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REVIEW STUDY ON: "PREDICTION OF WASTEWATER TREATMENT PLANT EFFICIENCY BY SUPPORT VECTOR MACHINE"

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ABSTRACT:

Wastewater treatment plants are essential infrastructures to maintain the environmental balance of the regions where they were installed. The dynamic and complex wastewater treatment procedure must be handled efficiently to ensure good quality effluents. This paper review presents a research and development work implemented to develop a model in Support vector machine for betterment and improvement for waste water and industrial waste water treatment plant efficiency by reducing the laboratory and laborious work. From the review study it is observed that the support vector machines is better for the prediction of monitoring characteristics like Chemical Oxygen Demand(COD), Total Suspended Solids(TSS), Biochemical Oxygen Demand(BOD),Temperature,pH(Potential of Hydrogen),conductivity for Municipal/Industrial Wastewater treatment plant.This review study focus the application of WEKA (Waikato Environment for Knowledge Analysis) Software 3.8.6 in the support vector machines tools for prediction of wastewater treatment plant efficiency.

Key words: - Chemical Oxygen Demand, Support Vector Machines, Temperature, Wastewater Treatment Plant, WEKA (Waikato Environment for Knowledge Analysis) Software 3.8.6.

INTRODUCTION:

Wastewater is the polluted form of water generated from rainwater runoff and human activities In simple we can say that wastewater is that grey-black dirty water which is released from hospital, industries, domestic waste, home, etc. with including organic and inorganic impurities, nutrient, bacteria and microbes as well as rich in lather mixed with oil, dissolved and suspended impurities in the form of liquid. Basically there are three types of wastewater Industrial waste, Domestic waste, and Storm waste. Industrial waste or sewage is used water from manufacturing and chemical process. Domestic waste carries used water from houses and apartments. Domestic sewage is also called as sanitary sewage. Storm sewage is runoff from precipitation that is collected in a system of pipes or open channels. In Domestic sewage divided into two category Grey water and Black water.

Wastewater treatment plants (WWTPs) are essential infrastructure that treat domestic and industrial wastewater with the goal of protecting public health in a commensurate manner with environmental concerns. Wastewater treatment plants (WWTPs) are designed to convert the wastewater into more environmentally friendly water and return it to the environment. Before discharge wastewater into the environment, lakes or streams it has treated in WWTP. A standard wastewater treatment process consist of primary treatment, secondary treatment and tertiary treatment. In primary treatment we have to remove floatable and settleable solids. In secondary treatment which is mainly removal biodegradable of organic matter and dissolved solid. In tertiary treatment, biodegradable and

non-biodegradable waste is removal which in organic matter in waste which can be broken down into carbon dioxide, water, methane or simple organic molecules by micro-organisms and other living things by composting, aerobic digestion, anaerobic digestion or similar processes.

• Sewage treatment is the cleaning of water is a process of removing pollutant before it enters a water body or is reused, this process of wastewater treatment is commonly known as sewage treatment. Wastewater treatment systems break down into four main categories:

1. Sewage Treatment Plants (STPs)
2. Effluent Treatment Plants (ETPs)
3. Activated Sludge Plants (ASPs)
4. Common or Combined Effluent Treatment Plants (CETPs)

The WWTP Case Study

Firstly, the sewage is put into the primary sedimentation tank, filtered and precipitated to remove large volume visible pollutants. Subsequently, it enters the aeration tank. The aeration tank is the core part of the activated sewage treatment method. It contains not only the sewage from the primary sedimentation tank but also the sewage from the hydrolytic acidification device, the activated sludge from the secondary sedimentation tank and the compressed air from the blower end mix thorough in the aeration tank. The organic pollutants are separated and degraded under the action of activated sludge for the purification of the sewage. As a new intelligent algorithm, the support vector machine regression algorithm is more accurate and applicable than the traditional neural network method in simulating the working model of the human brain, parallel distributed processing model, and self-learning capacity. It can accurately and quickly deal with the relevant evaluation and prediction problems in the field of non-linear and complex power plant chemistry. (XiaoMan Guan 2020).

Support Vector Machines (SVM)

Support Vector Machine (SVM) is a relatively simple Supervised Machine Support Learning Algorithm. In this model we gives labelled data both inputs and outputs then form a model on the basic of that labelled data and then put the new data and check the model will give the valid data or not .

Purpose of making machine learning is that computer can do work without human. It gets a experience of previous work or data and predicts the future. benefit of using SVM are it work more effective and efficient as well it takes relatively less time to give an accurate results .Support vector machine is work on Structural Risk Minimization (SRM) . SVMs represent novel techniques introduced in the framework of structural risk minimization (SRM) and in the theory of VC bounds.

The analysis was carried out the software Waikato Environment for Knowledge Analysis (WEKA).WEKA is a package manger and in this study, it is used for the regression analysis of data by using LibSVM package. In SVM, the data normalization is calculated from following equation (1) (Tenpe,Patel 2020)

$$X_n = (Xi - Xmin) / (Xmax - Xmin) \quad (1)$$

Where, X_n = Normalized value and Xi = Original value of the variable. (Tenpe,Patel 2020)

METHODOLOGY:

To collect the wastewater characteristics data i.e. Chemical oxygen demand (COD), Total suspended soilds (TSS), Biochemical oxygen demand (BOD), Temperature, Potential of hydrogen (pH), conductivity, from nearby Municipal/Industrial Wastewater treatment plant.

Software Requirements is WEKA (Waikato Environment for Knowledge Analysis) Software 3.8.6 version.WEKA is developed by University of Waikato, New Zealand in 1993. WEKA is a

collection of machine learning algorithms for solving real-world data mining tasks.It contains tools for datapre-processing, classification, regression, clustering, associations rules and visualization. Weka is a collection of machine learning algorithms for data mining tasks. It contains tools for data preparation, classification, regression, clustering, association rules mining, and visualization Weka comes with built-in help and includes a comprehensive manual. For an introduction to the machine learning techniques implemented in Weka, and the software itself, consider taking a look at the book Data Mining: Practical Machine Learning Tools and Techniques and its freely available online appendix on the Weka workbench, providing an overview of the software. Closely linked to the book, there are also free online courses on data mining with the machine learning techniques in Weka.

RESULTS :

For evaluation of WWTP performance, the value of BOD, COD, pH and SS in input and output of treatment were compared. The wastewater has a relatively good biological treatability considering the BOD / COD ratio of 0.6, relationship between COD and BOD of the wastewater was obtained by Linear regression (BOD=0.6COD). The realising wastewater parameters after treated should be in that desired ranges.

Sr. No.	Parameters	Characteristics of composite generated (Range)
1	pH	7.9-8.5
2	COD	720-784(mg/l)
3	BOD	298-340(mg/l)
4	Total Solids	786-1164(mg/l)
5	Total Dissolved solids	412-846(mg/l)
6	Total suspended solids	180-530(mg/l)

CONCLUSION:

The SVM models was developed to test its predictive performance on the quality of river water and WWTP and has a great opportunity as a predictive tool. Future research should direct attention to applying the same techniques to other catchments and consider relatively long data series to reasonably compare the performance of the models in water resources. The SVM model is a golden and valid instrument that optimizes the observational network by determining important monitoring sites and predicting river water variables quality with acceptable precision. This research line is crucial to understanding the means of linking together land use, water quality, disposal, pollutant loading and ecosystem impacts to efficiently model and predict water quality.

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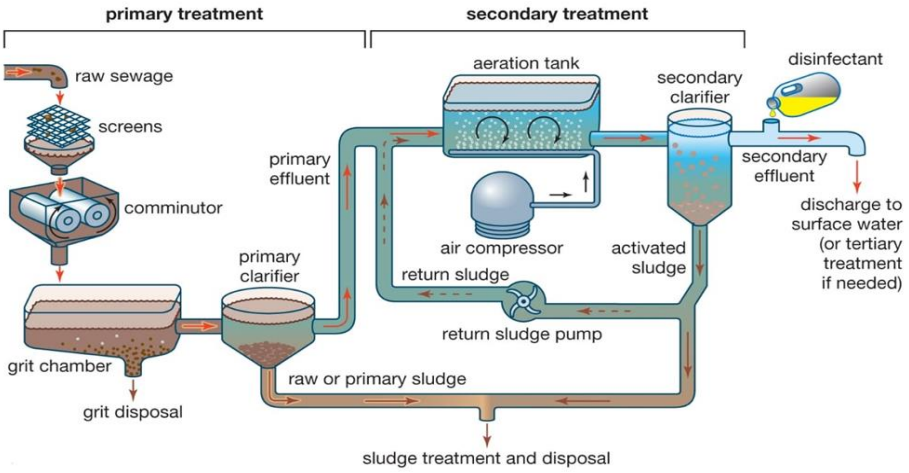

Fig. 1-Waste Water Treatment Process (XiaoMan Guan 2020)

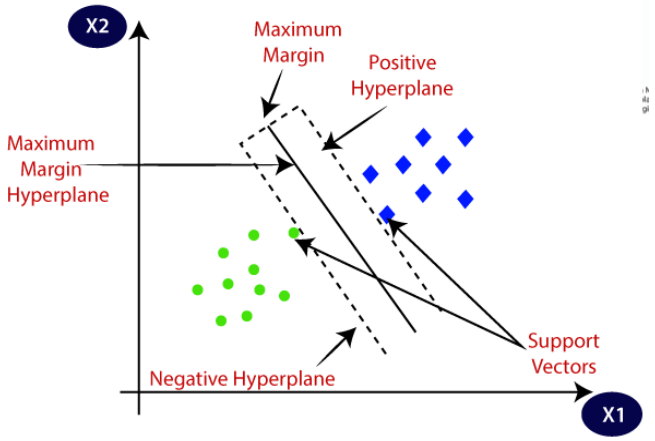

Fig-2 Support Vector Machines

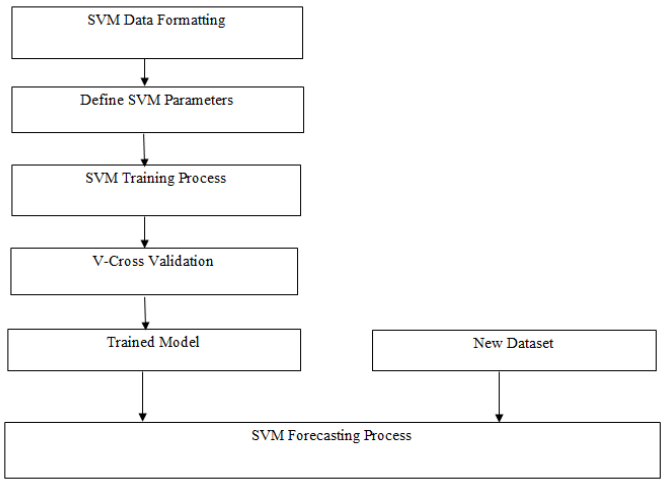

Fig.3 working of support vector machine