CHAPTER 3
OBJECTIVES AND SCOPE

The major objective of the present work was to study the comprehensive lake eutrophication dynamics by simulating artificial lake eutrophication scenario and its subsequent effective restoration mechanism with the help of predictive data-driven modelling. Lake eutrophication is a very complex process that is dependent on physical and biochemical factors and is greatly influenced by spatial and temporal variations. Data-driven modelling approaches have been used for successful lake management activities with different degrees of success in different parts of the world. Lake management with data-driven modelling is dependent on collection of an exhaustive water quality dataset. Under the circumstances where such prolonged data is unavailable for waterbodies particularly for remote areas in developing and under-developed countries, eutrophication management with modelling approach becomes a concern for stakeholders and policy makers.

In India, surface waterbodies like lakes, rivers etc. are getting increasingly polluted due to manmade activities around different parts of the country [171]. Assam, the economic and cultural hub of North-Eastern India, is bestowed with large number of lakes, ponds, and wetlands, but research works relating to their trophic state, water quality and management policies are meagre. Increased anthropogenic activities and use of chemical fertilizers to agricultural fields have made most of the urban and rural waterbodies susceptible to eutrophication. Periodic monitoring of water quality data in these water bodies are also unavailable. Keeping these aspects into consideration, the objectives of the presented work can be summarised under following points:

- To study the effect of nutrient loading on water quality parameters by replicating lake eutrophication scenario.
- Development of data-driven eutrophication models from the studied artificial lakes.

- To check the feasibility of the developed models to be used as eutrophication prediction tool in natural water bodies in Assam, India.
- To study the relative importance of water quality parameters on prediction of eutrophication indicators.

To fulfil these objectives, three numbers of artificial prototype lakes have been constructed and nutrient rich waste water was applied gradually to these lakes. The effect of nutrient enrichment on different physio-chemical water quality parameters have been monitored throughout the period of transition of the lakes from oligotrophic to hypereutrophic stage. With the dataset gathered through experimental investigation, models for eutrophication indicators DO, SD, and Chl-a have been proposed using data-driven machine learning algorithms like ANN, SVR, GPR, and ANFIS. The prediction performance of the well-trained models were checked against some natural water body data of Assam, India to check the feasibility of the trained models to be used as eutrophication management tool. Finally, to determine the relative importance of the input water quality parameters on the estimation of the eutrophication indicators DO, SD, and Chl-a, sensitivity analysis was carried out.