Explainable Artificial Intelligence for Patient Safety A Review of Application in Pharmacovigilance

ABSTRACT

Explainable AI (XAI) is a methodology that complements the black box of artificial intelligence, and its necessity has recently been highlighted in various fields. The purpose of this research is to identify studies in the field of pharmacovigilance using XAI. Though there have been many previous attempts to select papers, with a total of 781 papers being confirmed, only 25 of them manually met the selection criteria. This study presents an intuitive review of the potential of XAI technologies in the field of pharmacovigilance. In the included studies, clinical data, registry data, and knowledge data were used to investigate drug treatment, side effects, and interaction studies based on tree models, neural network models, and graph models. Finally, key challenges for several research issues for the use of XAI in pharmacovigilance were identified. Although artificial intelligence (AI) is actively used in drug surveillance and patient safety, gathering adverse drug reaction information, extracting drug-drug interactions, and predicting effects, XAI is not normally utilized. Therefore, the potential challenges involved in its use alongside future prospects should be continuously discussed.

**EXISTING SYSTEM**

In this study, the trend of XAI in the field of PV was examined. However, the trend was also explored broadly to more diverse aspects, including interpretable artificial intelligence. Although there is a clear difference between Explainable AI (knowledge about what different nodes represent and their importance to model performance) and Interpretable AI (ability to determine cause and effect in a machine learning model), based on the same aim, they were comprehensively reviewed.

There has been a surge in XAI studies in drug-related applications since 2019, with relatively few studies from 2013 to 2018 (Fig. 1). The limited number of publications indicates a demand for more research on XAI in PV applications.

The selection of appropriate search terms for the exploration of XAI-related research in PV was not easy; we started manually with broad keywords. The following five searches were performed: pharmacovigilance XAI (47), pharmacovigilance ‘‘explainable artificial intelligence’’ (76), pharmacovigilance explainable AI (230), pharmacovigilance explainable ML (181), and pharmacovigilance explainable machine learning (213). These search terms were used in a Google Scholar search on 22 June 2022, and the numbers in parentheses are the number of articles returned from each search. Retrieved articles were first screened for titles and abstracts to exclude duplicates, then articles were added through a first full-text review for relevance and a second full-text review based on a selective methodology, resulting

in a final selection of 25 unique publications.

**Disadvantages**

• The complexity of data: Most of the existing machine learning models must be able to accurately interpret large and complex datasets to detect Patient Safety.

• Data availability: Most machine learning models require large amounts of data to create accurate predictions. If data is unavailable in sufficient quantities, then model accuracy may suffer.

• Incorrect labeling: The existing machine learning models are only as accurate as the data trained using the input dataset. If the data has been incorrectly labeled, the model cannot make accurate predictions.

Proposed System

The aim of this study was to review the literature on the use of XAI in PV by identifying publications related to ML/AI and drugs and the rationale for the reported findings. From the perspective of AI and XAI usage, these studies were analyzed, and the findings were summarized, in which the use of XAI in the field of PV is referred to as ‘‘PV XAI’’. The main contributions are highlighted and discussed below:

- This study is clearly an early attempt to review XAI research in PV. Unlike other fields, we found that XAI research in PV is at an early stage of development, limited to a few articles and some methodologies.

- Nevertheless, we have identified the positive potential of PV XAI for drug therapy, ADRs, poly pharmacy and drug repurposing.

- While safety issues in real-world healthcare settings may limit the growth of the field, we expect PV XAI research to expand as it has in other areas, and we

encourage collaboration and ongoing research discussions with experts in the field.

**Advantages**

1) We propose Deep neural networks (DNNs) are the foundation of modern AI models.

2) The proposed system implemented Tree-based algorithms in which conceptually simple but powerful ML methods that are effective on small and large datasets to solve linear and nonlinear modeling problems..

**SYSTEM REQUIREMENTS**

➢ **H/W System Configuration:-**

➢ Processor - Pentium –IV

➢ RAM - 4 GB (min)

➢ Hard Disk - 20 GB

➢ Key Board - Standard Windows Keyboard

➢ Mouse - Two or Three Button Mouse

➢ Monitor - SVGA

**SOFTWARE REQUIREMENTS:**

* **Operating system :** Windows 7 Ultimate.
* **Coding Language :** Python.
* **Front-End :** Python.
* **Back-End :** Django-ORM
* **Designing :** Html, css, javascript.
* **Data Base :** MySQL (WAMP Server).