# CSCD94 Week 8 Update

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1. Retrained N-HiTS Model

- Training the W-GAN to generate 300+ days takes way too long and does not produce the greatest results.
- Rather than using 300 days as the lookback period and forecasting 50 days, I now use 100 days as the lookback period and forecast the next 20 days.

- MAE: 4.11   RMSE: 6.04   MAPE: 0.03   (all improvements)

Example of the New N-HiTS Forecast

Predicted vs Actual for stock KO (all), MAE: 0.9402918219566345
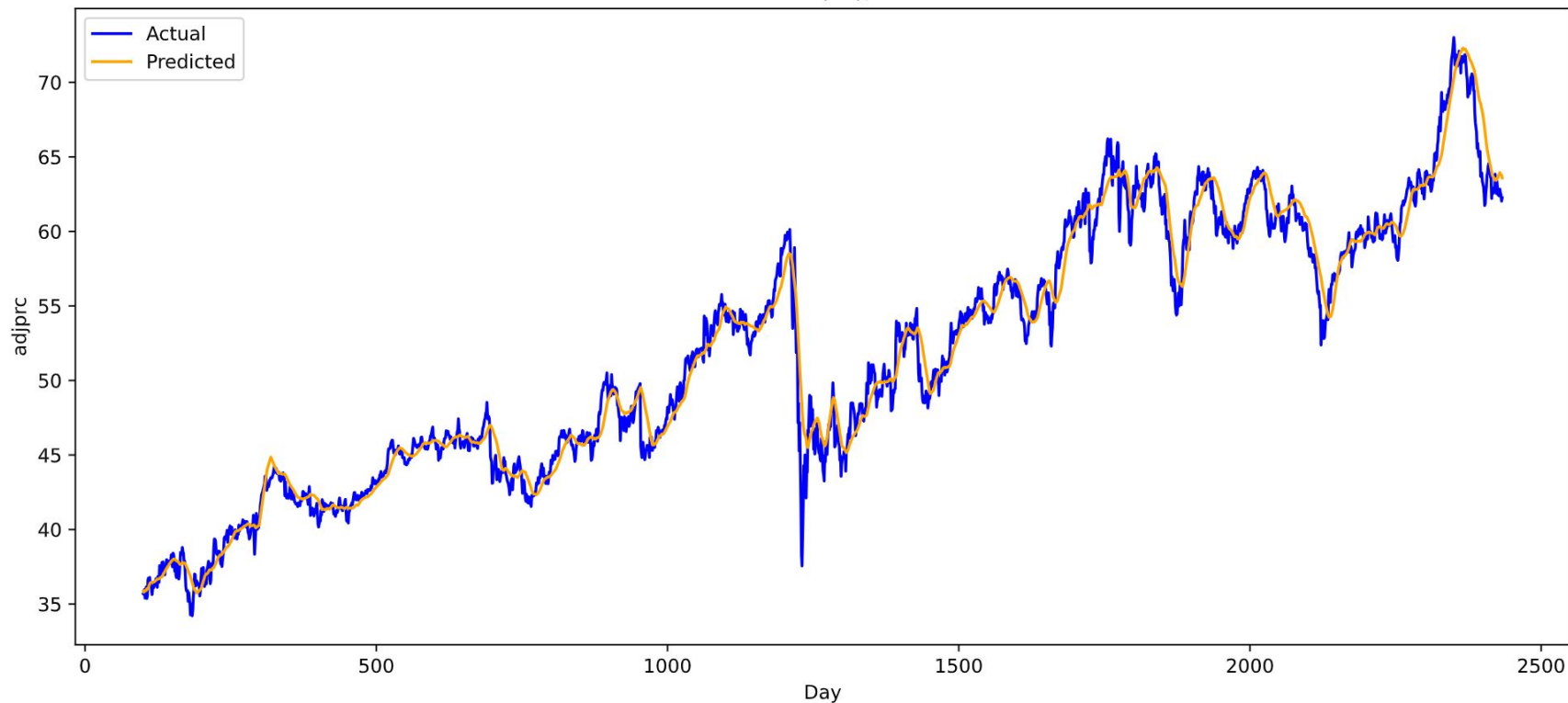
2. W-GAN Training

- Increased the generation size to 119 days (after converting to adjprc it will be 120 days).
- Experimented with the number of times to perform the gradient penalty.
  - Currently, doing the autograd computation is extremely slow when there are GRU blocks, so I experimented with once and twice for n_critic.
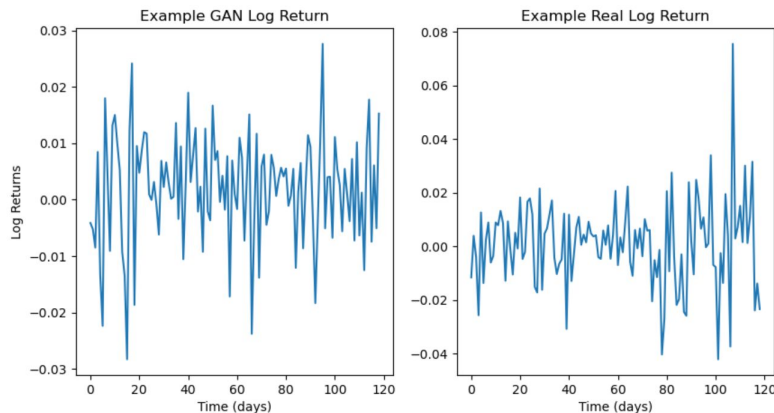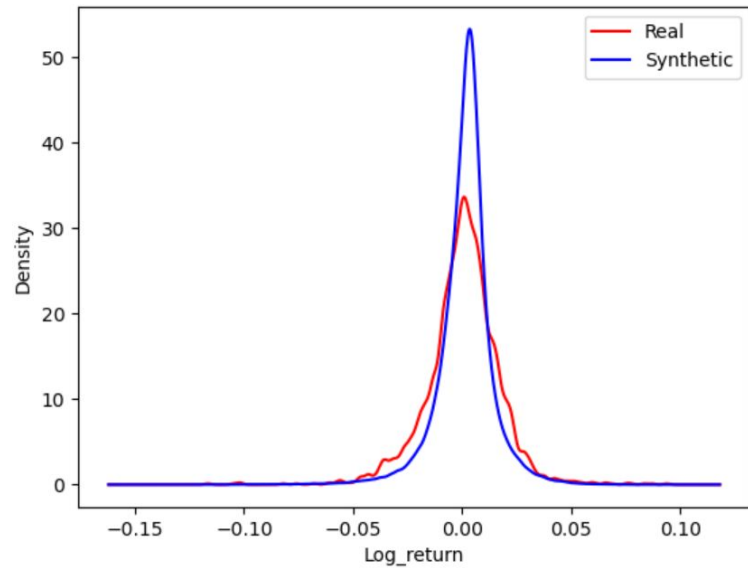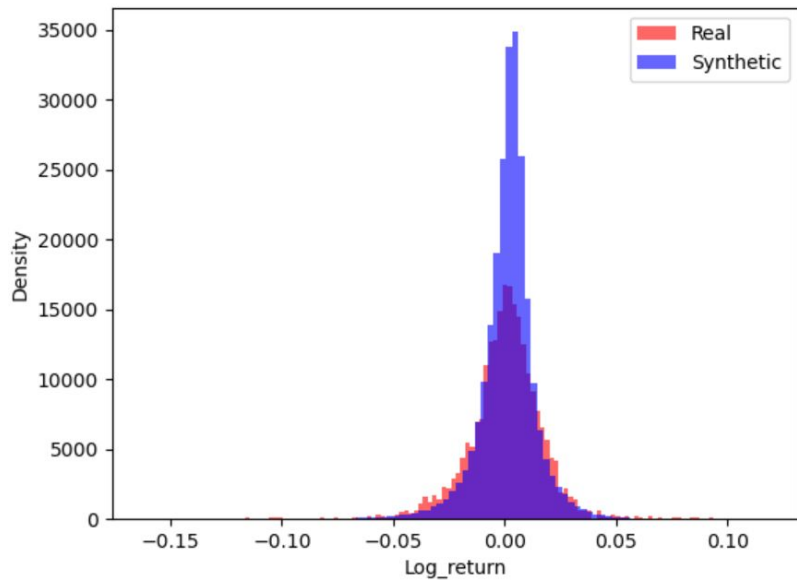
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Real Mean: 0.00055486776639624956, Fake Mean: 0.00164367636647064137
Real Stdev: 0.016361259937159617, Fake Stdev: 0.012419826211090647
Real iqr: 0.017987517512264007, Fake iqr: 0.011217974818574561
Real skew: -0.39868453962741535, Fake skew: -0.544680191657642
Real kurtosis: 6.188532143454775, Fake kurtosis: 6.770008502501479
Loss: 0.3594462069459293
MMD: 0.000900708202664191

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3. Incorporated the N-HiTS Model Into a Simplified Adversarial Network (Toy Model)

- While my GANs were training, I integrated the N-HiTS model with a simplified adversarial network, which just contains the generator and not the critic.
- The generator was trained to match the global mean, std, skew and kurtosis of the recording (same generator as W-GAN).
- Loss was a simple combination of a MSE for the global metrics and a MAE for model predictions.
- Currently need to figure out a good way to ensure the model generates realistic results, while maximizing the error.

Avenues to Explore (for Toy Model and W-GAN)

- Scheduler: Start off training the model as normal, but after every x epochs/iterations increase the scaling factor of the adversarial loss.
- Transfer learning: Train a model as normal, preload it, and train with the adversarial loss incorporated.
- MAG-GAN Training: Have a 3 player game until convergence [1]:
  - 1) Train the model you are trying to fool as normal
  - 2) Game between Critic and Generator until some criteria (Nash equilibrium)
  - 3) Game between Generator and Model (you are trying to fool) until some criteria (Nash equilibrium)

Next Steps

- Plug in the critic into the Toy Model.
- Try to experiment with the W-GAN to get more variance in the generated samples.
- Regenerate the baseline attacks for the updated N-HiTS model.

References

[1] J. Chen, H. Zheng, H. Xiong, S. Shen, and M. Su, "MAG-GAN: Massive attack generator via GAN," *Information sciences*, vol. 536, pp. 67–90, 2020, doi: 10.1016/j.ins.2020.04.019.