Communities and Crimes

ECS 171: Group Project

Group 12: Vedant Apte, Annmarie Adams, Loren Aguilar, Matthew Boentoro, Dongyu Chen, Anqi Liu, Tien Ly, Boyang Meng, Matthew Morales, Yifan Shen, Hengze Ye

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Problem Description

Why do we care?

- Violent crime is ubiquitous in modern American society.
  - Violent crime rates vary across different communities in the United States
  - High crime rates have severe economic and social impacts on communities
- **Motivation:**
  - To identify why violent crime rates vary
  - To provide solutions for reducing violent crime rates
  - To assist policymakers in enacting effective legislation

- **Goal:**
  - Identify the relationships between communal attributes and violent crime rates in communities
  - Build a ML model to predict the violent crime rate per 100K given certain communal attributes

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Related Work

Similar work done on the topic

- FBI. Crime in the United States by Community Type. 2011.
- Noah Atchison. Community Organizations Have Important Role in Lowering Crime Rates. *Brennan Center*, April 20, 2018.
- Kerry L. McIver, Marsha Dowda, Cheryl L. Addy, Russell R. Pate, William H. Brown, Karin A. Pfeiffer. Social and environmental factors associated with preschoolers' non-sedentary physical activity. *Society for Research in Child Development, Inc.*, 05 February 2009.
- Brandon C. Welsh, David P. Farrington. Preventing crime: What works for children, offenders, victims and places. *Springer*, 2007.
- Dan Jasper. How community involvement can reduce crime. *Street Civics*, 2021.

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Data Set Description

How we solved the problem

Family:

- PctKids2Par: percentage of kids in family housing with two parents
- TotalPctDiv: percentage of population that is divorced
- PctIlleg: percentage of kids born to individuals that never married

Wealth:

- PctPopUnderPov: percentage of population that is under the poverty level
- pctWPubAsst: percentage of population with public assistance income
- pctWInvInc: percentage of population with investment income

Race:

- racepctblack: percentage of population that is African American
- racePctWhite: percentage of population that is white

Goal

- ViolentCrimesPerPop: total number of violent crimes per 100K population

- UCI's Communities and Crime Data Set
  - 128 attributes: 122 predictive, 5 non-predictive, 1 goal
  - 1994 instances

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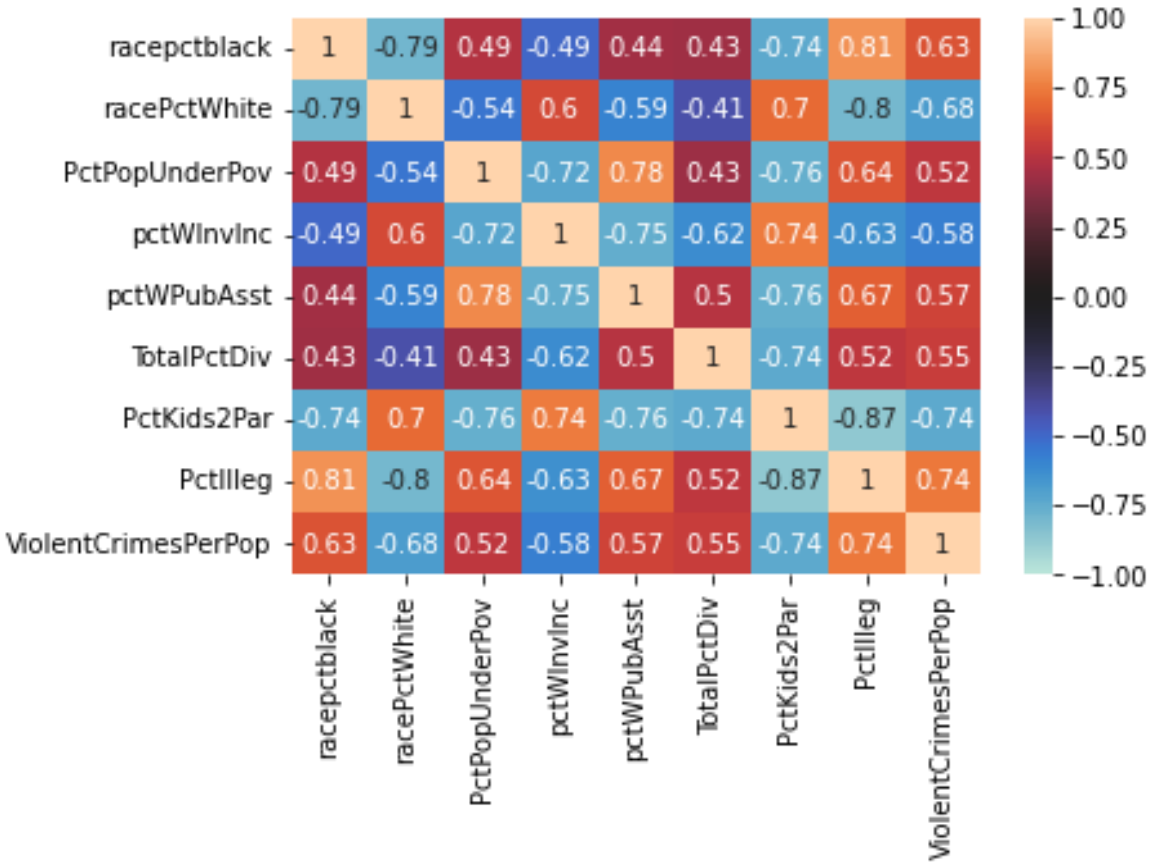
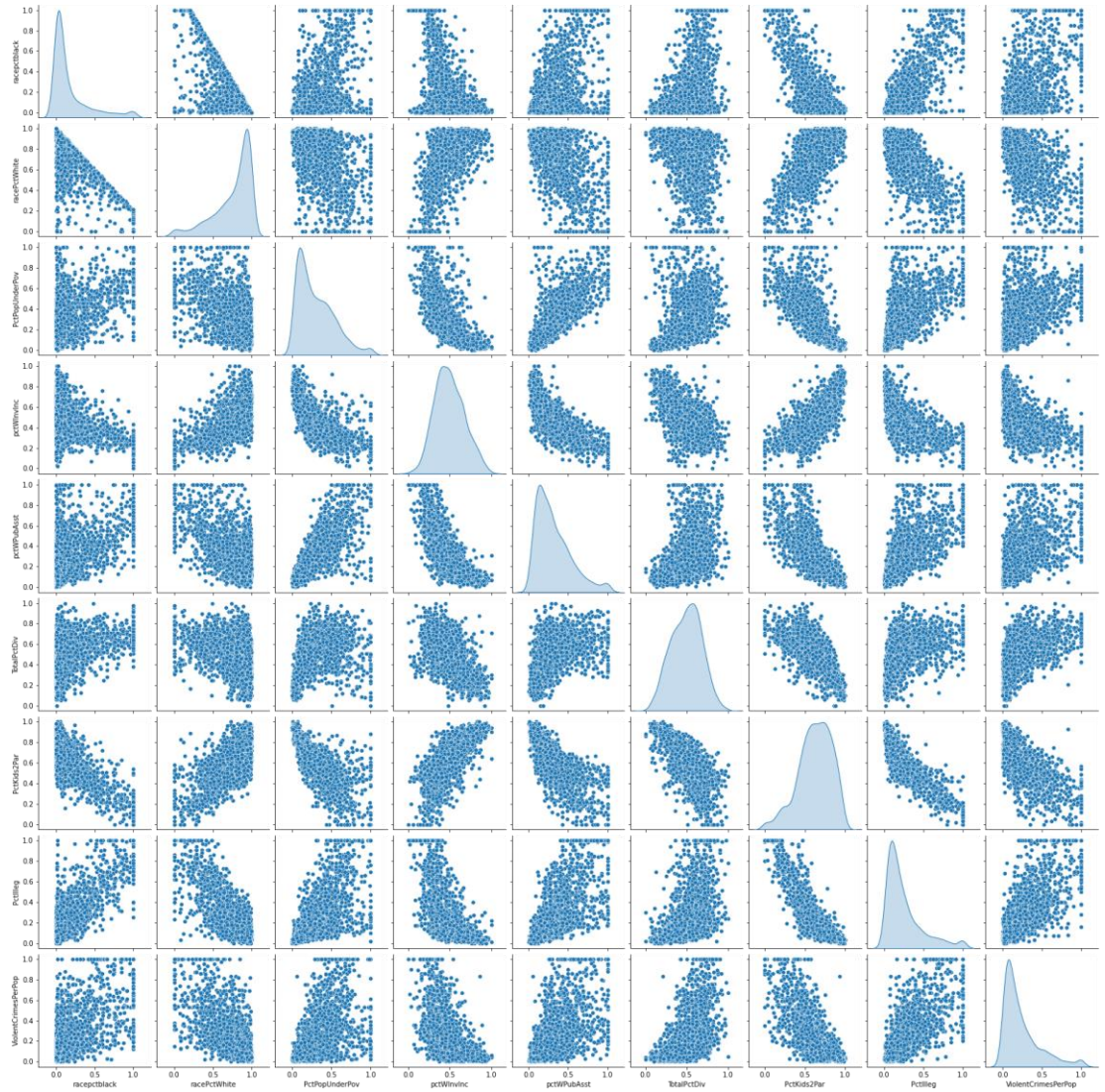
Proposed Methodology

How we solved the problem

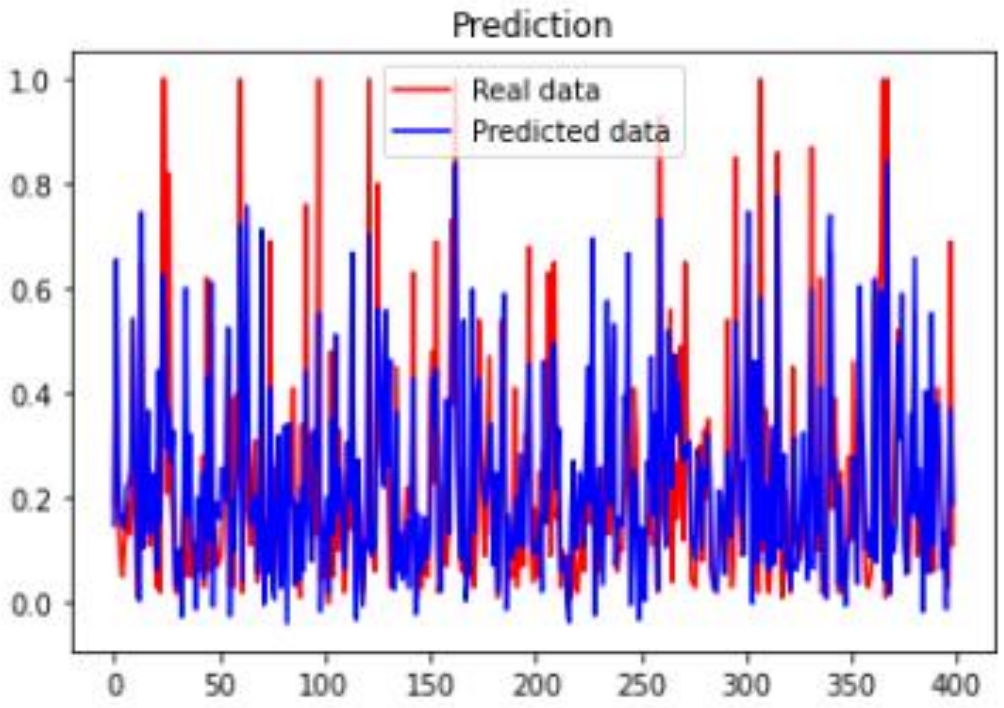




Evaluation of Methods

Linear Regression Model

Comparison Type vs. Violent Crimes Per 100K	Average MSE (10-fold cross validation)
Family attributes	0.0223
Wealth attributes	0.0337
Race attributes	0.0278
All attributes	0.0210



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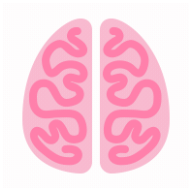
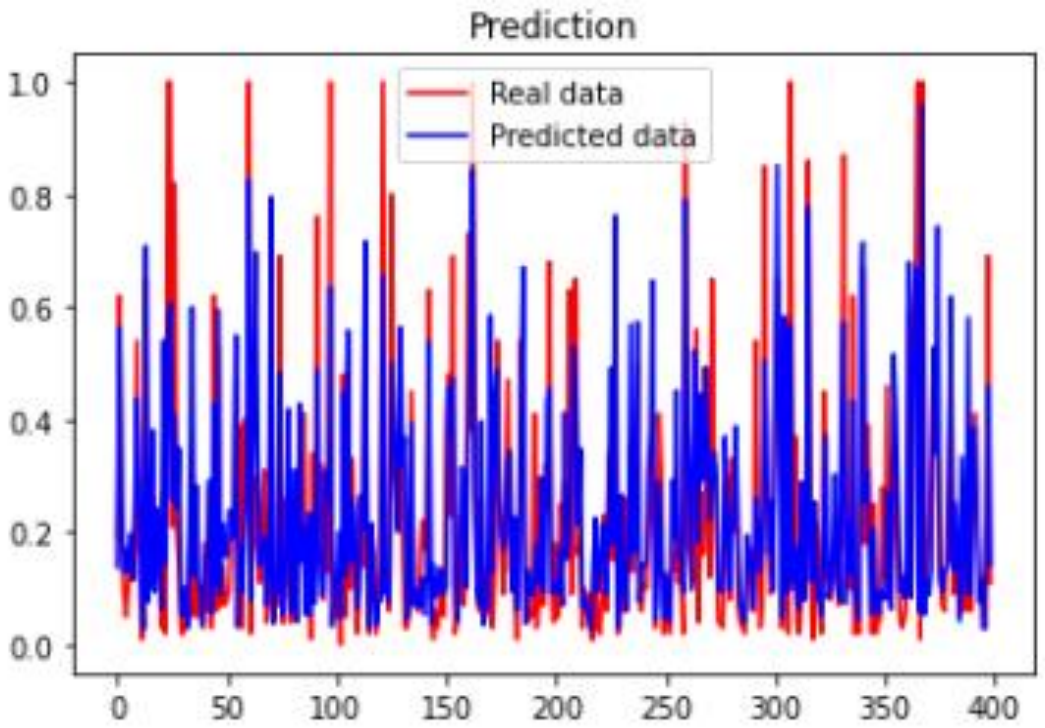
Evaluation of Methods (cont.)

Neural Network Model

- 3 hidden layers (40, 10, 4)
- ReLU activation
- Learning rate: 0.01



Comparison Type vs. Violent Crimes Per 100K	Average MSE (10-fold cross validation)
Family attributes	0.0216
Wealth attributes	0.0320
Race attributes	0.0275
All attributes	0.0179



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Conclusion

Results and call to action

- Both linear regression (MSE = 0.0210) and ANN (MSE = 0.0179) performed well.
  - Because the data set was not perfectly linear, the neural network performed marginally better.
  - Current values only predict a normalized number for violent crimes per 100K.
  - Future plan: use the unnormalized dataset and normalize it ourselves, then apply our model and transform the prediction back to a numeric number
- Because there are considerable links between community attributes and crime rates, improving these attributes can aid in stabilizing our social security.
  - Reduce racial profiling
  - Increase general social wealth / fight poverty
  - Encourage healthy and complete families / improve family relationships

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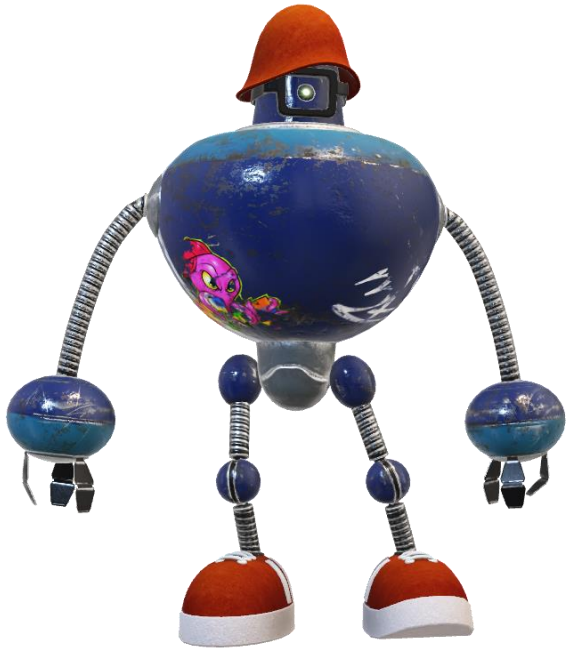

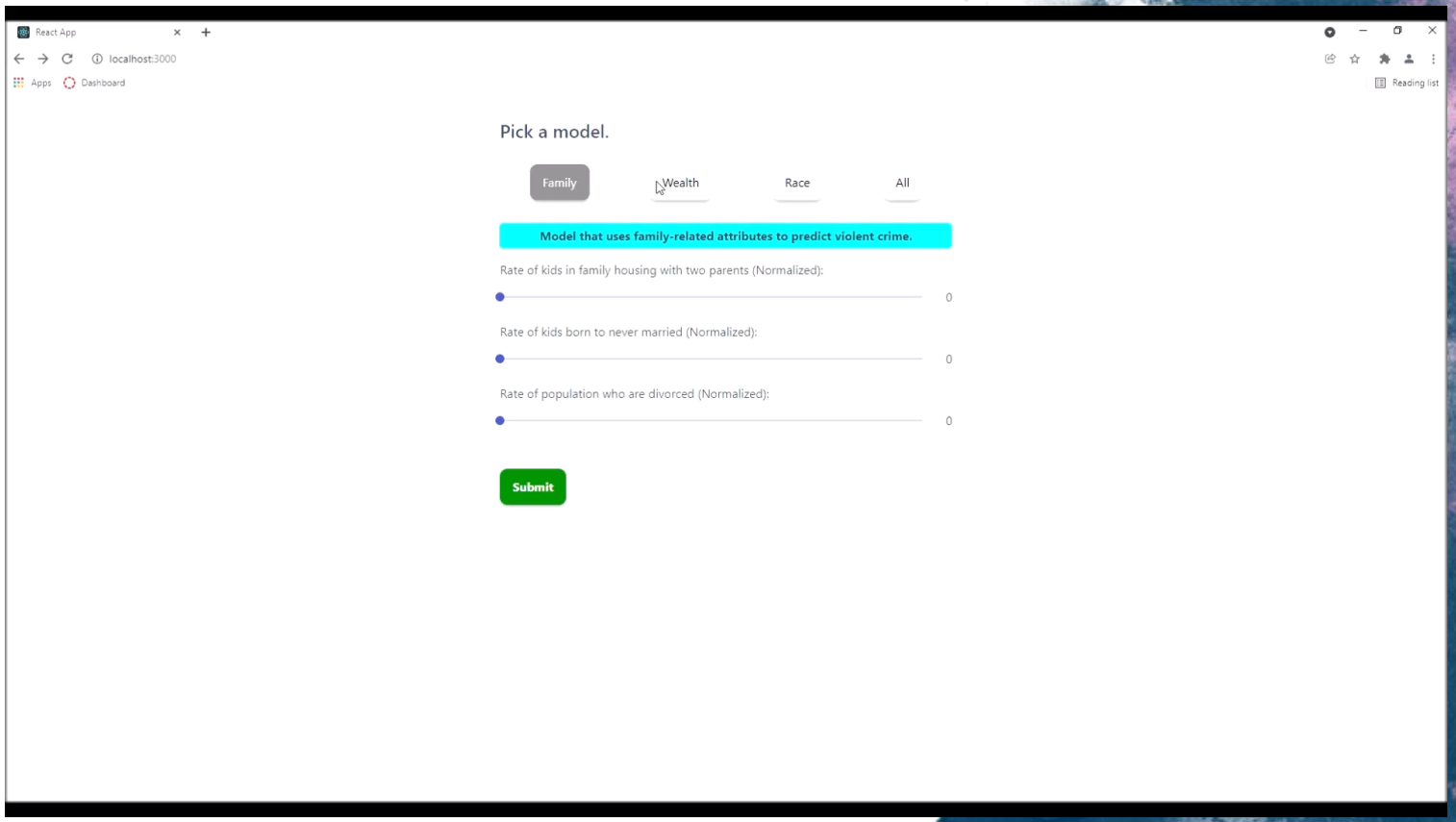

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Questions?