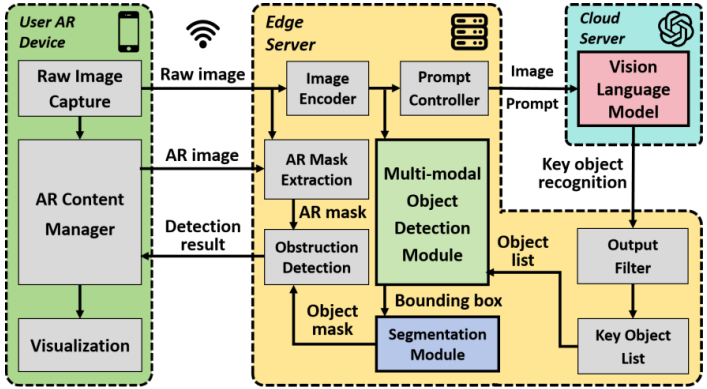
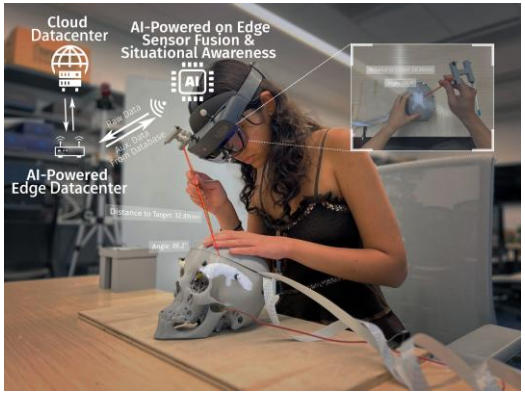
Looking Back and Moving Forward: 10 Years of Edge Computing





Maria Gorlatova

December 5, 2025

About the Speaker

- James N. & Elizabeth H. Barton Associate Professor, ECE/CS, Duke University
- Working on edge computing since 2016
  - Started as an Associate Research Scholar @ Princeton University
  - OpenFog Consortium technical committee member, working group co-chair, board of directors alternate

- Teaching *ECE 654: Edge Computing* since 2018

By 2016: Foundations Already Laid

- Rich foundations for a decade of growth

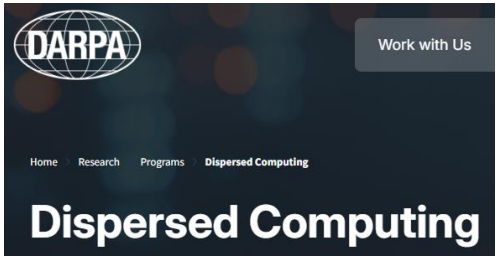
The Case for VM-Based Cloudlets in Mobile Computing

A new vision of mobile computing liberates mobile devices from severe resource constraints by enabling resource-intensive applications to leverage cloud computing free of WAN delays, jitter, congestion, and failures.

COVER FEATURE **EDGE COMPUTING**

Ganesh Ananthanarayanan, Paramvir Bahl, Peter Bodik, Krishna Chintalapudi, Matthai Philipose, Lenin Ravindranath, and Sudipta Sinha, Microsoft Research

Video analytics will drive a wide range of applications with great potential to impact society. A geographically distributed architecture of public clouds and edges that extend down to feasible approach to meeting the strict of large-scale live video analytics.

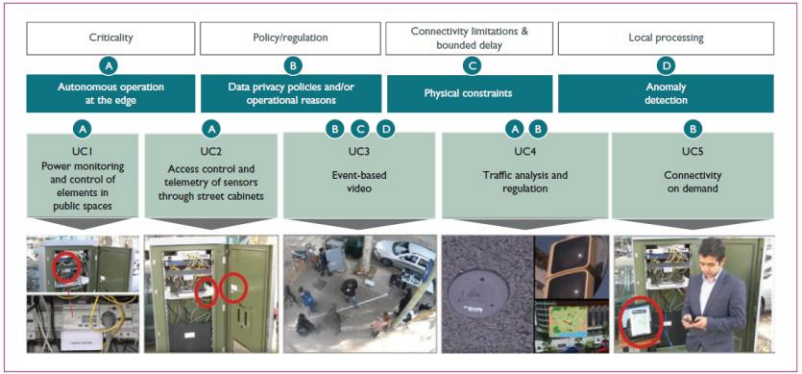


FC Fast Company

How DARPA, The Secretive Agency That Invented The Internet, Is Working To Reinvent It

The agency has launched a program that takes advantage of the computing resources of smartphones, tablets, connected vehicles, IoT endpoints...

Nov 7, 2017



My vision, 2018:

NETWORKWORLD

Topics Spotlight: Cloud Computing Latest Newsletters Resources Buyer's Guides Events

Augmented reality, fog, and vision: Duke professor outlines importance of smart architectures

AR: Core Mobile Technology of the Future

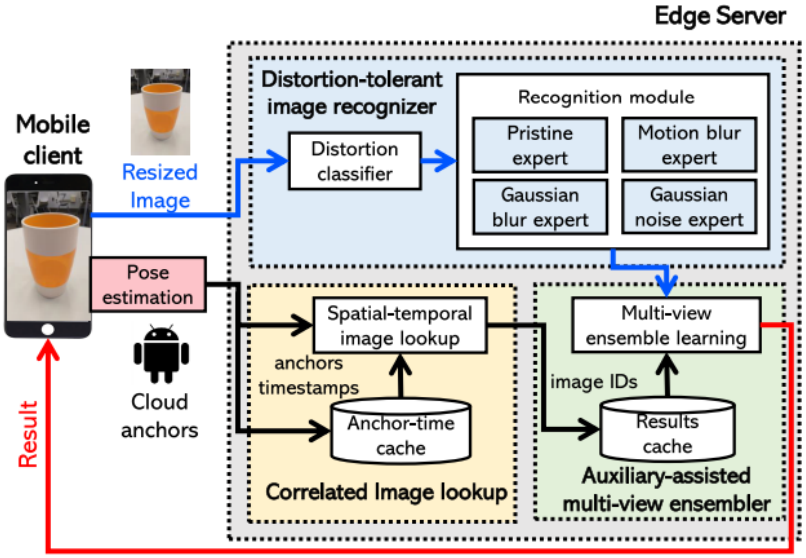
"AR will redefine our relationship with technology"

"It is the next big thing, and will pervade our entire lives"

AR **needs** edge

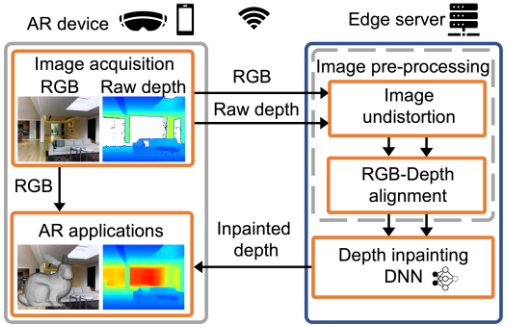
Qualcomm CISCO ERICSSON

Edge Support is Vital for AR

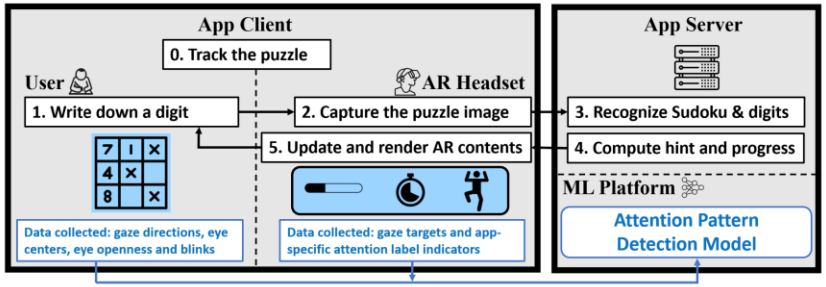


ACM/IEEE IPSN'20

Best Research Artifact Award



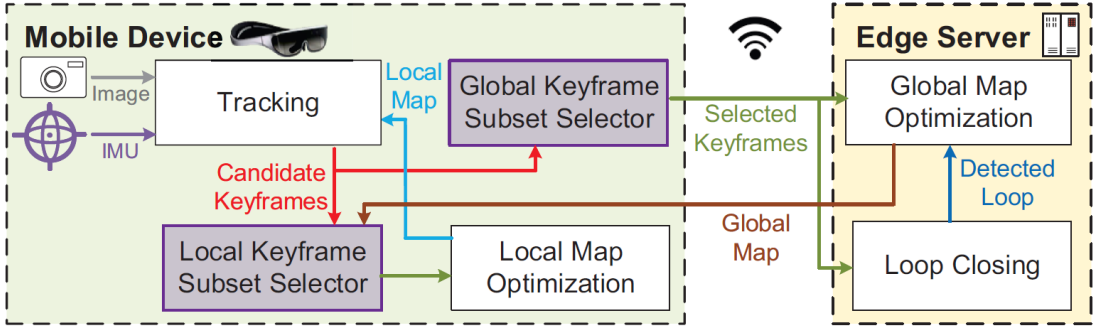
ACM IMWUT'22

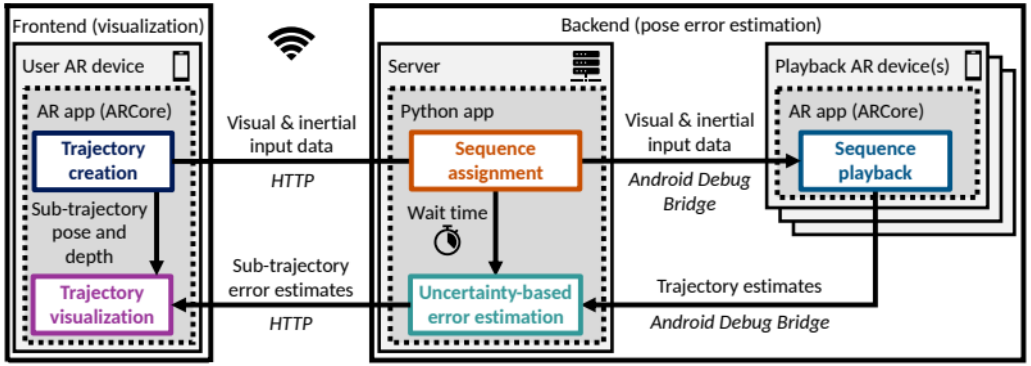


IEEE ISMAR'24

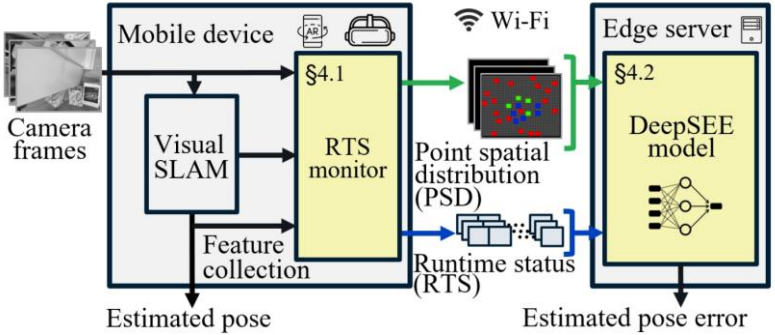
Edge Support is Vital for AR

IEEE INFOCOM'23



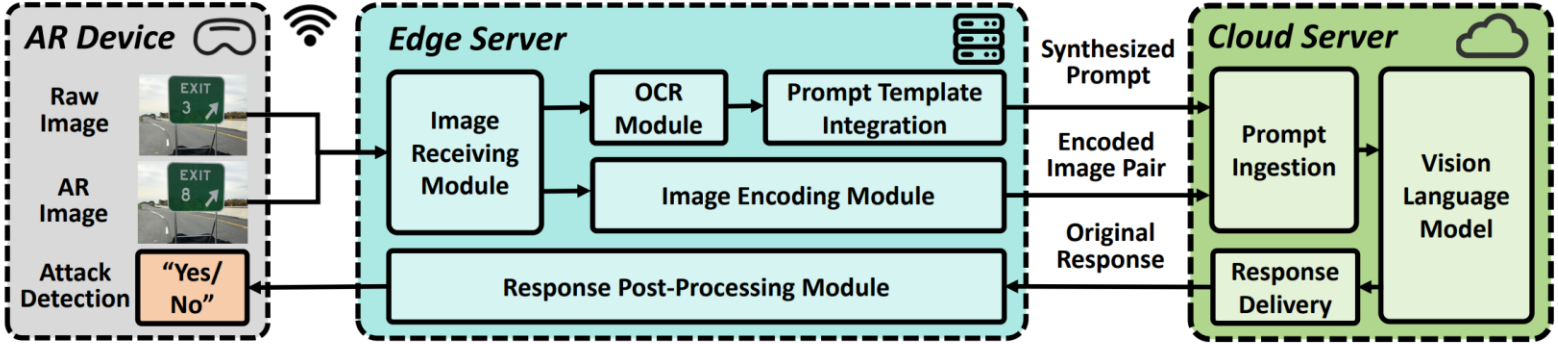


IEEE ISMAR'23



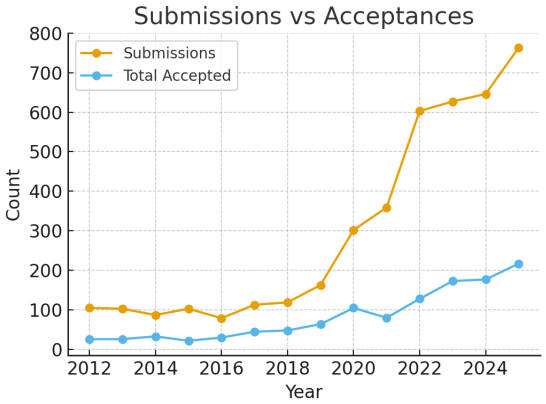
ACM SenSys'24

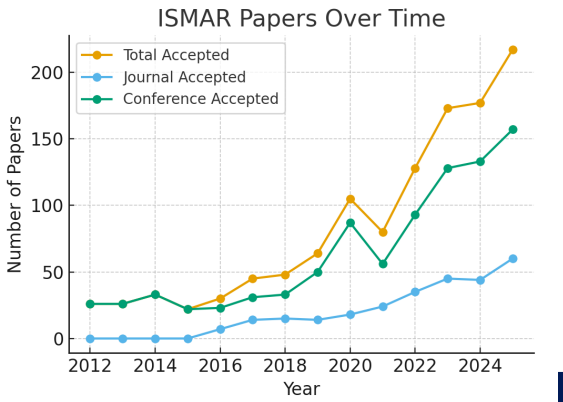
Edge Support is Vital for AR



IEEE TVCG 2025. **IEEE ISMAR 2025 Best Paper Award**

XR community growing **dramatically**





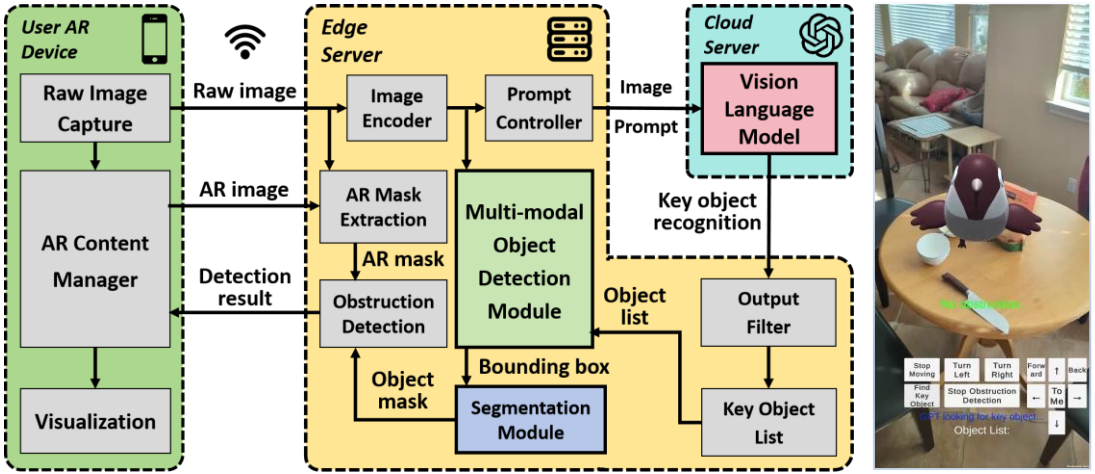
Last 10 Years: Era of Edge, Era of AI

- NSF AI Institute for **Future Edge Networks and Distributed Intelligence**, led by Prof. Nes Shroff, Ohio State

- NSF AI Institute for **Edge Computing Leveraging Next Generation Networks**, led by Duke ECE Prof. Yiran Chen

Moving Forward: Edge + LMMs

- Opportunities for new capabilities and use cases
  - Personalization
  - Privacy, low latency, …
- Exciting *AI-for-systems* opportunities



IEEE TVCG'25: Securing AR experiences via edge-based caching of LMM outputs

Moving Forward: Edge + 5/6G + “Verticals”

- Promising verticals: **XR**, **robotics**
- Exemplified by NSF Breaking Low, VINES
  - ➢ Gets 5G, edge, core, verticals people talking to each other

- Our recently funded Breaking Low effort: Umich, Duke, Columbia, Nokia building low latency AR solutions
  - ➢ Led by Prof. Jiasi Chen, ACM SEC 2023 TPC Chair

- Promising and potentially transformative
  - ➢ Will give new momentum to technology, once fully funded

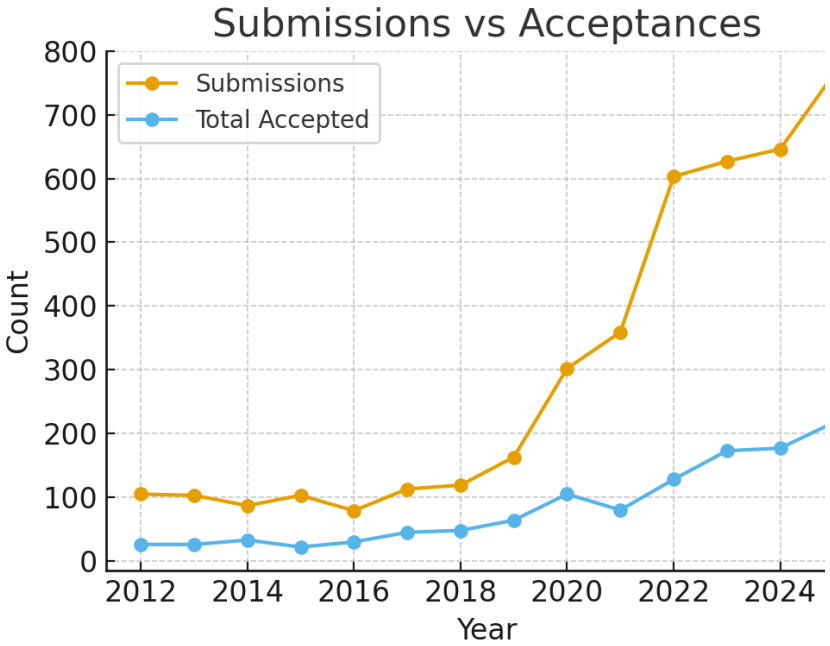
Looking 10 Years Ahead: Era of Human-Facing Intelligent Spatial Systems

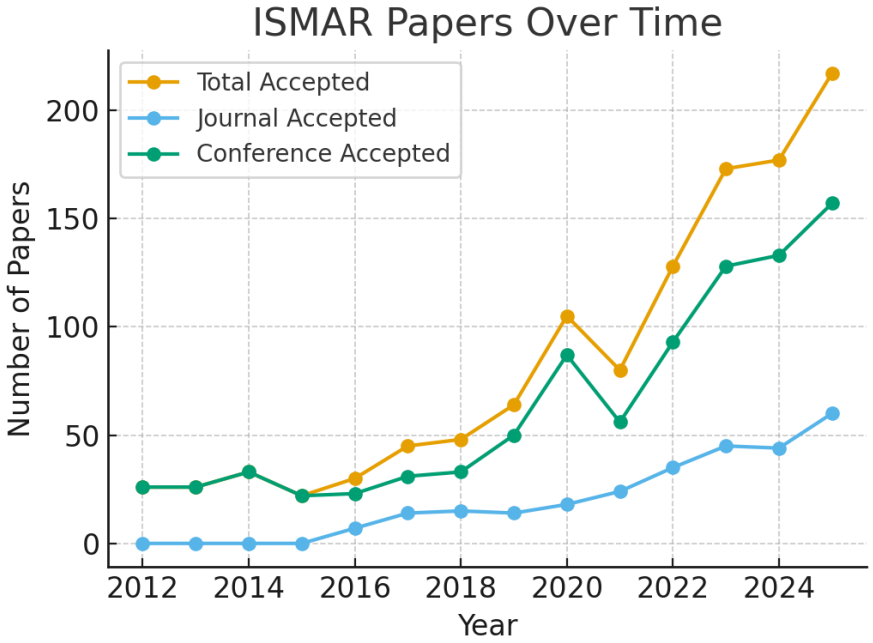
- **Inevitable** – future belongs to the edge
- AR, robotics will converge
  - ➢ AI as a driver of capabilities and user experience
  - ➢ Edge: will be a day-to-day necessity
    - For AI, for multi-agent coordination
- Spatial computing → spatial cyber-physical-human systems

- **Will we take the opportunity to make our systems *better*?**

And So Has XR

- [XR is growing *dramatically*]





Source: https://www.ismar.net/past_symposiums/