Problem Statement

Contents

1 Quantum Finance

Now, this is one of the interesting application of quantum computing we have in our plates, so to give a brief over-view to you guys. Lets start over with some of the problem statements which can be solves using quantum algorithms. Basically these would include algorithms in which we can use statistical concepts, kind of like really complex algorithm in class of classical machine learning concepts like naive Bayes, restricted Boltzmann machine(Note: it one of the widely used deep learning concept in time-series analytic). We would be applying Monte-Carlo(MC) methods which is a bit advanced version of RBMs(Restricted Boltzmann machines), a thing to note advanced doesn't meant it a levelled up version of RBMs, the only similarity b/w MC and RBM is that both are statistical methods.

So, we have assets pricing or option pricing same piece of cloth basically, time series prediction of stocks, credit default swaps(pretty interesting given 2008 global financial crisis revolved all around this guy).

Now, getting down to business we would be solving the use of credit valuation adjustment(CVA), why this problem? Well because looked interesting, found an article by industry on it, and quite a valuable algorithm to bankers, and as mentioned above is of great importance since the 2008s financial crisis.

1.1 What is Credit Value Adjustment

Credit valuation adjustment (CVA) is the difference between the risk-free portfolio value and the true portfolio value that takes into account the possibility of a counter party's default. In other words, CVA is the market value of counter party credit risk. This price depends on counter party credit spreads as well as on the market risk factors that drive derivatives' values and, therefore, exposure. CVA is one of a family of related valuation adjustments

1.2 The Algorithm

Well first of all you guys should get yourself acquainted with the article Quantum algorithm for credit valuation adjustments You guys have to read all of it but understand the thing I have uploaded in the the github repository with highlighted parts. And understand the section III and section IV in particular.

- Build the circuit for state preparation, get the unitary for it, then gates and do the implementation, we would be using the QCBM one initial as its gate structure is given and we can later on introduce MPS encoding if you guys can effectively understand Appendix B of the article.
- Built the circuit for controlled rotation, now we would be using the CRCA circuit for this operation to make our lives easier, the circuit is given in Fig.(10) of the article.

- Find the CVD value using the assumption that there is no error in our model, basically the noisless measurment.
- Find the CVD value using the engineering likelihood function by implementing the operation sets given in Appendix E.