OPTION HEDGE USING DEEP REINFORCEMENT LEARNING

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ABSTRACT

One of the main objective of performing delta-hedge is to reduce exposure to the underlying asset of an option. The hedge ratio, to which a hedge trader adjusts his/her replicating portfolio, is determined by Black-Scholes Equation. It is based on the simple assumptions that the yield of an underlying asset follows Wiener process and the volatility is constant over the life of the option. The well-known fact that the distribution of the yield of an underlying has kurtosis that is rather different from that of the normal distribution, a stock market shows mean-reversion property and the volatility index(VIX) oscillates even for a very short term indicates that the hedge ratio derived from Black-Scholes is not the best one to reduce the risk of short position of an option.

The fundamental problem of the delta hedge is that the complexity of a financial market is poorly modeled by a single PDE. The recent advance in the reinforcement learning combined with the deep learning makes it possible to find an improved hedge ratio. The model-free algorithm tries to construct an optimal hedge portfolio by exploiting the kurtosis and mean-reversion of a market and high degree of derivatives of an option with respect to volatility, which is not considered in the former delta hedge. This show us that a performing hedge an option itself could be a notable way of statistical arbitrage.

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