University of Tabriz

| EXTENDED ABSTRACT |

Predicting Waste Generation Rate in Tabriz Using Artificial Intelligence (ANN and SVM) Methods and Wavelet Preprocessing for a Long Time

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1. Introduction

Numerous parameters affect the solid waste production rate, including weather-climate parameters and parameters related to people's economical-social and cultural conditions, format, and detail of the city population, lifestyle, etc.

In studying the effects of the mentioned criteria on the waste production rate, classic methods cannot analyze the time-based changes in parameters and the dynamic changes in solid waste production rate. On the other hand, the lack of precise data, an overall plan on solid waste management increases the need for a dynamic method. Linear regression is not a decent method in this research because of the seldom linear relation between parameters. A method, including modern estimation methods and models, is needed to omit the mentioned errors.

ANN and LSSVM are for modeling in this research. Considering the significant part of seasonal patterns, using a preprocessing method that can extract such patterns can improve modeling; therefore, using the WT-ANN method can help.

2. Methodology

This research occurs in Tabriz city, Iran, a metropolis with a population of about 1.8 million. National ministry researches show that waste disposal per capita is about 700g/day in Tabriz city.
The past data trend forecasts population and income- expenditure data. This research used the climate change approach to apply future weather and climate conditions (Nourani et. al., 2019).

Based on a review of the technical literature and the possibility of data access, the input parameters to the forecasting model are considered in three categories as economic variables (including household income-expenditure), social (including population), and climate (including the average monthly temperature variable).
Statistical data on monthly changes in the population and Income-expenditure and culture were obtained from the related organizations. People's culture and weather conditions were also involved in the research via the count of graduates and literates and the temperature data. The amount of waste production monthly data for the years 2010 to 2017 was obtained from the Waste Management Organization of Tabriz.

Population, income-expenditure forecasted as the past trend continues. The climate change approach is also used to apply future climate conditions (Nourani et. al., 2019). Due to fluctuations and various factors that affect waste generation, estimating the generated amount is a challenging and vital issue.

Knowing the amount of predicting solid waste production is one of the key factors to build landfills. According to the extracted data, the amount of solid waste generated in Tabriz city has increased from 900 tons

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to 1149 tons yearly from 2005 to 2017. This study uses artificial intelligence models approaching climate change effects using preprocessed data with the wavelet method's help. ANN and LSSVM were the primary artificial intelligence modeling system in this study. With the extracted data as variable parameters, the mentioned modeling system can predict solid waste production. The pre-fed three-layered Perceptron neural network and LSSVM are the models in this research. The models' performances are compared by Determination Coefficient and Root mean Square Error.

3. Results and discussion

Population growth and the future population were predicted with different methods. And the amount of trash produced per capita is assumed the same as now, which is 700 gram/person/day. The temperature prediction results from Nourani et al. (2019) are used to insert the effect of temperature conditions. ANN and LSSVM, models with the ability to extract the non-linear patterns hidden in the in/output data, are used to predict solid waste production.

MLR method was also used in this research to compare artificial intelligence.
The results showed the advantage of ANN over LSSVM; therefore, the superiority of WT-ANN compared to other models used in this research.

Monthly solid waste production for years 2050 and 2100 according to scenarios RCP4.5 and RCP 8.5 were predicted. (Fig. 1.)
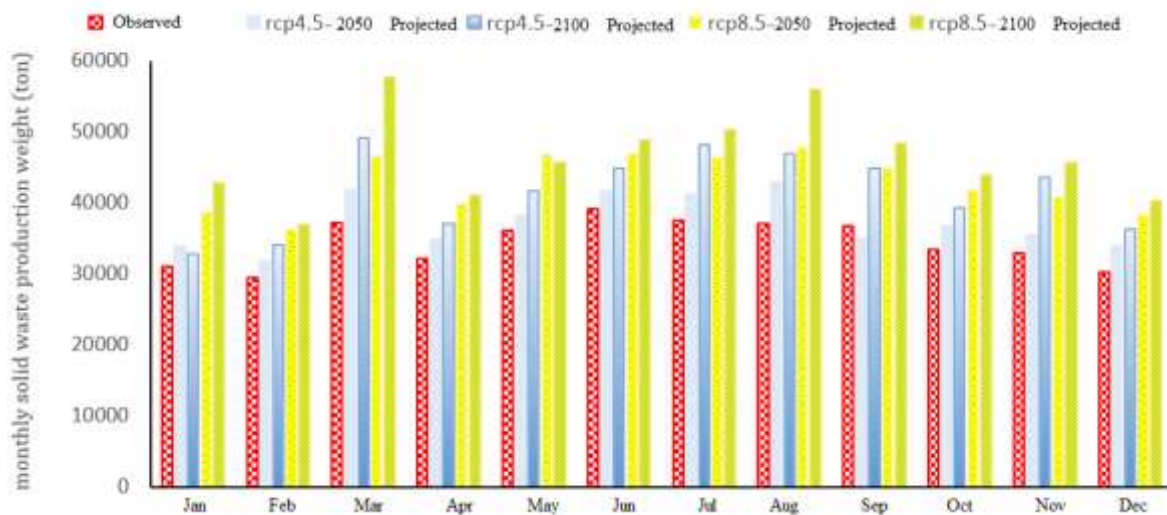

Fig. 1. Monthly production of solid waste for 2050 and 2100 according to RCP 4.5 and RCP8.5

Local population increase made by tourism, Holiday shopping on some occasions can cause increment solid waste production. In winters, the productions subside because of the low tourism activity and the different use patterns at this time of the year.

4. Conclusions

Less solid waste production in RCP 4.5 predictions comparing to RCP 8.5 shows that with worse climate change situations and an increase in temperature, the solid waste production increases as well.

Fig. 2 compares the prediction models such as ANN and Classic models only according to population increase and solid waste production per capita.
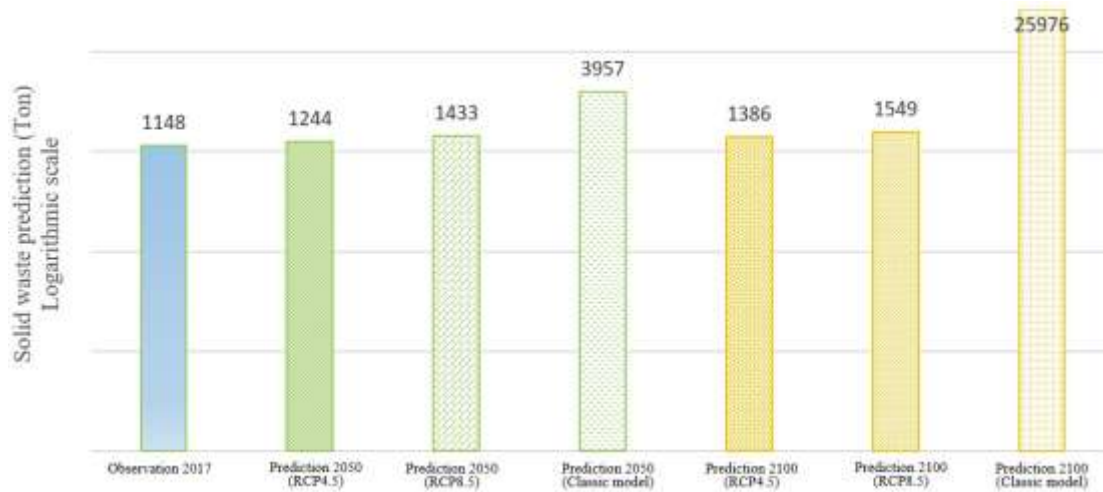
Fig. 2. Daily solid waste production for every month in 2017 with WT-ANN based modeling according to climate change scenarios and classic prediction model

5. References

Nourani V, Razzaghzadeh Z, Baghanam AH, Molajou A, "ANN-based statistical downscaling of climatic parameters using decision tree predictor screening method", Theoretical and Applied Climatology, 2019, 137 (3-4), 1729-1746.

Younes MK, Nopiah ZM, Ahmad Basri NE, Basri H, Abushammala MFM, Maulud KNA, "Solid waste forecasting using modified ANFIS modeling", Journal of the Air and Waste Management Association, 2015, 65 (10), 1229-1238.