Enhancing Option Pricing Techniques via Deep Learning

Supervisors:

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We are looking for PhD candidates with understanding of finance and very high mathematical skills, perhaps gained via an earlier degree in mathematics, natural sciences or engineering. Prior knowledge in computing will be helpful but could be learned during the research work.

The considerable recent improvements in Deep Learning / Machine Learning capability mean that it has moved up to become a method of choice for inclusion into option pricing techniques. As an example of a possible research direction: in the most recent work in our group, we train an artificial neural network by optimising a purposefully constructed cost function, thereby solving the governing partial differential equation for the cumulative distribution function of any given underlying price process. Once the network is trained, we have an ultra-fast transition density generator, tailored to the underlying model and portable to other calculation setups and computers. That paper is the first in the literature to use a Deep Learning approach in approximating transition probability density successfully for any model of the underlying. We demonstrate via the QUAD method, which was developed in the group, showing how to implement the method in cases where there are no transition density functions and approximation functions are unavailable.

Our aim is to crack further problems in finance, for two purposes: because they are academically stimulating for us to solve and especially because doing so would be practically useful in finance for e.g. London & NY as well as the expanding markets elsewhere, notably China. The research will likely include collaboration with colleagues at other universities, particularly Dr Haozhe Su (a former doctoral student with the group, now a lecturer at Nottingham Trent University's Business School) and Professor Michael Tretyakov (at Nottingham University's School of Mathematical Sciences).

References:

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