An emergent addition for the optimal systemization of wastewater utilization plants using artificial intelligence

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ABSTRACT

The treatment of wastewater is an essential factor in preventing pollutants and promoting the quality of the water. The inherent complexity, influential impact and the solid waste infrastructure all lead to confusion and variance in the primary clarifier for wastewater. These inconsistencies lead to variations in the purity and capacity constraints of wastewater and the existential impact of water receipt. Water treatment is a complicated task that has chemical, technical and biochemical aspects. A credible artificial neural network (ANN) method is necessary for another wastewater treatment plant to prevent the breakdown of the processes. Virtual reality seems to have become a strong solution for preventing waste management uncertainties and problems. This is not only due to extreme changes but also to significant external disturbances that water systems are subjected to when controlling challenges. Climate is among the most significant of such disturbances. Various environmental conditions actually include different influx frequencies and levels of substances. Water contamination has become one of the extremely serious growing concerns; sewage treatment plant identification is a key major issue here and the agencies enforce tighter requirements when operating wastewater software systems. This article plans to create models of achievement and prospects when possible future guidance of recent research borders for the use of artificial intelligence in wastewater treatment plants that concurrently deal with pollutants. This study has shown us that the composite ANN provides a greater level of competence in plant prediction and systemization.

Key words: artificial neural networks, climate, plant prediction, solid waste, wastewater treatment plants

HIGHLIGHT

• The ANN parameters are tuned with different weights and biases to obtain effective results and a solution to achieve the best results.
• The proposed research methodology also suggests that this research can be made more effective by fine-tuning ANN parameters using optimization techniques.
• This paper explores the effective utilization of artificial intelligence for wastewater.
• The composite ANN has been found to deliver a higher level of competence in plant prediction and systemization in this study.
• The behavior of input water in wastewater treatment plants must be predicted using a neural network.

INTRODUCTION

The processing of wastewater has to be the most critical strategy for reducing electrolyte pollutants and promoting groundwater. The formulation of wastewater is exceedingly complicated, with influential assets and waste products, and waste management systems that differ widely. In addition, managers must consider allowing access to the system for deterministic disturbances and influential heterogeneity. The sophistication of weather occurrences, the activity of anthropology and processes for treating wastewater create certain inconsistencies (St-Onge et al. 2019). In addition, considering the quantity, purity and disposal cost savings of wastewater, these inconsistencies vary significantly on their own. Solid wastes water treatment plants are facing growing limitations on emissions and new rules for energy consumption and conservation of resources.

Urban and industrial wastewaters are responsible for various kinds of pollutants disposed of into other aquatic environments. Failure to operate a plant-specific wastewater infrastructure may create serious concerns regarding environmental and human health issues (Mingzhi & Jinquan 2015). The advancements of a wastewater treatment plant control unit are essential to achieve outstanding quality and achieve a sustainable process. Artificial neural network (ANN) involvement in effective tracking, forecasting productivity, and monitoring procedures, but also aspects of complex non-linear as well as multivariate systems such as
environmental science, misprocessing and wastewater treatment, has consistently increased over recent years. A credible ANN method is necessary for another wastewater treatment plant to prevent the breakdown of the process.

ANNs consist of a weighted-connected given node (synaptic strength training) from one nerve cell output to another outlet in order to estimate or ‘guesstimate’ operations that depend on several feeds (HongGui et al. 2014). In relevant biological engineering, moreover, ANN is often used as an exciting instrument due to its convenience in execution and because the use of evolutionary algorithms can substantially improve ANN achievement and its constraints, as in a lower education ratio and the hazard of local minimal obstruction.

A wide range of biological treatments is operated by an on–off control, a reciprocal circle or by proportional–integral–derivative (PID) analysis systems in a realistic sewerage system. These traditional techniques are used to control wastewater treatment Unlimited Register Machines (URMs) based on power consumption voltage regulators and input to alter the wastewater treatment procedure. The above spatial systems will then optimize the setting pointers based on overall quality criteria (Piotrowski & Skiba 2015). The disproportionate, integrated, differentiated coefficients of these traditional control schemes have often been challenged by human expertise or by trial and error. Therefore, it may take a significantly long time to create a traditional selector.

For wastewater treatment plants (WWTPs), the control of certain efficiency strategies has been introduced more recently, including optimized neural networks, to make predictions. The WWTP pattern is indeed very prominent in such optimization algorithms. But the accurate scientific formula for WWTP is difficult to attain due to its extensive and incomplete information features (HongGui et al. 2014). Based on the mathematical equation, this prototype computer model would be used. The required data of a distributed system are taken mostly during virtual prototyping systems in order to achieve a highest learning style productivity by eliminating prediction error.

In order to meet the specifications of a non-chronological research framework and the embodied qualities of smarter technical solutions, an intelligence procedure will be used in the development of domain experts by convolutional neural networks when treating symptoms of efficiency in an existing manufacturing project process. For instance, computer program identification was designed for WWTP status data to aid the computer program controller (Lai et al. 2015). To adapt the feedback signal set statements for the best functioning of the shaft oven in response to changes, a template segmentation entails approach was advocated. These tools may modify the digital objective, which is to maximize the difficult system of management.

This research contributes to improving the water quality by comparative analysis of artificial intelligence (AI) and other techniques. ANN models on nutrient elimination in a biological treatment are discussed to improve performance. The main objective of this paper was that an AI system should be applied to a water treatment facility, a simulated test framework developed, and an internet instant checking tactic established, and that high definition artificial intelligence was developed and operated for complicated applications that require continuous and intellectual surveillance, prognosis and regulation.

This paper is organized in the following sections. The first section contains a literature review of various studies. The next section presents the wastewater types, issues and challenges, followed by a description of wastewater utilization processing. AI techniques on wastewater treatment models are presented and research methodology is proposed. Finally results are analysed, followed by a discussion and the conclusion.

**REVIEW OF LITERATURE**

López-Morales & Rodríguez-Tapia (2019) indicated that ANNs are an important AI technique and a scientific neuronal model. ANN can solve multinomial non-linear difficulties by providing an adequate classification model and a correct number of time. ANNs are also often used in methodological approaches for sewage management to eliminate pollutants.

Fan et al. (2018) explain that ANNs use slightly simpler patterns made up of many modules that include activation function linked to flight recorder systems depictions via frequency deviations linking. Every neuron receives, works and sends feedback signals to the brain, which further passes to the successive nerve cells.

Zhang (Zhang 2017) proposed that ANN interprets labeled images and gathers information interactions that could be used for modeling, forecast and optimization. ANNs are more like a processor compared to a human mind that ranges from policies and requirements layered to intra-multinetworks that have several informational chain reactions and layers.

Adeloye and Dau (Adeloye & Dau 2019) explain that overlap and heterogeneity are really the primary concepts for the process of analytical governors to chromosome communities. In the GA issue set, a series of sequences of multiple criteria vectors containing various responses are portrayed. ES can replicate the judgement procedure to solve complex problems given the knowledge and experiences of other professionals in a given field.
Sattar et al. (2019) The AI system also covers uncommon approaches like MT, DM, algorithms for clumping, BN, PSO and SVM. This approach can then be used to resolve societal inequalities through divisions of input into subdirectories for the use of a parametric normality test for subsystems. The structure portrayal of the database can indeed be achieved by means of a pieced normal distribution to resemble a possible correlation.

Bagheri et al. (2019) Difficulties in DM are addressed through division into various subdomains and the combination of the results. Convergence is an uncontrolled data grouping approach using a certain mutual information The proposed method organizes the unclassified input images into clusters according the accumulation concept, a qualitative, different figure. BN, a Bayesian creed system, is a modeling of acyclic curves containing the associated nodes’ vertices and their direction. Every module represents a random sample and the likelihood assignment distributions of dungeons.

Qiao et al. (2019) Proposed the PSO, an adaptive system that resolves optimizing issues by randomly finding the optimized solution via iterations. SVM is a least squares classification algorithm which creates the issue of supervised learning based on the optimum class segregation concept. For implementation in problem solving, SVMs and similarity measures have quickly evolved.

WASTEWATER
Sewage is a liquid caused by social activities and is made up of a diverse variety of materials. Although there a various pollutants the main contaminants are carbon and phosphorus, which are the primary focus of both traditional electrocoagulation and urban renewal processes. Numerous materials are steps for important nodes.

Sources and types of wastewater
The resources are primarily comparable, although rainwater differs from community to community. A summary of nodes is included in the current example.

Wastewater at workplace
The far more specific type of municipal sewage is essentially the liquid from houses or medical centers and can be additionally categorized into two parts: 1. Brown water mostly from individuals or individuals’ mouths and blood. 2. Carry water tainted by drinking, laundry, eating and the like. Dark gray water is not divided in a number of situations and enters the treatment plant as a blend. The fact that such activities lead to a certain characterization of particulate matter feeds in water is critical for surgical procedures.

Wastewater manufacturing
During power generation such from as manufacture, purification or cooling, industrial wastewaters are water contaminated. Distinguishing formulation of industrial effluent versus wastewater discharges, it is heavily dependent on the quality of industrial dump. Each source thus possesses its own features. Although a charging device releases high concentrations of chemical oxygen demand (COD) into other water, some have a percentage of toxic elements. The neural network model with genetic approach has been studied (Park et al. 2019). The mixture will vary considerably day by day if another supply chain is arranged in the clusters. The implementation of control system generated voltage is complicated by these unknowables.

City wastewater (municipal)
Municipal wastewater is public water and represents a blend of polluted water from households and also from industry.

Wastewater farming
Energy use in agriculture produces livestock wastewater. Pesticides, fertilizers, chemicals etc. are common toxins. Only agriculture raw sewage from diffraction gratings, such as living projects supported, is of concern to processing plants. Polluted water does not normally gather on the soil or in the aquatic environment directly.

Water intrusion
Water for intrusion is a particular kind of discharge. It could also be argued in a strict sense that it is not groundwater. Information warfare seawater can penetrate the drainage system (normally aquifers).

Water surface
The Earth’s crust’s waste is industrial wastewater sewage from roads, car parks and other adjoining sealed materials. Furthermore, gasoline, gasoline, metal, gasoline, road corrosion, etc. are pollutants/When the WWTP is connected to treated
wastewater, the influential effect on the facility grows markedly, it will become important for the water source and also the care provided.

WASTEWATER UTILIZATION PLANTS

Physical, chemical and biological cleansing procedures are used in these industries. Microbial ritual cleansing comprising carbon, nitrogenous compounds in a main generator is then performed following different mechanical chlorination steps. The final process is accompanied by the selective removal of the awakened locks from the water by settling. The final cleansing stage is desirable and is only used when the reliability of the wastewater is especially strict.

The underlying structure of a conventional water source is shown in Figure 1. The following paragraphs explain the appropriate phases as well as the interventions options (Kern et al. 2014).

AI TECHNIQUES FOR WASTE WATER UTILIZATION PLANTS

In combination with other AI methods, the hybrid AI method provides an inference engine to circumvent more of the biggest drawbacks of specialized systems. The consulting system depends on consulting human experts upon this accumulation of expertise, however when scientific technology remains essential, it cannot apply experiences in a changing situation. The smart computer program blends knowledge from specialist information.

Figure 2 shows a description of both the hybrid AI management system for the imaginary wastewater treatment plant. From the simulation environment ‘conspammed’ by the optimization technique, the skills necessary data were constructed for the computer program. The computer program then learned from the institution of experts the patterns of control. The professional system produces an influence value in the air compressor, then takes the value to the computer program to produce the recycled raw sewage percentage. If the raw sewage recycling rate is a serious problem, except for when the biochemical oxygen demand (BOD) intensity is high in the air vessel, the expertise process delivers a further significance level for the BOD before the vital solution is satisfied during the process.

![Layout of a typical wastewater utilization plant.](image1)

![A hybrid AI system applied to the control of a wastewater utilization plant.](image2)
The wastewater utilization plant consists of static screens, pumping station, anaerobic lagoons, aerated lagoon, sedimentation and chlorination tanks shown in Figure 3.

**The class hierarchy of the wastewater utilization plants**

One of the benefits is that a superclass as a feature is declared and the subclasses possess the characteristics of the superclass. Many legacies cause the subclasses to be superclassed in any quantity. Conversely the subclasses inherit several characteristics of all the attributes and methods of its kin. Liquids are defined by flow quantitative and qualitative qualities at a water treatment facility (Alver et al. 2015).

The entity model is shown in Figure 4 and illustrates the classification of the group. In the raw sewage plant and sewer processing plant, there are two types of fluids which flow as persistent channels. Two sections of the wastewater treatment have to be linked between the tubes and the pump. The pump is thus a subclass of components and the pipe is a subset of the connection. The regulator can regulate the energy and flow rate. Membrane separation is discussed in Asghari et al. (2018). The devices can observe the WWTP that the monitoring or command software is as needed. In this design, no consideration was given to the signal delay from the detector to the device.

**Classification tree of AI technology used in wastewater utilization plants**

ANNs are a significant aspect to artificial neurons based on AI. ANNs can solve multinomial non-linear problems when they have an acceptable method and a correct amount of information. ANNs are often commonly adopted during water/wastewater treatment in methodological approaches to eliminate pollutants. ANNs are made up of extremely simplistic models made up of several processing components, artificial neurons linked to security testing structures by ties of variable weight. Each receiving node, recognizes and transfers feedback information from other neurons, which are then moved on to corresponding neurotransmitters as inputs. The ANN learns from the testing phase and collects the links that can be used for modeling.

![Figure 3](image1)

**Figure 3** | Schematic diagram of the wastewater utilization plant.

![Figure 4](image2)

**Figure 4** | Class hierarchy of the wastewater utilization plants.
estimation, and enhancement among data sets. ANNs are a set of information monitoring systems similar to a human brain that vary from single direction logic levels to multi-input complex networks with several directional feedbacks.

The technology of AI also involves certain uncommon techniques, for example MT, DM, cluster, BN, PSO, and SVM. The MT system can be used by dividing the entry into subsites and implementing a linear, multivariate regression model to subdomains to overcome constant class problems. The conceptual description of the set of data can also be achieved by the use of a generalized linear model in part, approximating a non-linear interaction. In DM, issues are solved by splitting them into multiple subproblems with the results. Grouping is an unattended data aggregation process using given mutual information.

The AI technologies used in sewage treatment research can be categorized as single and mixed methods in Figure 5. The proposed method organizes the highly classified function vectors into groups according to the classification concept in statistical methods. BN, a Bayesian belief system, is the design of monocyclic graphs that contain associated edges’ clusters and users access. The PSO is an innovative metaheuristic algorithm that solves combinatorial optimization problems by randomly finding a solution and by means of optimization seeking the perfect solution. SVM is a generalized linear classification algorithm that solves the issue of binary classification based on the different classes theorem. For pattern recognition tasks, SVMs and underlying structures have developed rapidly.

Wastewater reuse opportunities

Saudi Arabia is one of the highly advanced nations in the world with gross domestic product (GDP) by field, economics and social theorists, agricultural production: 8.1%; sector: 27.7%; and services: 64.2%. Central recycling systems for wastewater are probably bad everywhere. However, person (household) and on-site disposal systems are also essential and can also be strengthened by gray wastewater treatment solutions. The choice of a method for treating wastewater relies on a wide variety of cultural factors such as use, place, climate, water availability, social values and religious views. As well as raising attention, it is also essential to plan and city officials to implement resource recovery laws and regulations.

Higher water needs are changing public curiosity in the supply of water in some regions, but the goal should always be to modify the current sewage treatment plants and build new sewage treatment plants with reusable facilities (Alver et al. 2015).

Figure 6 shows the types and levels of wastewater utilization processes. There is a great opportunity to use innovative existing technology for treating wastewater and reuse in advance to efficiently eliminate contaminants like salinity, bacteria, toxic substances and volatile substances as found for ultraviolet light, degradation, ripening lakes, fluid filtering, and electrical and chemical therapies. The wastewater treatment model is described in Table 1.

RESEARCH METHODOLOGY

ANN’s frame is comprised of an input layer, one or more hidden layers and output layers. A set of integrated modules are made up of neurons in each layer of the network. These neurons are weight-based and interacting with each other. Every neurons in the next layer is linked to all neurons. The data are displayed in the input layer in the neural network.
Figure 6 | Types and levels of wastewater utilization processes.

Table 1 | Wastewater utilization processes technology

<table>
<thead>
<tr>
<th>s no.</th>
<th>Type of Wastewater</th>
<th>Type of wastewater Treatment</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Domestic wastewater</td>
<td>SMBR</td>
<td>Elimination of chemical and mineral contaminants</td>
</tr>
<tr>
<td>2.</td>
<td>Dormitory and residential settlement pollutants</td>
<td>Dipped vacuum (VPM) + MBR</td>
<td>Elimination of emerging pollutants and minerals</td>
</tr>
<tr>
<td>3.</td>
<td>Raw sewage enabled waste plant organized industrial district (OID)</td>
<td>Chemicals and the exchange of ions To treat and increase the effluent in an OID processing plant</td>
<td>Its quality of water to the recycle rate of industrial textile requirements</td>
</tr>
<tr>
<td>4.</td>
<td>Residential wastewater</td>
<td>Lagoons in anaerobic</td>
<td>Elimination of chemical compounds and mineral</td>
</tr>
<tr>
<td>5.</td>
<td>Direct gray water from an apartment unit</td>
<td>SMBR</td>
<td>MBR activity without fertilizer restriction and the biodegraded use of a process modeling method to examine wastewater in MBR</td>
</tr>
<tr>
<td>6.</td>
<td>Urban wastewater</td>
<td>Urban waste and traditional therapy facilities for polluted water</td>
<td>Four different facilities’ improves work study</td>
</tr>
<tr>
<td>7.</td>
<td>Urban wastewater</td>
<td>The ponds have been created</td>
<td>To assess the efficiency of built humidity networks Plant material in the extraction</td>
</tr>
<tr>
<td>8.</td>
<td>Raw sewage tanning</td>
<td>AOP</td>
<td>COD elimination</td>
</tr>
<tr>
<td>9.</td>
<td>Household wastewater</td>
<td>The floodplain program was installed</td>
<td>Research on changes in wastewater efficiency</td>
</tr>
<tr>
<td>10.</td>
<td>Domestic wastewater</td>
<td>Wetlands built horizontal subsurface flow</td>
<td>To find the best degree of mechanical load for efficient of extraction</td>
</tr>
<tr>
<td>11.</td>
<td>Groundwater for olive oil mill Sunset, Sunshine</td>
<td>Low altitude earth processes that give, reactor of PVC</td>
<td>For the factory owners to use wastewater rather than big convection tanks to provide a sustainable actual option of a small land treatment process</td>
</tr>
<tr>
<td>12.</td>
<td>Wastewater domestic</td>
<td>The reservoirs have been created</td>
<td>To measure the impact on the therapy efficiency of various filter media</td>
</tr>
</tbody>
</table>
Based on the magnitude of the issue the number of hidden layers should be chosen. Usually, the examination of most of the issues requires one secret layer. The quantity of neurons in the hidden layer should be chosen from the minimum and then increased depending on the scale of the issues, by experimentation process. A collection of input and target output values is presented for the neural network operation. Parameters of input will be selected for output of influencing parameters. The back-propagation method has been widely used to model genetic challenges (Hassan et al. 2020).

The neural network output should be shown for the specified input data by the output layer. These networks can calculate causal interactions among input and output by means of hidden layers. Figure 7 shows the architecture of an artificial neural network. Basically, back propagation is a differential lowering process for reducing the model for network error:

\[ E = \sum_{j=1}^{K} \sum_{i=1}^{n} (e_i(j) - t_i(j)) \]

where \( e_i(j) \) and \( t_i(j) \) are estimated and targeted values, respectively. ‘\( n \)’ is the number of output nodes, and ‘\( k \)’ is the number of training samples.

Weights are immediately randomized before the beginning of an ANN instruction. Weights are modified based on the replication of errors:

\[ \Delta W_{ij}(n) = \alpha \frac{dE}{dW_{ij}} + \beta \Delta W_{ij}(n - 1) \]

where \( W_{ij}(n) \) and \( W_{ij}(n - 1) \). In neighboring iterations, weights increase between I and J nodes, and \( \alpha \) and \( \beta \) are the training rate and impetus component. For efficient training of the recurrent neural network, appropriate examination and adequate learning rate adaptation is required. Some previous contributions to ANN models on nutrient elimination in a biological treatment have been cited in previous publications.

**Steps in designing ANN architecture:**
The developed model for ANN includes ANN architecture, microstrainer treatment of groundwater, electrolysis, flotation, soil erosion and filtering, ANN preparation, evaluation of findings, validation of and application of ANN.

Figure 8 shows the flow diagram of the ANN measures used. Raw river water has been taken. Microstrainer, ozonation and coagulation, lime-dose milk, sedimentation, oxygenation and activated charcoal oxygenation were controlled. The coagitation mechanism was dominated by unrefined water sediment and electric permeability with pH adjustment and colloidal formulation without dosing to aid flocculation. Three conditions for filter scrubbing are surface tension in a system textile wastewater less than 0.2 FNU, particulate matter larger than 1 \( \mu \)m and a filter runtime greater than 65 h.

**Figure 7 | Architecture of an artificial neural network.**
The importance of preventing overgrowth of microbes, and for health reasons, was influenced by the three major determinants. During the filtering runs, observations showed a gradual increase due to a pressure loss in the filter although the filter’s runtime was not limited (Asghari et al. 2018). The fast filtration water was gathered in the setup pond using the sedimentary sludge. The loam was drained to the wastewater system and the wastewater was deposited to the wastewater reservoir.

The network used was a feedback system or a feedback system multilayer (Hassan et al. 2020). Using a back-propagation algorithm, forwarding connections are most frequently practiced. The quantitatively described three-layer neural back-propagation network follows:

\[
O_{pk} = f_1 \left[ \sum_{j=1}^{L} W^p_{j,k} f_2 \left[ \sum_{j=1}^{N} W^h_{j} x_{pi} \right] \right]
\]  

(1)

**RESULTS AND DISCUSSION**

The pureness of wastewater is based on water parameters such as pH values, biochemical oxygen supply, suspended substances, etc. For primary settlers and secondary settlers, the ideals of these elements are established. Groupings produced are then analysed and segregated as contaminated water, unadapted liquid and drinkable water (Deepashri & Kamath 2017). Tables 2 and 3 shows the wastewater utility of primary and secondary settlers respectively.

**Waste water utilization plants primary settler:**

The consequence from the primary settler compared with the secondary settler is that the water is in a secondary state as fit and unfit. As can be seen in Figure 9, clean water is 13%, 39% is unfit and 54% is contaminated. Figure 10 shows the secondary settler performances.
The content of distilled water in secondary settlers was 20%, 42% was unsuitable and 48% was contaminated. There was more dirty water in the main settler than the secondary settler. This demonstrates that the water was cleaner in secondary settlers than in primary settlers.

**Table 2** | Waste water utilization plants primary settler

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Aspects</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fit</td>
<td>13</td>
</tr>
<tr>
<td>2.</td>
<td>Unfit</td>
<td>39</td>
</tr>
<tr>
<td>3.</td>
<td>Polluted</td>
<td>54</td>
</tr>
</tbody>
</table>

**Table 3** | Waste water utilization plants secondary settler

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Aspects</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fit</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>Unfit</td>
<td>42</td>
</tr>
<tr>
<td>3.</td>
<td>Polluted</td>
<td>48</td>
</tr>
</tbody>
</table>

**Figure 9** | Wastewater utilization plants primary settler.

**Figure 10** | Wastewater utilization plants secondary settler.

**Waste water utilization plants secondary settler:**
The content of distilled water in secondary settlers was 20%, 42% was unsuitable and 48% was contaminated. There was more dirty water in the main settler than the secondary settler. This demonstrates that the water was cleaner in secondary settlers than in primary settlers.
**Analysis of wastewater utilization plants using ANN algorithm**

Table 4 shows the analysis of wastewater utilization plants using the ANN algorithm. As shown in Figure 11, the secondary settler generates better water than the primary settler with the ANN algorithm and less contaminated water.

In the result analysis, the primary and secondary settlers give takes the fit, unfit and polluted results. In this, the primary settler obtains the value of 13% (fit), 39% (unfit) and 54% (polluted). The secondary settler is 20% fit, 42% unfit and 48% polluted results. Overall, optimal value for both the true negative and true positive values was analyzed for primary and secondary settler, which is taken based on alpha value.

**Optimal value calculation:**

The test standard is $\alpha$, which is supposed to be the likelihood of a type I error, and a process of modification was used to decrease the type I error. We performed a numerical research to test the maximum k centers that represent the value should not be strict. Here, 100 examples have been chosen and further measures have been considered.

In order to achieve the optimum solution, we have set $\alpha$ values and tested each condition. According to our study and as shown in Table 5, the ideal solution for the value $\alpha = 0.0001$ will be achieved, where the real positive value in comparison to other main and secondary settlers is more true. The optimal value calculation is given in Table 5 and respective graph model is given in Figure 12.

**Table 4 | Analysis of wastewater utilization plants using ANN algorithm**

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Aspects</th>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fit</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>Unfit</td>
<td>39</td>
<td>42</td>
</tr>
<tr>
<td>3.</td>
<td>Polluted</td>
<td>54</td>
<td>48</td>
</tr>
</tbody>
</table>

**Figure 11 | Analysis of wastewater utilization plants using an ANN algorithm.**

**Table 5 | Optimal value calculation**

<table>
<thead>
<tr>
<th>Alpha value ($\alpha$)</th>
<th>Primary value</th>
<th>Secondary value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>True positive</td>
<td>True negative</td>
</tr>
<tr>
<td></td>
<td>True positive</td>
<td>True negative</td>
</tr>
<tr>
<td>0.0004</td>
<td>54</td>
<td>50</td>
</tr>
<tr>
<td>0.0003</td>
<td>63</td>
<td>41</td>
</tr>
<tr>
<td>0.0002</td>
<td>71</td>
<td>33</td>
</tr>
<tr>
<td>0.0001</td>
<td>74</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>56</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>66</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>74</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>27</td>
</tr>
</tbody>
</table>
CONCLUSION

The control strategies used, such as intelligent machines, artificial neural and AI networks, were shown to be strong instruments, particularly when they are used for monitoring processes that are misunderstood or complicated to design using conventional control measures. Next versions of waste management AI techniques will be able to provide the operators of wastewater treatment plants with online learning and support. An upgraded treatment system for wastewater must use AI techniques in the design or renovation of wastewater treatment and automatically diagnose influential wastewater to change its operation. A neural network must be used to determine the behavior of the inflow water for future AI systems used in wastewater treatment plants. Furthermore, the expert method must be able to adapt the microbes in the aeration tank to the influential adsorbent dose.

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DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

REFERENCES


