



***“Gheorghe Asachi” Technical University of Iasi, Romania***



# PREDICTION OF SUSPENDED SEDIMENT LOAD IN RIVERS USING RANDOM FOREST INTEGRATED WITH LONG SHORT-TERM MEMORY (RF-LSTM) – CASE STUDY: EGHLID, FARS PROVINCE

**Mohammad Shabani<sup>1\*</sup>, Hossein Fathian<sup>2</sup>, Mohammad Ali Asadi<sup>3</sup>, Mohammad Hosseini<sup>4</sup>**

<sup>1</sup>Department of Water Engineering, Shiraz Branch, Islamic Azad University, Shiraz, Iran

<sup>2</sup>Department of Water Resources Engineering, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran

<sup>3</sup>Department of Computer, Shiraz Branch, Islamic Azad University, Shiraz, Iran

<sup>4</sup>Department of Civil Engineering, Meymand Center, Firoozabad Branch, Islamic Azad University, Firoozabad, Iran

## Abstract

The accurate forecasting of rivers suspended sediment load (SSL) plays a key role in the studying, planning, designing, and implementing of water and environmental projects. There are several methods for forecasting SSL of rivers with different performances. This paper introduces a new hybrid model called Random Forest integrated with Long Short-Term Memory (RF-LSTM) to forecast the daily SSL in the Shour River located in the Kharestan watershed, Fars province, Iran. In the first step, the partial mutual information (PMI) algorithm was used to select efficient input variables (EIVs) on daily SSL. Then, daily SSL values were forecasted using three standalone models: support vector regression (SVR), random forest (RF), and long short-term memory (LSTM). The results were assessed based on four evaluation criteria including root mean square error (RMSE), Nash-Sutcliffe efficiency (NSE), correlation coefficient (R), and relative error (RE). Finally, two models with the best performance in terms of the evaluation criteria were combined and daily SSL were forecasted based on the new hybrid model. The results of the PMI algorithm indicated that the streamflow at time  $t$  ( $Q_t$ ) and streamflow with the delay of 1 day ( $Q_{t-1}$ ) were considered as the EIVs on daily SSL. In addition, combining the RF-LSTM based on the PMI algorithm with MAE = 18.963 ton/day, RMSE = 25.514 ton/day, NSE = 0.914, R = 0.960, and RE = 6.124% showed more accuracy in forecasting of daily SSL compared to standalone models.

**Key words:** long short-term memory, PMI algorithm, random forest, suspended sediment load, support vector regression

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\* Author to whom all correspondence should be addressed: e-mail: mshabani577@gmail.com; Phone: +989177059916