

# RUICHUN MA

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

## EDUCATION

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### 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

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Ruichun Ma and Wenjun Hu, **Cross-Media Wireless Made Easier: Tuning Media Interfaces with Flexible Metasurfaces**, <https://arxiv.org/abs/2306.02367>, under review

- *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

Ruichun Ma, Shicheng Zheng, Hao Pan, Lili Qiu, et al, **AutoMeta: Automated Optimization of mmWave Coverage using Low-cost Metasurfaces**, under review

Hao Pan, Lili Qiu, Ruichun Ma, **Wireless Sensing for Glucose and Beyond**, under review

## RESEARCH EXPERIENCE

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### 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'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
- 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

## **TEACHING EXPERIENCE**

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Neural Networks and Learning Systems  
Digital Signals and Systems

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

## **TECHNICAL SKILLS**

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**Programming** MATLAB, C (embedded programming), C++ , Python, Rust, Go  
**Tools** HFSS (RF design and simulation), VNA (RF measurement and test)  
Altium (PCB design), PyTorch, LaTeX, NS-3 (network simulator)

## **HONORS AND AWARDS**

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

## **SELECTED COURSES**

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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**

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### **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