EGU21-13929
https://doi.org/10.5194/egusphere-egu21-13929
EGU General Assembly 2021

A Machine Learning Sustainable Development Goals Model for Water Resources Serious Gaming. Case Study: Combeima River, Colombia.

Laura Viviana Garzon Useche[1], Karel Aldrin Sánchez Hernández[2], Gerald Augusto Corzo Pérez[3], and German Ricardo Santos Granados[4]

[1]Colombian School of Engineering Julio Garavito, Civil Engineering emphasis Hydraulic Resources Msc, Bogotá, Colombia (laura.garzon-u@mail.escuelaing.edu.co)
[2]Colombian School of Engineering Julio Garavito, Civil Engineering emphasis Hydraulic Resources Msc, Bogotá, Colombia (karel.sanchez@mail.escuelaing.edu.co)
[3]Civil Engineer,PHD,Senior Researcher, IHE Delft Institute for Water education,netherlands,(gerald.corzo@gmail.com)
[4]Civil Engineer PhD, Posgraduate Head of Colombian School of Engineering Julio Garavito, Bogotá-colombia.(german.santos@mail.escuelaing.edu.co)

The importance of knowing and representing rural and urban development in water management is vital for its sustainability. An essential part of the management required that stakeholders are more aware of the consequences of decisions and in some way, can link decisions towards sustainability. For this, a mobile app serious game called Water Citizens has been proposed as knowledge dissemination and to provide a better understanding of the way decisions affect Sustainable Development Goals (SDGs). A complex model of a pilot region (Combeima in Ibague, Colombia) has been developed, and the model results are few into equations to estimate fluctuations of SDGs in the region. Running this complex model in real-time, for a mobile application, requires an extensive high-performance computing system linked to large and complex network setup. To solve this problem, a fast yet accurate surrogate model is proposed.

Therefore, this study contemplates an analysis of methods to forecast sustainable development indicators evaluated through climate change scenarios for a period between 1989-2039. The proposed scenarios associated the public health, livestock, agriculture, engineering, education and environment sectors with climate variables, climate change projections, land cover and land use, water demands (domestic, agricultural and livestock) and water quality (BOD and TSS). Generating the possibility that each player can make decisions that represent the actions that affect or contribute to the demand, availability and quality of water in the region.

Consequently, a set of indicators were selected to recreate the dimensions of each sector and reflect its relationship with the Sustainable Development Objectives, as opposed to the decisions made by each player. In addition, three categories were considered for the levels of sustainability: low (0.0 - 0.33), medium (0.34 - 0.66) and high (0.67 - 1.0) for the calculated SDG values.

Self-learning techniques have been employed in the analysis of decision-making problems. In this

study, the nearest K neighbours (k-NN) and a multilayer perceptron network (MLP) were used. Through an analysis based on the responses of the players and sustainability indexes, a multiple correlation analysis was developed in order to consolidate the learning dataset, which was randomly partitioned in proportions 0.7 and 0.3 for the training and test subsets respectively. Subsequently, the model fit and performance was carried out, analysing the MSE error metric and confusion matrix.

Finally, the results of this study will allow to determine the potential of supervised learning models as a decision-making tool for the evaluation of sustainable development, as well as to obtain a better abstraction and representation of the water resource to the challenges related to climate adaptation and water sustainability measures of citizen action, besides generating new approaches for the use of artificial intelligence in land use planning and climate adaptation processes.