

Explainable Artificial Intelligence in Healthcare: XAI-Healthcare 2021

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Abstract. XAI-Healthcare event provided a place for intensive discussion on all aspects of eXplainable Artificial Intelligence (XAI) in the medical and healthcare field. This resulted in cross-fertilization among research on Machine Learning, Decision Support Systems, Natural Language, Human-Computer Interaction, and Healthcare sciences. This meeting also provided attendees with an opportunity to learn more on the progress of XAI in healthcare and to share their own perspectives. The panel discussion provided participants with the insights on current developments and challenges from the researchers working in this fast-developing field.

This work summarises the activities and papers presented during the First International Workshop on Explainable Artificial Intelligence in Healthcare (XAI-HEALTHCARE 2021).

Keywords: Explainable Artificial Intelligence · Artificial Intelligence in Medicine.

1 Introduction

The first edition of XAI-Healthcare⁵ was co-located in conjunction with AIME 2021 conference and held in Porto, Portugal, in June 2021 in an online event due to the COVID-19 pandemic.

In total 12 papers were submitted to the workshop. All papers were carefully peer reviewed (single-blind review) by at least 3 experts from the Program Committee. As a result, 8 papers were finally accepted to be presented in XAI-Healthcare 2021.

The selected contributions were presented by the authors grouped according to their topics into two sessions: "Clinical Texts and Natural Language Explanations" and "Visualization and Interpretable Machine Learning". Each paper was presented in a 10-minutes oral presentation.

⁵ <https://www.um.es/aike/events/XAI-Healthcare/>

Among the papers presented during the workshop, the authors of the best papers have been invited to participate in a Special Issue of the prestigious Journal on Artificial Intelligence in Medicine to be published during 2022.

XAI-Healthcare workshop had also the honor to have a keynote speech delivered by Marinka Zitnik, from the Harvard Medical School entitled: Actionable Machine Learning for Drug Discovery and Development. The keynote and a selection of paper presentations were recorded and available to the public ⁶.

The workshop was concluded by a panel session where invited experts and attendees had an interesting discussion on the fundamentals of eXplanaible AI and its impact in healthcare. The panelists were Prof. Niels Peek, Prof. Riccardo Bellazzi, Prof. Carlo Combi, Dr. Marinka Zitnik and Dr. John H. Moore.

We wish that you will find our selection of papers of the XAI-Healthcare 2021 workshop interesting and stimulating.

2 Clinical texts and natural language explanations

Four papers were presented during the session, focused on the use of natural language in the clinical context as a source of data or as a tool to provide explanations.

The work *Association Rules Mining on triaged doctors' referrals for Otorhinolaryngology* by Chee Keong Wee and Nathan Wee [7] proposes ensemble based machine learning approach to perform clinical text mining from unstructured referral text to present the obtained knowledge in for of relationships among discovered medical terms.

In *Explainability feature analysis for treatment search engines* by Edeline Contempré, Zoltán Szilávik, Erick Velazquez Godinez, Annette ten Teije and Ilaria Tiddi [3], the authors describe the project where crowd-sourcing was used to asses the importance of various features for explainability of treatment search engine results. The implementation of such approach allows document re-ordering, generation of explanatory sentences and sentence ordering.

The work entitled *Improving Online Health Intent Analysis by Knowledge Inference Encoding* by Chaochen Wu and Guan Luo [8] explores the fast growing field of medical text understanding using neural networks. The proposed method was applied to the intent analysis of online health questions. Authors also demonstrated the value of the proposed model in recognizing new medical terms that rarely appear in the training corpus.

Finally, the research work *What is understandable in Bayesian network explanations?* by Raphaela Butz, Renée Schulz, Arjen Hommersom and Marko van Eekelen [1] introduces a comparison of four different approaches to explanation of the Bayesian network predictions. A survey asking a group of human participants to interpret the explanations was used to obtain the results. Most participants emphasized the importance of combining visualization with a simple, but precise text messages to achieve better explainability.

⁶ <https://www.youtube.com/channel/UCBKq6PEX2CUde1ou4TtRnkA>

3 Visualization and interpretable machine learning

The use of visualization techniques to provide explanations and interpretable Machine Learning, particularly decision trees, covered this session.

In Explainable Point-Based Document Visualizations by Primoz Godec, Nikola Dukic, Ajda Pretnar, Vesna Tanko, Lan Zagar and Blaz Zupan [5] the authors present a comparison of four different approaches to label clusters of documents on longevity. The results point at the fact that a combination of document embedding and label-based characterization of clusters yield very useful results.

The work Visualisation to Explain Personal Health Trends in Smart Homes by Glenn Forbes, Stewart Massie and Susan Craw [4] focuses on improving the visualization workflow in visualization of the recommendations based on data obtained from ambient sensors in smart homes. An approach based on color coded graphs is proposed to increase the confidence and trust in the AI based healthcare systems.

The research work Explanation of decision trees applied to liver transplantation by Pedro Cabalar, Brais Muniz-Castro, Gilberto Perez and Francisco Suarez-Lopez [2] presents a novel method for explanation of the decision tree results. Logic programming was used to derive explanations from the decision trees obtained for a liver transplantation dataset. Authors conclude that using the proposed approach simpler and more general explanations can be obtained.

Finally, the paper entitled Tree-based local explanations of machine learning model predictions – AraucanaXAI by Enea Parimbelli, Giovanna Nicora, Szymon Wilk, Wojtek Michalowski and Riccardo Bellazzi [6] presented an additional research work on explanation using the tree based representation. The proposed approach can be used to explain the predictions of a generic machine learning model and supports both classification and regression models. It improves fidelity and has the ability to deal with non-linear decision boundaries.

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