



VINGNANAM Research Conference

21st of July 2022



VRC-2022

Faculty of Science
University of Jaffna
Sri Lanka

Jointly Organized by

**Faculty of Science
University of Jaffna
Sri Lanka**



**Western Norway
University of
Applied Sciences**

Electronic health record auditing for automatic detection of malpractices using LTL rules

C. Wickramage^{1*}, C. Fidge², C. Ouyang³ and T. Sahama⁴

¹ Department of Computer Science, Faculty of Science, University of Ruhuna, Sri Lanka

² School of Computer Science, Faculty of Science, Queensland University of Technology, Australia

³ School of Information System, Faculty of Science, Queensland University of Technology, Australia

⁴ Health Information Science, University of Victoria, Australia

* Correspondence: chathurika@dcs.ruh.ac.lk

An audit serves to manage compliance initiatives as it measures current practice against a defined policy or a standard. One promising direction for auditing is the establishment of proper logging mechanisms using event logs that can be used to monitor malpractices, information misuse and performance. However, existing electronic health record (EHR) systems inadequately implement logging mechanisms, making it crucial to be used for policy compliance. This study aims to exploit the idea of conformance checking to detect malpractices by examining healthcare logs against health policies and standards represented in linear temporal logic (LTL) rules. Our method focuses on enriching healthcare logs, including designing a suitable log schema with distinct cases that enables existing conformance checking tools to identify the deviations of desired healthcare properties. A chronic case including a violation of drug-formulary checks defined in the objectives of “meaningful use” in the health information technology for economic and clinical health (HITECH) act during clinical practices is used as a case study to demonstrate our approach. OpenEMR, which is an open source EHR system, was used to capture actual events in an outpatient department. Then the log files are enriched into an appropriate format. ProM, which is an open-source process mining tool, was used to perform conformance checking. The enriched logs generated by OpenEMR were preprocessed such that the LTL conformance checking plug-in module in ProM could be applied against a pre-defined LTL formula. Twelve cases simulating an acute health management condition, specifically cases of patients with drug allergies, were selected to be processed. The cases include six accepted and unaccepted cases each. The six unaccepted cases, which were found to have deviated from the LTL rule, indicate potential malpractices. The findings of our study imply that such enrichment of healthcare logs can help detect healthcare malpractices automatically.

Keywords: *Auditing in healthcare, Log schema, Conformance checking, Linear temporal logic, Healthcare policies and standards.*