Abstract

Problem Selection : Long term Capacity Planning

Understanding of the problem chosen?

a. Understanding of the Problem :

Having a reliable estimation of future water demand is the basis for the respective systems. We are developing a demand model, not a requirement model wherein the socio-economic factors play a major role in predicting water usage.

The problem requires us to predict the water demand of Mumbai on a long term basis, so that appropriate steps can be taken to plan future demands.

b. Most Challenging aspect :

1) Climate change uncertainty: As our target is predicting data over 15-20 years, there will be a lot of uncertainty in climatic factors.

2) Varying demographics of Mumbai: 60% of the city's population is using 45 litres per capita per day and the rest are using 200. So, there is a clear discrepancy. And 3 million of the city's population is not getting access to the water they require on a daily basis.

3) Understanding the water demands of new users on the basis of existing user base and urban land use planning.

c. Reason for Choosing this problem :

Mumbai's water situation represents a classic paradox. In June 2019, there was an acute shortage of water, due to late rainfall. Just after a month, in July the city was clogged in a heavy downpour. This situation is an outcome of a lack of planning. In times like today when a water war is apparent, this sort of mismanagement needs to be stopped. This topic is chosen to solve this alarming situation.

Structure of the plan to approach the problem chosen?

a. Approach :

Identifying the factors that affect water demand:

General factors :

- Population density
- Climate or season
- Price
- Proximity to water sources
- Economic conditions
- Future technological impacts

Along with all these there are factors specific to type of use such as:

1. Domestic :
    a. Income
    b. No. of persons per family
    c. Size of the house
    d. Housing Density

2. Industrial/Commercial :
    a. Type of industry
    b. Location
    c. Size
    d. Water Tariffs Rates

3. Slums :
    a. Land Use Planning

Time series datasets for the above factors according to demographics are available on public domains.

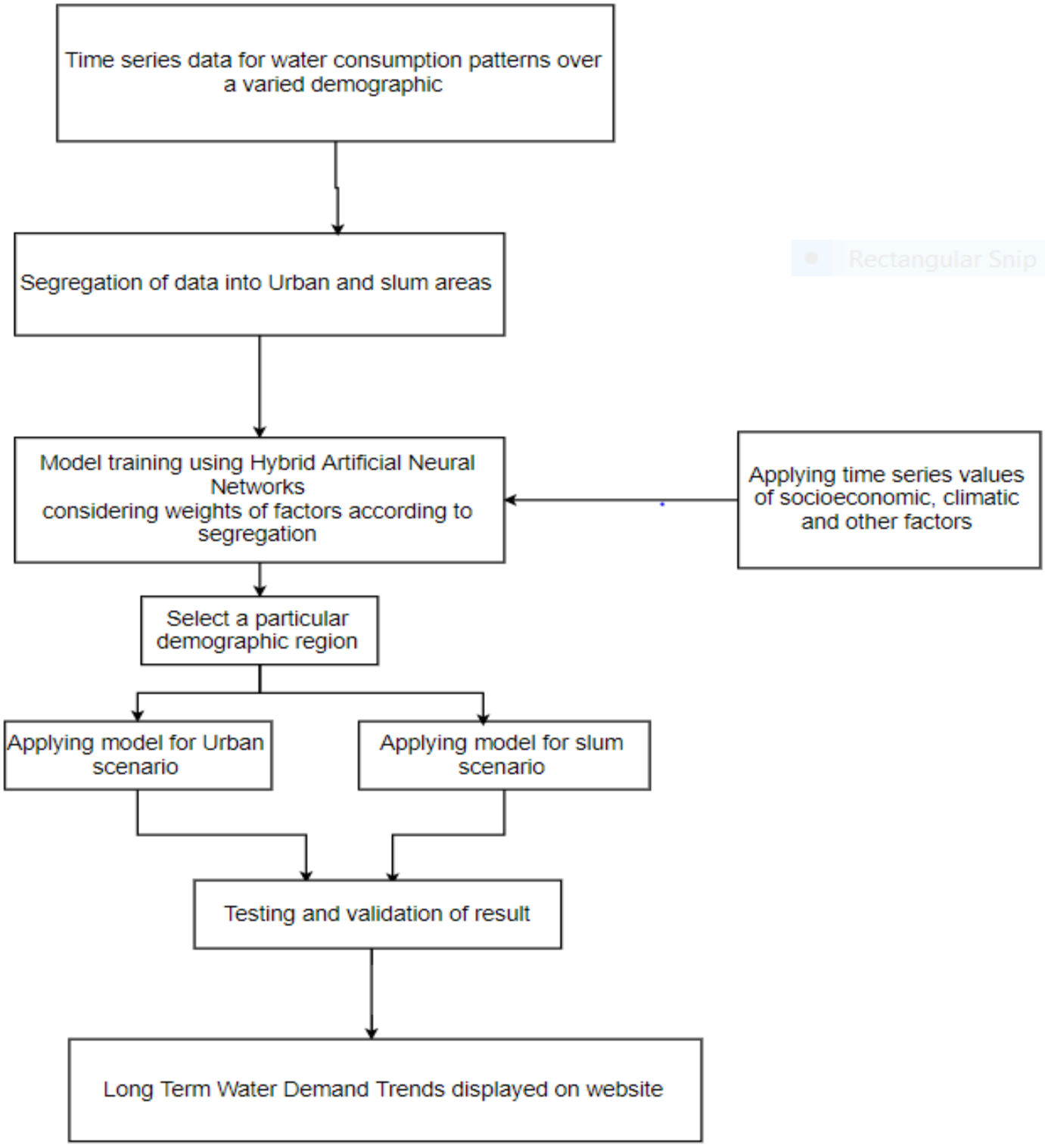
After collecting the data we will clean and label the data in terms of urban and slums. The urban data will have factors such as percentage of industrial, commercial, public and residential areas; whereas the slum will have greater weightage on land use planning; along with general factors listed above.

Depending on values of extra factors, weights can be assigned to factors, which will play an important role in determining the water consumption patterns.

After which the model will be trained using a Hybrid Neural Network. Input provided to Neural Networks will be data of water consumption and factors listed above in the form of a time series model.
The model will take into account the values of all factors over the span of 10-12 using time-series data and probabilistic approach.

Final output will be displayed on a website which will show water demand trends based on demographics.

b. Approach Diagram:



c. Platform/Coding Language/Framework :

- Python for cleaning data cleaning
- Keras for developing Neural Network
- Django for developing website

d. Database :

MongoDB

e. External Tools :

- Google Collaboratory
- Google Maps

f. Fortnightly targets :

1. Collection and Cleaning of various datasets.
2. Applying probabilistic approach and labelling data.
3. Assign weights to extra parameters.
4. Train the Hybrid Neural Network to respond to Urban and Slum.
5. Test and validate the model.
6. Develop website.

Why do we think our team will be able to implement a winning solution?

a. Previous Projects Undertaken :

- Digital agriculture using IoT (Looking Beyond Syllabus)
- Neural style filtering

- Wireless Doorbell
- Technical Paper Presentation
- Dispatch Bay Management Automation.[Smart India Hackathon 2019 (Hardware Edition)]

b. Team Strengths :
   - The biggest strength of our team is that we are all from various departments: Ria and Aishwarya are from computers, Tanya and Shreya are from electronics background. This diversity helps us to integrate knowledge from various fields and apply it to the problem statement.
   - Through the course of projects undertaken by us we have inculcated invaluable skills like:
     i. Problem solving tactics
     ii. Gaining conceptual knowledge while working
     iii. Effectively adapting to and implementing different methods.
     iv. Having an organised approach to tackling the problem.
     v. Cooperation between team members;
     vi. Sharing responsibility of all tasks

c. Team Achievements :
   - SIH 2019 [Hardware Edition]-Grand Finale,Runner Up
   - Qualified for semi-final round of LBS.
   - Finalist in ISA-Technovation.

- Won 2nd Prize in Technical Paper Presentation conducted by IEEE-VESIT.

d. Personal Motivations :

We believe that our only limitation is our imagination.

Being Mumbaikars, this problem is close to all of our hearts. There are endless complaints about mis-management of water resources in Mumbai. We have strong faith in our idea and approach towards the problem. The possibility of making a change in society is our biggest motivation.

We are combining various techniques and curating a model specifically for Mumbai's case, taking into consideration the 41% of the population who live in slum areas, along with the diverse urban areas.

Our goal from this project is to successfully predict long term water demand trends which will play a key factor in planning the water storage and supply chain for the future.