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Soft, wearable, digital stethoscope for continuous cardiac biometric security

Georgia Institute of Technology

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ECSA-8

The 8th International Electronic Conference on Sensors and Applications

01–15 NOVEMBER 2021 | ONLINE

sensors

MDPI

C H C I E

Applications in the Project

Continuous Monitoring

Biometric

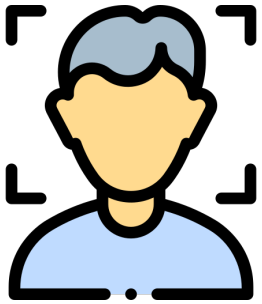
Disease Diagnosis

Current Biometrics Used

Fingerprint

Signature

Hand geometry/
Palm veins

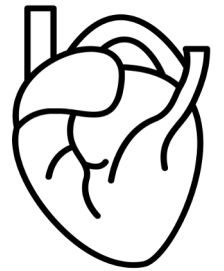


Face geometry

Voice

Ear Shape

Retina/Iris



Cardiac Sounds

Limitations of Current Biometrics

- **Accurate but existent error rates**
- **Bulky** and **expensive** sensors for biometrics
- **Not possible** of **continuously authenticate**
- **Cross contamination**

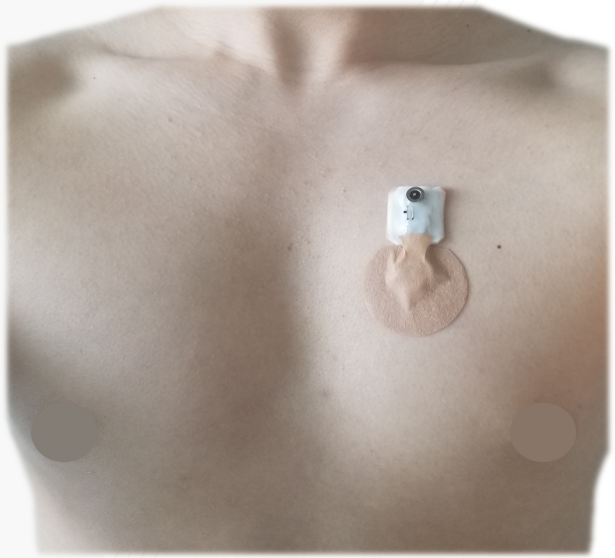
Fingerprint

Hand Geometry

Face

Voice

Advances in Soft Wearable Biometric



- **Detect & transmit** body sounds
- **Remote and continuous** authentication
- **Accurately receive** and **store** signals
- **Small**, **light-weight**, **flexible** electronic

Less than **$5** per patch!

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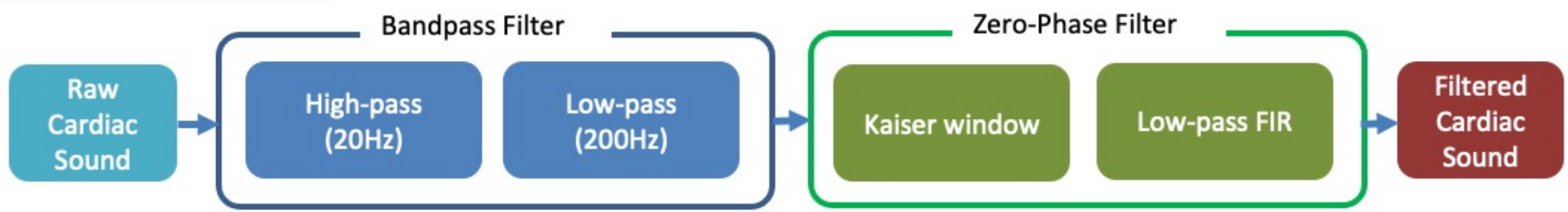
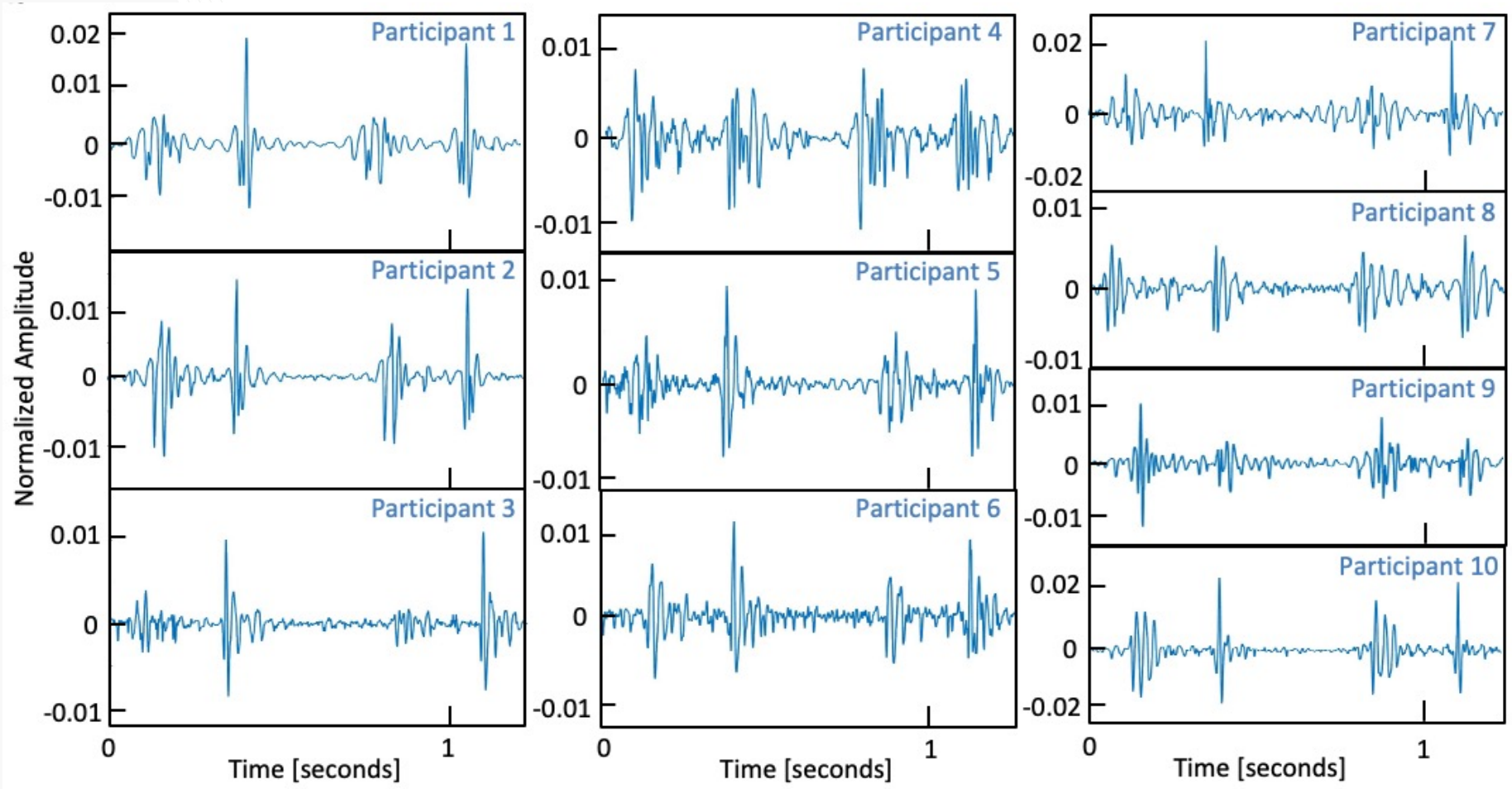
Signal Processing Stages

- **Bandpass Filter –** Filtering out unwanted signals and noise
- **Zero-phase filter**
  - Kaiser Window - **better sidelobe amplitude**
  - Low-pass FIR - **minimize round of noise error**



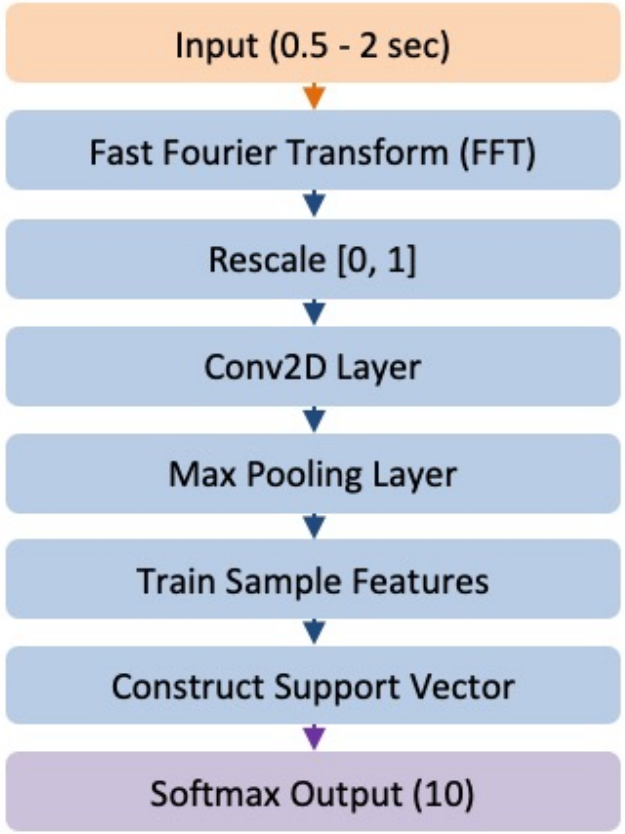
Signal Processing

- **Feature extracted heart sounds** (Each participant distinct)



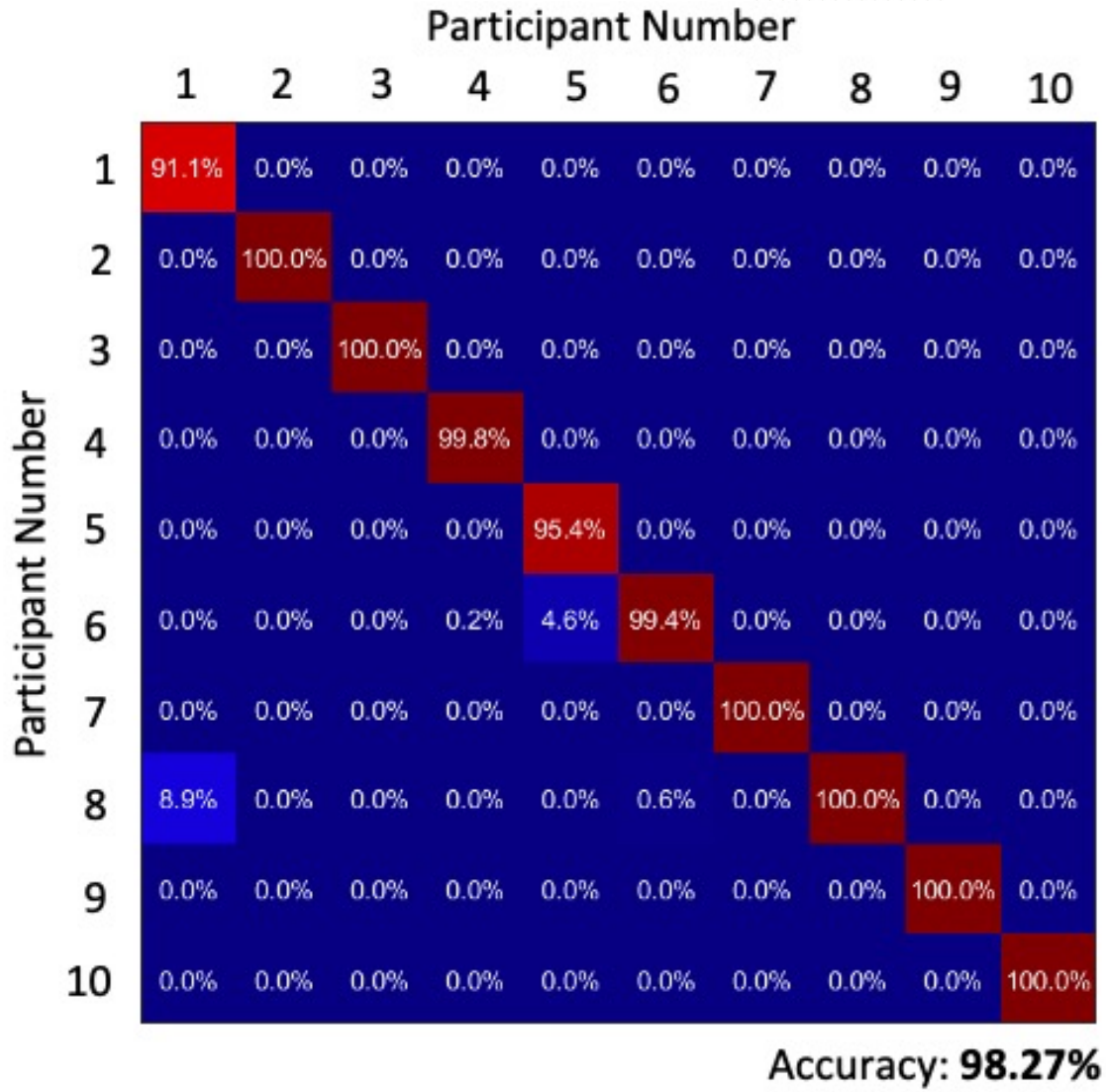
Machine Learning Stages

- **0.5 second to 2 second window for multiple samples**
- Fast Fourier Transform (FFT)
- Rescaling – Normalizing in the window from 0 to 1
- Convolution 2D Layer
- Max pooling Layer
- Constructing support vectors
- Outputting softmax of 10 classes



Machine Learning Results

- Cardiac Biometric Correction Rate (CRR) – **98.3%**
- Exceeding performance compared to Fingerprint, Signature recognition, Voice recognition
- Room for improvement on the accuracy of Iris/Retina scan



Accuracy: **98.27%**

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Summary

Traditional

Today

Next Generation

2FA:

Acknowledgement

Bio-Interfaced Translational Nanoengineering Group
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Thank you!

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