Homicide:

Predicting If a Murder Will Be Solved

Laura Borton

What can we do with these predictions?

Det McNulty: "The Wire"

<u>Murderers</u>
Who could I kill and get away with it?

<u>Police</u>
Will we solve this case?

...and what can we learn from that?

Data

Voluntary for Law Enforcement Agencies to Supply Information
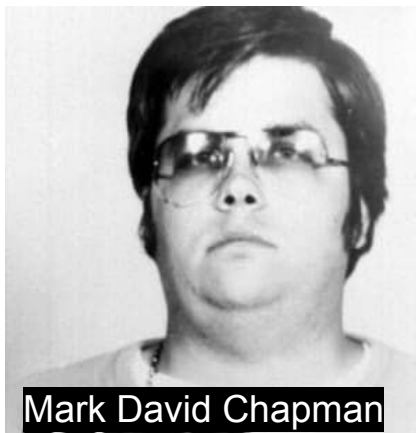
Years: 1976 - 2016
Reports are NOT updated
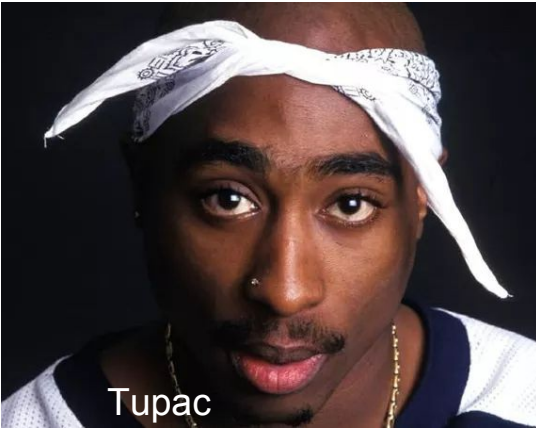
Cases: Over 750,000

Features:
- **Geography**
- **Type of victim**
- **Type of offender**
- **Method of killing**
- **Time of killing**

Data: Solved Case

John Lennon

Mark David Chapman

The Dakota, NYC

1980

Agen type	Cntyfips	Circum stance	MSA	Month	Off Age	Off Count	Off Ethnic	Off Race	Off Sex	Relatio nship	Situation	Solved	Vic Age	Vic Count	Vic Ethnic	Vic Race	Vic Sex	Weapon	Year
Muni cipal police	New York, NY	Circums tances undeter mined	New York-N ew Jersey- Long Island, NY-NJ	Decem ber	25	0	Unknow n or not reported	White	Male	Stranger	Single victim/sing le offender	Yes	40	0	Unknown or not reported	White	Male	Handgun - pistol, revolver, etc	1980

Data: Unsolved Case

Las Vegas Crime Scene

Tupac

?

Agent ype	Cntyfi ps	Circumst ance	MSA	Month	Off Age	Off Coun t	Off Ethnic	Off Race	Off Sex	Relation ship	Situation	Solved	Vic Age	Vic Count	Vic Ethnic	Vic Race	Vic Sex	Weapon	Year
Munici pal police	Clark, NV	Circumsta nces undetermi ned	Las Vegas -Parad ise, NV	Septem ber	999	0	Unkno wn or not report ed	Unknow n	Unkn own	Relation ship not determin ed	Single victim/un known offender(s)	No	25	0	Unkno wn or not reporte d	Black	Male	Handgun - pistol, revolver, etc	1996

Data: Unsolved Case

Las Vegas Crime Scene

Tupac

?

Agent type	C...	Circumst...	MSA	Month	C... Ag...	C... Coun...	C... tn...	Off...	Off... Sex	Relation sh...	Sit...	Solved	Vic Age	Vic Count	... th...	Vic Race	Vic Sex	Weapon	Year
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Considerations for Metrics

Predicted Values

|	Unsolved	Solved
Actual Values		
Unsolved	**TP** Effect: Murderers on the Street Law Enforcement knows	**FN** Effect: Murderers on the Street Law Enforcement Thinks it's Solved
Solved	**FP** Effect: Looks bad for Police Statistics	**TN** Effect: Murderers Captured Happy Citizens

Unsolved is Positive

Imbalanced Data:
70% Solved
30% Unsolved

<u>Accuracy</u>
Importance: Moderate

<u>Precision</u>
Importance: Low

<u>Recall</u>
Importance: High

Modeling: AUC

ROC curve
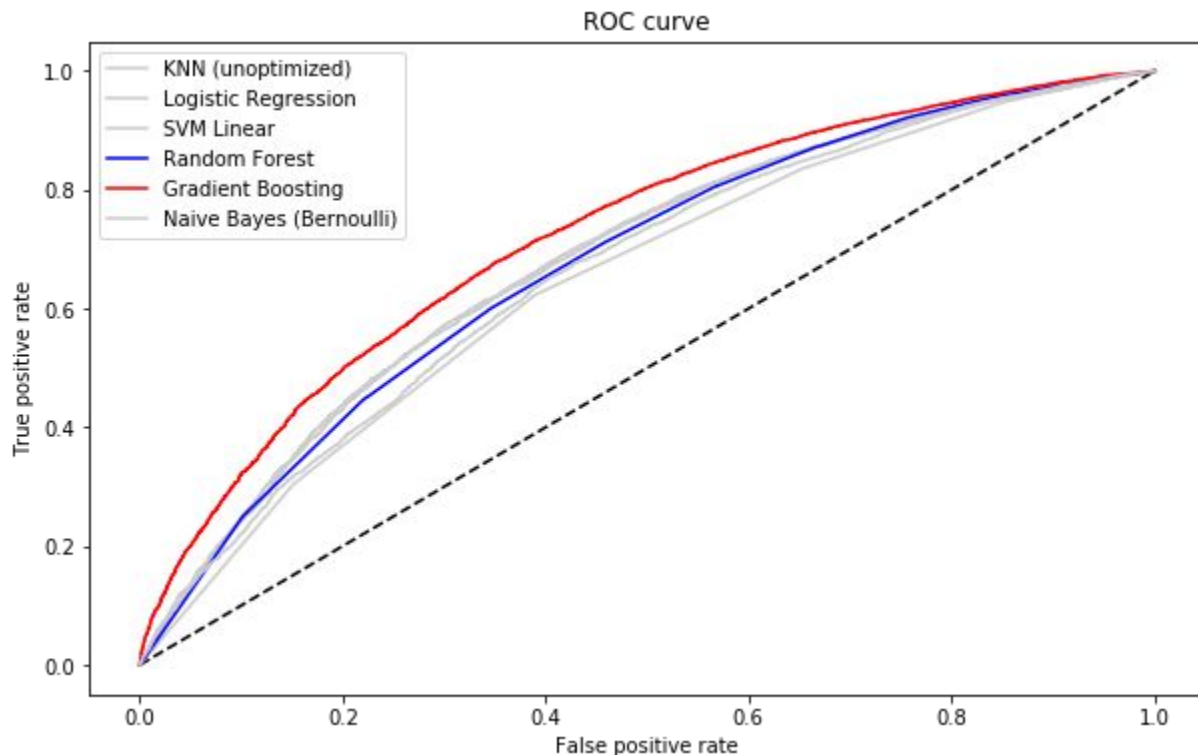
AUC scores:

KNN:	0.647
Linear Regression:	0.683
Linear SVC:	0.683
SVC:	0.679
Random Forest:	0.675
Gradient Boosting:	**0.721**
Naive Bayes:	0.662
Baseline:	0.500

Used 10% of Data = 70,000 Cases

Modeling: Recall

Baseline:

RF:

Recall scores:

KNN:	0.346
Linear Regression:	0.151
Linear SVC:	0.12
SVC:	0.247
Random Forest:	**0.430**
Gradient Boosting:	0.289
Naive Bayes:	0.327
Baseline:	0.0

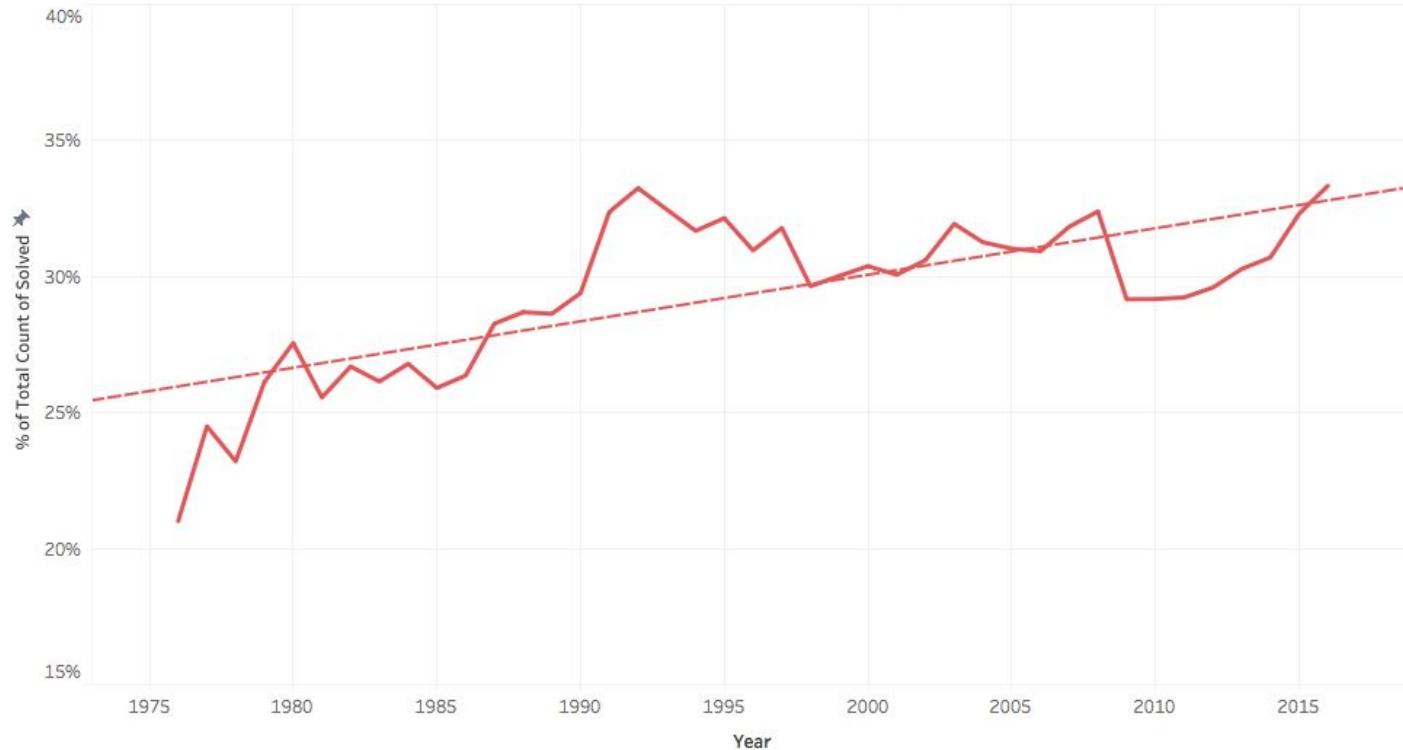| Actual Values	Predicted Values	
	Unsolved	Solved
Unsolved	Baseline: 0 RF: 2732	Baseline: 6337 RF: 3605
Solved	Baseline: 0 RF: 3038	Baseline: 15696 RF: 12658

Biggest Influencer: Age of Victim

More Unsolved Cases for Young Adults and Eldery
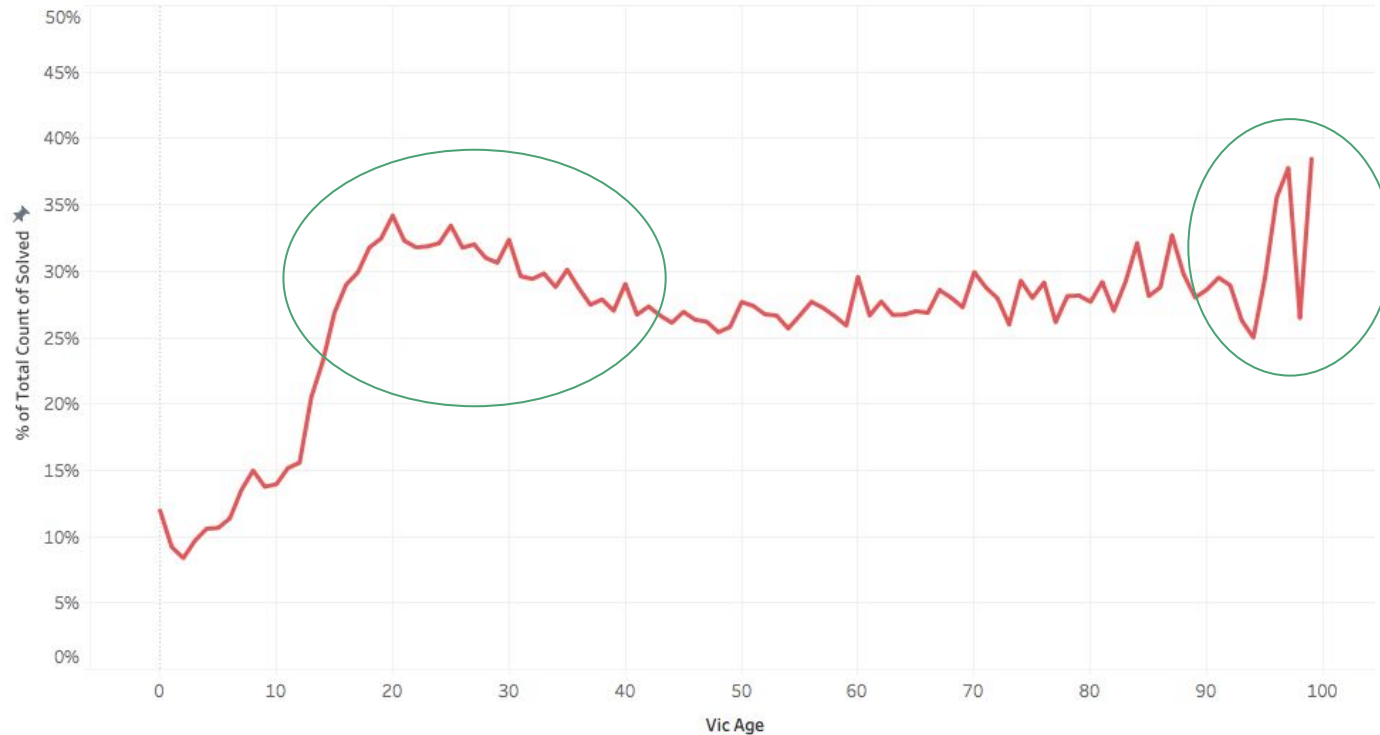
Second Biggest Influencer: Year

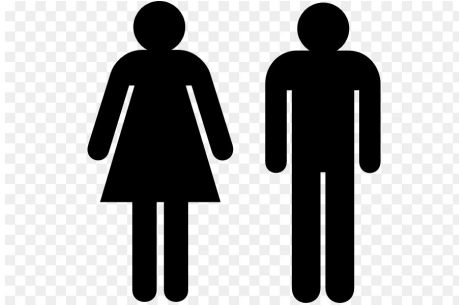

Unsolved Cases are Increasing

Minor Influencers

Victim Count

MSA - Other

Gender

Agent Type - Municipal Police or Other

Other Applications

1. Apply to other crimes

2. "Profile" perpetrators by crime details

Solved or Unsolved?

Me

- Poisoned
- August 2018
- In Seattle
- Investigated by Seattle Police