Safety and Security of College Campuses and their Adjacent Communities
NSF Project_ID: 1952102
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### PG, FY2020

Principal Research Investigators (Name, Institution)

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Community Partners (Name, Institution)

- Police Department, Marquette University
- Office of Community Engagement, Marquette University
- Various Community Stakeholder Organizations such as
  - Near West Side Partners,
 - Menomonee Valley Partners, and
  - Westown Association, Milwaukee, WI

Project Overview

Project Vision
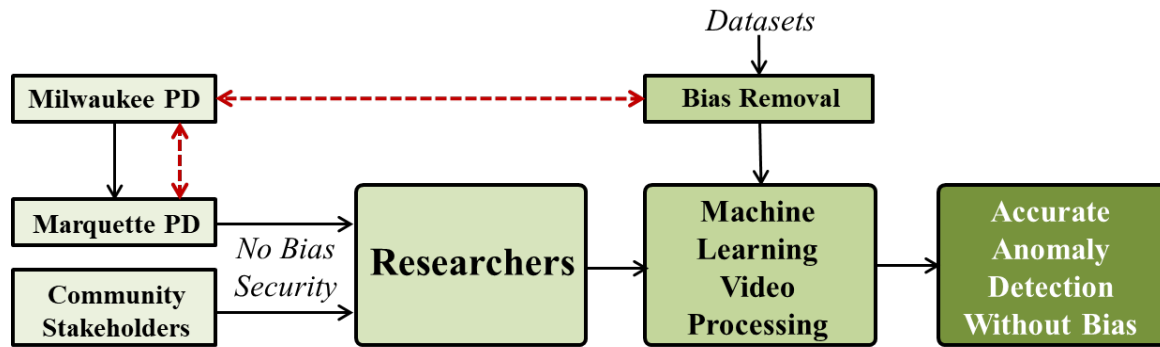
Expected Outcomes:

• Identify major safety issues, concerns, and challenges, including ethics, bias, and privacy, on and around the Marquette campus

• Run a preliminary feasibility study of data-driven smart sensing technologies to aid safety and security on extended campuses
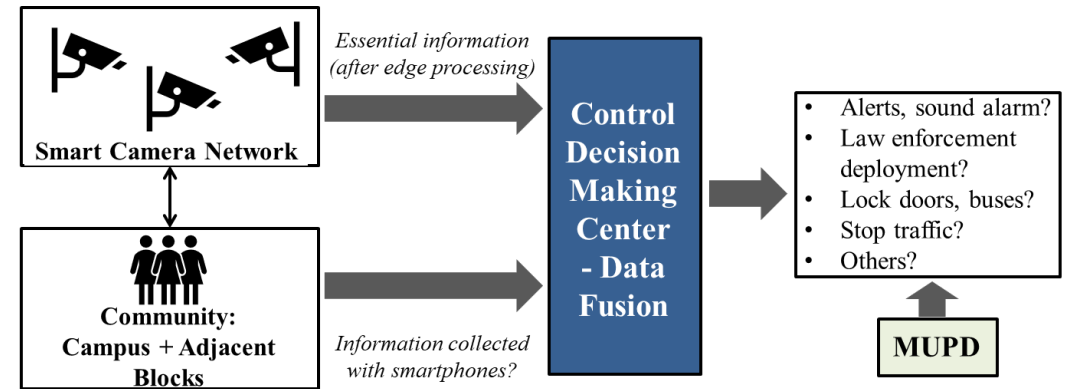
Vision for the IRG proposal:

Create a cyber-physical diagnostics and prognostics network of smart sensors for establishing safe and secure zones on and around college campuses

Applied Research Components:
  • Determine minimum necessary sensing infrastructure for automation
  • Data fusion needs
  • Develop application-specific edge processing algorithms
  • Characterize relationship between behavioral patterns and safety/security issues
  • Eliminate bias in data, in processing and in decision-making

Fundamental Research Needs:
  • Advances in machine learning for data analytics
  • Novel nonlinear and adaptive estimation and stochastic control algorithms for diagnostics, prognostics, and decision-making

Pilot Study:
  • Pilot run of the smart sensing system with Marquette PD in real-time

Project Overview

Use-Inspired Research

Addressed Problem: Supporting Marquette Police department in safety of Marquette campus and its surrounding communities via a Smart Sensor Network.

The target community: Marquette campus community and its adjacent communities. Marquette is in Milwaukee, WI. The community partners are Marquette Police Department and via Marquette Office of Community Engagement, Near West Side Partners, Menomonee Valley Partners, and Westown Association.

End User Needs: Marquette Police need a fast and accurate alert system with minimum false alarm rate in case of a security violation while avoiding bias in predictive policing.

Beneficiary Needs: Marquette students/faculty/staff and surrounding community need exactly what Marquette police need.

These end user and beneficiary needs have reshaped data choice, data processing and bias removal operations and emphasized the importance of keeping the constituents in the feedback loop during the project.

PG Activities

- Survey local and national campus safety and security issues
- Build a core group of faculty with common interest
- Recruit a PhD and an MS student, who have taken classes in image processing
- Conduct surveys on the frequency of various campus security issues and available technologies to detect anomalous behavior
- Decide on the nature of feasibility studies and the algorithms to be used for detection
- Build collaborations with and solicit feedback from relevant stakeholders
- Sharpen the research questions and hypotheses
- Continue to eliminate bias in data, processing of data and decision making
- Recruit more social scientists with expertise in crime
- Conduct initial feasibility studies of the conceived technological novelties

Project Update

Activities to Date:

1. **Explore the safety and security issues and challenges in our urban campus and its periphery**:
   a. Surveyed Annual campus crime reports;
   b. Solicited student/faculty/staff and adjacent community feedback
   c. Studied crime maps for the neighborhood
   d. Examined national campus crime statistics from the US Department of Education for translatability/scalability
2. **Build collaborations with and solicit feedback from relevant stakeholders:**
   a. Participated in local and national MU sponsored community engagement events
   b. Attended relevant workshops and webinars
   c. Communicated with campus student/faculty/staff and community leaders
3. **Sharpen the above-mentioned research questions and hypotheses:**
   Sharpened the research questions and hypotheses based on surveys on the frequency of various campus security issues, available technologies to detect anomalous behavior, and community concerns involving human and algorithmic bias
4. **Conduct initial feasibility studies of the conceived technological novelties**:
   a. Built a core group of faculty with common interest to mentor students
   b. Recruited a PhD and an MS student:
      - Conducted surveys on the frequency of various campus security issues
      - Surveyed available technologies to detect anomalous behavior
      - Participated in training to develop relevant technical expertise
   c. Identified the types of feasibility studies to be conducted
   d. Determined algorithms for detection and studies have started

When completed, these activities will form the framework, including sharpened goals and technical/social constraints, for the design of a cyber-physical diagnostics and prognostics network of smart sensors for establishing safe and secure zones on and around college campuses in the US.

Project Evolution

There are mainly two ways in which we have re-shaped our vision:

- Feedback from relevant stakeholders made us very aware of the possible biases in data gathering, data processing and automatic decision making. Therefore, there will be several checkpoints in our smart sensor network to detect and alleviate such pitfalls.

- Based on the negative public perception of completely autonomous systems, outputs of the Control and Decision-Making Center will not be used directly to initiate a law enforcement action. These outputs will be used instead as alerts to the security personnel as to which cameras need their attention with a recommendation for follow-up actions. The security personnel will have the final determination as to how to proceed.