3.3.2 Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings per teacher during year (2019-20)

| S No. | Name of the teacher | Title of the book/chapters published | Title of the paper | Title of the proceedings of the conference | Name of the conference | National / International | Year of publication | ISBN/ISSN number of the proceeding |
|---|---|---|---|---|---|---|---|---|
| 1 | Mrs.Lalitha Saroja Thota | | Rule-based Mining of Juvenile Delinquency | International Conference on Computer Communication and Informatics (ICCCI -2020), Jan. 22 – 24, 2020, Coimbatore, INDIA | International Conference on Computer Communication and Informatics (ICCCI -2020), Jan. 22 – 24, 2020, Coimbatore, INDIA | International | 2020 | 2329-7190 |
| 2 | Mrs.Alla Sravani | | Rule-based Mining of Juvenile Delinquency | International Conference on Computer Communication and Informatics (ICCCI -2020), Jan. 22 – 24, 2020, Coimbatore, INDIA | International Conference on Computer Communication and Informatics (ICCCI -2020), Jan. 22 – 24, 2020, Coimbatore, INDIA | International | 2020 | 2329-7190 |
| 3 | Mr.S.Rajender | | Rule-based Mining of Juvenile Delinquency | International Conference on Computer Communication and Informatics (ICCCI -2020), Jan. 22 – 24, 2020, Coimbatore, INDIA | International Conference on Computer Communication and Informatics (ICCCI -2020), Jan. 22 – 24, 2020, Coimbatore, INDIA | International | 2020 | 2329-7190 |
| 4 | Mrs.Koppula Shireesha, | | Rule-based Mining of Juvenile Delinquency | International Conference on Computer Communication and Informatics (ICCCI -2020), Jan. 22 – 24, 2020, Coimbatore, INDIA | International Conference on Computer Communication and Informatics (ICCCI -2020), Jan. 22 – 24, 2020, Coimbatore, INDIA | International | 2020 | 2329-7190 |

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# Rule-based Mining of Juvenile Delinquency

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*Abstract*— **The incremental expansion of juvenile delinquency or criminal offence done by children below 18 years age is extensively perceived in India. There are innumerable elements like family & parents, schooling & education levels, monetary problems, internet, easy online videos availability, peer groups, mental issues, drugs, media, etc tender for immoral ideas in the teens. In this research paper, we extend the work of association rule mining of Juvenile delinquency [3] with two major risk elements, family background & education levels of children convoluted in crimes. We discover strong rules connecting family background, education levels and juvenile delinquency with Indian Juvenile crime dataset by association rule mining, a rule-based machine learning mechanism**

***Keywords-Juvenile delinquency, Data mining, machine learning, Association rule mining, Support, Confidence, WEKA tool***

## I. INTRODUCTION

The incremental expansion of juvenile delinquency or criminal offence done by children below 18 years age is extensively perceived in India. The recent Hyderabad Disha rape case and Delhi Nirbhaya rape case are few of heinous crimes which persisted long in peoples mind and media. Shockingly some minor childrens are convoluted in these crimes. In 2015 year alone, over 31000 juvenile cases are filed in India as per statistics of National Crime Records Bureau NCRB India [1]. Fig 1 gives graphical overview of the major juveniles crime cases statistics for the years 2010-15 in India.

The soft children mind can be carved and turned towards crimes by innumerable elements like family & parents, schooling & education levels, monetary problems, internet, easy online videos availability, peer groups, mental issues, drugs, media, etc [2]. Family is the learning center for children to learn bad or good qualities. The rejected children by parents or children living with guardians or homeless children are found at high risk of becoming offenders. In building the personality of youth, school education also plays a pivotal role. Some key elements in the schooling setup like expulsions, failures in academics, disciplinary punishments and school dropout also adds juvenile offence cases.

In this research paper, we extend the work of association rule mining of Juvenile delinquency [3] with two major risk elements, family background & education levels of children convoluted in crimes. We discover strong rules connecting family background, education levels and Juvenile delinquency with Indian Juvenile crime dataset by association rule mining, a rule-based machine learning mechanism

## II. RELATED WORK

The primitive growth hubs of children are family and home. The family and the parents are primarily responsible for overall development of children and protect them towards negative criminal moments. If a family does not provide support and guidance, the children tend towards crimes.

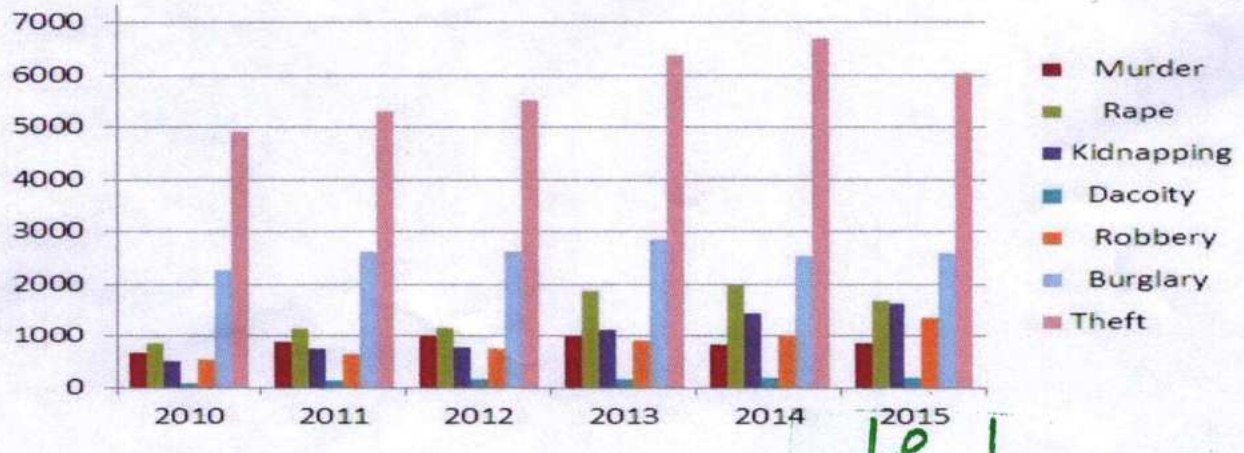


Figure 1. Major Juvenile crimes statistics of India during 2010-15

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The primary risk elements regarding the family which motivate juvenile crimes are low parent monitoring levels, hard strictness of parents like rude punishments, breakup cases of parents, quarrels & clashes between family members, criminal parents, brothers or sisters etc. [3]. School education is a foundation component in childs life. In school-to-prison pipeline the primary parts found are school suspensions, punishments, academics failures and dropouts. Schept et al [4] reports that crime offending nature in children who dropout schools are eight times more when compared to children passing high school.

Several classification and clustering techniques available in data mining were employed for crime identification, detection and analysis [5,6]. In this research paper, we extend the work of association rule mining of Juvenile delinquency [3] with two major risk elements, family background & education levels of children involved in crimes to discover strong rules in Juvenile delinquency dataset of India

## III. Methodology

Valuable knowledge and information are hidden in large databases and data warehouses. Mining hidden knowledge with various algorithms and methods is data mining process. Few techniques of data mining used in hidden knowledge extraction are generalization, association, classification, clustering etc. which use different algorithms and methods of machine learning. In many fields like banks, insurance, sales & marketing, manufacturing, CRM, health care, bioinformatics, crime analysis and fraud identification etc data mining is used as a powerful tool [7] for beneficial explorations.

Association rule mining [8] is a rule-based machine learning mechanism to discover rules, associations and relations, frequent patterns among key attributes in large warehouses and databases by applying key measures like support, confidence. Rules of association mining are generally like if/then relation having two parts, (if) an antecedent part and (then) a consequent part. The rule form:

Antecedent → Consequent [support, confidence]

An association mining rule example is like:

buys(x,"tea") ^ buys(x,"sugar") → buys(x,"milk") [65%, 95%]

The juvenile crime dataset is built from the overall crime statistics of India [1]. The dataset is loaded in WEKA tool and preprocessing steps are applied. The clean juvenile data is deployed for association mining task to generate association rules which meet minimum support level (65%) and minimum confidence (95%) levels specified by the user. The association rules generated are investigated and appraisal is made for making inferences and interconnections between juvenile crimes and two major risk elements, family background and education levels. An overview of the association rule mining architecture employed with juvenile dataset is shown in Fig 2.

Java an object oriented programming language was used to build WEKA data mining tool. WEKA stands for Waikato Environment for Knowledge Analysis. WEKA software was created by University of Waikato in New Zealand. Several algorithms, methods of machine learning are implemented in WEKA for data preprocessing, association, classification, clustering etc. Huge data can be seen graphically in WEKA with in-built visualization functions [9]

## IV. Experiments, Results and Discussions

In this research paper we extend the work of association rule mining of Juvenile delinquency [3] with two major risk elements, family background & education levels of children involved in crimes. The juvenile crime dataset is built from the NCRB statistics of India [1]. The crime data contains many crime statistics for years 2001-15. Juvenile crime records (527) are collected by applying filter on the crime data and save in excel sheet. The juvenile crime data of India (part) for years 2001-15 is presented in Fig 3

Excel juvenile data file is saved in CSV format and used in WEKA tool for further processing. In preprocessing stage, we load CSV file and remove unnecessary attributes (area, year, sub group) and discretize some attributes (education level attributes illiterate, upto primary, above primary but below matric, matric or above, family background attributes homeless, living with parents living with guardian and total crime) and prepare the juvenile dataset for association rule mining task. After preprocessing stages, the CSV file is saved in ARFF format. Association rules mining task is applied on the dataset in juvenile ARFF file with apriori algorithm and parameters min support (65%), min confidence (95%) and the five top rules are generated. The WEKA output file with association rules are presented in Fig 4 which shows the co-relating rules of childrens family background & education levels and juvenile crimes.

The top five rules generated with juvenile family background and education levels combined with crimes discovers more illiterate juvenile's are in first category to make crimes. The children who live guardians are in second group youth incline to crimes. The children who study upto primary school are in third tier youth to offend juvenile crimes. Similarly on investigating the fourth and fifth top rules we derive youth who finish metric and above education are in fourth level and juveniles who lives with parents are in fifth zone are making juvenile crimes. We discover strong rules connecting family background, education levels and Juvenile delinquency with Indian Juvenile crime dataset by association rule mining, a rule-based machine learning method

The crime reports and analysis of data in 2015 by NCRB India [1] shows 86% of the apprehended children lived with parents and one third of total juvenile crimes are offended by minors study only upto primary school. The outcome association rules generated in the experiment are similar and in line of the overall NCRB crime statistics of India [1].

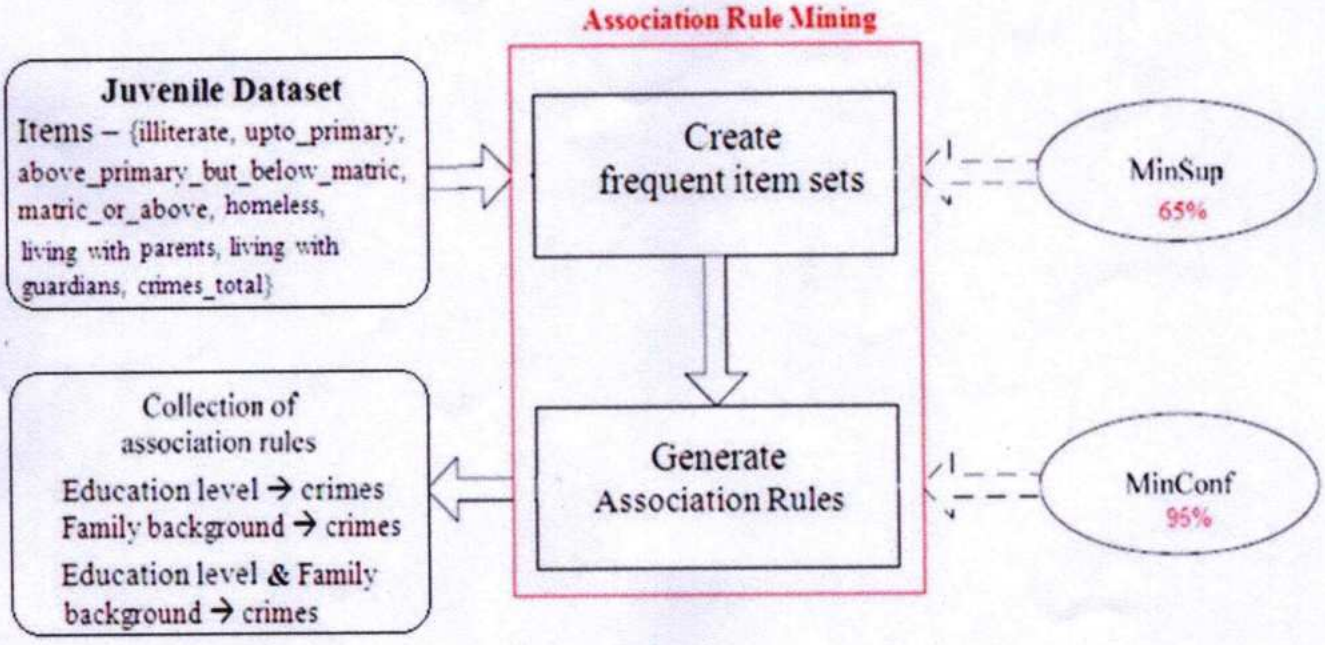
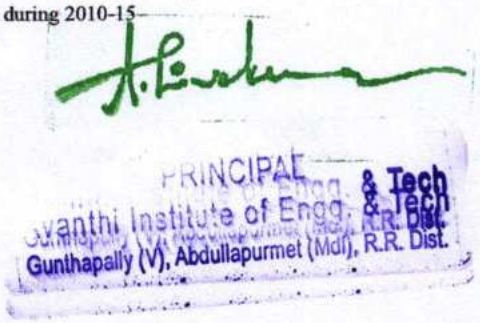



Figure 2. Association rule mining of Juvenile dataset

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | area_name | year | sub_group_na | illiterate | upto_primary | above_primary_but_below_matric | above_matric_or_higher |
| 2 | Andaman & Nicobar | 2001 | 1. Education | 0 | 4 | 12 | 0 |
| 3 | Andhra Pradesh | 2001 | 1. Education | 640 | 683 | 178 | 64 |
| 4 | Arunachal Pradesh | 2001 | 1. Education | 16 | 70 | 39 | 12 |
| 5 | Assam | 2001 | 1. Education | 91 | 88 | 74 | 0 |
| 6 | Bihar | 2001 | 1. Education | 190 | 253 | 87 | 56 |
| 7 | Chandigarh | 2001 | 1. Education | 12 | 26 | 33 | 0 |
| 8 | Chhattisgarh | 2001 | 1. Education | 205 | 748 | 348 | 61 |
| 9 | Dadra & Nagar Have | 2001 | 1. Education | 0 | 2 | 0 | 0 |
| 10 | Daman & Diu | 2001 | 1. Education | 2 | 0 | 0 | 0 |

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | area_name | year | sub_group_name | homeless | living_with_parents | living_with_guardian | total_crime |
| 2 | Andaman & Nicobar | 2001 | 3. Family Background | 0 | 16 | 0 | 16 |
| 3 | Andhra Pradesh | 2001 | 3. Family Background | 552 | 726 | 287 | 1565 |
| 4 | Arunachal Pradesh | 2001 | 3. Family Background | 0 | 79 | 58 | 137 |
| 5 | Assam | 2001 | 3. Family Background | 21 | 158 | 74 | 253 |
| 6 | Bihar | 2001 | 3. Family Background | 43 | 442 | 101 | 586 |
| 7 | Chandigarh | 2001 | 3. Family Background | 0 | 67 | 4 | 71 |
| 8 | Chhattisgarh | 2001 | 3. Family Background | 37 | 1182 | 143 | 1362 |
| 9 | Dadra & Nagar Have | 2001 | 3. Family Background | 0 | 2 | 0 | 2 |

Figure 3. Juvenile crime data (part) of India during 2010-15



```
=== Run information ===
Scheme:   weka.associations.Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0 -c -1
Relation:   juv5-weka.filters.unsupervised.attribute.Remove-R1-2-weka.filters.unsupervised.attribute.Discretize-B2-M-1.0-Rfirst-last-
precision6-unset-class-temporarily
Instances:  211
Attributes:  8
        illiterate
        upto primary
        above primary but below matric
        matric & above
        living with parents
        living with guardians
        homeless
        total crime
=== Associator model (full training set) ===
Apriori
=======
1. illiterate=0_242 151 ==> total crime=0_4006 151    <conf:(1)> lift:(1.09) lev:(0.06) [12] conv:(12.17)
2. living with guardians=0_175 150 ==> total crime=0_4006 150    <conf:(1)> lift:(1.09) lev:(0.06) [12] conv:(12.09)
3. upto primary=0_436 149 ==> total crime=0_4006 149    <conf:(1)> lift:(1.09) lev:(0.06) [12] conv:(12)
4. matric & above=0_144 149 ==> total crime=0_4006 149    <conf:(1)> lift:(1.09) lev:(0.06) [12] conv:(12)
5. living with parents='(-inf-0.5]' 147 ==> total crime=0_4006 147    <conf:(1)> lift:(1.09) lev:(0.06) [11] conv:(11.84)
```

Figure 4. WEKA output file and association rules relating Education levels & Family background of Juveniles and total crimes

## V. Conclusion And Future Work

We examine and analyze the connection of family background & education level risk elements which primarily cause juvenile delinquency with an experimental study with Indian juvenile crime dataset. The results show a strong association of family background & education levels and juvenile delinquency. The association rules generated are similar and in line with India NCRB crime statistics.

In future, studies like this can be undertaken for evaluating many risk elements with distinct algorithms and techniques of machine learning to investigate the connection between all primary risk elements and juvenile delinquency

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