Prof. Samantha Foley

Research Interests

- Scientific Computing
- High Performance Computing
- Cloud Computing
- Computer Science Education
- Promoting Diversity in Computing

Past Projects

- Past/Current 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

- **Concurrency Visualizer**
  - extend the work with more applications and more powerful visualization of the results
- **PySLEUTH (high-performance and Python versions of SLEUTH)**
  - Current work:
    - reimplement in Python
    - use DSLEUTH on larger datasets in the meantime
  - Future work:
    - understand the performance when working with much larger data sets
    - Automate calibration steps
- **Other projects dealing with parallelism**

Dr. Mao Zheng
Nov. 2023

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
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	
A Web-based Application for Optimal Inventory Redistribution	An Android UWL Campus Guide App (Java)	

Current Projects & Future Ideas

- A Design of Low-cost Indoor Tracking and Navigation System

Looking for Students:

- Mobile App Development

- Software Models, Design, or Testing

- Machine Learning (with Dr. Song Chen @ UWL Mathematics & Statistics Department)

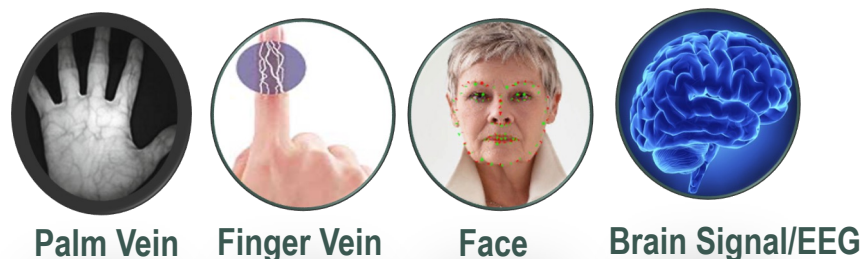# Research Activity & Future Projects

by

Dr. Rig Das

Assistant Professor

Department of CS & CE

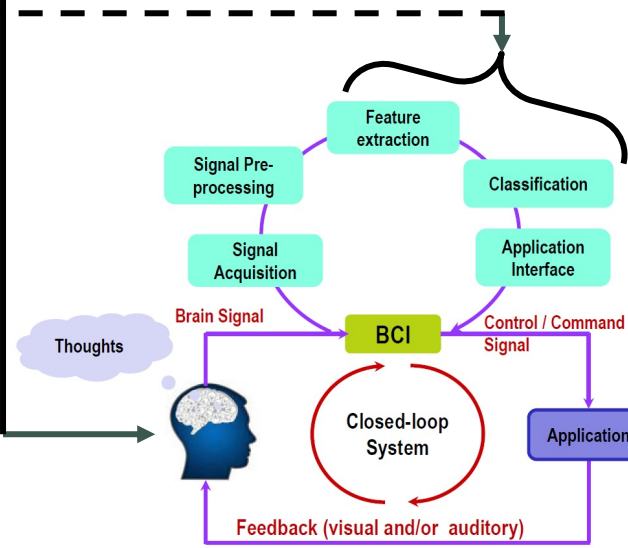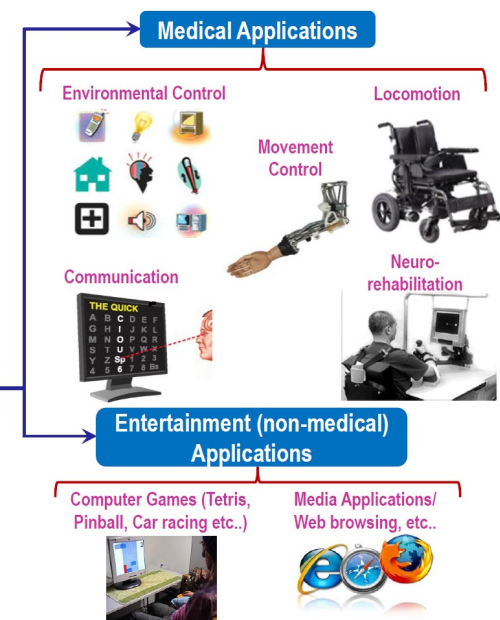University of Wisconsin, La Crosse (UWL)

02-Nov-2023

My Research Area

Palm Vein   Finger Vein   Face   Brain Signal/EEG

Biometrics

BCI

Authentication/Recognition

19 channels EEG Signal

Feature extraction

Signal Pre-processing

Classification

Signal Acquisition

Application Interface

Thoughts

Brain Signal

BCI

Control / Command Signal

Closed-loop System

Application

Feedback (visual and/or auditory)

Typical BCI Setup & Overview

Medical Applications

Environmental Control

Locomotion

Movement Control

Communication

Neuro-rehabilitation

THE QUICK

Entertainment (non-medical) Applications

Computer Games (Tetris, Pinball, Car racing etc..)

Media Applications/ Web browsing, etc..

Brain Computer Interface

What is Brain Computer Interface (BCI) ?

EEG   control signal

Subject/Patient → Brain Computer Interface → Device
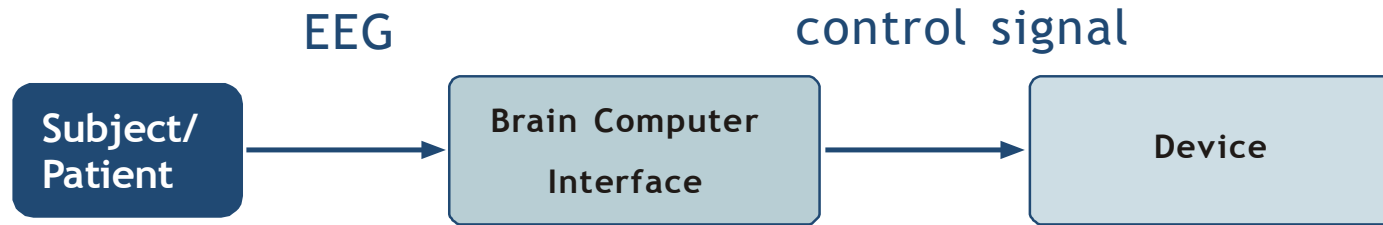
- A BCI system provides a direct interaction pathway/channel between the brain and a peripheral device by translating the electrical activities (e.g., the electroencephalogram (EEG)) of the brain into control/command signals.

- 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 appliances etc.

Drone Control Application (SSVEP)

BCI For Drone Control

https://www.youtube.com/watch?v=Tjv2P1_h_CU

Biometrics

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)	
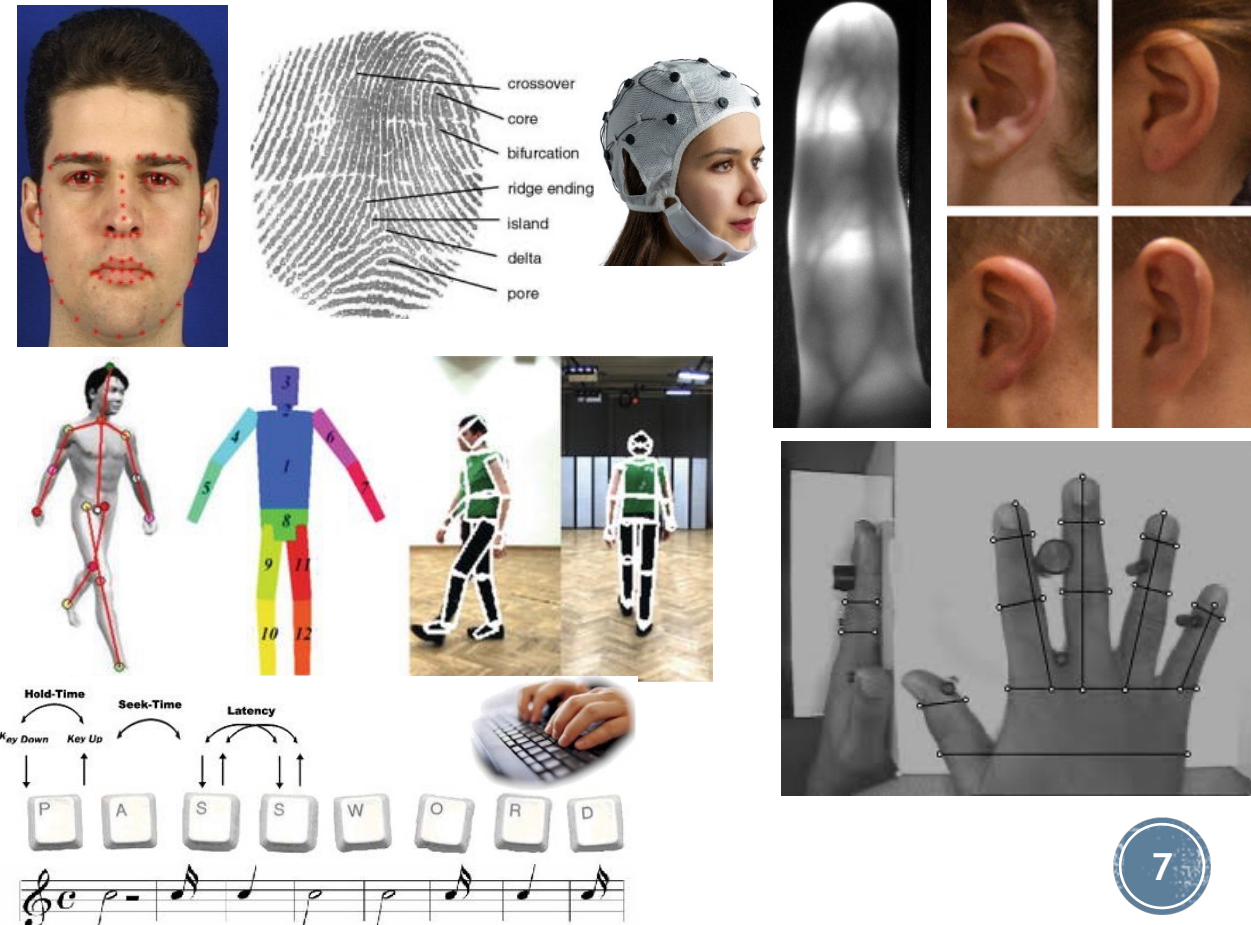
EEG Biometrics using Resting State EEG

EEG Biometrics Using rsEEG

- EEG signals, elicited when the subject is in resting state condition [3].

- Two protocol, with Open Eyes and Closed Eyes,

- The database will be acquired in UWL

- This experiments will consists of EEG signals collected from 2 distinct sessions, spanned over a period of 2 weeks.

- One session for training/enrolment of the subjects and other session for testing/authentication.

Table-3: EEG Database

No. of Subjects	No. of Channels	Sessions
20	16	2 (Separated by 2 weeks)

[3] **R. Das**, E. Maiorana and P. Campisi, "*EEG Biometrics Using Visual Stimuli: A Longitudinal Study*", *IEEE Signal Processing Letters*, vol 23, no 3, pp 341-345, March, 2016

EEG Acquisition Device

- Expected to Arrive at UWL by Dec 2023
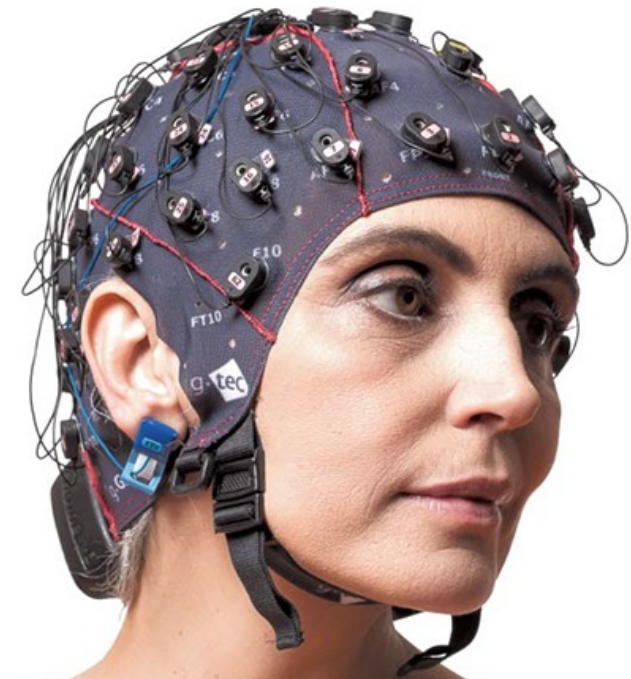
g.Nautilus by g.tec System

Preprocessing & Channel Selection of EEG Signals

- Signal Processing for EEG signals pre-processing in order to increase their signal-to-noise ratio.

- Channel Selection; to reduce the no of channels without compromising on the performance.

(a)   (b)
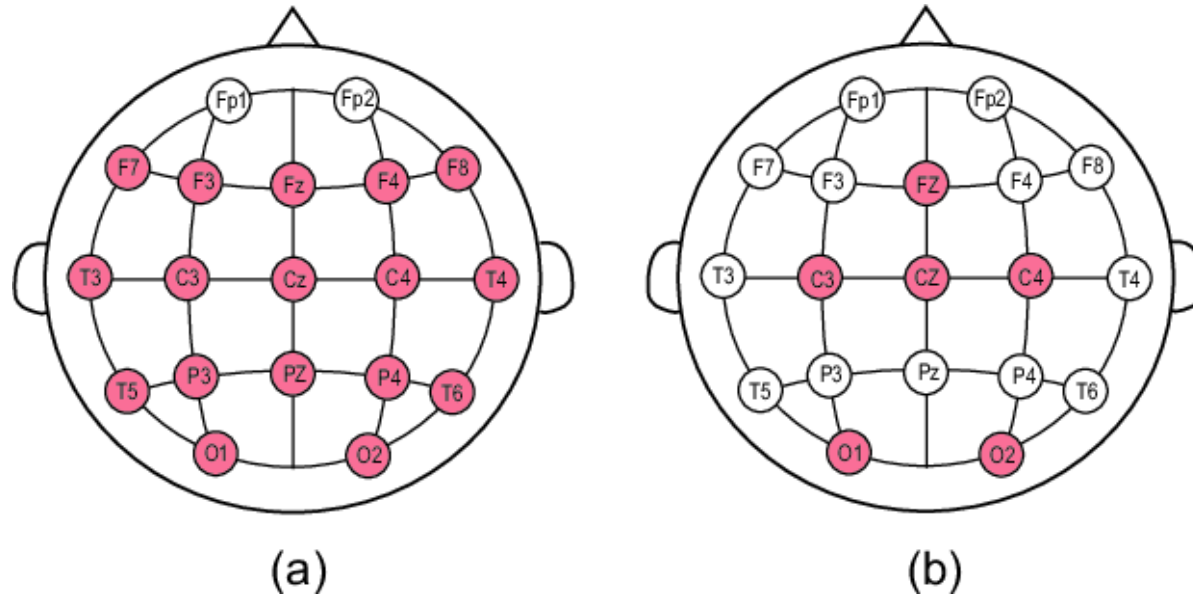
Brain Signals/EEG for Early Prediction of Parkinson's Disease

Objective

- Primary objective: Acquire and analyze electroencephalogram (EEG) data from healthy control subjects during a resting state condition.

- Early-stage Parkinson's patients' (PD) EEG data collected from the Mayo Clinic in Rochester.

- Comparison between Healthy Control and PD patients' resting state EEG data

- To gain valuable insights into the alterations in brain activity exhibited by PD.

- To early predict the progression of Parkinson's disease.

Prof. W. Michael Petullo

Prof. Petullo: Recent Projects

- ▶ SIMPLEFLOW Modification to Linux kernel; implemented information-flow access control model https://www.flyn.org/projects/SimpleFlow/

- ▶ VISORFLOW Constrain Windows and Linux from hypervisor https://www.flyn.org/projects/VisorFlow/

- ▶ Industrial Age Building teams around a hacking assembly line model

- ▶ Aquinas Adding more check types and linters

https://www.flyn.org/publications/
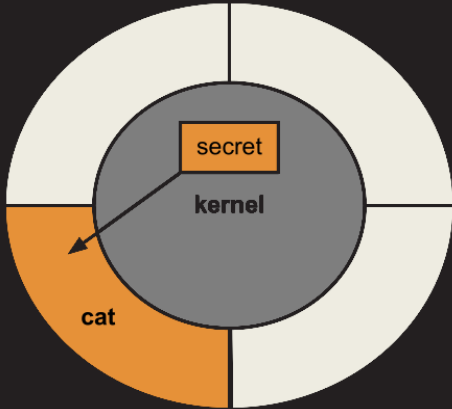
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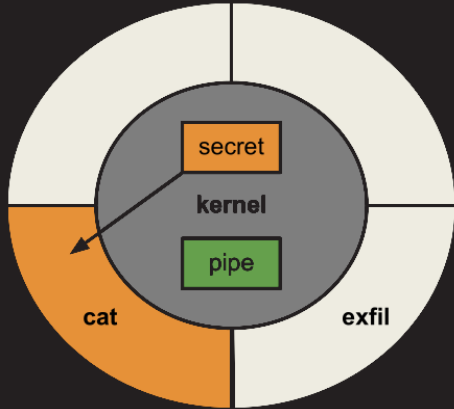
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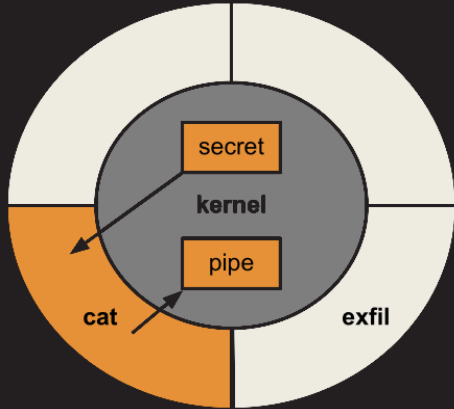
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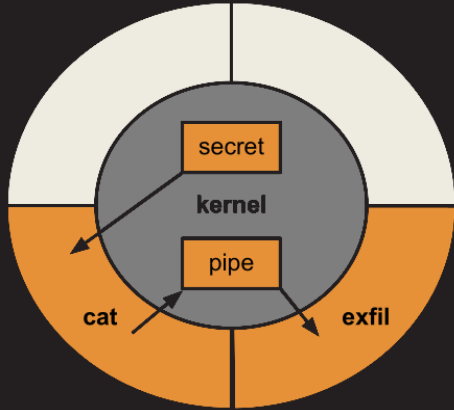
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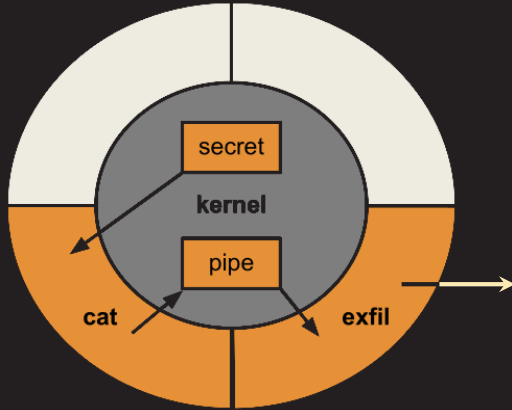
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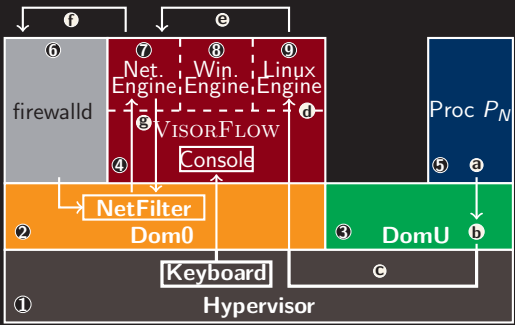
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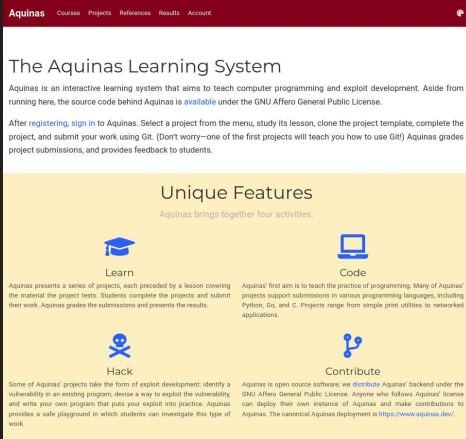
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Prof. Petullo: Recent Projects

The Aquinas Learning System

Aquinas is an interactive learning system that aims to teach computer programming and exploit development. Aside from running here, the source code behind Aquinas is available under the GNU Affero General Public License.

After registering, sign in to Aquinas. Select a project from the menu, study its lesson, clone the project template, complete the project, and submit your work using Git. (Don't worry—one of the first projects will teach you how to use Git!) Aquinas grades project submissions, and provides feedback to students.

Unique Features

Aquinas brings together four activities:

Learn
Aquinas presents a series of projects, each preceded by a lesson covering the material the project tests. Students complete the projects and submit their work. Aquinas grades the submissions and presents the results.

Code
Aquinas' first aim is to teach the practice of programming. Many of Aquinas' projects support submissions in various programming languages, including Python, Go, and C. Projects range from simple print utilities to networked applications.

Hack
Some of Aquinas' projects take the form of exploit development: identify a vulnerability in an existing program, devise a way to exploit the vulnerability, and write your own program that puts your exploit into practice. Aquinas provides a safe playground in which students can investigate this type of work.

Contribute
Aquinas is open source software; we distribute Aquinas' backend under the GNU Affero General Public License. Anyone who follows Aquinas' license can deploy their own instance of Aquinas and make contributions to Aquinas. The canonical Aquinas deployment is https://www.aquinas.dev/.

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▶ Cybersecurity (and insecurity)

▶ Software systems

▶ Open-Source Software

https://www.flyn.org/proposals/

▶ Cybersecurity (and insecurity) $\left\{\begin{array}{l}\text{CS356, Software Exploitation}\\\text{CS455, Fundamentals of Information Security}\\\text{CS456, Secure Software Development}\end{array}\right.$

▶ Software systems

▶ Open-Source Software

https://www.flyn.org/proposals/

▶ Cybersecurity (and insecurity)

▶ Software systems $\left\{\begin{array}{l}\texttt{https://flyn.org} \text{ \& } \texttt{https://aquinas.dev} \\ \text{Fedora packaging} \\ \text{OpenWrt packaging} \\ \text{SELinux policy work}\end{array}\right.$

▶ Open-Source Software

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https://www.flyn.org/proposals/
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▶ Cybersecurity (and insecurity)

▶ Software systems

▶ Open-Source Software — CS410, Open Source Development

https://www.flyn.org/proposals/

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**
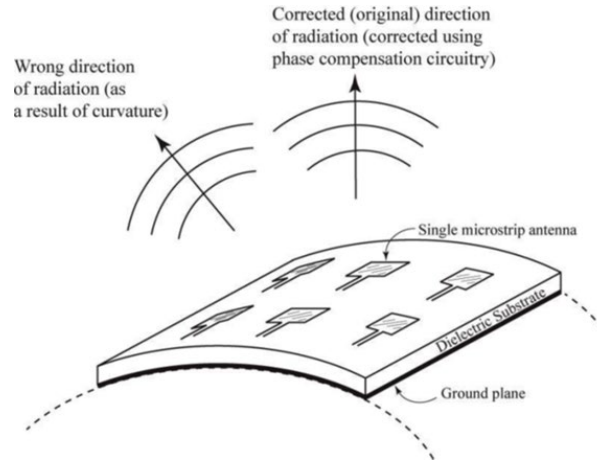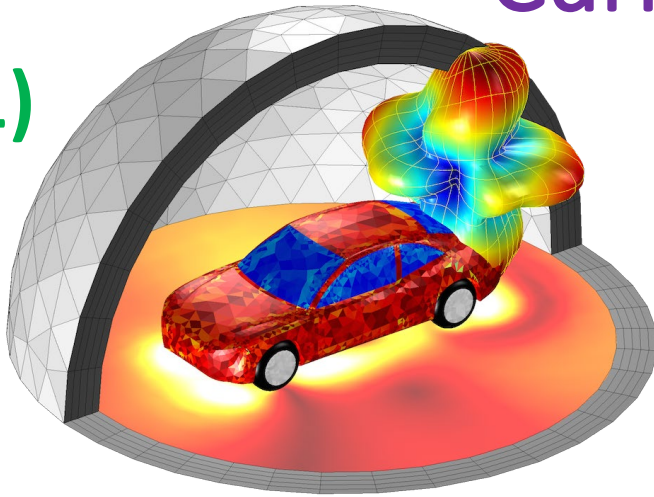

- **3D-Printed Flexible and Wearable Electronics**
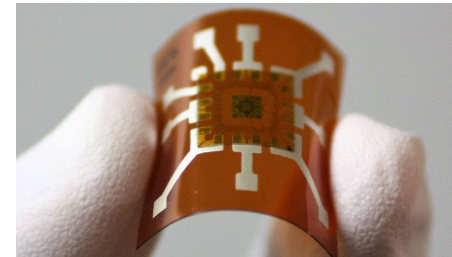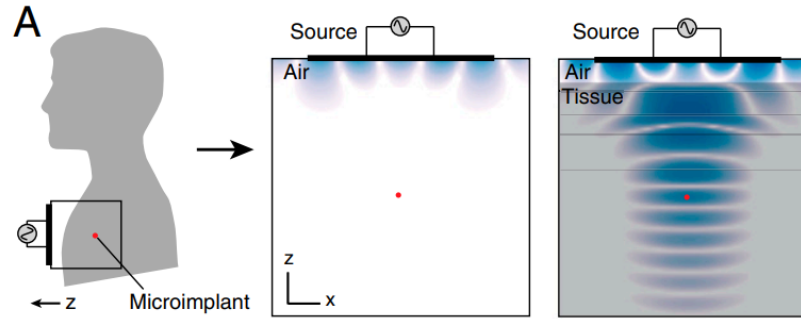

- **Transformation Electromagnetics/Optics**
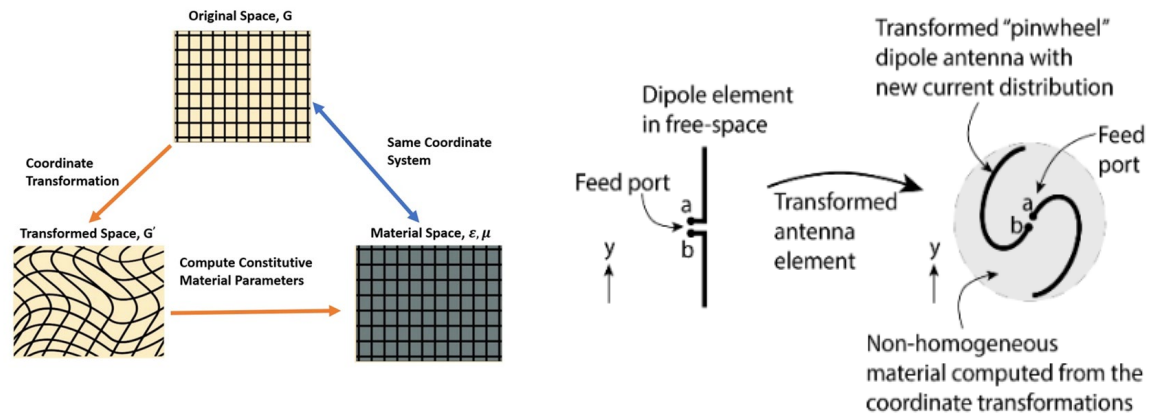
Current and Future Research

(1)

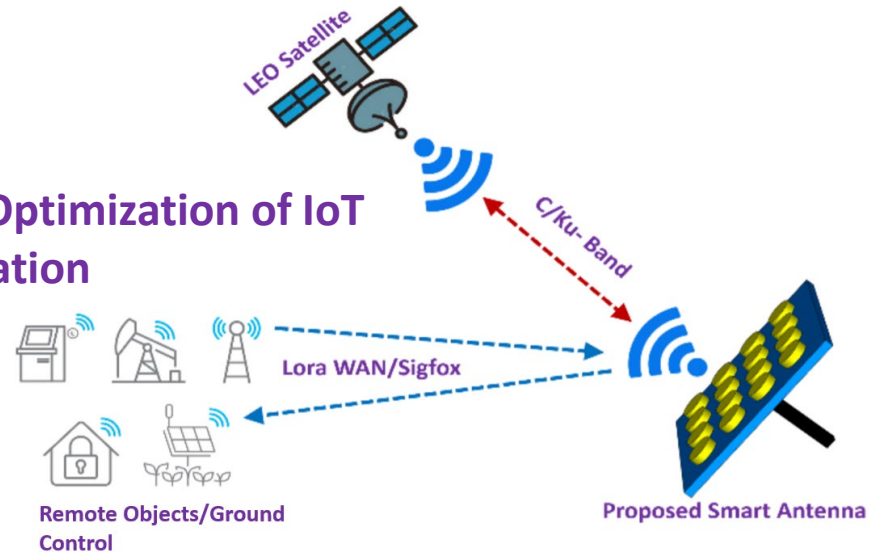**Real Environment Antenna Simulation using COMSOL Multiphysics**
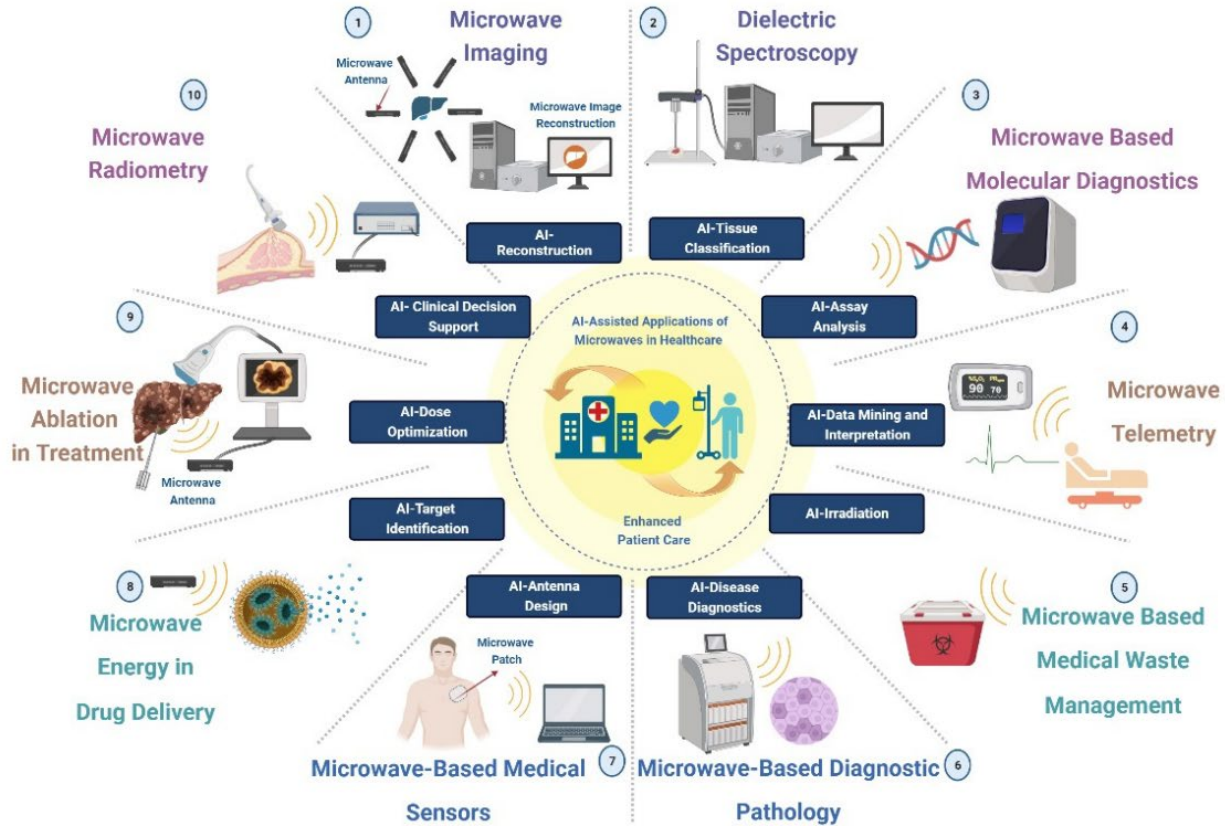
(2)

Near-Field Sensing for various Biomedical Applications

(3)

ML-based Optimization of IoT Communication

Remote Objects/Ground Control

Proposed Smart Antenna

Current and Future Research

(4)

AI Applications of Microwaves in medicines for Better Health Care

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

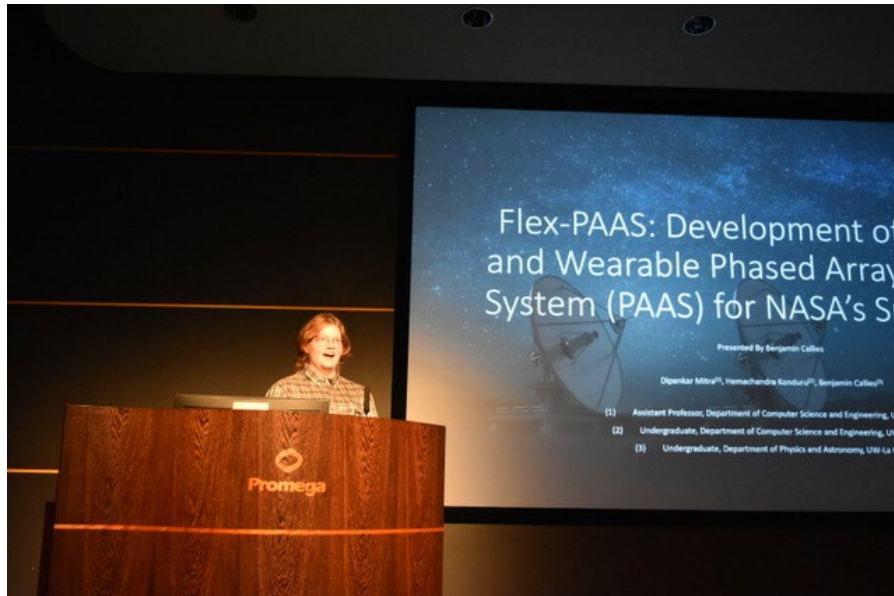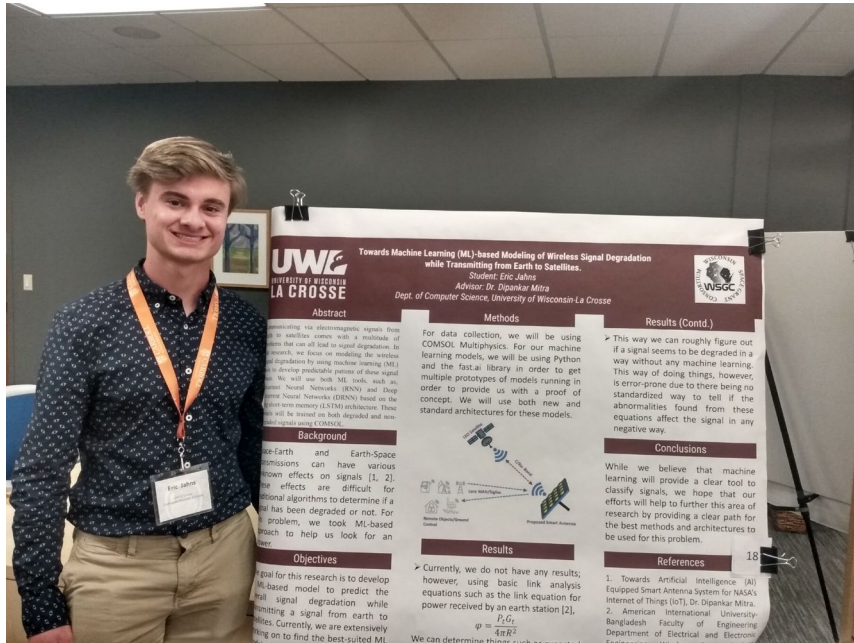- Two UG Students went to Grad School (ASU and UBC)

- 2 Dean's Distinguished Fellowship (DDF) in Summer, 2023

- 3 went for Internships in Top Companies (Summer 22 and 23)

-Currently, 4 students working on different Projects

-Students Published in IEEE Papers

- One Student Co-authored a Book Chapter With me

Research Sponsors

❖ NASA Wisconsin Space Grant Consortium (WSGC)

❖ UWL FRG

❖ Gundersen Health Care

❖ WiSys

❖ Microwave and Imaging Lab (MEIL), Department of Medicine, Mayo Clinic, Rochester, MN

❖ Potential Support from: NSF and Wisconsin Innovation Grant