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Diagnostics in the field of civil engineering using artificial neural networks

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Summary

Discovery of Artificial Neural Networks has opened new opportunities in civil engineering to solve problems for which mathematical models, that have no algorithm but have examples of solutions and for which the calculation time is unacceptable could not be established. From our studies, neural networks are successfully used in most forecasting, design, diagnostics, during time and optimization issues.

The problems faced by the field of Civil Engineering are described and solved using artificial neural networks capable of learning based on examples of solutions to generate their own rules by providing correct answers for inputs different from those used for training. Also, emerging issues are solved with neural networks based on image processing.

In the doctoral thesis we have studied various problems faced by the field of civil engineering using neural networks:

- ISANNIF (Intelligent System Artificial Neural Network Internal Forces) was developed in Matlab programming environment; the software is based on the processing of .png, .jpg, .bmp, and .jpeg image using artificial neural

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networks and determination of internal tension in any section and on any direction in a structural element using tension maps provided by the finite element programs; the program also offers the possibility of limiting the tensions to a certain amount declared by the user as a result of the exit from the workability of some sections;

- the ucANN (uniform concrete Artificial Neural Network) program was developed in Matlab programming environment; the software proposes a new method of identifying the homogeneity of the reinforced concrete in the absence of known resistance to compression; the proposed method introduces a new distribution coefficient associated with homogeneity, a coefficient which takes into account the dispersion in concrete of recyclable materials (rubber, PETs, glass, polystyrene granules, wool, etc.), oclused air, aggregates, additives , composite materials, etc.;
- ANNCO2 (Artificial Neural Network Carbon Oxygen 2) program was developed in Matlab programming environment; the software establishes the ecological performance of structural elements in plain concrete and reinforced concrete; the program forecasts the carbon footprint for the first phase of the life cycle (raw material processing and processing).