Building Safe and Secure Communities through Real-Time Edge Video Analytics

NSF Project ID 1831795

Hamed Tabkhi, Ph.D., University of North Carolina Charlotte

IRG, FY2018

Principal Research Investigators

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Community Partners

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City of Charlotte, Sustainability Office
Charlotte Mecklenburg Police Department (CMPD)

UNC CHARLOTTE

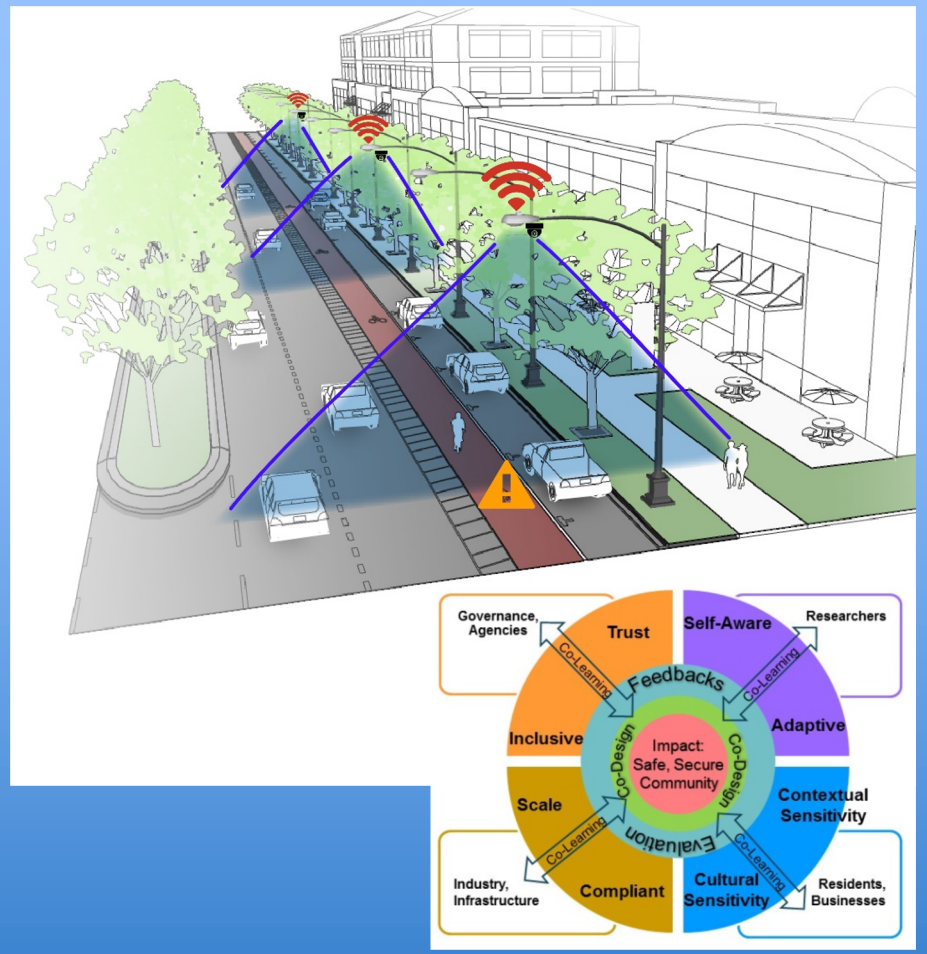
CENTRAL PIEDMONT

CHARLOTTE

POLICE
CHARLOTTE-MECKLENBURG

Project Overview

Visual Schematic



Project Vision

- To bring law enforcement and communities together to design a technology solution that will offer wide data collection opportunities that maintain citizen privacy and, ultimately, lead to reduced crime, fewer unnecessary police-citizen interactions.

- To create a proactive mechanism that ensures privacy while identifying macro/micro scalable behaviors, transactions, and demand/supply chains without detecting or storing information related to identities of citizens.

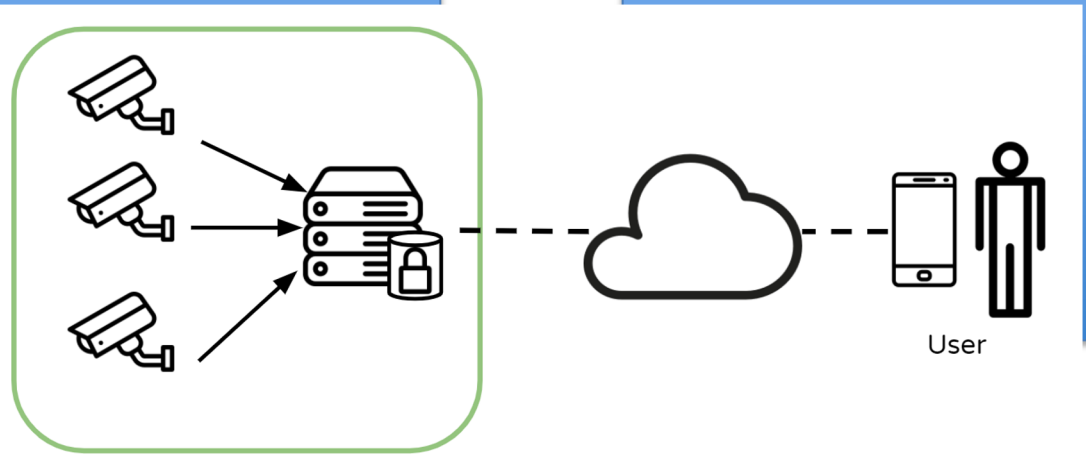
Project Overview

Use-Inspired Research

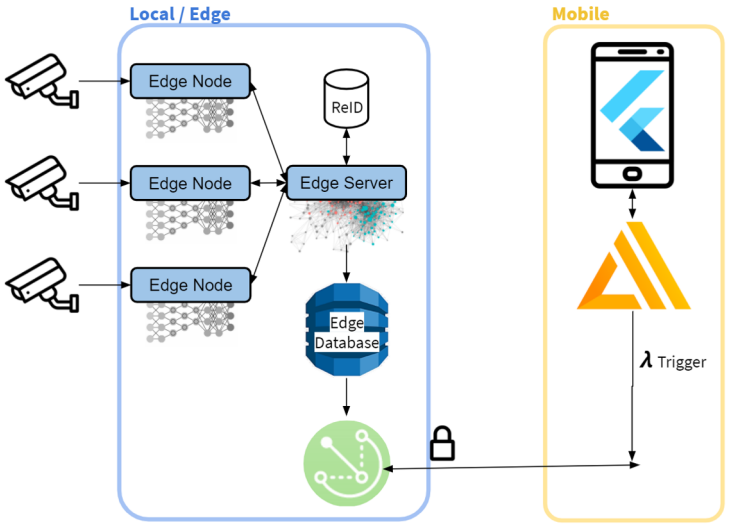
- **Privacy:** Developing data governance and privacy protection policies to protect Personally Identifiable Information (PII).
- **Transparency:** Developing feedback methods and transparent user interfaces to bring back the processed information to stakeholders, and community residents on-spot.

Fundamental Research Contributions

- **Algorithm:** Pedestrian re-identification, and behavioral analysis across multiple sensors/cameras **without performing facial recognition**.
- **IoT Infrastructure:** Decentralized real-time AI processing across multiple cameras on the edge, independent from the cloud.



Project Update



- **Algorithm:** First to develop fully functional end-to-end behavioral analysis without facial recognition or PII information
  - REVAMP2T; IEEE Journal of IoT
- **System:** Developed fully integrative IoT infrastructure with capability of real-time edge computing, independent from cloud.
  - MEZ; IEEE Access

- **Data Collection:** Created a labeled dataset for public safety through close collaboration with CPCC criminal justice students and facilities

- **Demo and Engagement:** Created a mobile test beds and demoed technology at CMPD headquarter, and CPCC campus

Project Evolution

Observation/Lesson Learned: *Through engaged with community residents, we have learned the is a general Lack of trust on AI and our proposed technology*

Adaptation/Adjustment: *We developed demos to present the benefits of technology in measuring basic human movements, e.g., mobility assessment or social distancing, in a full privacy-preserving fashion.*

Observation/Lesson Learned: *Throughout the development of technology, we have learned that there is a huge publicly available unbiased dataset related to Public safety*

Adaptation/Adjustment: *We developed criminal justice fellowship at CPCC, with the mission of developing labeled dataset for parking lot crimes.*

Observation/Lesson Learned: *Through tenement with residents and community partners, we have learned that to gain the trust and attention, a real-word fully-functioning demonstrator is a MUST.*

Adaptation/Adjustment: *We revised the first pilot to create on a fully installed integrated technology at CPCC campus, with focusing on parking lot crimes,*

Observation/Lesson Learned: *Through tenement with CMPD, CPCC and other local business owners, we have learned that our community partners (CMPD) are interested to a technology that can be easily integrated to their existing legacy infrastructure.*

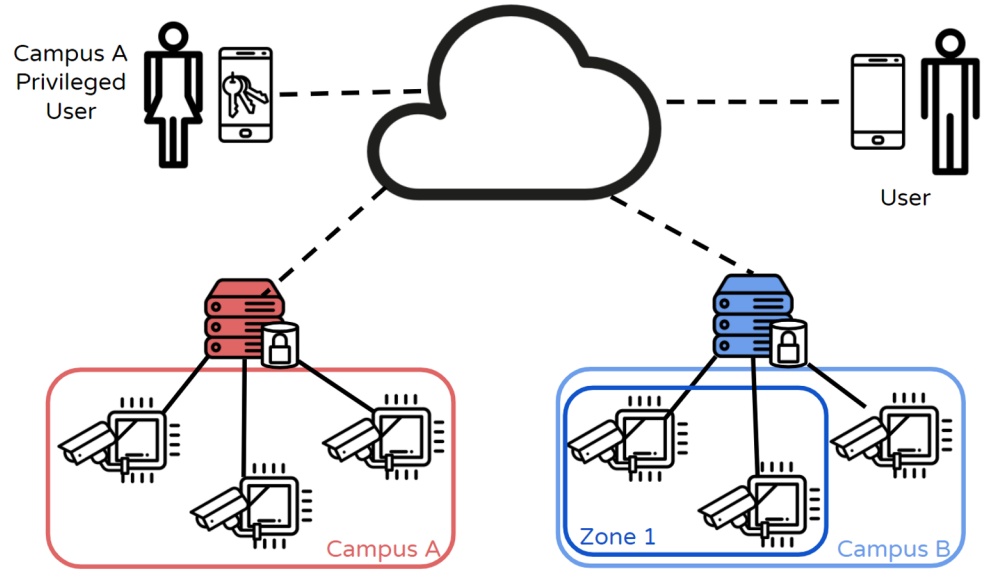
Adaptation/Adjustment: *We revised the technology as such that can work directly over existing camera feeds with minimum changes in infrastructure, but still performing all required computation on the edge, independent from cloud.*

Evaluating Project Impact on Communities

- Developed criminal justice fellowship to engage CPCC students and faculty in a unique experience and testbed development. Students have been actively involved in data creation and processing as well as other student learning objectives.
- Created a mobile pilot at CPCC campus as a demonstrator of technology to community residents, and CMPD police officers.
    - We are working toward a permanent pilot, to create AI for Public Safety. The MOU is in place, and most of the infester development, ad installation have finished.
- Organized a Charlotte Regional summit with title of “Technology and AI for Social Good”. This event took place on October 2019.
    - Brining UNCC researcher, community stakeholders (CMPD, City of Charlotte), local businesses, and neighborhood residents, and community leaders together.
    - Panels on citizen engagement strategies, data privacy, and ultimately how A.I. can be used for social good through the creation of safe and connected communities.
    - Presented a live pilot of our technology at the summit for broader public awareness and outreach.

Anticipated outcomes & success measures for next year

- Enhancing the algorithm constructs for complex behavioral analysis and anomaly detection models, focusing on crimes in the parking lots.
- Expanding the AI-powered real-time crime center lab at CPCC with campus-wide coverage across many cameras to explore and validate the practicality of developed algorithms in real-world scenarios.
- Continuation of our community engagement through workshops, online surveys, as well as in-person visits to the CPCC campus to provide a vivid experience of the developed technology in a real-world setting.
- Continue the discussion with CMPD on the potential integration of proposed technology with their training campus at CPCC.
- Media outreach and articles to create general public awareness of the technology and our project with video examples at the CPCC campus.
- Pursing commercialization and brining the technology to the market – The technology has been already protected and our company has been established (https://www.chimeras.ai/)



PROPOSAL TITLE (Do not include award type here, eg: SCC-PG:)

NSF Project_ID

Lead PI, Institution

Award Type (IRG, PG, RCN etc) + Solicitation Year (ex: FY2017)

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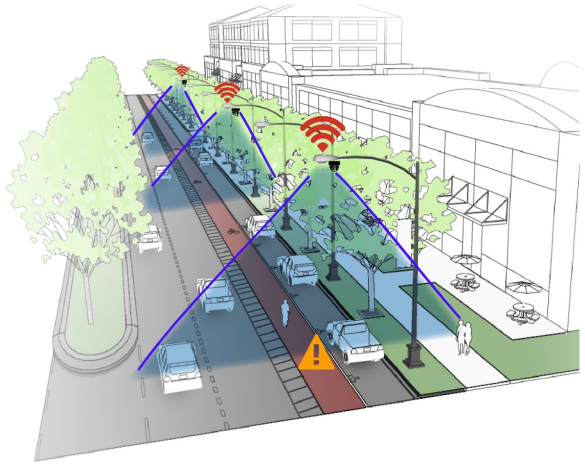

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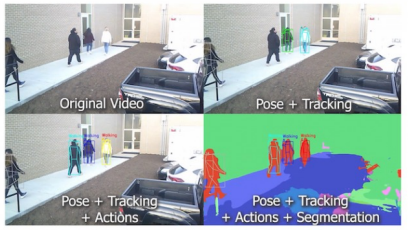

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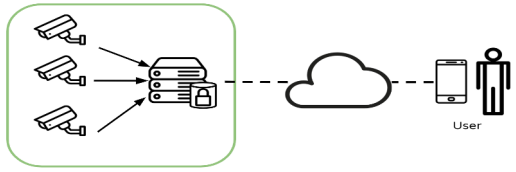

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