On the Intersectionality of Race and Lighting Conditions in Pedestrian Crashes

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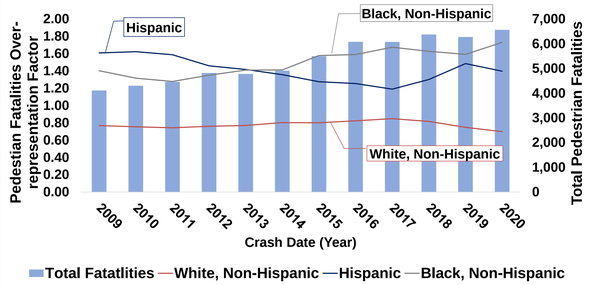
Introduction

- 60% increase in total pedestrian fatalities from 2009 to 2020
- Hispanic/Latino and Black pedestrians face higher fatality risks
- Magnitude of over-representation increased from 1.40 in 2009 to 1.73 in 2020 for Black people
- **Black pedestrians were 82% more likely to be involved in fatal crashes** compared to white pedestrians in 2009
- This disparity increased even more to **100%** in 2020



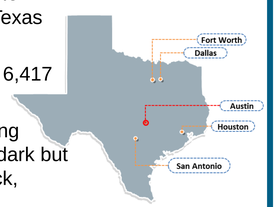
What are the underlying causes for racial disparities in pedestrian crash risk?

Research Goal

1. **Detailed Analysis of Racial Disparities**: Highlight the disproportionate risks faced by BIPOC in pedestrian crashes, emphasizing the need to understand and address the underlying racial, ethnic, and socioeconomic factors.
2. **Infrastructure Equity**: Show how differences in infrastructure quality contribute to pedestrian crash disparities.
3. **Lighting and Safety**: Investigating the role of lighting conditions in exacerbating crash risks for minority communities.
4. **Actionable Recommendations**: Offer clear, evidence-based actions for policymakers to mitigate safety inequities.

Data

- Includes severe pedestrian-vehicle crashes from 2012-2022 in five Texas metros
- Covers 5,499 CBGs and totaling 6,417 incidents
- Focuses on the interplay of lighting conditions (daylight, dark but lit, dark but unlit) and victim race (white, Black, Hispanic/Latino)



Framework

Exogeneous Variables

Census Block Group (CBG) Level	Crash Level
• Exposure • Built-environment • Sociodemographic	• Involved parties • Crash Location • Time covariates

Outcome Variables

Total count of severe and fatal pedestrian crashes in CBG

Crash Type Model

- **9 alternatives:**
  1. White pedestrian – Daylight
  2. White pedestrian – Dark and lit
  3. White pedestrian – Dark and unlit
  4. Black pedestrian – Daylight
  5. Black pedestrian – Dark and lit
  6. Black pedestrian – Dark and unlit
  7. Hispanic pedestrian – Daylight
  8. Hispanic pedestrian – Dark and lit
  9. Hispanic pedestrian – Dark and unlit

Modeling Results

Higher Crash Likelihood in Dark Conditions

Male Ped. · Ped. Age 19-40 · Male Driver · Ped. Under Influence · Ped. Failed to Yield · Hit and Run · Lack of Traffic Control · High Volume Roads

Higher Crash Likelihood for Black Pedestrians

Male Ped. · Ped. Age < 18 · Driver Age > 60 · Same Race Driver · Ped. Failed to Yield · Hit and Run · Lack of Traffic Control · Four-leg Intersection · Industrial Landuse

Higher Crash Likelihood for Black Pedestrians in Darkness

Female Ped. · Driver Age > 60 · Luxury Vehicle · High Volume Roads · Proximity to bus stops

Implications

Equitable traffic control and street lighting deployment

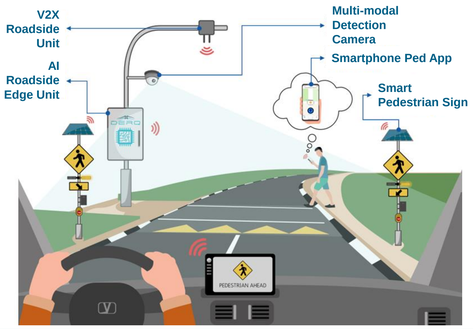
Safety by design

Careful bus stop placement

Community-driven solutions

Public awareness

Technology Strategies for Improvement



- Improve visibility and reduced reliance on driver perception
- Ensure equitable detection and mitigate implicit racial bias and visibility limitations
- Allow adaptive lighting control
- Identify high-risk scenarios before they occur, and alert drivers through connected vehicle communications

Technology for Safer Roads

Framework

Weatherproof Camera Module

6x Zoom Camera

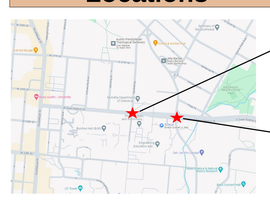
Cell Modem *for monitoring* · Digital Video Recorder · Cooling Fan · Storage

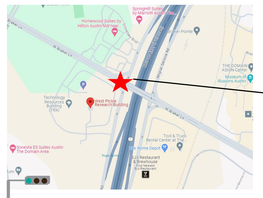
Analysis Process

Video Footage → YOLO Object Detection and Tracking → Is ped present? (Student "Oracle") → Car, Race, Behavior

- Age
- Skin Color
- Appearance
- Time
- Signal Phase
- Vehicle Events
- Crossing behavior

Locations





Dean Keaton - Speedway

Dean Keaton - San Jacinto

Mopac Service Rd – W. Braker Ln