HW4_2022

September 27, 2022

Homework 4, 46-921, Fall 2022

Due Wednesday, September 28 at 3:30 PM EDT

Question 1

We saw in class an example of where the normal distribution is a poor fit to log daily stock returns. Does the validity of the normal approximation improve when switching to weekly or monthly returns? Make a convincing argument, using both plots and formal model selection tools.

Comment: Visual evidence can include using normal probability plots and/or the types of comparisons used in lecture using kernel density estimates. By "formal model selection tools" I am referring to something such as AIC.

Comment 2: The question is not asking you to compare values of AIC from weekly and monthly return data sets. (As we described in lecture, this is not possible.) Instead, make the AIC comparison across different models for the weekly data set, and compare AIC values across different models for the monthly data set. Is it the case that the normal does not come out as the best fit in either of these cases? You can compare the visual summaries across the data sets (daily, weekly, monthly) and make a less-formal statement about improvement of the normal approximation.

Question 2

Update the function `fitSkewT()` given during lecture so that it also returns the covariance matrix for the estimated parameters. Your function should be able to handle both the cases where shift parameter is included or excluded. The covariance matrix should be in terms of the "original" parameterization, i.e., the $(k, n, \lambda, \sigma^2, \mu)$ parameterization.

Be sure to show some examples illustrating the function in use.

Question 3

Let $X_1, X_2, \ldots ...X_n$ be iid from the Beta(α, β) distribution. Write a Python function that **numerically** finds the maximum likelihood estimate for α and β.

The function should also return the covariance matrix for the MLE.

Print the function that you wrote and attach it to your homework, and also demonstrate that it works by using a few simulations.