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Data-Driven Approaches for Efficient Patient Flow Segmentation in Polyclinics

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Abstract

The current level of automation of healthcare service allows one to accumulate and process large amounts of data and analyze it to solve optimization problems. One of the main technologies of the digital economy is big data, neurotechnology and artificial intelligence. The tasks of analyzing and modeling large amounts of urban healthcare data using artificial intelligence technologies are of particular importance and relevance for the development of industry solutions in the framework of the digitalization of the economy, where data is a key factor in production. Urban outpatient facilities have data on appointments in information systems, however, the traditional approach to documenting visits does not allow a complete picture of all patient trajectories and their automatic analysis in real time. In addition, the diverse nature of diseases is reflected in the high variability of routes [1]. The formal presentation of the flow in the form of models allows not only to detect the main trajectories of movements within the framework of medical facilities, but also to identify the bottlenecks of the system to meet the demand of the patients. The study examined the problem of automatic modeling of clinical pathways of patients, based on the available data in medical facilities to improve standardization of management and solving optimization problems.

The purpose of the study is to develop a methodology based on the application of methods of process mining and machine learning to manage patient flow in urban medical facilities. The development and implementation of clinical pathways, or patient paths, is an important tool in healthcare management. In general terms, the patient's clinical pathway is understood as the trajectory of movements when receiving medical services in relevant institutions. Numerous research papers [2-8] are devoted to the study of clinical data pathways of a medical institution. The methodical approach for this study is based on the hard and soft clustering analysis: the hierarchical clustering algorithm and Additive Regularization of Topic Models (ARTM).

The main findings of the study include the proposed structure of the event log for the polyclinic, the use of multidimensional clustering algorithms and topic modeling methods to identify the most popular clinical pathways. Thus, the scientific significance of the research work lies in the application of technologies for the intellectual analysis of processes and predicative analytics for the development of the advisory service of urban medical institutions. In practice, the obtained clinical pathway clusters serve as a starting point for the development of a recommendation service and simulation model for further resource planning.

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