Tim Woodford

Curriculum Vitae

UC San Diego
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Education

2020–2023 **Ph.D.**, *University of California*, San Diego.
Wireless Networking and Sensing Systems

2018–2020 **Masters of Science**, *University of California*, San Diego, *GPA – 3.68*.
Wireless Networking and Sensing Systems

2014–2018 **Bachelor of Electrical Engineering**, *Bucknell University*, Lewisburg, PA.
GPA – 3.94

Publications

- Kai Zheng, Wuqiong Zhao, **Timothy Woodford**, Renjie Zhao, Xinyu Zhang, and Yingbo Hua. "Enhancing mmWave Radar Sensing Using a Phased-MIMO Architecture." ACM Mobisys 2024.
- **Timothy Woodford**, Kun Qian, and Xinyu Zhang. "Metasight: High-Resolution NLoS Radar Sensing through Efficient Metasurface Encoding." ACM Sensys 2023.
- Kai Zheng, Kun Qian, **Timothy Woodford**, Xinyu Zhang. "NeuroRadar: A Neuromorphic Radar Sensor for Low-Power IoT Systems." ACM Sensys 2023. (Best paper award.)
- **Timothy Woodford**, Xinyu Zhang, Eugene Chai, and Karthikeyan Sundaresan. "Mosaic: Leveraging Diverse Reflector Geometries for Omnidirectional Around-Corner Automotive Radar." ACM Mobisys, 2022. (22% acceptance rate.)
- **Timothy Woodford**, Xinyu Zhang, Eugene Chai, Karthikeyan Sundaresan, and Amir Khojastepour. "SpaceBeam: LiDAR-driven One-shot mmWave Beam Management." ACM Mobisys, 2021. (22% acceptance rate.)
- Renjie Zhao, **Timothy Woodford**, Teng Wei, Kun Qian, and Xinyu Zhang. "M-Cube: A Millimeter-Wave Massive MIMO Software Radio." ACM MobiCom, 2020. (Best paper award.)

Experience

Professional

2023- **Satellite Communications Researcher**, *MIT Lincoln Laboratory*, Lexington, MA.
- Led development of the first user terminal for a LEO communications system
- Designed signal processing algorithms for bit-accurate FPGA implementation
- Developed novel technique for practical satellite-based localization
- Engaged with funding agencies as PI of a research project

2020 **5G Networks Research**, *NEC Labs America*, Princeton, NJ.
- Developed novel RF ray-tracing methods to handle noisy 3D mesh data
- Conducted experiments matching real-world RF propagation to 3D mesh models
- Created detailed 3D reconstructions of indoor environments using RGBD camera

2017 **Wireless Communications Research**, *Air Force Research Lab*, Rome, NY.
- Oeveloped algorithm to improve directivity of graphene-based terahertz MIMO arrays
- Characterized antenna patterns of millimeter-wave antenna array

2015–2016 **Signal Processing Intern**, *Johns Hopkins Applied Physics Lab*, Laurel, MD.

- Developed an algorithm for efficient reconstruction of intermittent GPS LNAV messages
- Developed FPGA and embedded software for real-time software-defined radio application
- Built and submitted Linux kernel patch to work around network card hardware bug

Graduate Research

2018–2023 **M-Cube: mmWave Massive MIMO Software Radio**.

- Built first-of-its-kind mmWave MIMO software-radio with up to 256 antenna elements
- Reverse-engineered commercial 802.11ad radio and designed a flexible control channel to make it fully programmable
- Achieved order-of-magnitude cost reduction over current commercial software radios
- Providing tutorials and technical support to 15+ institutions who are using the M-Cube platform for experimental research.

2020–2023 **FPGA-based high-bandwidth baseband**.

- Built 4 Gsps super-sampling rate (SSR) baseband on Xilinx RFSoC implementing both radar and 802.11 communications waveforms and signal processing
- Developed data transfer mechanisms using Ethernet, PCIe, and AXI DMA

2019–2023 **AI-Operated mmWave Mesh Network**.

- Developed techniques needed to deploy reinforcement learning to control highly-dynamic mmWave backhaul networks
- Created and validated methods for sim-to-real transfer of RL policies

2021–2022 **Non-Line-of-Sight (NLoS) Automotive Radar Sensing**.

- Designed the first NLoS wireless sensing framework that harnesses arbitrary-shaped roadside reflectors and artificial reflectors
- Created novel radar detection algorithms for NLoS scenarios
- Designed fully-passive 3D printable metasurfaces and a novel spatial encoding algorithm for high-resolution NLoS sensing using HFSS
- Validated techniques using commercial automotive MIMO radar and fabricated metasurfaces

2022 **Low-Power Neuromorphic Signal Processing**.

- Built FPGA-based capture system for low-power neuromorphic sensing

Teaching

2020–2022 **Teaching Assistant for ECE158B (Data Networks II)**, *UC San Diego*.

Relevant Coursework

UCSD **Graduate Coursework**.

- DSP, Linear Algebra, Random Processes, Wireless Networks, Parameter Estimation, Information Theory, Digital Communications

Bucknell **Undergraduate Coursework**.

- ECE: Linear Systems, Electricity & Magnetism, Embedded Systems, Digital Design
- Mathematics: Modern Statistical Methods, Partial Differential Equations, Linear Algebra

Skills

Programming Python, Matlab, C, LaTeX, Java, C++, Shell scripting, Verilog

RF Network analyzers, spectrum analyzers, Wireless InSite

Networks NS3, iperf, socket programming, SDN