



Predicting the number of hospital admissions due to mental disorders from air pollutants and weather condition descriptors using stacked ensemble of Deep Convolutional models and LSTM models (SEDCMLM)

Toktam Khatibi ^{a,*}, Navid Karampour ^b

^a Department of Industrial and Systems Engineering, Tarbiat Modares University (TMU), Tehran, 14117-13114, Iran

^b Department of Industrial and Systems Engineering, Tarbiat Modares University, Tehran, Iran

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ABSTRACT

Air pollution has negative impact on health status of the population. Several previous studies have been assessed the short-term and/or long-term effect of air pollutants on different diseases. An important sign of increasing the number of new people suffering from a disease or worsening the disease among the persons is increasing the hospitalization rate due to the disease. Increasing the incidence rate or severity of mental disorders which leads to patient hospitalization due to these types of diseases have negative impacts on the socio-economic aspects on the affected countries. Therefore, predicting the hospitalization rate due to mental disorders in advance may be helpful for health institutions to be prepared for dealing with these situations. Thus, the main aim of this study is proposing a novel stacked ensemble of Deep Convolutional neural network model and long short-term memory model (SEDCMLM) to predict the number of hospitalizations due to psychological disorders from the air pollutants and weather condition descriptors. This study considers all mental disorders included in International Statistical Classification of Diseases and Related Health Problems (ICD-10). Previous studies have shown that weather descriptors are highly correlated with air pollution. Therefore, we consider both of them as input variables in this study. Input variables include air pollutant indices and weather condition descriptors gathered in range of March 21, 2014 to 1/18/2017 from Tehran Air Quality Control Company (AQCC) and Meteorological Organization of Iran, respectively. The experimental results show that SEDCMLM outperforms the compared models for psychological hospitalization prediction and it leads to desirable performance with Root Mean Square Error (RMSE) of 1.62, Mean Absolute Error (MAE) of 1.48 and Mean R^2 of 0.91. The short-term effect of air pollution on the number of admissions due to mental disorders are investigated for 1 to 10 previous days. It is shown that the best performance of the prediction models is obtained while considering data of 2–4 previous days. Moreover, considering air pollutants, weather descriptors and the number of psychological hospitalization in the previous days can lead to the best performance for predicting the number of psychological patient admissions in the current day. According to the experimental results, air pollutants are good predictors for number of patient admissions due to mental disorders per day. Therefore, it is recommended to use policies for reducing the level of air pollutants.

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1. Introduction

Air pollution is the fourth leading cause of death in the world

and has many negative effects on people's health status (Calderón-garcidueñas et al., 2016). About seven million death in 2012 was due to air pollution exposure (WHO., 2014). Air pollution in Tehran as the 19th most pollutant city in the world (Bayat et al., 2019) caused death to about 2194 in a year (Naddafi et al., 2012). Exposure to air pollutants may lead to different diseases in people, intensifying the severity of the diseases (Leiva et al., 2013; Liu et al., 2015;

* Corresponding author.

E-mail address: toktam.khatibi@modares.ac.ir (T. Khatibi).