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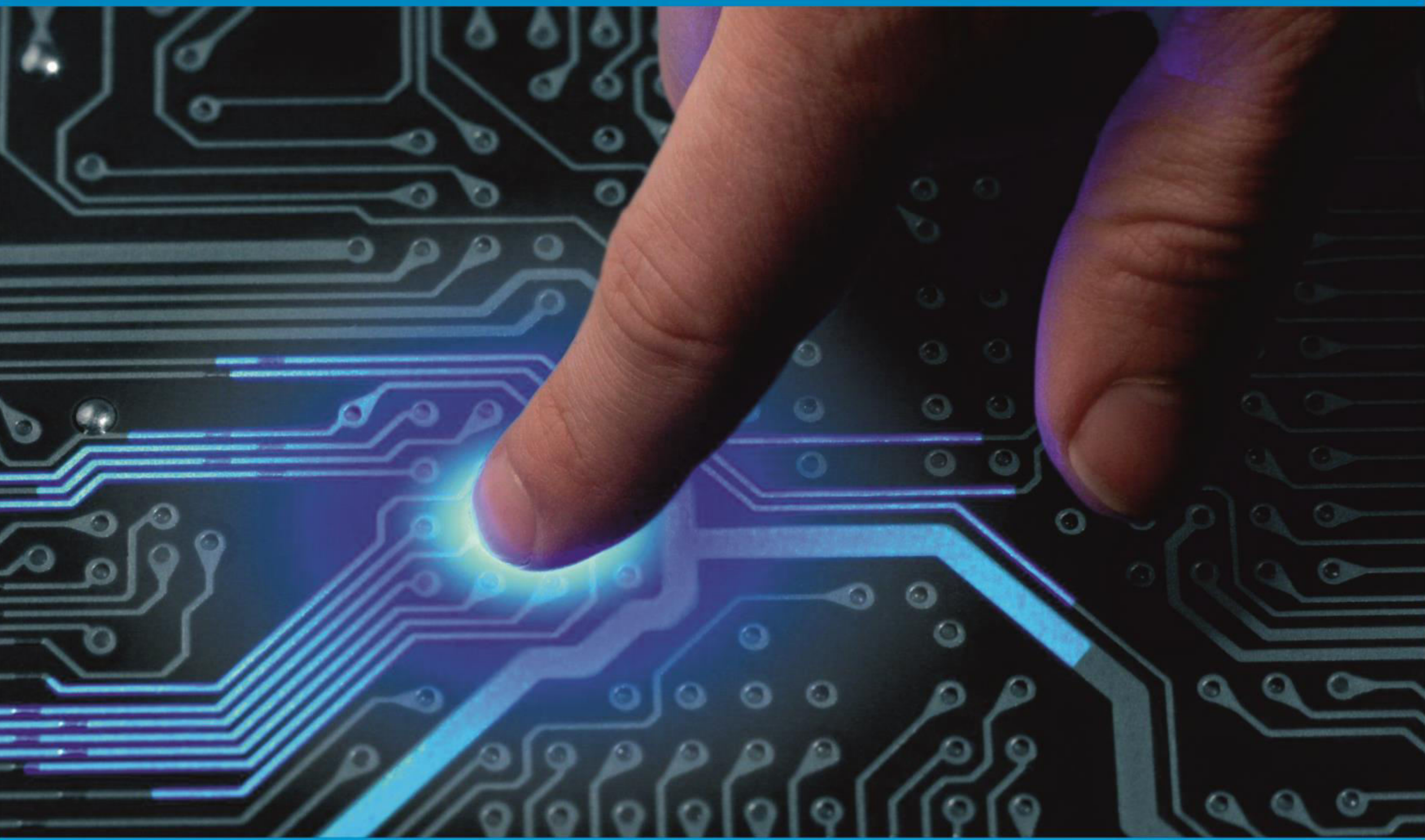

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Auto Ambulance Redeployment in User's Destination

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ABSTRACT: Emergency Medical Services (EMS) are of great importance to saving people's lives from emergent accidents and diseases by efficiently picking up patients using ambulances. The transporting capability of an EMS system (e.g. defined as the average pickup time of patients) significantly depends on the real-time redeployment strategy of ambulances. That is, which station should an ambulance be redeployed to, after it becomes available (after it transports a patient to a hospital or after it finishes the in-site treatment for a patient)? However, it is a challenging task concerning the multiple data D1-D5 as detailed in Introduction. To this end, in this paper, we propose a data-driven real-time ambulance redeployment approach that redeploys an ambulance to a proper station after it becomes available, so as to optimize the transporting capability of an EMS system, considering the aforementioned multiple data D1-D5. Specifically, the proposed approach consists of two stages to well consider the D1-D5. First, we propose a method (a safety time-based urgency index) to incorporate D1, D2, and D3 into each ambulance station's urgency degree (D*). Second, we propose an optimal matching algorithm to combine D*, D4, and D5 into the redeployment of the current available ambulance. Experimental results using data collected in real world demonstrate the significant advantages of our approach over many baselines. Comparing with baselines, our approach can save 4 minutes (35%) of the average pickup time for each patient, improve the ratio of patients picked up within 10 minutes from 0.684 and 0.803 (17%), and largely enhance the survival rate of patients (12% for patients in category A1 and 17% for patients in A2).

KEYWORDS: Urban computing, emergency medical services, ambulance redeployment, data and knowledge management.

I. INTRODUCTION

Emergency Medical Services play essential roles in saving people's lives in cities from emergent accidents and diseases, through efficiently picking up patients, conducting in-site treatments for patients and transporting patients to hospitals. After a patient sends an EMS request to an EMS center (e.g. call 911 in the USA or call 120 in China), the EMS center will dispatch an ambulance from one of the ambulance stations in the city to pick up the patient (the ambulance dispatching process). The ambulance becomes available after it transports the patient to a hospital or after it finishes the in-site treatment for the patient1, and then it should be redeployed to one of the ambulance stations in the city (the ambulance redeployment process). Once an EMS system has been established, its transporting capability significantly depends on the dispatching and redeployment strategy of ambulances.

However, as studied in previous literatures, e.g. [1], [2], the improvement of the transporting capability using complex dispatching strategies is highly limited. Besides, there exist quite a few hard constraints on the dispatching strategies in the real world, e.g. picking up a patient in 10 minutes or picking up a patient as soon as possible if the patient is in extreme danger. Therefore, EMS systems in real life usually dispatch the nearest ambulance to pick up an EMS request. As a result, for an established EMS system, the real-time redeployment of each available ambulance, i.e. which station should an available ambulance be redeployed to, becomes more important to improving its transporting capability. For instance, when an EMS request comes, whether there are available ambulances in stations nearby the request significantly depends on the redeployment results of previous ambulances.

However, the real-time ambulance redeployment problem is challenging since multiple complex and dynamic data should be considered. For example, ambulance a1 has transported a patient to a hospital and becomes ready to be redeployed to a station. When redeploying ambulance a1, we propose to consider at least the following data D1, the

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number of available ambulances at each station. For an ambulance station, the less available ambulances it contains, the more necessary for the EMS center to redeploy the currently available ambulance a1 to this station. D2: the number of EMS requests nearby each station in the future. Clearly, if more EMS requests will come near a station, it is better to redeploy the current ambulance a1 to this station such that EMS requests can be picked up timely, e.g. the station s1 or station s3 D3: the geographical location of each station. Usually, a remote ambulance station, like the station s1 requires ambulances more. This is because if station s1 contains no ambulance, the EMS center needs to dispatch ambulances in stations s2; s3; s4; s5 to pick up patients nearby station s1. That will significantly increase the pickup times of patients nearby station s1. On the contrary, for station s3, even if it runs out of ambulances, dispatching ambulances from stations s2; s4; s5 will only slightly increase the pickup times of patients nearby s3. D4: the travel time for the current available ambulance to reach each ambulance station.We expect that less time is needed for the ambulance a1 to reach the redeployed station. Therefore, a closer station to ambulance a1 is preferred, e.g. station s2 or s3 D5: the status of other occupied ambulances. The status of other occupied ambulances, e.g. ambulance a2, also significantly affects the redeployment decision for the current ambulance a1. Since ambulance a2 is transporting a patient and will also be available soon at a hospital much closer to station s1, it becomes less necessary for the EMS center to redeploy the current available ambulance a1 to station s1

II. LITERATURE SURVEY

In the year 2015,[3] the authors Albert Y. Chen, Tsung-Yu Lu, Matthew Huei-Ming Ma, and Wei-Zen Sun proposed a system for Demand Forecast Using Data Analytics for the Preallocation of Ambulances.
The objective of prehospital emergency medical services (EMSs) is to have a short response time. By increasing the operational efficiency, the survival rate of patients could potentially be increased. The geographic information system (GIS) is introduced in this study to manage and visualize the spatial distribution of demand data and forecasting results.

For instance in the year 2001[4] the authors Michel Gendreau, Gilbert Laporte, Frédéric Semet proposed a dynamic model for PARALLEL TABU SEARCH HEURISTIC FOR REAL-TIME AMBULANCE RELOCATION. This paper considers the redeployment problem for a fleet of ambulances. This problem is encountered in the real-time management of emergency medical services. A dynamic model is proposed and a dynamic ambulance management system is described. This system includes a parallel tabu search heuristic to precompute redeployment scenarios. Simulations based on real data confirm the efficiency of the proposed approach

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In another study in the year 2010,[5] Verena Schmid and Karl F. Doerner proposed a system for Ambulance location and relocation problems with time-dependent travel times. The problem is solved met heuristically using variable neighborhood search. We show that it is essential to consider time dependent variations in travel times and coverage respectively. When ignoring them the resulting objective will be overestimated by more than 24%. By taking into account these variations explicitly the solution on average can be improved by more than 10%.

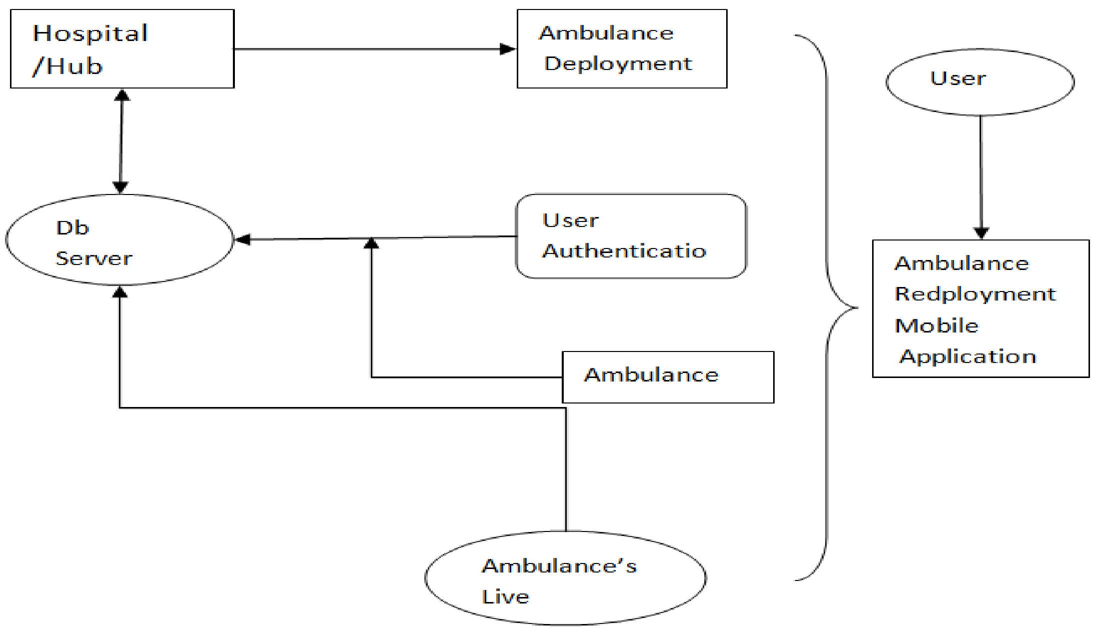
In the year 2010[6], Jing Yuan, Yu Zheng, Chengyang Zhang, Wenlei Xie Xing Xie, Guangzhong Sun, Yan Huang proposed T-Drive: Driving Directions Based on Taxi Trajectories. In this paper, we mine smart driving directions from the historical GPS trajectories of a large number of taxis, and provide a user with the practically fastest route to a given destination at a given departure time. In our approach, we propose a time-dependent landmark graph, where a node (landmark) is a road segment frequently traversed by taxis, to model the intelligence of taxi drivers and the properties of dynamic road networks. Then, a Variance-Entropy-Based Clustering approach is devised to estimate the distribution of travel time between two landmarks in different time slots.

III. EXISTING SYSTEM

In Existing,[9] EMS has become venues for initiating life-saving treatments prior to arrival at a health care. However many deaths happen around the cities because of EMS not reaching its location on time and deployed systems are not efficient in providing the nearest EMS to the patients and causing more and more time to reach the patient and it does not handle multiple requests of the patients at time making patients to wait longer and risking their lives. The user communicates via phone and cannot provide the exact location of the patients and EMS cannot be able to understand user location details. In case of patient emergency EMS moved to another location there is a chance that another patient can request the EMS in this scenario EMS is not available to the requested patient.

IV. PROPOSED SYSTEM

The Proposed System automatically assigns the ambulance to the requested user. This work proposed two methodologies for handling the multiple data request. A safety time-based urgency index and optimal matching algorithm First safety time-based urgency index organically merges a station's number of available ambulances, number of nearby EMS requests in the future and geographical location into the urgency degree of this station. Secondly an optimal matching algorithm, which can incorporate each station's urgency degree the travel time of the current available ambulance to reach each station and the status of other occupied ambulances into the redeployment of the current available ambulance.



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Modules in the system

- **User registration and Station creation**
- **Update request to server**
- **Ambulance Deployment**
- **Driver App and ambulance redeployment**

User registration and Station creation

In this module, the user registration process will be done. The admin logs in and creates the stations for the ambulances along with the information such as the name of the city and the number of ambulances for the respective stations.

Update request to server

In the second module, the user application will be provided from where the user will register and login and can request the ambulance. The requests for the need of ambulances will get updated to the server.

Ambulance Deployment

In this module, based on the number of requests, the ambulance will be deployed to those particular stations where the need of an ambulance is requested.

Driver App and ambulance redeployment

This module consists of driver application. The ambulance will reach the location from where the ambulance has been requested. This contains the pickup and drop location of the patient and after completing the request the ambulance will get deployed to the next requested location which was requested.

V. EXPERIMENTAL RESULTS

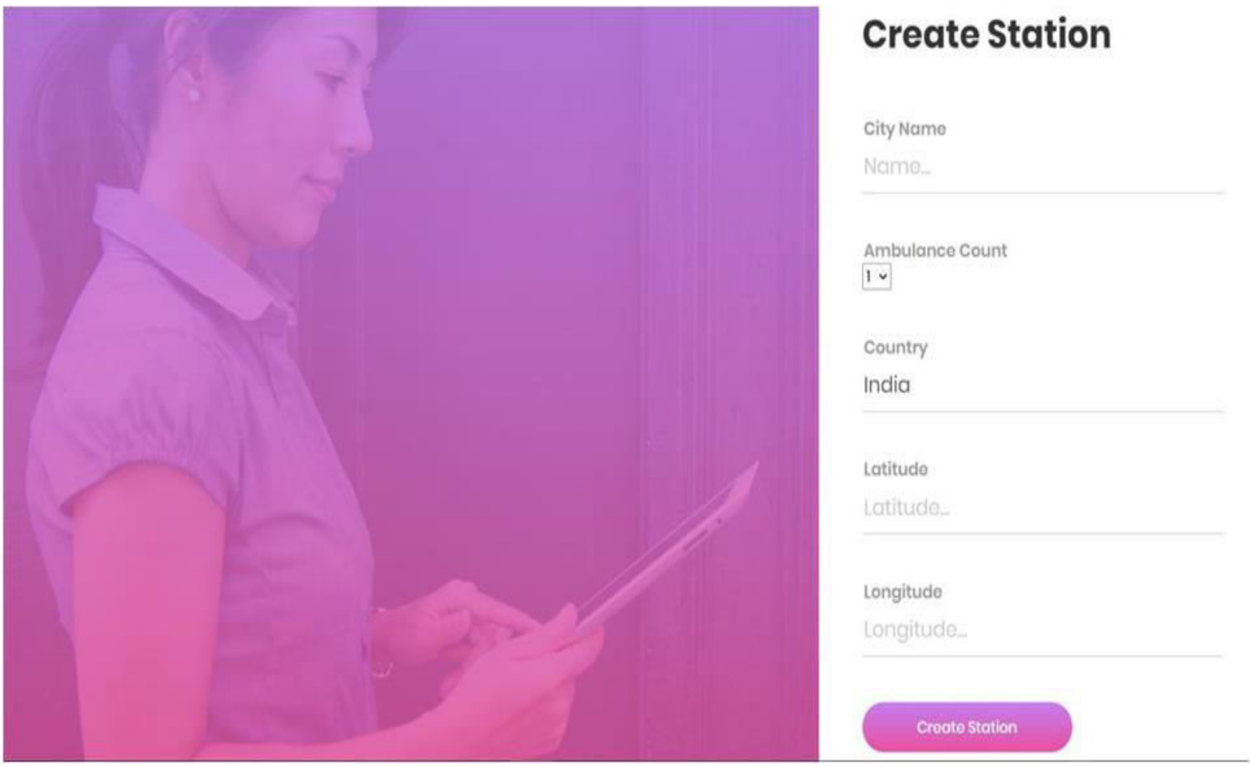

Figure 6.1 Admin website for adding ambulance station

In figure 6.1, the admin can add or remove an ambulance station by entering the city name, ambulance count, country, and its coordinates.

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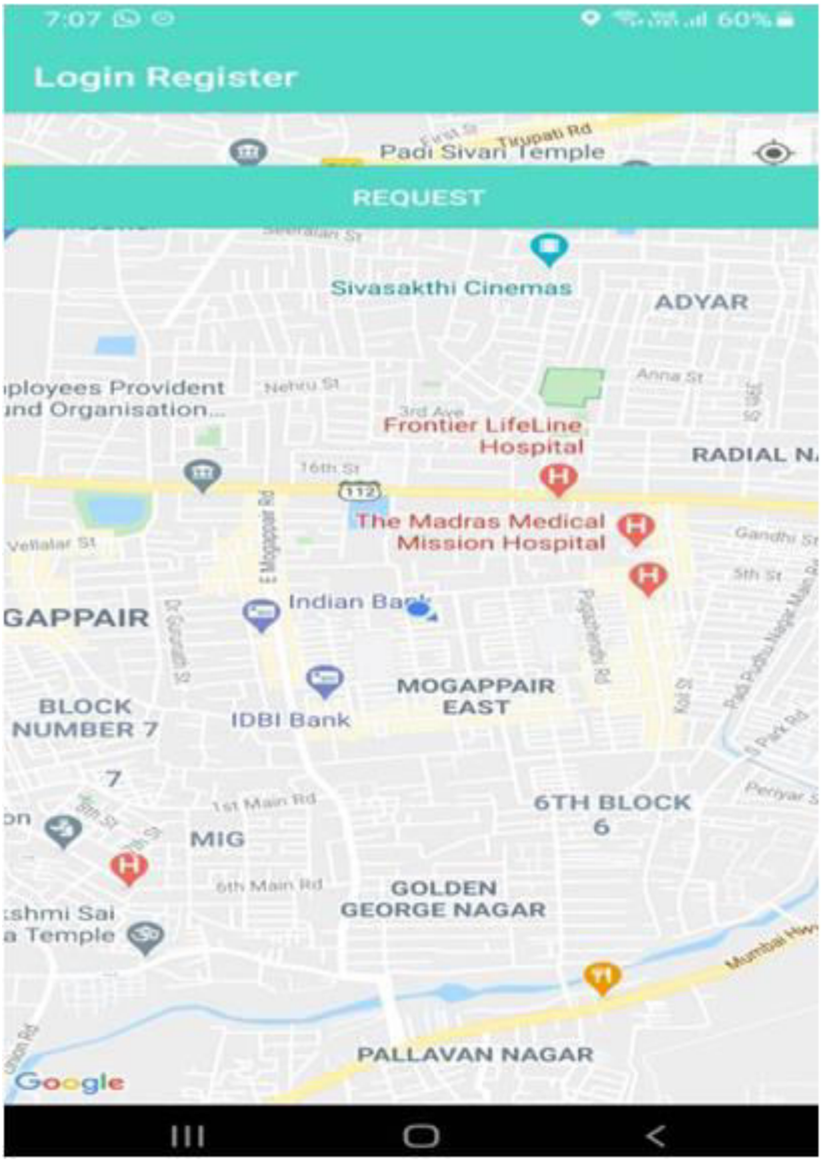

Figure 6.2 User App for Requesting Ambulance

In figure 6.2 the User App is used to request for an ambulance during an emergency situation. This application sends a request to the server. The location of the user is detected automatically and sent to the server.

VI. CONCLUSION

This project provides real time ambulance redeployment initiative to make the ambulance accessible to the appropriate station later it becomes available. So that the lives of many people can be saved by reducing waiting time and travel time. Since it is automated through a computer server, it can handle multiple requests simultaneously. In future, the UI of the mobile application for user and driver will be enhanced and the redeployment time will be reduced as much as possible by improving the algorithm and the factors considered. It will also be implemented in multiple cities, to save lives across the globe.

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REFERENCES

[1] C. J. Jagtenberg, S. Bhulai, and R. D. van der Mei, "Optimal ambulance dispatching," Operations Research for Health Care, vol. 248, pp. 269–291, March 2017.
[2] V. Schmid, "Solving the dynamic ambulance relocation and dispatching problem using approximate dynamic programming," European Journal of Operational Research, vol. 219, no. 3, pp. 611– 621, April 2012.
[3] M. S. Daskin, "A maximum expected covering location model: Formulation, properties and heuristic solution," Transportation Science, vol. 17, no. 1, pp. 48–70, 1983.
[4] C. Jagtenberg, S. Bhulai, and R. van der Mei, "An efficient heuristic for real-time ambulance redeployment," Operations Research for Health Care, vol. 4, pp. 27–35, 2015.
[5] D. Degel, L. Wiesche, S. Rachuba, and B. Werners, "Timedependent ambulance allocation considering data-driven empirically required coverage," Health Care Manag Sci, vol. 18, pp. 444– 458, 2015.
[6] V. Schmid and K. F. Doerner, "Ambulance location and relocation problems with time-dependent travel times," European Journal of Operational Research, vol. 207, no. 3, pp. 1293–1303, October 2010.
[7] L. V. Snyder and M. S. Daskin, "Reliability models for facility location: The expected failure cost case," Transportation Science, vol. 39, no. 3, pp. 400–416, August 2004.
[8] M. Gendreau, G. Laporte, and F. Semet, "A dynamic model and parallel tabu search heuristic for real-time ambulance relocation," Parallel Computing, vol. 27, no. 12, pp. 1641–1653, September 2001.
[9] Y. Wang, Y. Zheng, and Y. Xue, "Travel time estimation of a path using sparse trajectories," in Proceedings of the 20th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, September 2014, pp. 25–34.

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