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Ill-Posed Problem for the Black-Scholes Equation solution and Machine Learning

In the previous paper (Inverse Problems, 32, 015010, 2016), a new heuristic mathematical model was proposed for accurate forecasting of prices of stock options for 1-2 trading days ahead of the present one. This new technique uses the Black-Scholes equation supplied by new intervals for the underlying stock and new initial and boundary conditions for option prices. The Black-Scholes equation was solved in the positive direction of the time variable, This ill-posed initial boundary value problem was solved by the so-called Quasi-Reversibility Method (QRM). This approach with an added trading strategy was tested on the market data for 368 stock options and good forecasting results were demonstrated. We use the geometric Brownian motion to provide an explanation of that effectivity using computationally simulated data for European call options. We also provide a convergence analysis for QRM. The key tool of that analysis is a Carleman estimate. To enhance these results, the Neural Network Machine Learning is applied on the second stage. Real market data are used. Results of Quasi-Reversibility Method and Machine Learning method are compared in terms of accuracy, precision and recall.