Beating the market is possible, when using GANs for investment strategies tuning and combination

Generative Adversarial Networks for Financial Trading Strategies

Introduction
To obtain an edge in a highly competitive environment, the analyst needs to properly fine-tune its strategy, or discover how to combine weak signals in novel alpha creating manners.

Conditional Generative Adversarial Networks (cGANs) can have an impact into both aspects of trading strategies; also, we can list a few advantages of such method, like:

i. generating more diverse training and testing sets, compared to traditional resampling techniques;
ii. able to draw samples specifically about stressful events, ideal for model checking and stress testing; and
iii. providing a level of anonymization to the dataset, differently from techniques that re(shuffle/resample data.

In this work we provide a full methodology on (i) the training and selection of a cGAN for time series; (ii) how each sample is used for strategies calibration; and (iii) how all samples can be used for ensemble modelling.

CGAN: Training and Combining
Conditional GANs are an extension of a traditional GAN, when both G and D decision is based not only in noise or generated inputs, but include an information set v.

In our case, given a time series y₁, ..., y₂, ..., yₜ, our conditional set is v = [y₁-₁, ..., y₂-₁] and we are sampling/discriminating is x = [y₁ₜ]. We train the cGAN by solving this min-max problem:

\[
\min_G \max_D V(D, G) = \mathbb{E}_{x \sim p_{data}(x)} \left[ \log D(x | v) \right] + \mathbb{E}_{z \sim p_{z}(z)} \left[ \log (1 - D(G(z | v))) \right]
\]

Results
❖ SPX Index Results
❖ All results: Regression Tree
❖ Tree (Max Depth = 7): 0.1781 (error) = 0.0009 (bias²) + 0.0873 (var) + 0.0889 (noise)
❖ Ganning (B=10): 0.1420 (error) = 0.0010 (bias²) + 0.0511 (var) + 0.0889 (noise)
❖ Ganning (B=100): 0.1366 (error) = 0.0010 (bias²) + 0.0457 (var) + 0.0889 (noise)

Outcomes
❖ In combination of trading strategies, our results suggest that both approaches are equivalent in aggregate;
❖ In fine-tuning of trading strategies, we have evidence that cGANs can be used for model tuning, bearing better results in cases where traditional schemes fail.