Predictive Analysis Model for Recommending Police Personnel

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**Literature Survey**

Manish Gupta, B. Chandra and M.P. Gupta tries to understand the current scenario of Indian Police System and they apply data mining tool and techniques to real data set of Karnataka state and the applied it on data of whole state, Concluded that use of now a days technology will help effectively in decreasing crime rate and also help to find hot spot of crime etc things ("Crime data mining for Indian police information system.", Manish Gupta, B. Chandra and M.P. Gupta) [1].

Author developed a Business Intelligence solution for Personnel planning (Military Staff). Author used data mining concepts and work on how data mining process can carried out, how data from different can preprocessed and represented so that process may become more feasible. Author used Web based Application like OLAP and Google chart tool to represent data extracted ("Development of business intelligence solution for personnel administration.", Keerin, Phimmarin) [2].

They predict Employee Churn by using Data Mining. Since churn analysis done on customers mostly so they did it on data set of Employee of a Company and implemented data Classification techniques such as decision tree, Naive Bayes etc. ("An approach for predicting employee churn by using data mining.", Yiğit, İbrahim Onuralp, and Hamed Shourabizadeh) [3].

In year 2008 authors used Data Mining Technique to make effective use of Human Resource in construction company. They developed data mining framework to extract useful information about relation between personnel and work behavior. This helps in getting the right person for a job ("Data mining to improve human resource in construction company.", Youzheng, Chang, and Guan Ming) [4].

Sangita Gupta and V. Suma used data mining techniques like decision tree for getting right professional according to project requirement in field of Software Engineering so that the quality of software delivered get boosted ("Data mining: A tool for knowledge discovery in human aspect of software engineering.", Gupta, Sangita, and V. Suma)[5].

Compared different regression models like linear regression, support vector regression, decision tree, forest regression and find out which regression model gives better result ("A Comparison of Regression Models for Prediction of Graduate Admissions.", Acharya, Mohan S., Asfia Armaan, and Aneeta S. Antony) [6].

Author of this paper used data-driven approach to predict the short-term crime forecasting. They used deep learning architecture like artificial neural network. Type of ANN (i.e. LSTM, RNN etc.) is decided by using sum of least squared error and virtual leave-one-out test (VLOO) is used to optimize the number of hidden nodes. They were successfully able to train their NN on unstructured police records for Spatiotemporal data. (2018: Zbigniew M. Wawrzyniak, Stanisław Jankowski, Eliza Szczechla, "Data-driven models in machine learning for crime prediction") [7].

Author of this paper was motivated that by the relation between human mobility influencing crime behavior in big cities, this relation can be used to allocate police in to certain spots in the city. It was found that the correlation between police officer and FPA (floating population allocation) is much higher than RPA (resident population allocation), hence the allocation based on the clusters of floating population tends to be more adequate for fighting crime against properties because the distribution of police resources will naturally follow. (2017: Carlos Caminha, Vasco Furtado, "Impact of Human Mobility on Police Allocation") [8].

The authors state that crime records is highly spatial-temporal in nature where the traditional system of criminal records has failed to maintain the desired level of intelligence. To have usable information from time series data, big data and ARIMA (auto regressive integrated moving average) model was proposed. Crime records from National Crime Record Bureau for the state of Haryana(India) was used found that the Generalized Linear Model (GLM) for Crime Site Selection (CSS) using Big Data deliver better results and forecast spatio-temporal crime events with certainty (2018 : Romika Yadav , Savita Kumari Sheoran, "Crime Prediction Using Auto Regression Techniques for Time Series Data")[9].

In this paper the goal of the author is to estimate the staffing levels over different shifts on a time range of days in order to optimize the overall Estimated Time to Restoration (ETR) so that the maximizing crew efficiency can be achieved. The full mathematical model and the constraint programming formulation for the planning problem were presented to the paper. this exposes several decision knobs (node in decision tree) and constraints programming to model complex business constrains into a scheduling problem. (2015: , Ali Koc, Amith Singhee, Ashish Sabharwal, Richard Mueller, Gerard Labut, "Optimal spatio-temporal emergency crew planning for a distribution system")[10].

**Summary Table**

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| **Author** | **Title** | **Year** | **Finding** |
| Manish Gupta, B. Chandra and M.P. Gupta | Crime data mining for Indian police information system. | 2008 | Data Mining techniques helps in decreasing crime rates. |
| Keerin, Phimmarin | Development of business intelligence solution for personnel administration. | 2016 | Data Visualization using web based application like Olap and Google chart tool. |
| Yiğit, İbrahim Onuralp, and Hamed Shourabizadeh | An approach for predicting employee churn by using data mining. | 2017 | We can also use data mining concept in employee churn just like in customer churn. |
| Youzheng, Chang, and Guan Ming | Data mining to improve human resource in construction company. | 2008 | One more field where we can use data mining. In recruitment of workers. |
| Gupta, Sangita, and V. Suma | Data mining: A tool for knowledge discovery in human aspect of software engineering | 2015 | Selection of employee or professional in IT for particular project. |
| Acharya, Mohan S., Asfia Armaan, and Aneeta S. Antony | A Comparison of Regression Models for Prediction of Graduate Admissions | 2019 | Every model works better than other in different cases. |
| Zbigniew M. Wawrzyniak, Stanisław Jankowski, Eliza Szczechla | Data-driven models in machine learning for crime prediction | 2018 | virtual leave-one-out test is used to find the optimal number of hidden nodes for Spatiotemporal data |
| Carlos Caminha, Vasco Furtado | Impact of Human Mobility on Police Allocation | 2017 | correlation between FPA is more than that of RPA with crime rate. |
| Romika Yadav, Savita Kumari Sheoran | Crime Prediction Using Auto Regression Techniques for Time Series Data | 2018 | for time series data, big data and ARIMA model used for Crime Site Selection. |
| Ali Koc, Amith Singhee, Ashish Sabharwal, Richard Mueller, Gerard Labut | Optimal spatio-temporal emergency crew planning for a distribution system | 2015 | constraints programming to model complex business constrains into a scheduling problem |
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[7] Zbigniew M. Wawrzyniak, Stanisław Jankowski, Eliza Szczechla, "Data-driven models in machine learning for crime prediction" Wawrzyniak, Z. M., Jankowski, S., Szczechla, E., Szymanski, Z., Pytlak, R., Michalak, P., & Borowik, G. (2018). Data-driven models in machine learning for crime prediction. 2018 26th International Conference on Systems Engineering (ICSEng). doi:10.1109/icseng.2018.8638230

[8] Caminha, C., & Furtado, V. (2017). Impact of human mobility on police allocation. 2017 IEEE International Conference on Intelligence and Security Informatics (ISI). doi:10.1109/isi.2017.8004886

[9] Romika Yadav, Savita Kumari Sheoran, "Crime Prediction Using Auto Regression Techniques for Time Series Data"3rd International Conference and Workshops on Recent Advances and Innovations in Engineering, 22-25 November 2018

[10] Ali Koc, Amith Singhee, Ashish Sabharwal, Richard Mueller, Gerard Labut, "Optimal spatio-temporal emergency crew planning for a distribution system" 2015 IEEE Power & Energy Society Genera.