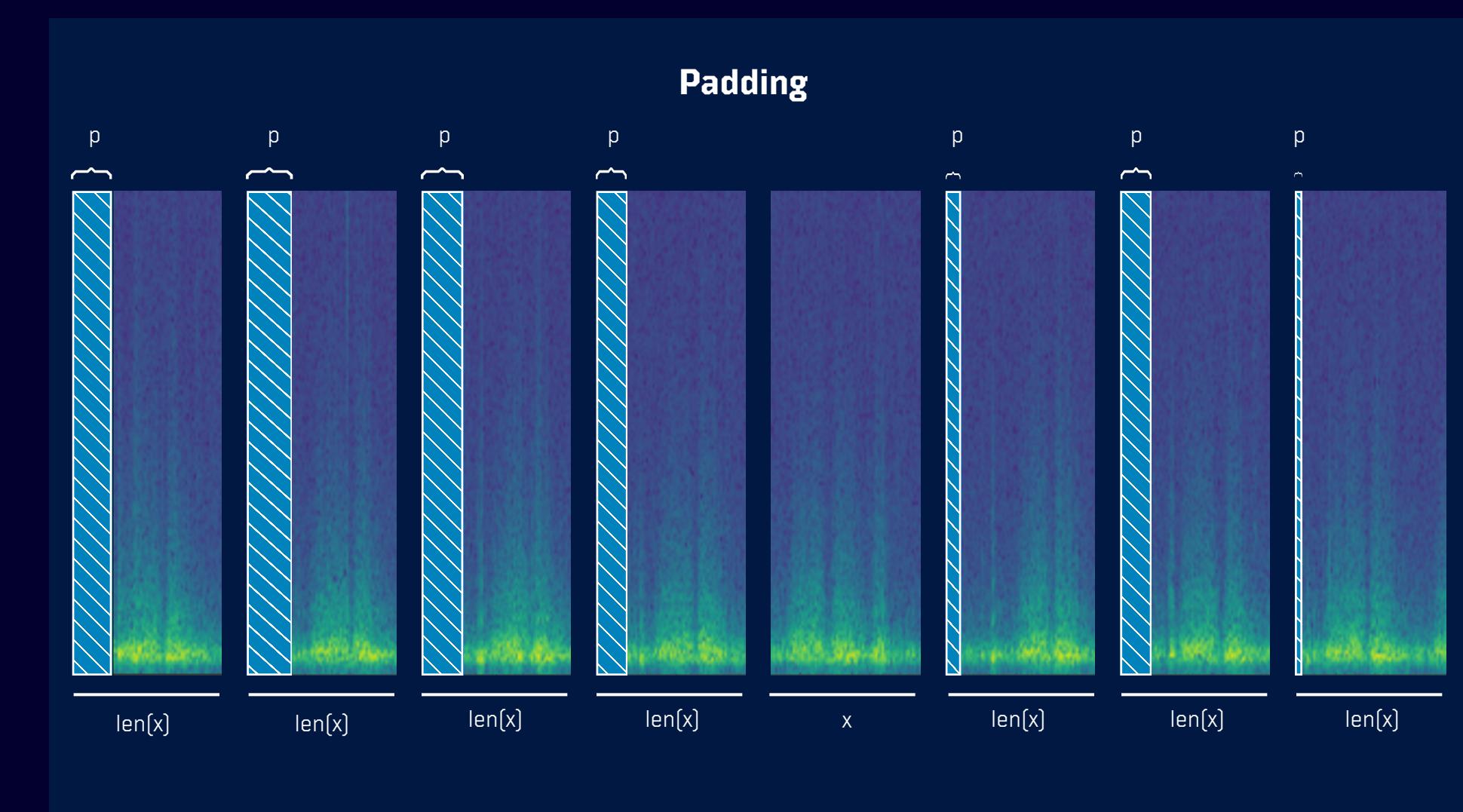


Higher/Lower Frequency

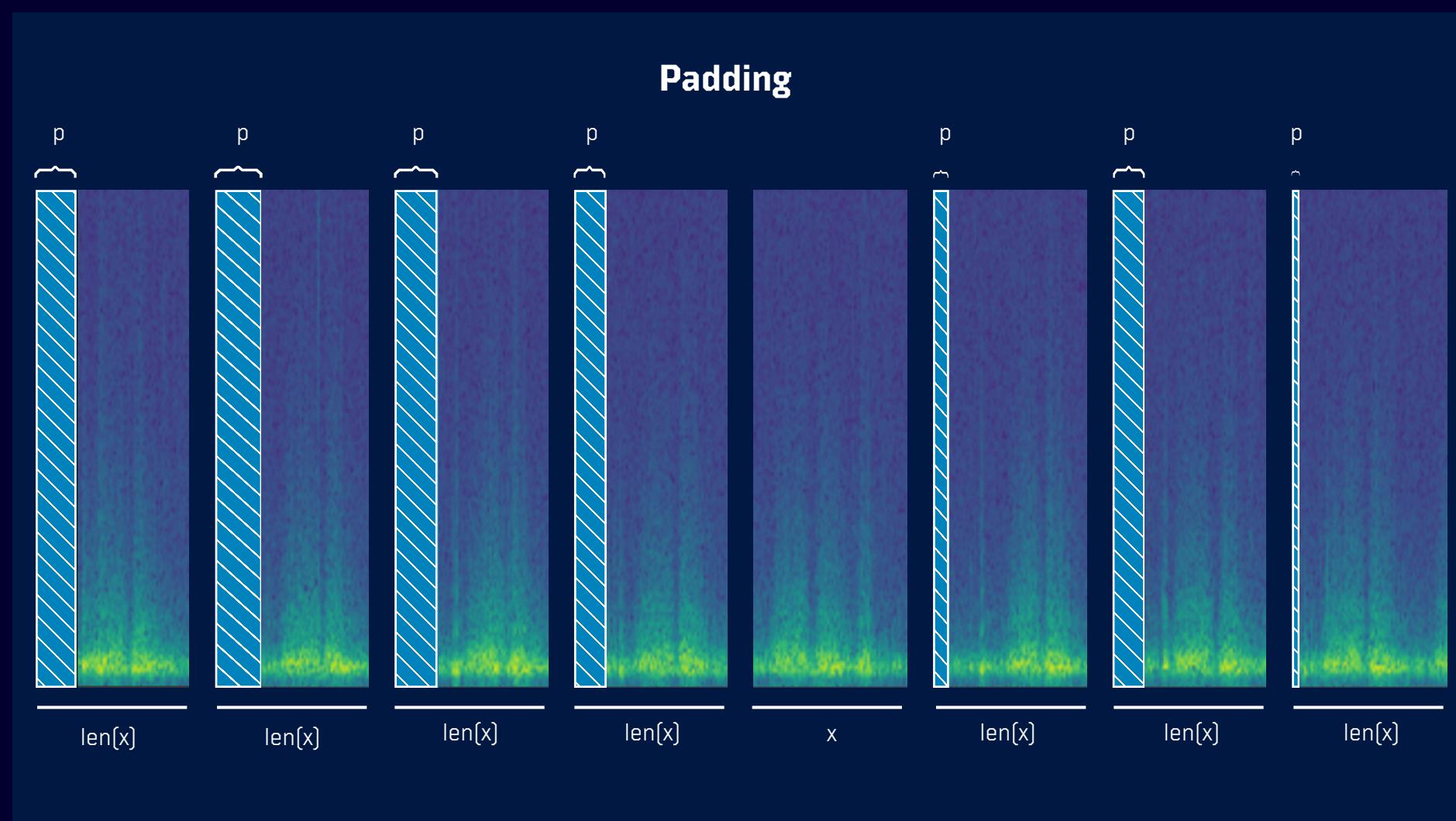
## Data Augmentation



## Padding



**Padding**



**CNN**



**Deep Neural Network**

