**Evaluation of predictive modelling using a Machine Learning Algorithm for assessing groundwater quality trends in Punjab, India.**

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*ABSTRACT*

The groundwater quality assessment is an inseparable part of comprehensive hydrological or environmental study, as it could offer critical insights into evolution of geological conditions, sustenance of ecosystem vitality and human health. In the recent times, the advent of machine learning algorisms in every aspect of research has enabled the researcher to apply these for predict crucial parameters related to any environment. In this context, the study tries to analyse recent groundwater quality trends in Punjab state, India. Through the application of Machine Learning algorithms like Gradient Boosting, it not only assesses the current conditions but also tries to predict critical parameters influencing groundwater quality. The application of this analytical framework in the study was able to identify potential areas of concern, and uncover nuanced trends, that could highlight sources of contamination. Furthermore, the study also tried to provide an insight into higher uncertainties in performance of ML models due to unbalanced data or point source contamination. These findings not only highlighted the groundwater dynamics of Punjab, but also advocated the wider use of predictive modelling of water quality parameters for fruitful implications in sustainable water management practices, along with strategizing of appropriate water treatment methodologies for and recommendation for preserving the aquifer systems.