

RUICHUN MA

ruichun.ma@yale.edu

<https://rui-chun.github.io/>

EDUCATION

Yale University

September 2020 - Now

Research Interests: Wireless networking, Network systems, Internet of Things

Ph.D. student in Electrical Engineering (CE track)

Advisor: Prof. Wenjun Hu

University of Science and Technology of China

September 2016 - July 2020

School of the Gifted Young (Rank:1/28)

Bachelor of Engineering in EE & AI

PUBLICATIONS

Ruichun Ma, Shicheng Zheng, Hao Pan, Lili Qiu, et al, **AutoMeta: Automated Optimization of mmWave Coverage using Low-cost Metasurfaces**, conditionally accepted to MobiCom'24

- *An automated service framework for ultra-low-cost metasurface-aided mmWave coverage*

Ruichun Ma and Wenjun Hu, **Cross-Media Wireless Made Easier: Tuning Media Interfaces with Flexible Metasurfaces**, conditionally accepted to MobiCom'24

- *The first programmable media impedance matching metasurface design and an end-to-end system that performs impedance matching and beamforming jointly at media interfaces.*

Ruichun Ma, R. Ivan Zelaya, and Wenjun Hu, **Softly, Deftly, Scrolls Unfurl Their Splendor: Rolling Flexible Surfaces for Wideband Wireless**, In MobiCom'23

- *A soft smart surface with a wideband tunable operating frequency and a control algorithm to simultaneously enhance different wireless networks across sub-6 GHz bands.*

R. Ivan Zelaya, Ruichun Ma, and Wenjun Hu, **Towards 6G Wireless: Smarten Everything with Metamorphic Surfaces**, In HotNets'21

RESEARCH EXPERIENCE

Bridging Heterogeneous Wireless Networks with Metasurfaces

September 2020 - Now

Research @ Yale

Advisor: Prof. Wenjun Hu

- Designed metasurface systems as a cross-layer tool to support heterogeneous wireless networks
- Built prototypes to enhance wireless/IoT links through beamforming and impedance matching
- Related research works are published in MobiCom'24, MobiCom'23 and HotNets'21

Metasurfaces for Next-gen Networks

Jan 2023 - August 2023

Research Internship @ Microsoft Research Asia

Advisor: Prof. Lili Qiu

- Designed several metasurfaces for mmWave, satellite communication, and wireless sensing projects
- Developed an automated service framework for metasurface-aided mmWave coverage (MobiCom'24)
- Built a mmWave testbed with 802.11ad routers and a ROS robot
- Demonstrated metasurface-based wireless glucose sensing to Mr. Bill Gates

Wireless Mesh Network Protocol Design

July 2019 - October 2019

Research Internship @ UIUC

Advisor: Prof. Haitham Hassanieh

- Built a mesh network testbed with Raspberry Pi nodes by modifying the 802.11n driver

- Improved the spatial reuse of mesh networks with preamble detection and concurrent transmission
- Reduced the average packet delay by 30% under NS3 simulation of 802.11ax networks

Meta-RL Based Bitrate Adaptation Model

April 2019 - June 2019

Undergrad Research @ USTC

Advisor: Prof. Hancheng Lu

- Applied meta-reinforcement learning method to bitrate adaptation for video streaming
- Implemented a meta-RL model based on Model-Agnostic Meta-Learning framework
- Achieved fast learning for different QoS metrics of rate adaptation

Wireless Backscatter Tracking System

March 2018 - October 2018

Undergrad Research @ USTC

Advisor: Prof. Panlong Yang

- Developed a hand-writing tracking system based on a wireless backscatter tag
- Achieved millimeter-level tracking accuracy and led to a UbiComp'19 paper

TECHNICAL SKILLS

Programming Tools	MATLAB, C (embedded programming for IoT), C++ , Python, Rust, Go HFSS (RF design and simulation), Altium (PCB design), SDR (Software Defined Radios), ROS (Robot Operating System), PyTorch
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TEACHING EXPERIENCE

Neural Networks and Learning Systems
Digital Signals and Systems

Teaching Assistant, 2021 Fall @ Yale
Teaching Assistant, 2019 Fall @ USTC

HONORS AND AWARDS

EE Honor Program (top 10%)	2016-2020
Merit Student Scholarship (top 5%)	2017-2020
Outstanding Cadres of Students Union	2017

SELECTED COURSES

Microwave Techniques and Measurement	Mobile and Embedded Systems
Building Distributed Systems	Topics in Networked Systems
Optimization and Computation	Stochastic Processes
Principles of Modern Communications	Modern Software Engineering

PROJECTS

OLSRv2 Protocol Implementation on IoT devices

March 2021 - May 2021

Course project of Topics in Networked Systems @ Yale

- Implemented OLSRv2(RFC7181) for mobile ad-hoc networks based on FreeRTOS with C
- Deployed and tested the implementation on resource-constrained ESP32 embedded devices
- Received Honor grade (highest) from the course instructor, Prof. Y. Richard Yang

Real-time RSSI and CSI Collection and Display

March 2021 - May 2021

Course project of Wireless Technologies and IoT @ Yale

- Implemented remote RSSI and CSI data collection and display on embedded ESP32 devices
- Demonstrated real-time CSI-based movement sensing application (code and videos)
- Received Honor grade (highest) from the course instructor, Prof. Wenjun Hu