# Modified genetic algorithm-based feature selection combined with pre-trained deep neural network for demand forecasting in outpatient department.

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**Resumen:** A well-performed demand forecasting can provide outpatient department (OPD) managers with essential information for staff scheduling and rostering, considering the non-reservation policy of OPD in China. Based on the results reported by relevant studies, most approaches have focused on forecasting the overall amount of patient flow and ignored the demand for other key resources in OPD or similar department. Moreover, few studies have conducted feature selection before training a forecast model, which is a significant pre-processing operation of data mining and widely applied for knowledge discovery in expert and intelligent system. This study develops a novel hybrid methodology to forecast the patients' demand for different key resources in OPD, by combining a new feature selection method and a deep learning approach. A modified version of genetic algorithm (MGA) is proposed for feature selection. The key operators of normal genetic algorithm are redesigned to utilize useful information provided by filter-based feature selection and feature combinations. A feedforward deep neural network is introduced as the forecast model, and the initial parameter set is generated from a stacked autoencoder-based pre-training process to overcome the optimization challenges in constructing deep architectures. In order to evaluate the performance of our methodology, it is applied to an OPD located

at Northeast China. The results are compared with those obtained from combinations of other feature selection methods and demand forecasting models. Compared with GA and PCA, MGA improves the quality and efficiency of feature selection, with less selected features to get higher forecast accuracy. Pre-trained DNN optimally strengthens the advantage of MGA, compared with MLR, ARIMAX and SANN. The combination of MGA and pre-trained DNN possesses strongest predictive power among all involved combinations. Furthermore, the results of proposed methodology are crucial prerequisites for staff scheduling and resource allocation in OPD. Elite features obtained by MGA can provide practical insights on potential association between manifold feature combinations and demand variance. [ABSTRACT FROM AUTHOR]



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