Mechanical and structural properties of FRP concrete: data-driven, machine learning approaches

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Material properties extraction has been facilitated by the vast number of data stored in various electronic databases and being accessible in the research community, such as experimental, simulation, graphical, and various literature data. The application of statistical methods, and, especially, the incorporation of artificial intelligence and machine learning techniques, has given a new direction to the problem. Physical sciences and engineering have recently followed these data-driven approaches, for predicting materials behavior and calculate properties in various timescales, simple and complex geometries, under ambient or extreme conditions[1]. More specifically, in the field of materials incorporated in structural and civil engineering, ML techniques have been employed to predict concrete properties that affect its strength and quality measures, such as the compressive strength [1]. In this work, purely experimental data from measurements of the compressive strength of fiber-reinforced polymer (FRP) concrete composites have been employed. Various structural and mechanical properties have been found to affect the compressive strength and each one is evaluated on the effect on the acquired compressive strength measurement. The process followed is summarized in Fig. 1. We conclude that data science and ML can be valuable tools towards the full exploitation of the vast amount of data coming from experiments and simulations [2], as they may pose as alternatives to expensive or extreme case experiments or computationally intensive simulations, complement their applicability, and extend our ability to argue on hidden data connections.

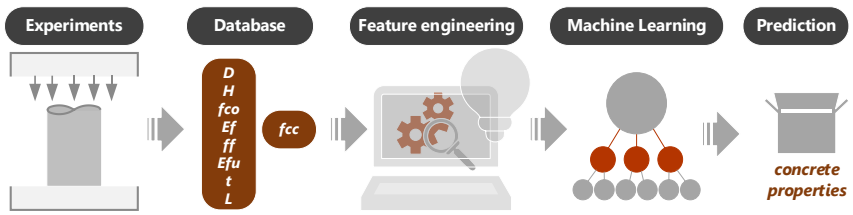

Figure 1: Machine Learning data flow for compressive strength prediction

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References

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