Dr. Mao Zheng
Nov. 4, 2025

https://www.cs.uwlax.edu/~mzheng

Research Interest

- Software Engineering
  - Software Testing
    - Specification-based testing(formal model, automation)
    - UML testing (informal model, scenario-based)
  - Software Model & Software Design
    - Context-aware computing
      - Context models
      - Design and implementation based on the model
      - Context-aware applications: mobile apps.

Past Projects

Machine Learning	Mobile App Development	Software Engineering
A Web Application for Sales Forecasting	Explore Mobile App Development with React Native	DataTracker: A Comprehensive Artifact Management Tool for Embedded Chiller Applications
Building a Stock Machine Learning Model using Numerai Dataset	Workout Track & Plan App	Launch Web Tool Document Generator from Legacy tool Spectrum to Generate Equipment Submittals
A Detection Tool for Traffic Objects	An Android App for Detecting Sleep and Pausing Media	
Tongue Diagnosis in Diabetes by Deep Learning	An Android UWL Campus Guide App (kotlin)	Test Case Generation from UML Models
Developing an Autonomous Driving Model Based on Raspberry Pi	A Ride Sharing Application: UberLite	A Web-based Testing Tool
Using Machine Learning to Play the Game Super Mario Kart	Context-based Mobile User Interface	A Design of the Test Engine
A Web Application for Restaurant Recommendations	A Mobile Application for Collecting Plant Observation Data	

Current Projects & Future Ideas

- A Predictive Model to Analyze Stock Trends and Make Future Predictions

Looking for Students:

- Mobile App Development: Kotlin or React Native
- Software Models, Design, or Testing
- Machine Learning

Interests

- Adaptive Mobile AI
  - Adaptive interfaces
- Privacy-preserving AI on personal devices
  - Train models without sharing raw data
  - Ensure the user's identity cannot be inferred from AI models
- Cross-Device Context and Ecosystem-level Awareness
  - Mobile devices coordinate other devices to infer richer context

A Project from a Non-Profit Organization

- The goal of the project is to create a user-friendly, web-based scheduling tool that helps us manage shifts, reduce critical scheduling errors, and plan internal resources more efficiently.
- Our organization currently provides over 600 hours of job coaching to individuals with disabilities each week, supporting nearly 300 people a year.
- Our goal is to help improve their work skills, independence, and economic freedom. We believe this could be a valuable real-world opportunity for a student interested in software development, particularly with a focus on web applications and user-centered design

A Project from Campus

Exercise and Sports Science

Create an electronic medical record system for La Crosse Exercise and Health Program(LEHP): an adult fitness and cardiac rehabilitation program

- Obtain medical records from hospitals on our LEHP participants, conduct exercise assessments, and formulate exercise plans.
- Document their medical history, medications, EKGs, lab values, etc.

Dr. Dipankar Mitra

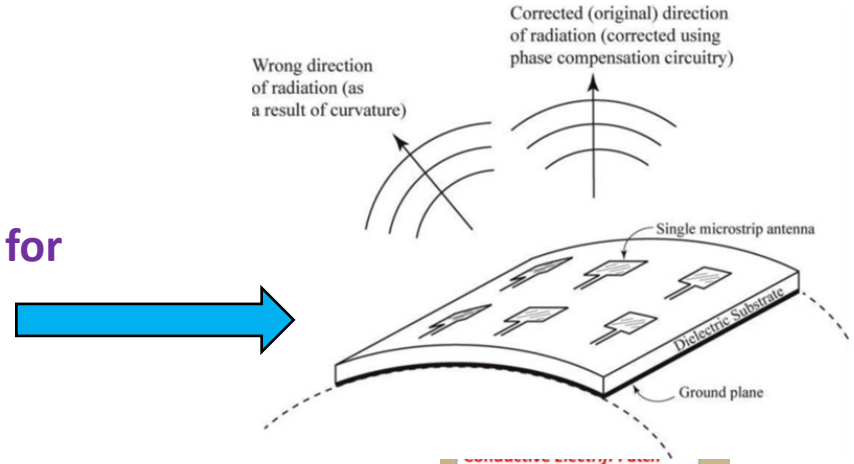
Assistant Professor

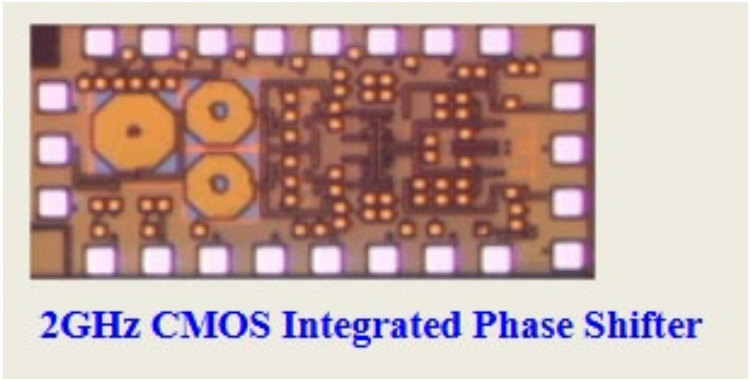
Dept. of Computer Science & Computer Engineering

University of Wisconsin-La Crosse

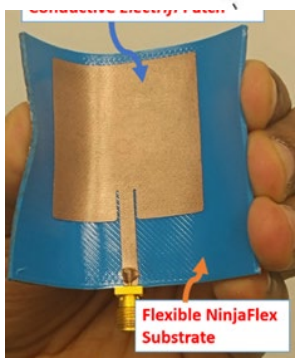
Research Background

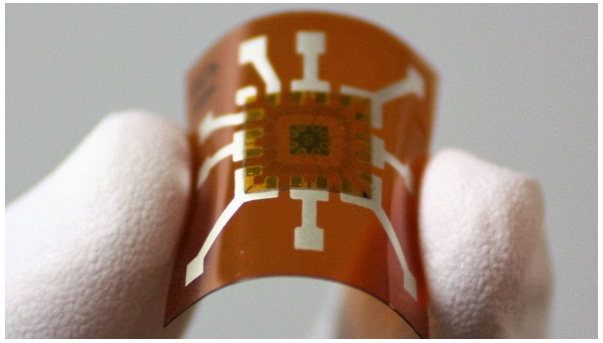
- **CMOS Integrated Beamformer for Phased Array antenna**



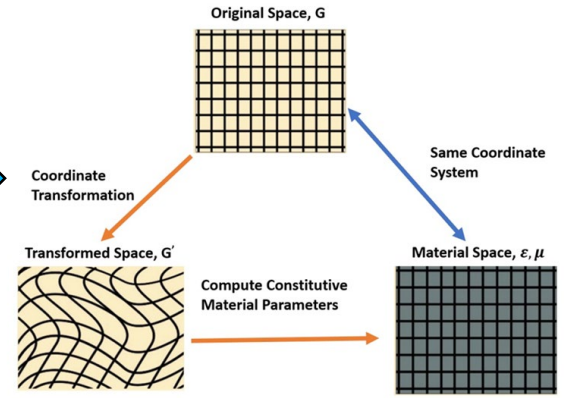


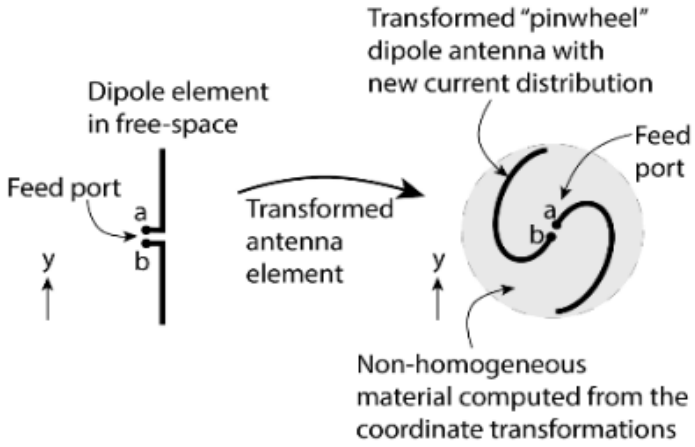
- **3D-Printed Flexible and Wearable Electronics**





- **Transformation Electromagnetics/Optics**





Current and Future Research

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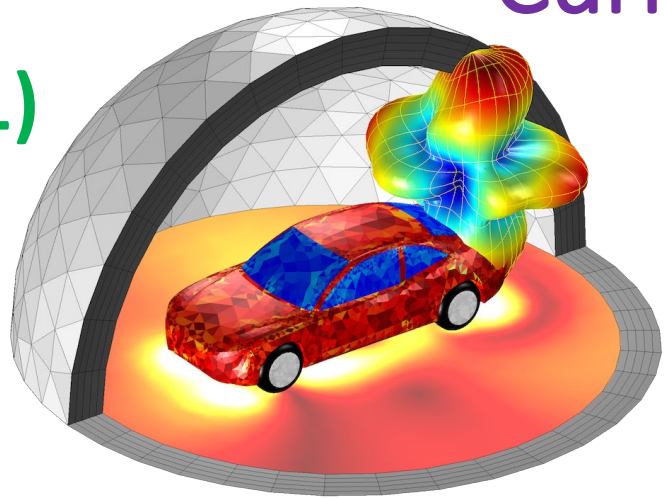
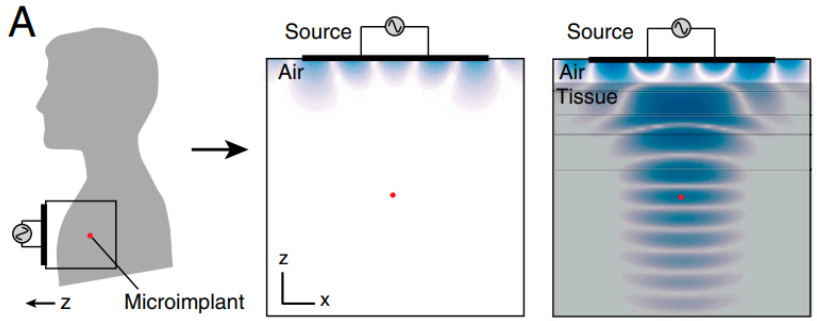


Real Environment Antenna Simulation using COMSOL Multiphysics

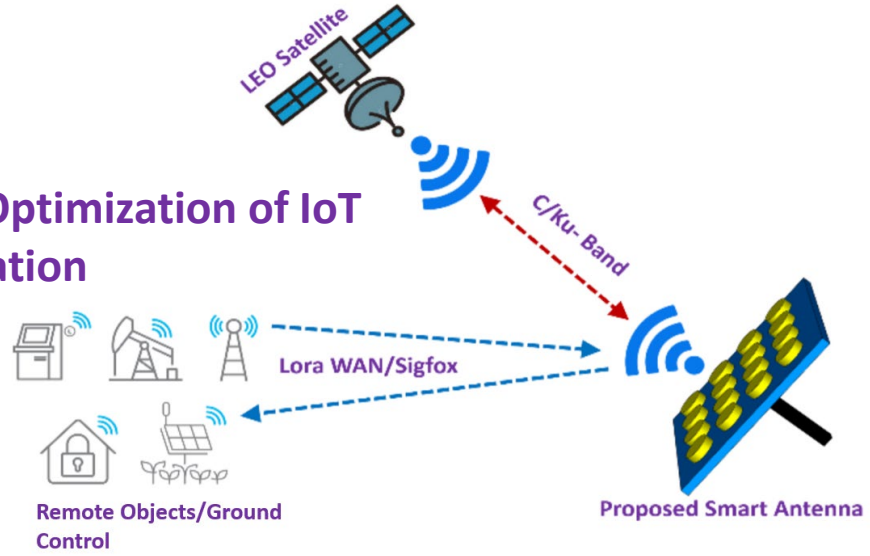
(2)



Near-Field Sensing for various Biomedical Applications (Collaboration with Mayo)

(3)

ML-based Optimization of IoT Communication



Current and Future Research

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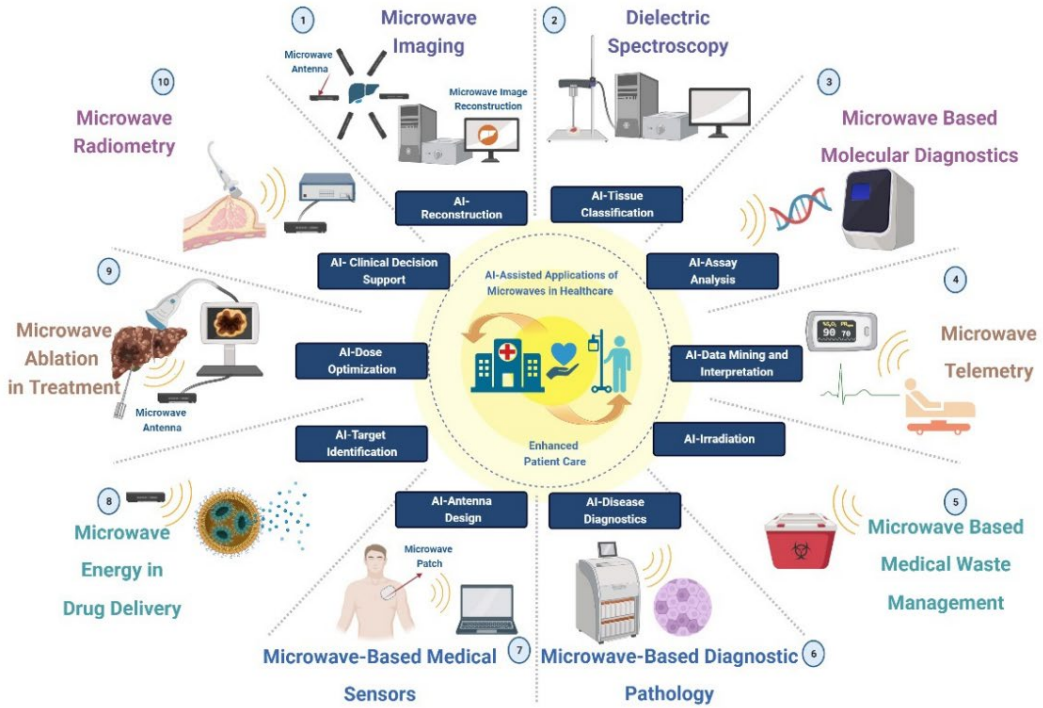

AI Applications of Microwaves in medicines for Better Health Care (Collaboration with Mayo and Gundersen Health)

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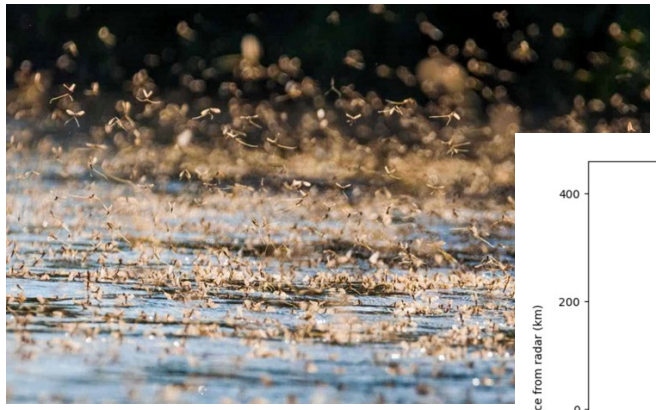
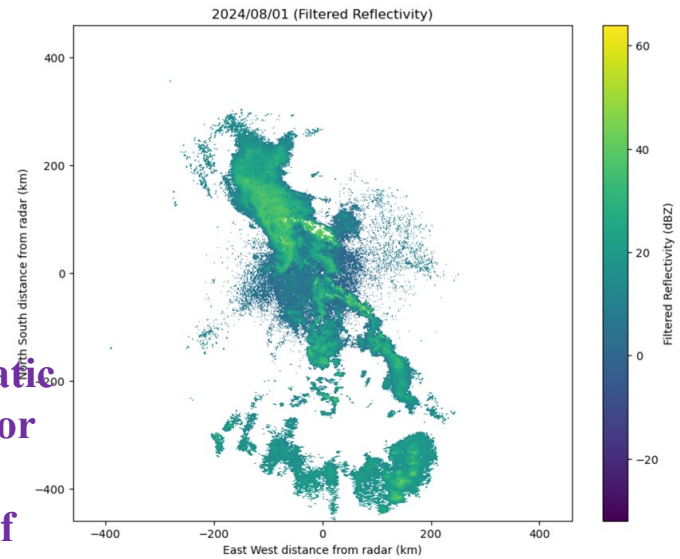


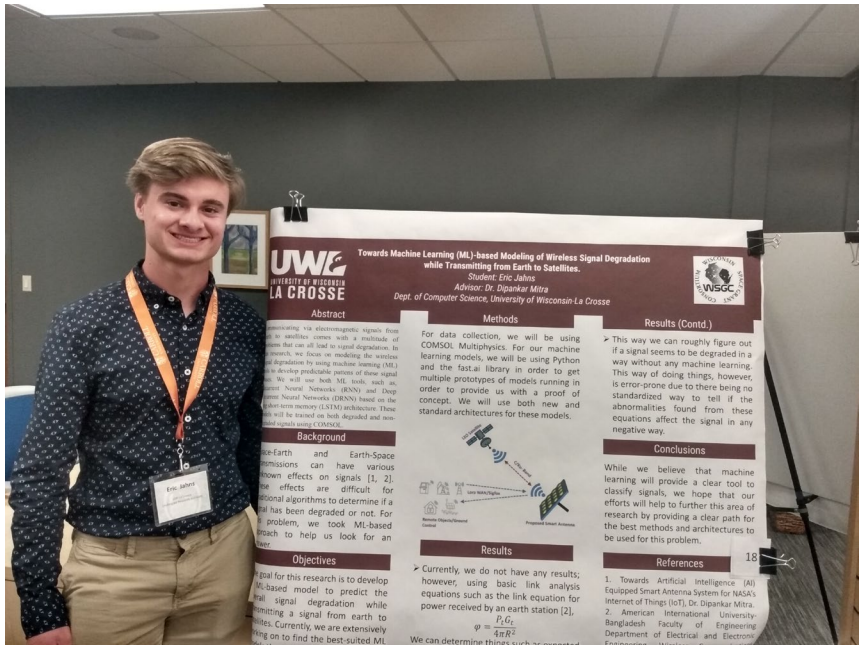


ML-based prediction of aquatic insects (MayFly) in UMRR for predicting water health (Collaboration w/ WI Dept of Natural Resources)

Scope and Potential Opportunities:

- **Learn Industry scale CAD Tools: COMSOL, CST, ADS**
- **Internship Opportunities @ Mayo Clinic, Patfoci Technologies Inc., Rochester, MN, NASA WSGC**

Student Success



- Two UG Students went to Grad School (ASU and UBC)

- 4 Dean's Distinguished Fellowship (DDF) in Summer, 2023 and 2024

- 4 went for Internships in Top Companies (Summer 22, 23, and 24)

-Currently, 4 students working on different Projects

-Students Published in IEEE Papers

Research Sponsors

- NASA Wisconsin Space Grant Consortium (WSGC)
- UWL FRG
- Gundersen Health Care
- WiSys Ignite and Spark
- Microwave and Imaging Lab (MEIL), Department of Medicine, Mayo Clinic, Rochester, MN
- Potential Support from: NSF, Wisconsin Innovation Grant, WI DNR

Prof. Samantha Foley

Research Interests

Scientific Computing

High Performance Computing

Cloud Computing

Samantha Foley – sfoley@uwlax.edu - Wing 220

Past Projects

- Past MSE Projects
  - DSLEUTH – parallelize an urban growth modeling program to run on multicore machines
  - KSLEUTH – using the same approach as DSLEUTH, but using Kubernetes and Docker containers
  - PySLEUTH – reimplement the SLEUTH code in a modern language
  - OnRamp – a web portal for running parallel programs for education
  - Concurrency Visualizer – a web application that demonstrates classic synchronization programs with a backend written in Go
  - Suite of GPU applications for learning about parallel computing

Current and Future Projects

- ***PySLEUTH (high-performance and Python versions of SLEUTH)***
  - Reimplement model in Python using high-performance libraries
  - Develop and incorporate tools for post-processing
- ***Concurrency Visualizer***
  - extend the work with more applications and more powerful visualization of the results
  - Other tools for teaching concurrency topics in databases and operating systems
  - Presented at MICS 2024 and SIGCSE 2021
- ***Advising Chatbot***
  - Currently working with two students to develop a website and chatbot for answering common advising questions and working on additional course planning tools
  - Presented at MICS 2025 and at UWL

Lightning Talk 2025

by

Dr. Rig Das

Assistant Processor

Department of Computer Science & Computer Engineering

University of Wisconsin-La Crosse (UWL)

Email: rdas@uwlax.edu

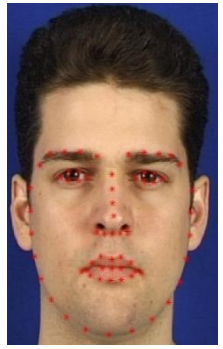
04-Nov-2025

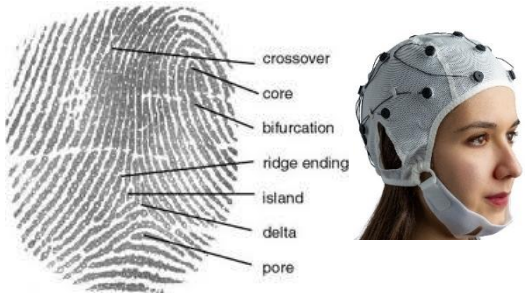
Biometrics & BCI with Brain Signals

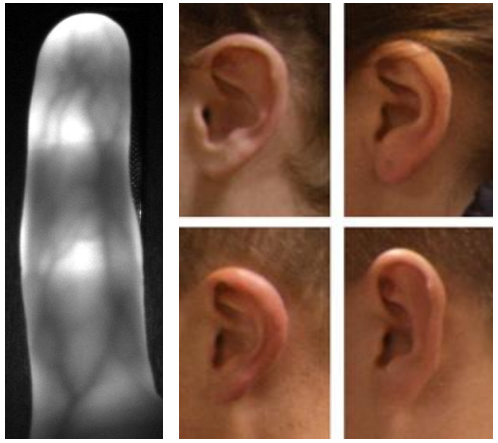
What is Biometrics?

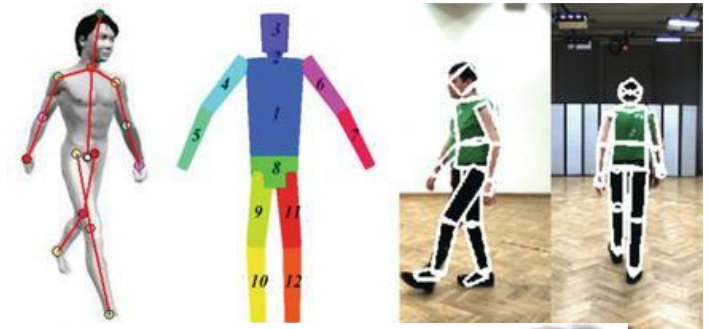
- Automated method for recognizing/authenticating individuals based on measurable biological and behavioral characteristics.
- Why Biometrics: Next-generation technological solution to strengthen the social and national security.
- Two types of Biometric Identifiers/Traits

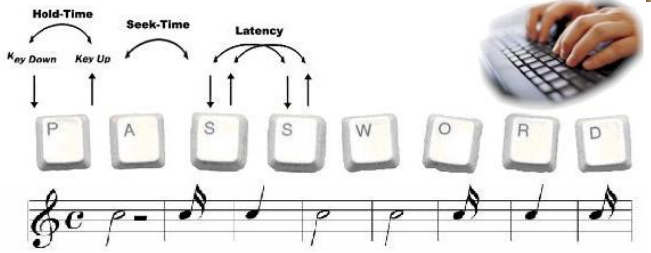
Physiological	Behavioural
Face	Signature
Fingerprint	Voice
Vein Pattern	Gait
Ear Shape	Keystroke
Oder	Lip Motion
Iris	
Retina	
EEG (electrophysiological)	

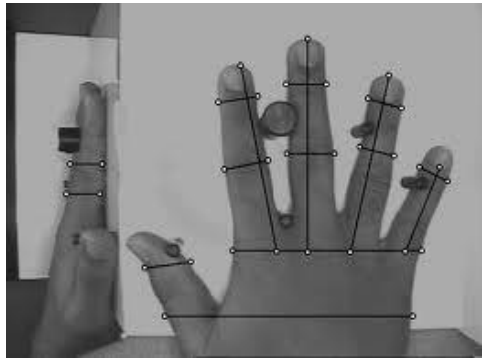






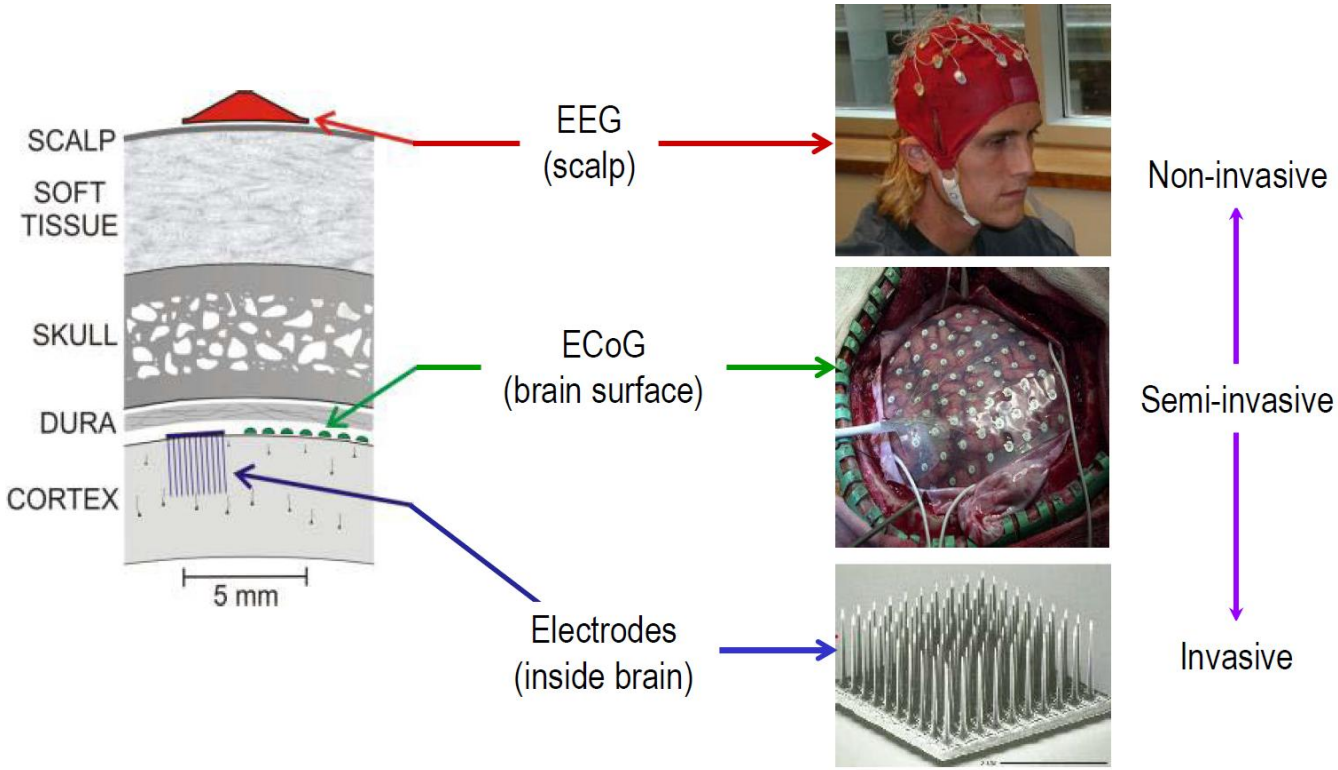




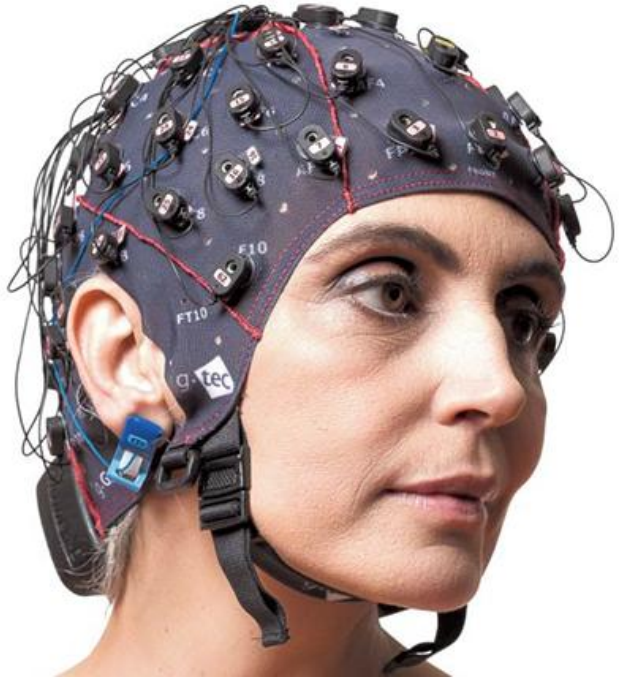


What are Brain Signals ?

- Brain signals constitute the information that are processed by millions of brain neurons.
- Three types of Brain signals.
- Application:
  - Medical: Diagnosing and predicting many abnormal brain diseases and cognitive impairments, such as, Epilepsy, Parkinson's Disease.
  - BCI: Enables a person to control an external device using brain signals.



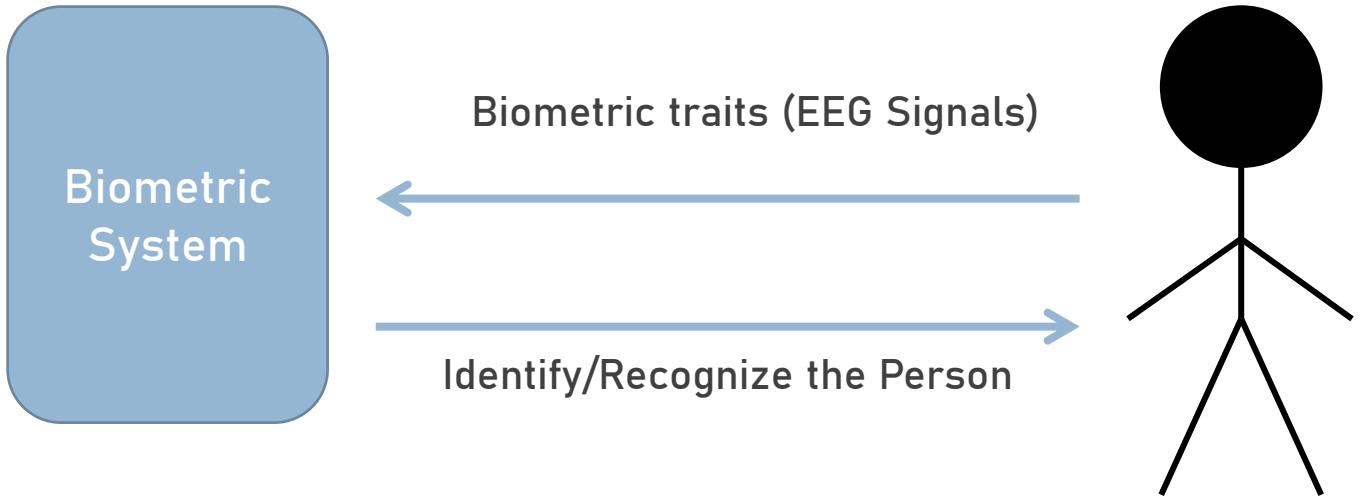
EEG Acquisition Device



g.Nautilus by g.tec System

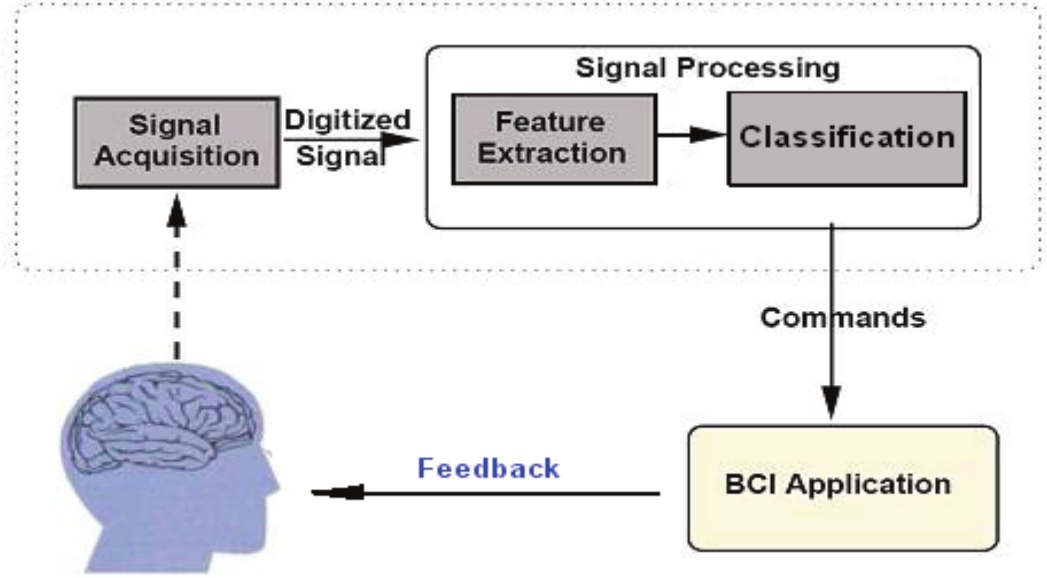
EEG Biometrics

- Brain signal or Electroencephalographic (EEG) signal, have emerged as futuristic traits, as it is more fraud resistant.
- EEG-based biometric system are useful for physically disabled people, who are unable to use the conventional biometric systems like fingerprints, retinal scans etc.
- EEG biometrics can have a far-reaching applications to different fields such as law enforcement, defense systems and others.



Brain Signals/EEG for BCI

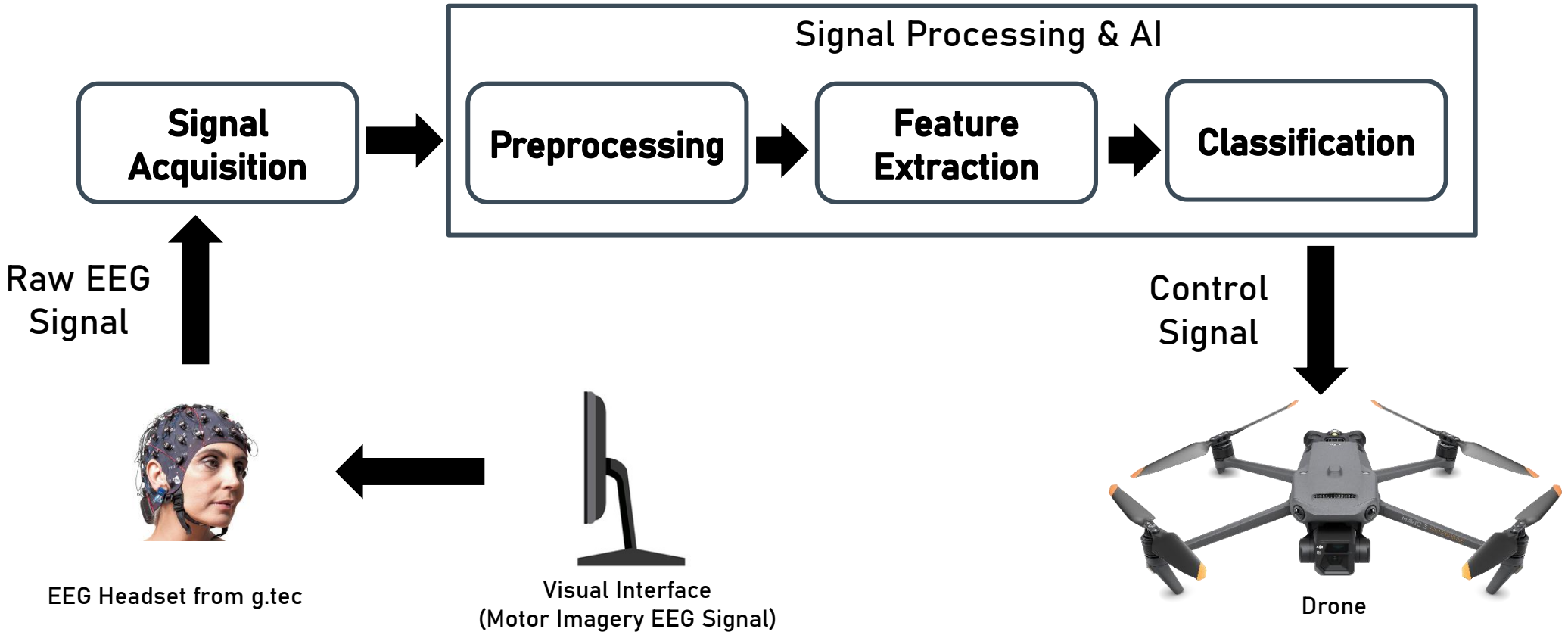
What is Brain Computer Interface (BCI) ?



- BCI is a direct communication pathway between the brain's electrical activity and an external device, most commonly a computer or robotic limb

- BCI application includes:
  - Rehabilitation of patients suffering from neural injuries and neuromuscular diseases, such motor disabilities, spinal cord injuries (SCI), or stroke, etc.
  - Controlling external devices e.g. computer, wheelchair, neural orthosis/prosthesis, home appliance etc.

BCI System


Signal Processing & AI
Signal Acquisition
Preprocessing
Feature Extraction
Classification
Raw EEG Signal
Control Signal
EEG Headset from g.tec
Visual Interface
(Motor Imagery EEG Signal)
Drone

Brain-Computer Interface for Drone Control

- Imaginary Movements:
  - Left Hand: Move drone left
  - Right Hand: Move drone right
  - Both Feet: Ascend/Descend
  - Tongue: Forward/Backward motion

- Advantages of Using Motor Imagery: No physical movement required; enhances control for individuals with limited mobility.

NeuroID: An EEG-Based Biometric Authentication System for Neurodegenerative Patients

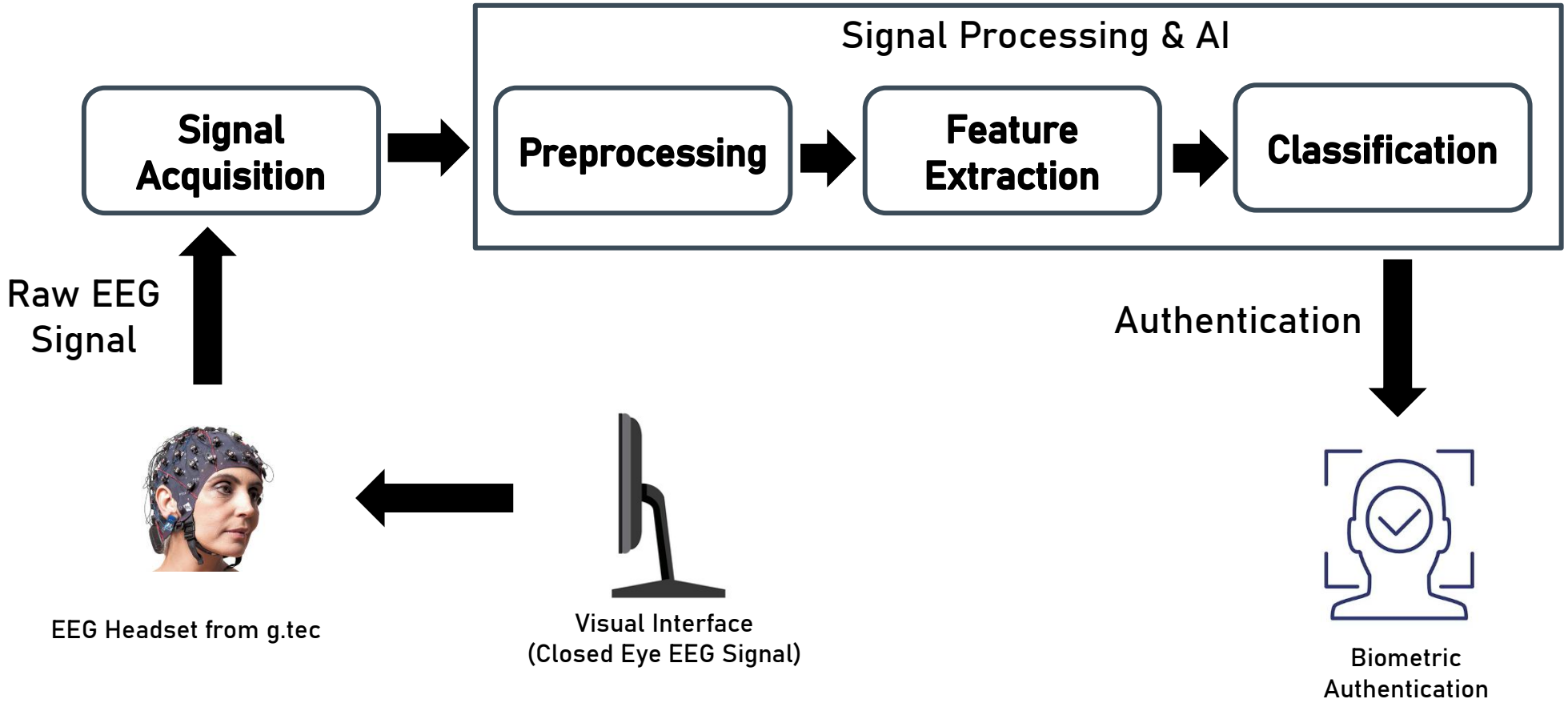
Project Details

- Grant: UWL-Mayo Seed Grant 2025-2026
- Goal: Analyze EEG to detect neurodegenerative progression
- Target groups: Parkinson's + RBD patients
- What's New: EEG as biometric authentication for neuro-patients.

- EEG recording: open-eye, closed-eye, motor imagery
- Analysis: Spectral power, connectivity, ERD/ERS (Event-Related Desynchronization / Event-Related Synchronization
- Deep learning for identity verification & person identification

- Expected Outcome
  - EEG biomarkers for early disease detection
  - Secure EEG-based authentication system
  - Open-access EEG dataset for research

Project Architecture




Thank
you!