Least Squares Monte-Carlo with TensorFlow

Part I, LSMC with polynomial features

In this problem we will use apply the LSMC method to price American put options. Specifically, we will replicate the result in the first row, 6th column of Table 1 in Longstaff and Schwartz 2001.

Item (a)

Read the introduction of the paper.

Item (b)

We will price an american put option as described in page 126 of the aforementioned article. Read paragraphs 1 and 2 of page 126.

Item (c)

As we saw in class, one of the ways we can use linear regression to fit nonlinear functions is to use polynomial features. A common choice in many applications is to use the so called "Chebyshev polynomials". Chebyshev polynomials are defined recursively by:

$$\begin{aligned} T_0(x) &= 1 \\ T_1(x) &= x \\ T_{n+1}(x) &= 2xT_n(x) - T_{n-1}(x) \end{aligned}$$

This code implements the LSMC algorithm using Chebysev features.Study the code and be sure you understand each function and each step.

Implement a TensorFlow version of the provided code. You are not allowed to use any Numpy function.

Part II, LSMC with neural networks

Implement a version of that code where you use neural networks to approximate to continuation values (instead of polynomials). Use tf.keras to construct the networks. You are free to choose every other design choice, such as the optimizer, hyperparameters, number of simulated paths, batch size, activation functions etc.

P.S.: If you want, you can use this template to build your code.