MATH 640 Project Proposal

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Background

Methods

Our data sample is the 5-minute intrady OHLCV-Candles for Bitcoin trading on the Coinbase exchange, dating from July 1, 2016-April 14, 2021. With these candles we calculate the intraday Realized Volatility (RV), where $RV = \sqrt{\sum_{i=1}^{288} r_i^2}$, where $r_t = log(p_t) - log(p_{t-1})$ deontes the return for time period t, and 288 comes from 288 5-minute candles in a day. Our goal is to use a Gibbs Sampler to estimate the paramters for 2-3 Stochastic Volatility models on the data sample ranging from 2016-2019, and then test the results on the data sample ranging from 2020-201 for applicability. The general form of a stochastic volatilty model is $d\nu_t = \alpha_{\nu,t}dt + \beta_{\nu,t}dB_t$, where dB_t is standard Brownian Motion.

An example of a specifc model that we may use is the Heston Model, which parametrizes the differential equation above as the following:

$$d\nu_t = \theta(\omega - \nu_t)dt + \xi\sqrt{\nu_t}dB_t$$

In this example, we would build a Gibbs Sampler to draw θ, the rate at which volatility tends back to the mean, ω, the long run mean for RV, and ξ, the long run variance of volatility (sometimes called "Vol of Vol"). After we have sampled these parameters using our train data, we will then test our results on the out of sample data from January 2020-April 2021. This sample also includes the highly volatile trading days of March 2020, when all markets were highly volatile due to global uncertainty amid the Covid-19 outbreak. This makes it a good test sample to see how well the models perform under times of extreme outliers.