Analyses and Predictions:

THE IMPACT OF CANNABIS LEGALIZATION on the U.S. OPIOID CRISIS

A UC Berkeley Extension Data Analytics Bootcamp Capstone Project

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PROJECT PREMISES

- ❑ A growing acceptance of cannabis as a medicinally helpful drug
- ❑ A growing advocacy for federal legalization; descheduling and decriminalization
- ❑ A persisting opioid epidemic
- ❑ The counter-argument to the “gateway drug” theory: cannabis as an “exit drug”
- ❑ Our resolution to objectively review the data for all 50 states

QUESTIONS TO ANSWER

Is there any correlation (negative or positive) between cannabis consumption and opioid misuse?

Do states that allow medical and/or recreational cannabis have lower, higher, or similar per capita opioid fatalities compared to states that have not legalized?

What kind of predictions can we make about opioid fatalities using machine learning?

DATA EXPLORATION

Sourcing:

- cannabis consumption estimates by state, 2014 - 2020 (Substance Abuse and Mental Health Services Administration's National Survey on Drug Use and Health)
- Annual opioid fatalities by state, 2014 - 2020 (National Vital Statistics System multiple cause-of-death mortality files)
- annual state population estimates (U.S. Census Bureau)

Initial Cleansing:

- dropping null values and unnecessary rows
- making sure each state was there, accounting for missing data

Formatting:

- converting to correct data types
- adding new columns for legality and per capita figures using formulas

Merging:

- using pandas to merge data into larger datasets
- format and export data as .csv for use in Tableau and JavaScript

MACHINE LEARNING

Model scoring list

	MAE	RMSE
Deep Neural Network	322	370
Lasso	306	512
DecisionTreeRegressor with TargetRegressor	263	668
RandomForestRegressor with TargetRegressor	240	648
GradientBoostingRegressor	205	604
XGBoostRegressor	17	40

XGBoostRegressor

Works well on

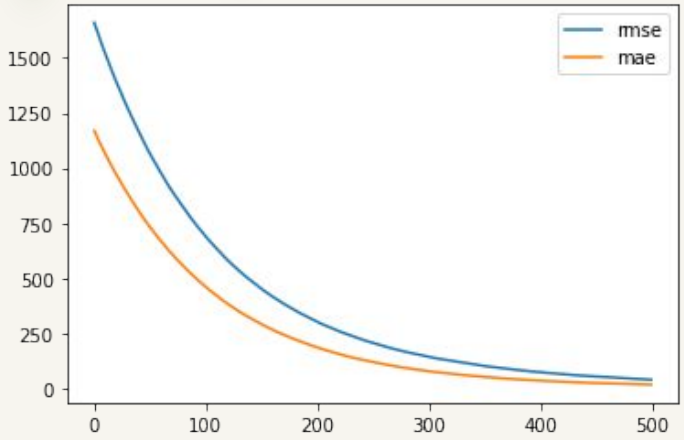
- Small data
- Big data
- Data with subgroups
- Complex data

Does not work well on

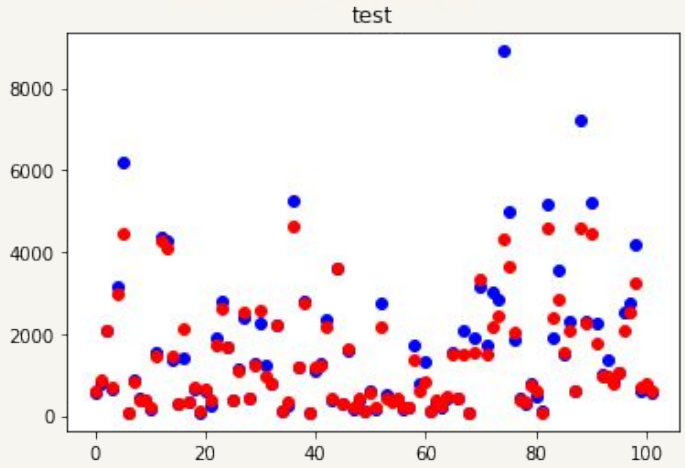
- Sparse data
- Thoroughly dispersed data
- Effect sizes for population

XGBOOSTRegressor

Ideal for small datasets like ours standing at 357 rows



RMSE vs MAE improvements in training



Predictions (red) vs original y-test (blue)

LIVE DEMO

https://alberzitas.github.io/

CONCLUSIONS

- **Opioid death percentages have continued to rise in most states, independently of their cannabis policies.**
    - Oklahoma, Utah and New Hampshire (all medically legal states) were the only states with an overall decrease in per capita opioid deaths since 2014.
    - As of 2020, the remaining states had increases since 2014 ranging from 37% (in Wyoming, where cannabis is illegal) to 554% (in the District of Columbia, where cannabis is fully legal).
- **2020 saw the reversal of almost all progress that some states had made towards reduced opioid fatalities between 2016 and 2018.**
- **Cannabis consumption also rose sharply in most states during 2020 (strong positive correlation with rise in opioid deaths).**
- **The analysis was limited by factors such as the willingness to self-report cannabis usage and the accuracy in reporting opioid deaths which may have resulted from other comorbidities. It would be worth studying again once data from 2021 & 2022 are available.**

Thanks!

Questions?

Data Sources

- Annual state population estimates
https://www.census.gov/programs-surveys/popest/technical-documentation/research/evaluation-estimates/2020-evaluation-estimates/2010s-state-total.html

- An annual survey of self-reported cannabis consumption, once or more within the past year for ages 12 and up
https://www.samhsa.gov/data/nsduh/state-reports-NSDUH-2

- Opioid prescribing rates per 100 people, ages 12 and older
https://www.cdc.gov/drugoverdose/rxrate-maps/index.html

- Opioid overdose rates, ages 12 and older
https://www.kff.org/statedata/collection/opioid-epidemic/