



Analyses and Predictions: THE IMPACT OF CANNABIS LEGALIZATION on the U.S. OPIOID CRISIS

*A UC Berkeley Extension Data Analytics Bootcamp
Capstone Project*

November 2022



TABLE OF CONTENTS

1

INTRODUCTION

2

**QUESTIONS TO
ANSWER**

3

**DATA
EXPLORATION**

4

**MACHINE
LEARNING**

5

LIVE DEMO

6

CONCLUSIONS

OUR TEAM



[Overviewing Editor]

**PAULA
ADAMS**



[Site Curator]

**JORGE
JURADO**



[ML Specialist]

**JOHN
LANDEEN**



[Visionary Visualizer]

**JANASIA
ROEMLING**



[Data Processor]

**ALBERT
ZENG**

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

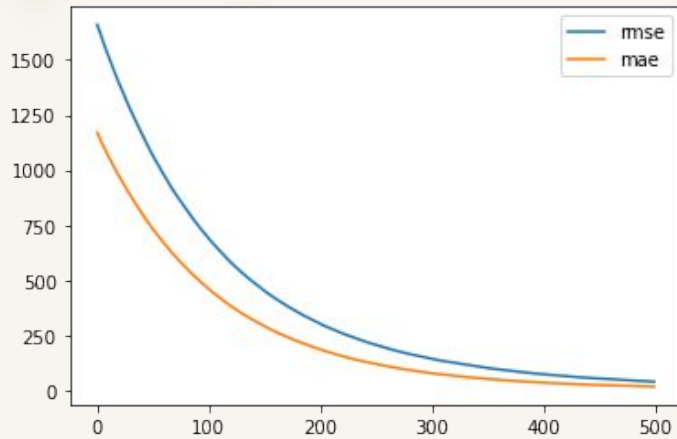
	MAE	RMSE	
Deep Neural Network	322	370	Works well on
Lasso	306	512	- Small data
DecisionTreeRegressor with TargetRegressor	263	668	- Big data
RandomForestRegressor with TargetRegressor	240	648	- Data with subgroups
GradientBoostingRegressor	205	604	- Complex data
XGBoostRegressor	17	40	Does not work well on
			- Sparse data
			- Thoroughly dispersed data
			- Effect sizes for population



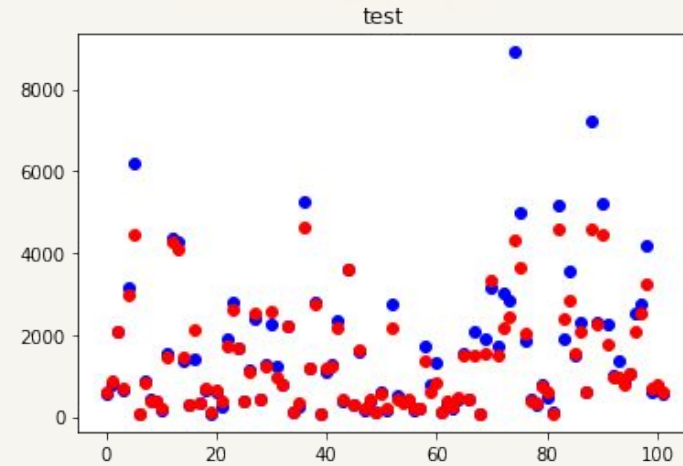


XGBOOSTRegressor

Ideal for small datasets like ours standing at 357 rows



RMSE vs MAE improvements in training



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



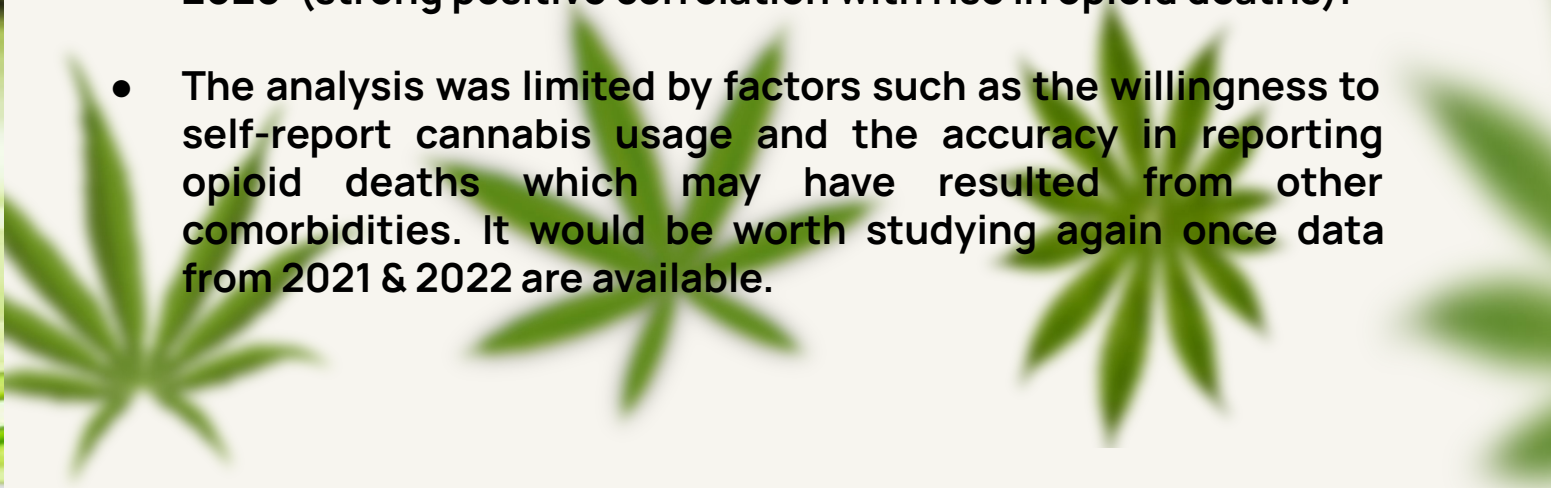
LIVE DEMO





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>

Annual survey of self-reported cannabis consumption, once or more within the past year for respondents ages 12 and up

<https://www.samhsa.gov/data/nsduh/state-reports-NSDUH-2020>

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/other/state-indicator/opioid-overdose-deaths-by-type-of-opioid/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>

Additional Resources

<https://pubmed.ncbi.nlm.nih.gov/?term=cannabis+opioid>

Attribution:

This presentation was inspired by templates from [Slidesgo.com](https://www.slidesgo.com) and [Poweredtemplate.com](https://www.poweredtemplate.com), including icons by Flaticon, infographics and images by Freepik.

