

Detecting Severe Incidents from Electronic Medical Records Using Machine Learning Methods

Kazuya OKAMOTO^{a,1}, Takashi YAMAMOTO^b, Shusuke HIRAGI^a,
Shosuke OHTERA^a, Osamu SUGIYAMA^c, Goshiro YAMAMOTO^a,
Masahiro HIROSE^d, and Tomohiro KURODA^a

^a*Division of Medical Information Technology and Administration Planning,
Kyoto University Hospital, Japan*

^b*Patient Safety Unit, Kyoto University Hospital, Japan*

^c*Preemptive Medicine & Lifestyle-Related Disease Research Center,
Kyoto University Hospital, Japan*

^d*Faculty of Medicine, Shimane University, Japan*

Abstract. The goal of this research was to design a solution to detect non-reported incidents, especially severe incidents. To achieve this goal, we proposed a method to process electronic medical records and automatically extract clinical notes describing severe incidents. To evaluate the proposed method, we implemented a system and used the system. The system successfully detected a non-reported incident to the safety management department.

Keywords. Safety management, supervised machine learning, medical records

1. Introduction

In order to prevent medical accidents at hospitals, it is important to grasp those events at early stages that lead to severe medical accidents and then take appropriate actions based on the events. These events, which are defined as incidents, are usually reported by medical staff to the safety management department, that is responsible for the prevention of medical accidents in hospitals. The reports are analyzed by the department in order to decide which measures should be implemented by the clinical staffs. This mechanism is called an incident reporting system [1].

One of the main issues related to incidents is a long delay or even lack of reporting [2,3]. It is especially important to detect those cases since they affect the safety management departments ability to respond properly.

The goal of this research is to design a solution to detect these non-reported incidents, especially severe incidents. To achieve this goal, we develop methods to process electronic medical records and automatically extract clinical notes describing severe incidents. The extracted notes are treated as incident candidates which are shown to the safety management department for further analysis.

¹Corresponding Author: Kazuya Okamoto, Kyoto University Hospital, 54 Kawahara-cho, Shogoin, Sakyo-ku, Kyoto, 606-8507, JAPAN; E-mail: kazuya@kuhp.kyoto-u.ac.jp.

2. Methods

We develop methods to process electronic medical records and automatically extract clinical notes describing incidents of injection by using the SVM based technique [4].

First, we manually label a training set of clinical notes into two categories based on whether they include a severe incident report or not. Next, by morphological analysis, the training set is separated into words and arranged in a vector space using single words as the axes. Then, the SVM creates the machine learning models from the arranged training set with labels.

Finally, based on the created machine learning models, the SVM extracts positive clinical notes which are estimated as clinical notes with incident reports. The extracted notes are treated as incident candidates which are shown to the safety management department for further analysis.

3. Experiments

Using the proposed method based on the linear kernel SVM, we implemented an incident candidate reporting system. To evaluate the system, we asked a staffs of the safety management department to judge whether extracted incident candidates were incidents or not.

4. Results

The system extracted 121 incident candidates from the 294,731 clinical notes. 34 of them were judged to include severe incident reports by the staff of the medical safety department, which means that the precision is 28.1%. 31 of them were related to sudden critical changes of patients' conditions; other two were related to incidents during surgeries; the other was related to a fall from a bed. Moreover, several sudden critical changes among the detected incidents were not reported actually.

5. Conclusions

In this research, we aimed to establish a method to extract incident candidates from clinical notes in order to detect non-reported severe incidents. In addition, we implemented a reporting system that presents incident candidates extracted by using the proposed method. The system successfully detected a non-reported incident to the safety management department, thus our goal was achieved.

References

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