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INSTRUCTIONS FOR PREPARATION AND SUBMISSION OF FULL-PAPERS FOR PUBLICATION IN THE PROCEEDINGS OF XL CILAMCE

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Abstract. Compressive strength is the main characteristic of concrete. The correct prediction of this parameter results in cost and time reduction. This work built predictive models for 6 different ages of concrete samples (3, 7, 14, 28, 56, and 100 days). Was used a dataset with 9 variables: compressive strength, age, and 7 ingredients (water, cement, fine aggregate, coarse aggregate, fly ash, blast furnace slag, and superplasticizers). Another 6 variables were added to represent the proportions of the main ingredients in each sample (water/cement, fine aggregate/cement, coarse aggregate/cement, fine aggregate/coarse aggregate, water/coarse aggregate, and water/fine aggregate). The predictive models were developed in R language, using the caret package with the Parallel Random Forest algorithm and repeated cross-validation technique to optimize the parameters. The results were satisfactory and compatible with other studies using the same data set. The most important model, 28 days old, obtained RMSE of 4.717. The 3-day model obtained the best result, RMSE of 3.310. The worst result was the 56-day model, with RMSE of 5.939. The work showed that the compressive strength of concrete can be predicted. The choice of creating a model for each age, instead of using age as a predictor, allowed to get compatible results with the available data at each age. It was a promising alternative since good results were achieved by training with just one algorithm. This work facilitates exploration and new efforts to predict the compressive strength of concrete, it can be replicated using different algorithms or the combination of several.

Keywords: Concrete, Compressive Strength, Machine Learning, Prediction

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2.3 Equations, symbols and units

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$$q_r = -4pr^2k\frac{dT}{dr}. \tag{1}$$

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Cite as Eq. 1.

2.4 Figures and tables

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Table 1. Coefficients in constitutive relations

Constitutive relation	Nomenclature	Value
Turbulent tensor	C	0.09
Turbulent tensor	C	0.69
Lateral lift	C	0.08
Virtual mass	C	0.80

Cite as Figure 1 and Table 1.

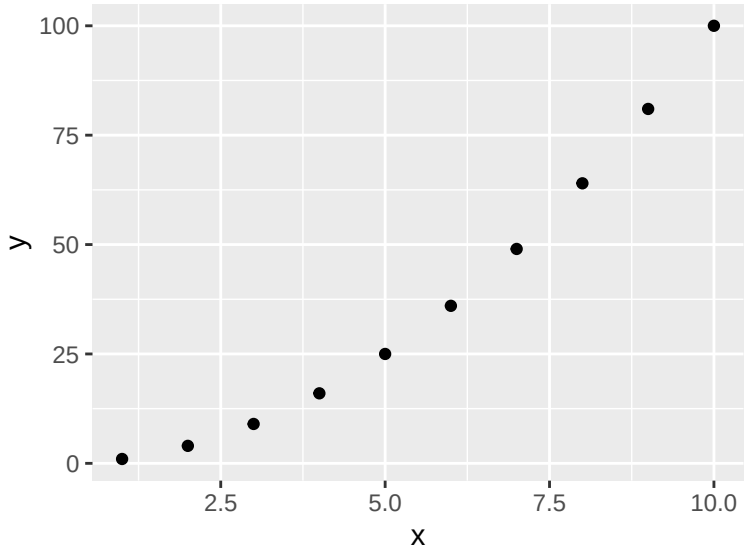

Figure 1. Pressure variation along the nozzle: experimental data

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3 References

Example of reference: “Yeh [1] proposed… Hameed [2]”. Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna

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References

[1] Yeh, I.-C., 1998. Modeling of strength of high-performance concrete using artificial neural networks. *Cement and Concrete Research*, vol. 28, pp. 1797–1808.

[2] Hameed, Mohammed e Khalid, M., 2020. *Prediction of Compressive Strength of High-Performance Concrete: Hybrid Artificial Intelligence Technique*, pp. 323–335.