AI Models Necessary to Reduce Racism in Criminal Justice In The United States of America

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Abstract

As this project commenced, I first focused on gaining some general knowledge about the applications of Artificial Intelligence. As I went through this, I ended up choosing The main focus of this project was to figure out which kind of AI model is best for use in a court setting or the criminal justice system.The goal was to ensure the AI model is accurate and free of skewed/biased data. Throughout this research project, three different regression models are looked at in order to narrow down the most accurate models. This research found that the AI models that can provide the most accurate results are DecisionTreeRegressor, MLPRegressor, and BaggingRegressor. As this research project commenced, it was shown that the BaggingRegressor method enables programmers to train artificial intelligence systems to make decisions in the most accurate manner possible, with the margin of errors and biases decreasing by almost 82% from the MLPRegressor.

Introduction

Racism has always been an issue that the United States has been facing. This issue dates back to before the original founding of the United States, since the colonial days. This situation occurs when one racial or ethnic group dominates, excludes, or seeks to eliminate other racial or ethnic groups. In the case of the United States, this occurred when African were forcibly brought onto American soil in 1619 and when the original Spanish colonizers enslaved the Native Americans in 1492, and when Europeans decided to emigrate from their homes to the United States, in the 1800s, due to issues in their previous areas of residence. While the US holds

significant power as the “Land of the Free,” such events established a dark past for the United States.

In today’s world, hate crimes, unjust police violence, and racially-motivated arrests are occurring throughout the United States. Furthermore, in recent years, there have been great leaps in technology, specifically the development of artificial intelligence. Nowadays, it is possible to use artificial intelligence to complete research projects and get answers.

At the start of the COVID-19 pandemic, many hate crimes and police violence incidents started to arise, causing the rate of protest and chaos in the United States to skyrocket. These numbers and facts caused a big concern about racism in the criminal justice system. Furthermore, such results can move the usage of artificial intelligence in the criminal justice system on the incorrect path. Artificial intelligence is used in this field to profile people and assess the probability of committing a crime in the future.

The following project evaluates the number of total arrests and people killed based on race in each of the 50 States, as well as Washington, District of Columbia. Other factors, such as the budget for the police, as well as the funding for education per pupil, to figure out which kinds of AI models can be used to make sure that the race or ethnicity of suspects does not influence artificial intelligence while making accurate predictions at the same time.

Background

Regression refers to finding relationships between two or more variables in a dataset in order to predict one variable depending on another variable. The three best regressors for this criminal justice situation are DecisionTreeRegressor, MLPRegressor, and BaggingRegressor.

The following project utilizes a large number of regression methods in order to make accurate predictions.

Current Method of Predicting and Preventing Future Crimes

In the past, police departments have implemented various predictive policing programs. However, many of these systems were either inconsistent, biased or just seriously flawed as a program in general. Because of this, the programs ended up being discontinued. Furthermore, some police departments create their own programs to be used in terms of predictions. These programs mainly focus on areas of interest, not people of interest.

However, predictive policing programs that focus on people of interest first became available in 2012 and were used by the Chicago Police Department. The program created lists of people who were considered to commit violent crimes again. However, this program was scrapped in 2012 as it was biased and included everyone arrested or fingerprinted in the city of Chicago since 2013. The technology has not been fully implemented in the criminal justice system on a larger scale and unbiasedly. This is mainly due to the fact that, unfortunately, many individuals of color tend to be the subject of many crimes. With their photo taken and uploaded to the database, the system will only be able to use the available photos to train. Given the disproportionate amount of photos with people of color as the subject, that unfortunately results in a biased artificial intelligence being used by law enforcement.

Dataset

The project required reliable data in order to be successful and accurate. The final dataset used for this project came from two different datasets. The first one was premade and was found on kaggle.com. The second piece of data was created individually, using multiple sources found

in this paper's 'References' section. The premade dataset focuses on violent crimes, arrests, and police killings based on race from 2013 to 2018. The second dataset focuses on violent crimes, arrests, and police killings based on race from 2021. The years that are missing in terms of data are 2019 and 2020.

These two datasets were merged to make one dataset that focuses on statistics at the state level. Fifty samples are included in the final dataset, with eight distinct features included in the final dataset.

Initially, there were not eight distinct features in the final dataset. There was a lot more. However, as testing of the AI models commenced, it was shown that unnecessary information in a dataset could lead to the model being less accurate. Feature extraction started when the datasets were being merged. First, the datasets were incorporated based on the set, using a pandas Dataframe. From there, the command 'df.drop' was used to ensure any undesirable features were taken from the dataset. The features that were dropped were violent crimes reported from 2013 to 2018. This is because the criminals committed violent crimes, not the police. As the crimes committed by criminals cannot promote police violence, it is an unnecessary feature that can mess up the accuracy of the predictions.

Once the unnecessary features were removed, it was required to be able to both train the AI model and then test the AI model afterward. To do this, the dataset must be split into training and testing sets. The ratio of training to testing sets was 2:1, which means that the data is put towards training the model, and 33% of the information is put towards testing the data.

Table 1.1.

State	City	Police Department	Black People Killed by Police (1/1/2013-12/31/2019)	Hispanic People Killed by Police (1/1/2013-12/31/2019)	Native American People Killed by Police (1/1/2013-12/31/2019)	Asian People Killed by Police (1/1/2013-12/31/2019)	Pacific Islanders Killed by Police (1/1/2013-12/31/2019)	White People Killed by Police (1/1/2013-12/31/2019)	Unknown Race People Killed by Police (1/1/2013-12/31/2019)	Total	Black	White	Amer. Indian	Asian	Hawaiian	Other	Two or more races	Hispanic	Black-White Dissimilarity Index (2010)	Murder and nonnegligent manslaughter	Violent crimes 2013 (if reported by agency)	Violent crimes 2014 (if reported by agency)	Violent crimes 2015 (if reported by agency)	Violent crimes 2016 (if reported by agency)	Violent crimes 2017 (if reported by agency)	Violent crimes 2018 (if reported by agency)	2013 Total Arrests (UCR Data)	2014 Total Arrests	2015 Total Arrests	2016 Total Arrests	2017 Total Arrests	2018 Total Arrests
New Mexico	Albuquerque	Albuquerque Police Department	3	18	2	2	2	10	1	545,852	14,878	229,933	20,627	13,674	418	1,224	10,043	255,055	28.48	30	4325	4934	5406	6245	7686	7646	27700	25447	22126	20341	21130	22254
California	Anaheim	Anaheim Police Department	3	7	2	2	2	3	3	336,265	8,209	92,362	743	49,210	1,437	628	6,209	177,467	27.78	14	1130	1101	1271	1209	1253	1192	7891	8137	8381	9415	8869	10019
Alaska	Anchorage	Anchorage Police Department	1	1	2	2	2	5	4	291,826	15,308	182,814	22,047	23,208	5,776	562	20,050	22,061	34.33	12	2435	2605	3226	3422	3564	3824	17601	14748	14387	13294	13871	13973
Texas	Arlington	Arlington Police Department	7	1	2	1	2	4	1	365,438	67,087	164,022	1,338	24,564	373	597	7,188	100,269	39.74	13	1837	1854	1946	2188	5311	1784	17258	16222	13989	11024	8397	9566
Georgia	Atlanta	Atlanta Police Department	13	7	2	2	2	1	1	420,003	224,316	152,377	754	13,098	115	739	6,789	21,815	74.12	93	5517	5577	5203	5121	4504	3814	30505	26958	23460	22161	22581	20182
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Table 1.2.

State	Black People Killed by Police	Hispanic People Killed by Police	Native American People Killed by Police	Asian People Killed By Police	Pacific Islander Killed by Police	White People Killed by Police	Black-White Dissimilarity Index	Murder and Nonnegligent Manslaughter	Violent Crimes	Total Arrests	Budget Per Capita	Total Population
Alabama	8	1	0	0	0	14	57	484	25,754	877	$449.00	5,039,877
Alaska	0	0	2	0	0	5	53	49	6,352	26,408	$524.00	732,673

Arizona	6	9	0	0	0	16	52	502	33,107	183,595	$253.00	7,276,316
Arkansas	1	0	0	1	0	9	65	321	17,702	96,714	$413.00	3,025,891
California	21	69	2	3	2	31	62	2,197	173,038	844,802	$526.00	39,237,836
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Table 1.3.

	Black-White Dissimilarity Index (2010)	Murder and\n nonnegligent manslaughter	Total # of Arrests (2013-2018)	Total Population (2021)	Budget Per Capita for Police	Total # of Educated	State_Alabama	State_Alaska	State_Arizona	State_Arkansas	…	State_Texas	State_Utah	State_Vermont	State_Virginia	State_Washington	State_West Virginia	State_Wisconsin	State_Wyoming	budget_normalized	population_normalized
0	62.560000	52.000000	140573.000000	5039877	$449.00	6.863449e+07	1	0	0	0	…	0	0	0	0	0	0	0	0	0.126005	0.115395
1	34.330000	12.000000	87874.000000	732673	$524.00	6.863449e+07	0	1	0	0	…	0	0	0	0	0	0	0	0	0.615282	0.003980
2	30.820000	41.000000	128298.166667	7276316	$253.00	6.863449e+07	0	0	1	0	…	0	0	0	0	0	0	0	0	0.037229	0.173246
3	52.346446	71.017019	153136.060066	3025891	$413.00	6.863449e+07	0	0	0	1	…	0	0	0	0	0	0	0	0	0.152998	0.063299
4	38.651176	43.823529	97406.529412	39237836	$526.00	6.863449e+07	0	0	0	0	…	0	0	0	0	0	0	0	0	0.296734	1.000000
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…

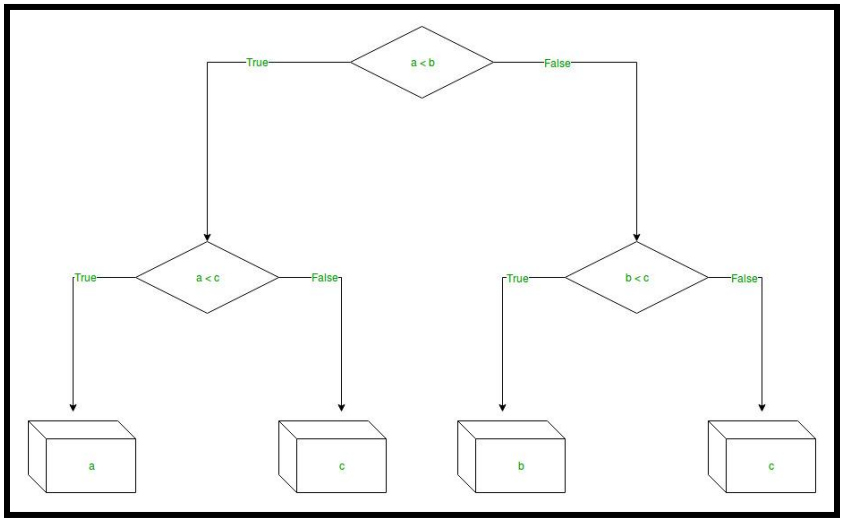
Methodology/Models

First off, the project contained two datasets. One focused on data from 2013 to 2018, and the other focused on data in 2021. With these two datasets, they were merged together in order to make up the final dataset that will be used throughout the project in order to get our answers.

In order to get predictions, and an estimate on the accuracy of the predictions, regressors such as ‘DecisionTreeRegressor’, ‘MLPRegressor’, and ‘BaggingRegressor’ were used. The predictions made by these AI models, first by splitting 67% of the final dataset into training sets, and 33% of the final dataset into testing sets. Furthermore, the final results provided by the model would rely on the usage of the testing set of the final dataset in order to get accurate values that make up the results of the testing set. The testing set refers to the test variables and results of features such as ‘Black-White Dissimilarity Index’, ‘Total # of Arrests (2013-2018)’,

‘Total Population (2021)’, ‘Budget Per Capita for Police’, and ‘Total # of Educated’. This is assuming the fact that there is not much of a difference between the total arrests from 2013 to 2018, and in 2021. The same holds true for the total population.

DecisionTreeRegressor

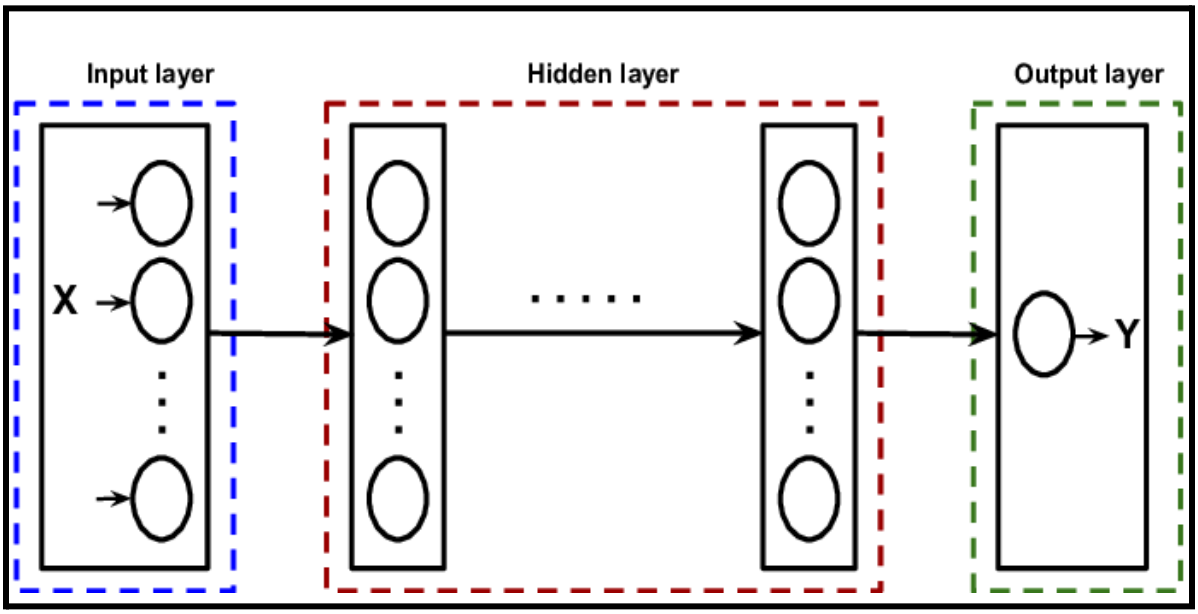


A ‘DecisionTreeRegressor’ is used to build a regression model that breaks down a dataset into smaller subsets. The final result is a regression model with decision nodes and leaf nodes. The decision node has ‘branches’ that represent values for the attribute that is being tested, whereas leaf nodes represent the decision. This kind of AI Model is useful for a situation such as making predictions of the probability of being involved in such police violence or in an arrest based on your race, because the data from the dataset is laid out in a manner that allows the model to make a very accurate prediction.

I used the command ‘from sklearn import tree’ in order to start the DecisionTreeRegressor model. From there, I set the minimum split to be 6, the maximum depth to be 4, and the maximum leaf nodes to be 4, as well. From there, I conducted a ‘clf’ prediction

test with X_test data, and set the results equal to a variable called “prediction_test”. From there, I found the mean squared error and the mean absolute value.

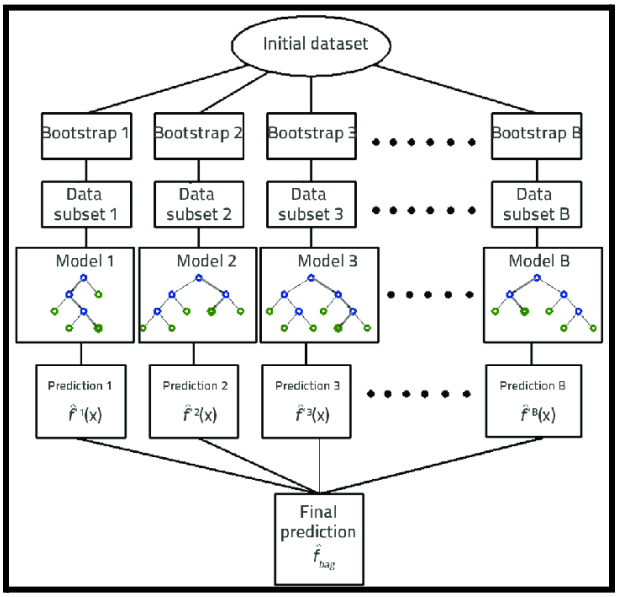
MLP Regressor



“MLP”, which stands for “multi-layer perceptron”, is a kind of neural network. An ‘MLPRegressor’ is an AI model that trains iteratively because at each step, the model uses a loss function to update the parameters of the dataset.

For starters, I used the command ‘from sklearn.neural_network import MLPRegressor’ in order to start the MLPRegressor model. From there, I conducted a “regr” prediction test with the X_test data, and set the results equal to a variable called “Y_predictions”. From there, I found the mean squared error and the mean absolute value.

BaggingRegressor



A 'BaggingRegressor' is an estimator model that fits base regressors in random subsets of the original dataset, and then averages the individual predictions in order to form a final prediction. A 'BaggingRegressor' is useful, as it makes sure the models are as stable as they can be. This allows the AI Model to make a very accurate prediction.

I used the command 'from sklearn.ensemble import BaggingRegressor' in order to start the BaggingRegressor model. From there, I conducted a "regr" prediction test with the X_test data, and set the results equal to a variable called "Y_predictions". From there, I found the mean squared error and the mean absolute value.

Results & Discussion

Figure 1.1: Mean Squared Error vs. AI Model

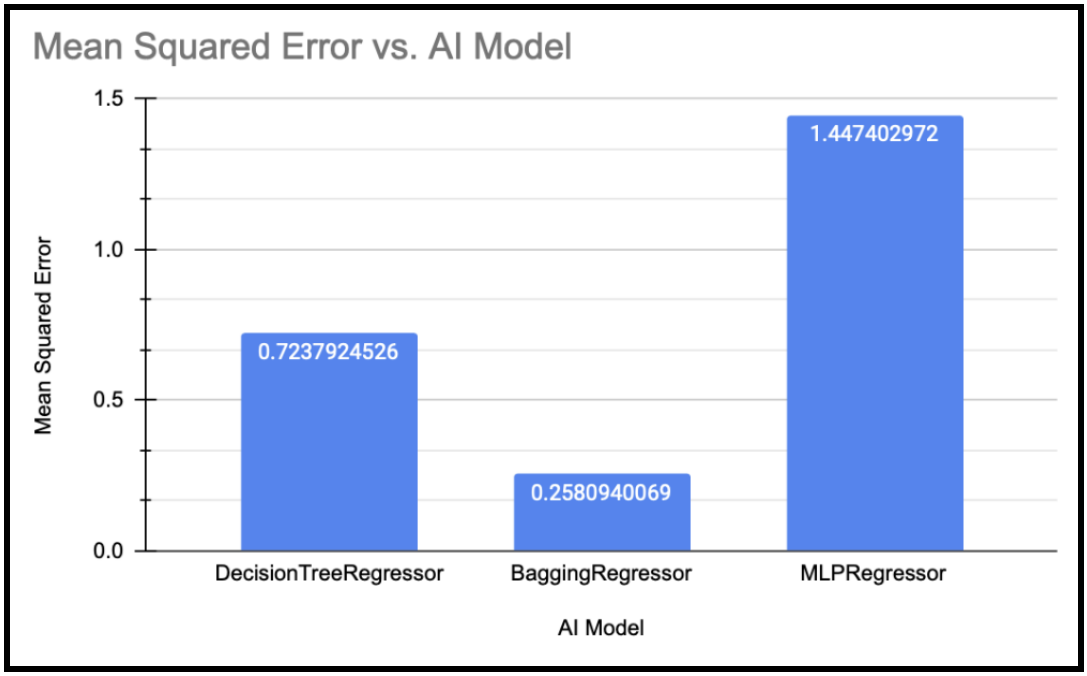


Figure 1.2: Mean Absolute Error vs. AI Model

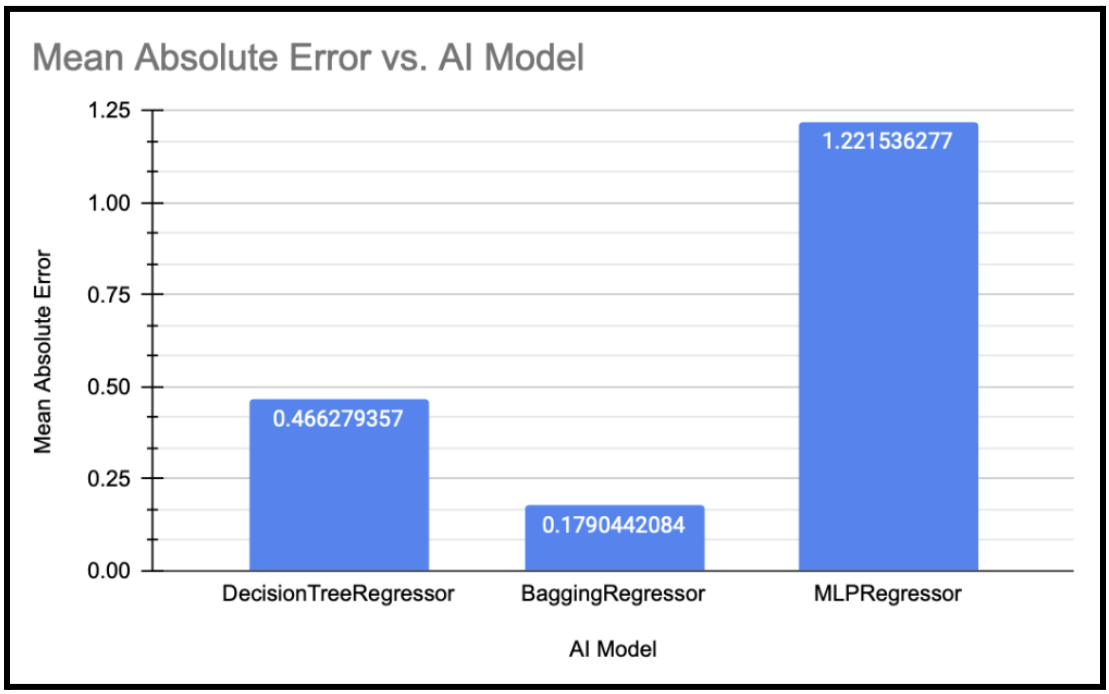


Figure 1.1 depicts the Mean Squared Error values for the three kinds of AI models used in the program. As shown, the BaggingRegressor has the lowest value, the DecisionTreeRegressor is in the middle, and the MLPRegressor has the highest Mean Squared Error value out of these three AI models.

Figure 1.2 depicts the Mean Absolute Error values for the three kinds of AI models used in the program. As shown, the BaggingRegressor has the lowest value, the DecisionTreeRegressor is in the middle, and the MLPRegressor has the highest Mean Squared Error value out of these three AI models.

The data suggests that the BaggingRegessor is one of the best methods to train artificial intelligence systems. The BaggingRegressor had the lowest levels for both the Mean Squared Error and the Mean Absolute Error, followed by the DecisionTreeRegressor. The MLPRegressor had the highest levels for both the Mean Squared Error and the Mean Absolute Error.

Having a low error value when it comes to the predictions of the future actions and conviction of people can enable departments, such as the United States Department of Justice, to have accurate information and predictions necessary to take necessary and unbiased actions. Furthermore, having lower error values can enable us to instill and establish human values into artificial intelligence systems, not only in the criminal justice system but anywhere in general.

One thing to note is that there was missing data during the training and testing of the AI models. There was no data for 2019 and 2020 for any of the features. Furthermore, information about education rates per state from 2013 to 2018 was not present. Given these outlying facts, followed by the received results, it can be assumed that providing a more complete and extended time-spanned dataset can enable more accurate predictions and lower error margins to be obtained from the various AI models.

Given that there were eight distinct features in the final dataset, having more features can also enable more accurate predictions and lower error margins from the various AI models. Throughout this research project, what was found is that the greater the number of features in the final dataset, the more solid, stable, and accurate the AI model is.

As this research project started, the theory was that the DecisionTreeRegressor would be the best method of training AI models in the criminal justice field to be as unbiased as possible. This was because decision tree regression enables predictions to be made in non-linear relationships in the data. However, after seeing the final results, it is now clear that the bagging regression better enables prediction to be made with better accuracy. This is because it uses randomization to improve the performance of the model.

Conclusions

The results found are that using methods such as 'Bagging Regression' can lower the margin of error made by artificial intelligence systems when making predictions, by more than 82%, compared to regressors such as the DecisionTreeRegressor and the MLP Regressor. The BaggingRegressor is one of the most accurate AI models that can be used for training artificial intelligence.

In the future, this information can be used to provide AI training professionals with new ideas to create technologies that can assist in creating a more fair and efficient criminal justice system for their nation. The information can be provided by giving presentations to professionals or informally spreading the word through conversations with people of interest.

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