EFFECT OF WAVES ON BLOCKS SET BY DOCKS

Abstraction:

Cylindrical blocks of large diameters were used for creating wall-like structures in water. These blocks served several purposes of holding water sectors. There was a continuous impact of waves on these blocks. The cost of each block up to 10 meter depth priced in lakhs. The effect of waves on different blocks was observed with the help of experiments. Therefore, it was necessary to develop an algorithm from the observed experimental values which will determine the effect of waves of different height on blocks with different diameters.

Problem Statements:

To develop a model which will determine the effect and the erosion losses on the block due to waves of different heights.

To create our own program for different algorithms implemented using MATLAB.

To determine the best algorithm for which the predictions yield nice accuracy metrics values.

Introduction:

The waves data set comprised of about 200 rows which were the practical observations of various experiments carried out on different material shapes. These wave breaking structures were installed in water were and were eroded by the waves. The erosion depended on several factor like material shape, position, design as material parameters and of course on the wave height and velocity .
The losses and erosion were observed and their values for different radius were noted.
Our aim was to check the relation between the parameters and the values Kr and Kl which were analyzed and calculated by the various algorithms on Matlab.
Various Artificial Intelligence Algorithm , more precisely machine learning and deep learning algorithm were used in order to observe whether the formula fits perfectly for the observed data.

R	d	Hi/gt2	d/gT2	R/gT2 S	hs/d	d/hs	Kr values Hi	T

S/D=2	S/D=3 Kr(inter)	S/D=4 Kr	S/D=5 Kr	S/D=2.5 Kr	S/D=2.5adj Kr	S/D=2	S/D=3 Kl	S/D=4 Kl	S/D=5 Kl

R:Radius
D:Depth
g:Accleration due to gravity
Kr: Resistance
Kl:Loss
T:Time

Algorithms:

- Linear Regression
- Support Vector Machine
- Decision Tree
- Random Forest

- ❖ Artificial Neural Networks
- ❖ Anfis
- ❖ Levenberg

Methodology:

1. Database comprised of 8 columns and 200 rows.
2. Column SD14 had some missing values,so we replaced them in the pattern same as pattern observed in the previous values.
3. Then we carried out the feature engineering and selected the significant columns to avoid over-fitting. For this purpose we implemented the Principal Component Analysis.
4. Then after standardization, normalization and advance pre-processing, we implemented the ML and DL algorithms.
5. Among the Machine Learning algorithms Random Forest Algorithm gave us the best accuracy metrics.
6. (In the next meeting we decided to analyze the results which were observed through the Matlab).
7. Several of those algorithms were not included in the standard library ,so there was the necessity to include several functions all together for creating those algorithms.

8. We divided the different algorithms among different small groups so that we can work in a very effective way on each algorithm and then combining all the efforts will yield a collection of well developed algorithms. After the cluster of efforts we were able to find the functions by the virtue of which we could implement the neural network algorithms such as ANFIS, Levenberg
9. The Deep ANN algorithm used the mechanism like deep neural network with some additional formulation.
10. ANFIS algorithm considered normal and fuzzy members along with some complex neural network for predicting the values.
11. (In the next meeting we decided to spend some more time to work on Levenberg as it gave good results in Matlab)
12. Levenberg was also one algorithm which used methods of damped squares and complex neural networks for prediction of values.

Conclusion:

We got an amazing accuracy for predictions of Kr and Kl values using different algorithms.

Algorithms such as Random Forests, ANFIS, ANN Levenberg yielded the accuracy above 90%.

These algorithms us to understand the impact of waves on the blocks with different parameters of blocks and waves. That would help to develop the blocks accordingly. Also, that would save a lot of time, money, efforts and resources which would have been the result of more expensive lab experiments of striking a tide of certain height and velocity on the blocks of different radius.

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We would like to express our gratitude towards our guide Dr. Ajay Deshmukh, Dr. Smita Kandekar, Dr. Pavan Dodya for all the guidance, support and encouragement they gave us throughout our journey in this developing this algorithm. We express our sincere thanks for their valuable guidance, inspiration and vast knowledge.