

NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS AND P-HARMONIC FUNCTIONS ON GRAPHS

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We study the well-posedness (uniqueness and existence of solutions) of a class of nonlinear Partial Differential Equations (PDEs) on a finite graph. These results are obtained using the discrete comparison principle and connectivity properties of the graph. This work is in the spirit of the theory of viscosity solutions for partial differential equations.

The equations include the graph Laplacian, the p -Laplacian, the Infinity Laplacian, and the Eikonal operator on the graph.

This work is motivated by algorithms for mining large data sets, such as clustering algorithms. Very large graphs challenge the primarily combinatorial tools originally designed to study them. The PDEs of the types we study here can be solved quickly (in log-linear time or quadratic time) on structured graphs.