- **Organization**: The University of Texas at Austin
- **Research Group**: The System-Level Design (SLD) Group
- **Lead Investigator**: Prof. Radu Marculescu
- **Team Members**:
  - Ph.D. students:
    - Mustafa Munir – Efficient computer vision and generative AI
    - Md Mostafijur Rahman – Multi-modal AI
    - Allen Farcas – Continual federated learning, efficient distributed systems
    - Sofia Hurtado – Network science, multi-agent modeling and simulation
    - Geffen Cooper – Batteryless AI, efficient multi-modal sensing
    - Yuedong Yang – Efficient gradient propagation for AI training
    - Xiwen Wei – Continual learning
  - MS students:
    - Aswin Ram – Information Theory, Network information propagation

Principal Investigator

- Radu Marculescu has 25+ years of experience in computer systems modeling, analysis, and optimization. He is a recognized leader in the area of AI/ML design and optimization of embedded and cyber-physical systems.
- His recent research focuses on AI/ML learning methods (both algorithms and hardware prototypes) for Edge AI and IoT applications.

Team

- 7 PhD students
- 1 Masters student

Infrastructure

- The research facilities in the ECE Department at The University of Texas at Austin and TACC offer a large number and variety of computers available for faculty and graduate students
- **SLD resources:** Our lab contains a diverse range of edge and IoT devices, including BLE-based microcontrollers, various Raspberry Pi and Odroid edge devices, Jetson Nano and Jetson Orin Nano boards, and multiple GPU-powered workstations. Additionally, we have power profiling tools to monitor and measure energy consumption of different workloads

SLD research brings together AI/ML, network science, and systems optimization. End-Gen is fundamentally about generative waveform design so our research can *unify advanced optimization (AI/ML) with communications theory and systems design.*

AI/ML:

- **Description:** Data-driven techniques that allow machines to learn patterns, make predictions, and generate new content from modeling data distributions
- **Examples:** Deep learning, GenAI, video editing, image segmentation, federated learning

Edge AI

- **Description:** EdgeAI refers to the ability to run various AI applications directly on edge devices, hence minimizing size, power, or even eliminating the need to rely on the Cloud
- **Examples:** Energy-aware ML techniques and hardware prototypes that leverage the network and system characteristics to enable federated learning for distributed applications

Hardware & Real-Time Constraints

- **Description:** End-Gen program imposes real test environments (“over the air” or “in the lab”)
- **Examples:** Success demands embedded-systems know-how, plus integration skills to orchestrate training and inference on SDRs or other specialized hardware

Systems

- **Description:** Cyber-physical systems (CPS) bring together sensing, computation, communication, and control to enable a continuous interaction with the physical world
- **Examples:** System optimization, energy-aware resource management, distributed computational platforms for computer vision applications, software

- **SLD group has had multiple successful collaborations**
  - Our group has been a central contributor to the theory and practice of system-level design, from early innovations in low-power design at CMU to broader, AI/ML-centric research at UT Austin
  - Our group's work has repeatedly shaped next-generation approaches to low-power, high-performance computing and intelligent systems
- **Our group seeks teaming up with experts in multiple areas**
  - Communications: Teams able to adapt and optimize waveforms in situ under dynamic conditions
  - Software Defined Radios (SDRs): Hands-on experience with SDR platforms and transducer-based testbeds (e.g., RF, acoustic, etc.)
  - Systems Integration: Robust software/hardware integration to handle SDR testbeds and dataset creation & annotation
- **Type of research groups we seek to partner with**
  - Interdisciplinary groups that can help with the ML + Comms "Bridge"

Contact Information

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