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A Real Time Application for Crime Trends Prediction using ML Algorithms

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ABSTRACT
Transformation in the transportation sector is imperative to address the environmental issues and combat climate change. The study examined the determinants of intention to adopt cycling as a sustainable work travel mode among individuals in mumbai city. The responses were collected using a structured questionnaire based on the theory of planned behaviour. Individuals riding a cycle or sometimes using a cycle to workplace were the target audience of the study. Sem technique was used to identify the significant determinants of intention to adopt cycling as a sustainable work travel mode. The analysis found the "perception of environment" as the only significant contributor to the intention to adopt cycling as a sustainable work travel mode. The study highlights the urgent need to augment the infrastructure for cycling. The findings of the study may help enhance the usage of cycles as a work travel mode.
Keywords: Bicycling, Cycling, Sdgs 2030, Sustainability, Transportation, Vehicular Emissions

1. INTRODUCTION

In real time crimes are increasing more and there are various types of crimes such as pickpocket, murder, kidnap etc.… Several crime related works have proposed many of techniques to solve the crimes that used too many applications [3]. Crimes are increasing more in day today life. All cities and all over world facing this crime problems. Crime type depends onmany factors such as location, Population, school zone, hospital zone etc... It is very significant to identify the frequent crimes and take necessary actions to reduce thecrimes. In this proposed work we build real time application for crime sector to find frequent crimes in anarea and also we predict relationship between different types of crimes. We apply efficient ML algorithms to process crime data and prediction is done. Data Science,is the trending technology that can applied to solve all type of problems in all types of fields [1]. In this work data science applied to crime sector to process old crimedata or previous years crime data and to find the frequentcrime types and their correlations. Machine learning is useful to train the system using training datasets. Here we use crime datasets, effective algorithms for machine learning are employedto process crime datasets and hidden crime patterns are extracted. Unsupervised learning methods used to train the system and results predicted. Efficient unsupervisedlearning algorithms such as Apriori algorithm, Apriori TID algorithms used to process crime datasets and frequent crimes and their relationships predicted. We develop a real time web application to predict frequent crimes and crime patterns using ML algorithms.

We develop machine learning algorithm for predicting frequent crimes and their relationships and comparing the proposed algorithm with existing algorithm. Our system does identifying crimes and related correlations and provides solution to reduce crimes and making public more alert and active. Systemfinds the correlations between different crime types suchas murder, chain snatching, kidnap, pick pocket, robberyetc.…. We are building a real time application to find the frequent crimes happening today where it is useful for crime sectors to reduce the crimes.

2. RELATED WORKS

Survey Papers

A) IEEE PAPER TITLE: Crime Pattern Detection usingSimple Apriori Algorithm

https://www.semanticscholar.org/paper/Time%2C-Place%2C-and-Modus-Operandi%3A-A-SimpleApriori- ChenKurland/1e0e269245c6501f48ea83b23f52bb298fc 1d98c

https://ieeexplore.ieee.org/document/8633657YEAR OF PUBLICATION: 2020

AUTHORS: Peng Chenn, Justin Kurland.

METHODOLOGY: Apriori Algorithm Used.

DESCRIPTION: This paper aims at applying apriori algorithm to process crime data and suspect crime patterns. Data science techniques are powerful subject toprocess data. This paper aims to resolve the crime problems and bring some solution using previously underutilized parameters from police recorded crime data. To ensure that to achieve the goal, a crime procedure is proposed and 3 factor (1) time; (2) setting;and (3) modus operandi.

LIMITATIONS:

- Uses efficient data mining algorithms
- Huge data required
- More time required for prediction
- Not Implemented as Real Time

B) IEEE PAPER TITLE: A Model for Visual and Intuitive Crime Investigation Based on Associative Rule Mining Technique

https://ieeexplore.ieee.org/abstract/document/8764876 YEAR OF PUBLICATION: 2020

AUTHORS: Edigar adero, George okeyo, Wawerumwangi.

METHODOLOGY: Apriori Algorithm used.

DESCRIPTION: Crime has been part of our society eversince the concept of laws was first approved. There is anincreased concern at governance level due to escalatinglevels of crime both internationally as well as locally inKenya. In this article, the researcher suggests the utilizeof Associative Rule Mining to come up with a model suitable for crime analysis and prevention using Apriorialgorithm to represent mutual implications among criminal occurrences.

LIMITATIONS:

- Apriori Algorithm used which process hugeamount of crime data. Needs more data.
- Needs more time for crime data analysis.
- Doesn't predicts the crime relationships.

C) IEEE PAPER TITLE: Predicting Crime ThroughData Mining Methods

https://www.researchgate.net/publication/220765686_Crime_Forecasting_Using_Data_Mining_Techniques

YEAR OF PUBLICATION: 2020

AUTHORS: Chung-Hsien Yu, Max W. Ward, MelissaMorabito, and Wei Ding.

METHODOLOGY: Classification Techniques Used.

DESCRIPTION: Most crimes are "undetermined." It doesn't always happen at random, but it also doesn't happen in space or time consistently.In this research, wediscuss preliminary results of a crime prediction model developed in collaboration with local police departments in the northern United States. We analyzedseveral classifications to determine which method is best at predicting crime "hot spots." We also focused at the addition or formation of groups.

LIMITATIONS:

- Data mining Algorithms used, so huge amount of data required
- Less Accurate Results

3. Difference between Existing Works and Proposed Work

❖ In most of the current projects the implementationis successful, but the algorithms used are not programmed and they use off-the-shelf libraries and tools that the algorithms use. However, in the system concept, we program the algorithm, that is,we program own logic for the algorithm and the results are tested.

❖ Many research works uses less amount of training data-sets, in the proposed system we use huge data-sets for processing.

❖ All existing works uses PYTHON or R Language or Ready Data science tools for prediction and which works for static datasets, but in the proposedsystem we implement the concept for dynamicdatasets (real time application).

❖ All existing works are just model development, can't be used in real time. Here we build thisconcept as real time application using front end technology as "*visual Studio*" and back end technology as "*SQL Server*" and C# as programming language.

❖ Suggested system is a real world application with model using Microsoft technologies.

Current Work

The proposed procedure can also be applied to criminalcases. The planning process includes crime modeling, accurate detection, equipment planning and replacement, and operation time to find out thenecessary algorithms for crime detection. The proposedsystem detects criminal behavior, predicts crime, accurately analyzes and manages huge amounts of information gathered from various sources. The proposed system uses data science technology"association rules" to predict the relationship between different types of crimes.

Example: location "vijayanagara", depending on theearlier crime data we can predict the different types of crime that takes place in future.

Output – Crime patterns with different crime types in "vijayanagara" for upcoming days.

1. Robbery, murder related to suicide
2. Child abusing related to murder
3. Chain snatching, robbery related to murder
4. Pick pocket, chain snatching related to robberyand murder

	A
1	Crimes
2	Murder, Kidnap, Chain Snatching, Robbery, Half Murder
3	Kidnap, Chain Snatching, PickPocket, Neck Hanging
4	Murder, Single Car Chain Snatching, Half Murder
5	Murder, Kidnap, Chain Snatching, Hit n Run
6	Hit n run, Drunk n Drive, Chain Snatching, Theft
7	Murder, Kidnap, Chain Snatching, Neck Hanging, Man Handling
8	Murder, Chain Snatching, Robbery
9	Drunk n Driven, Kidnap, Chain Snatching, Theft
10	Kidnap, Hit n run, Half Murder
11	Kidnap, Chain Snatching, Robbery, Half Murder
12	Murder, Kidnap, Chain Snatching, Robbery, Half Murder
13	Chain Snatching, Kidnap,Hit n run, Neck Hanging, Man Handling
14	Single Car Accident, Chain Snatching, Hit n Run
15	Bad Light, Kidnap, Chain Snatching, Hit n Run, Neck Hanging
16	Kidnap, Chain Snatching, Neck Hanging, Hit n Run
17	Murder, Single Car Chain Snatching, Half Murder
18	Murder, Kidnap, Chain Snatching, Hit n Run
19	Hit n run, Kidnap, Chain Snatching, Neck Hanging
20	Bad Light, Kidnap, Chain Snatching, Hit n Run, Neck Hanging

MysDept

Fig 1*:* Crime Datasets

4. METHODOLOGY

4.1 Unsupervised Learning

A Descriptive model is used for tasks that would benefitfrom the insight gained from summarizing data in new and interesting ways. There are no predefined labels in unsupervised learning technique. The goal is to explorethe data and find some structure with in. Unsupervised learning works well on transactional data.

In our project Association learning algorithms used such as "Apriori Algorithm and Apriori TID Algorithm. These algorithms preferred as algorithms supports small datasets and also large datasets.

4.2 Process Flow

Step 1: Previous year's crime data gathered from different sources such as kaggle.com, dataworld.com, data.gov.in, githib.com etc...

Step 2: Here crime data is preprocessed, where we remove unwanted data and fetch the required data.

Unwanted data such as crime no, serial no etc. will be removed.

Step 3: Required data is inputted to algorithms. We use efficient algorithms such as Apriori algorithm and Eclatalgorithm to process the data.

Step 4: After processing, frequent crimes will be extracted and displayed.

Step 5: Relationship between different types of crimes will be extracted and displayed.

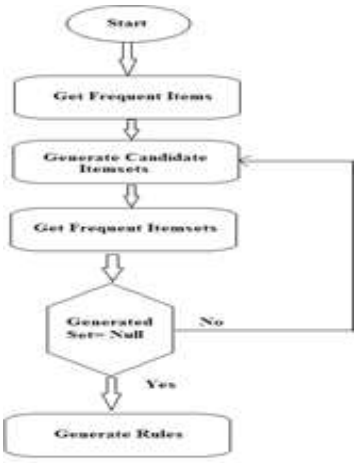
Step 6: Both algorithms results compared and efficient algorithm will be chosen.

Step 7: Final outputs displayed on GUI.

Step 8: Comparative analysis of algorithms displayed using graphs.

4.3 Apriori Algorithm Pseudo-code

1) L1 = {flarge 1-itemsets};
2) for (k = 2; Lk-1 ≠0 ; k++) do begin
3) Ck = apriori-gen(Lk-1); // New candidates
4) forall transactions t ϵ D do begin
5) Ct = subset(Ck, t); // Candidates contained in t
6) forall candidates c ϵ Ct do
7) c:count++;
8) end
9) Lk = {c ϵ Ck | c:count ≥ minsup}
10) end
11) Answer = U k Lk;

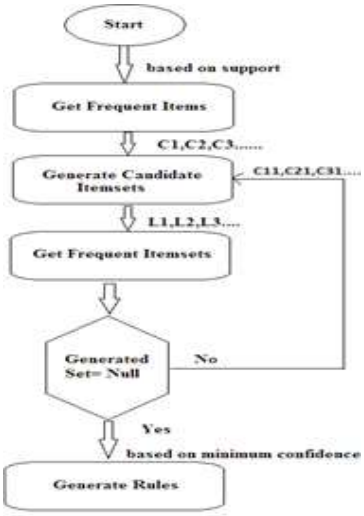


Flow of the Algorithm

Fig 2*:* Flow of Apriori Algorithm

4.4 Apriori TID Algorithm Pseudo-code

1) L1 ={ large 1-itemsets} ;
2) $\bar{C}1$= database D;
3) for (k = 2; Lk-1 ≠0; k++) do begin
4) Ck = apriori-gen(Lk-1); // New candidates
5) $\bar{C}k$ = 0;
6) forall entries t ϵ $\bar{C}k$-1 do begin
7) // determine candidate itemsets in Ck contained in the transaction with identfier t.TID
Ct = {c ϵ Ck | (c - c[k]) ϵ t.set-of-itemsets ^ (c c[k-1]) ϵ t.set-of-itemsets};
8) forall candidates c ϵ Ct do
9) c.count++;
10) if (Ct ≠0;) then $\bar{C}k$ += < t.TID, Ct >;
11) end
12) Lk = {c ϵCk | c.count ≥ minsup}
13) end
14) Answer = Uk Lk;



Flow of the Algorithm

Fig 3: Flow of Apriori TID Algorithm

4.4 Association Learning

Sample Dataset

TID	Crimes
1	Robbery, Kidnap, Chain snatching
2	Robbery, Kidnap, Pickpocket
3	Robbery, Murder, Kidnap, Pickpocket
4	Murder, Pickpocket

Minimum Support = 50%

Minimum Confidence = 80%

C1	
Items	**Support**
Robbery	75%
Murder	50%
Kidnap	75%
Chain snatching	25%
Pickpocket	75%

L1	
Items	**Support**
Robbery	75%
Murder	50%
Kidnap	75%
Pickpocket	75%

C2	
Items	**Support**
Robbery, Murder	25%
Robbery, Kidnap	75%
Robbery, Pickpocket	75%
Murder, Kidnap	50%
Murder, Pickpocket	25%
Kidnap, Pickpocket	50%

L2	
Items	**Support**
Robbery, Kidnap	75%
Robbery, Pickpocket	50%
Murder, Pickpocket	50%
Kidnap, Pickpocket	50%

C3	
Items	**Support**
Robbery, Kidnap, Pickpocket	50%
Robbery, Murder, Kidnap	25%
Robbery, Murder, Pickpocket	25%
Murder, Kidnap, Pickpocket	25%

L3	
Items	**Support**
Robbery, Kidnap, Pickpocket	50%

FREQUENT ITEM SET (L)

Items	Support
Robbery	75%
Murder	50%
Kidnap	75%
Murder, Kidnap, Pickpocket	25%
Pickpocket	75%
Robbery, Kidnap	75%
Robbery, Pickpocket	50%
Murder, Pickpocket	50%
Kidnap, Pickpocket	50%

GENERATE CONFIDENCE

RULE X	RULE Y	C
{ Robbery }	> { Kidnap }	100%
{ Kidnap }	> { Robbery}	100%
{ Robbery }	> { Pickpocket }	66%
{ Pickpocket }	> { Robbery }	66%
{ Murder }	> { Pickpocket }	100%
{ Pickpocket }	> { Murder }	66%
{ Kidnap }	> { Pickpocket }	66%
{ Pickpocket }	> { Kidnap }	66%
{ Robbery }	> { Kidnap, Pickpocket}	66%
{ Kidnap }	> { Robbery, Pickpocket}	66%
{ Pickpocket }	> { Robbery, Kidnap}	66%
{ Kidnap, Pickpocket }	> { Robbery}	100%
{ Robbery, Pickpocket }	> { Kidnap}	100%
{Robbery Kidnap }	>{ Pickpocket	66%

STRONG ASSOCIATION RULE

1. { Murder } -> { Pickpocket }
2. { Kidnap Pickpocket } -> { Robbery }
3. { Robbery Pickpocket } -> { Kidnap }
4. { Robbery } -> { Kidnap }
5. { Kidnap } -> { Robbery }

5. EXPERIMENT RESULTS

Apriori Algorithm - Accuracy, Correct Patterns andIncorrect Patterns

Fig 4: Apriori Patterns with Accuracy

6. CONCLUSION

Identifying different types of crimes that can take place in upcoming days plays a significant role in the current crime or investigation sector. Taking precautionary measures to avoid crimes is also important to reduce crimes in a city. Proposed system predicts frequent crimes and their relationship in advance, so that police or investigation departments can take

necessary actionsto reduce crimes. We are building a real timeapplication where it is useful for crime sectors to decrease the number of crimes. Now day's crimes are increasing rapidly and we need a system which detects crimes and stops crimes before it starts. Finding frequent crimes and relationship between crime types is a challenging tasks in the current crime sector. There is no automation for crime prediction. Crime prevention and detection becomean important trend in crime and a very challenging to detect and solve crimes. Determining the crime patterns is a major challenge in today's world to reduce the crimes and to take the precautionarymeasures to avoid crimes. So our system is applicable in the field of crime. We built a real time application where it is useful for crime sectorsto reduce the crimes. We use data science algorithms for crime patterns prediction to get better results and our system helps publics and police departments in identifying the crimes in right time and to reduce the crimes.

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