Calm in the eye of the storm

how to thrive in noisy environment

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1 Introduction

Financial markets are complex systems full of noise and unpredictable dynamics. They lack regularity, seasonality and occurring trends are often misleading. Predicting future price changes is exceedingly hard, but offers ample opportunity for profit if done well. It has to be noted that achieving accuracy even slightly higher than dictated by Bayesian priors is invaluable and even minute improvements to model's effectiveness (in scale of $0.1\%p$) usually lead to visible improvement is investment quality.

Financial market prediction is most commonly approached as classification. Majority of the models predict direction of future price change. Probabilistic models, which offer not just class labels but also confidence estimates, have gained traction due to their ability to quantify uncertainty - a pivotal feature in financial forecasting.

Here I demonstrate that by discarding predictions below certain threshold of confidence we are able to improve model's accuracy and what follows - effectiveness of the investments strategy relying on it. The central point of this study is a empirical evaluation of the impact of selectively discarding uncertain predictions on classification accuracy in financial forecasting setting.

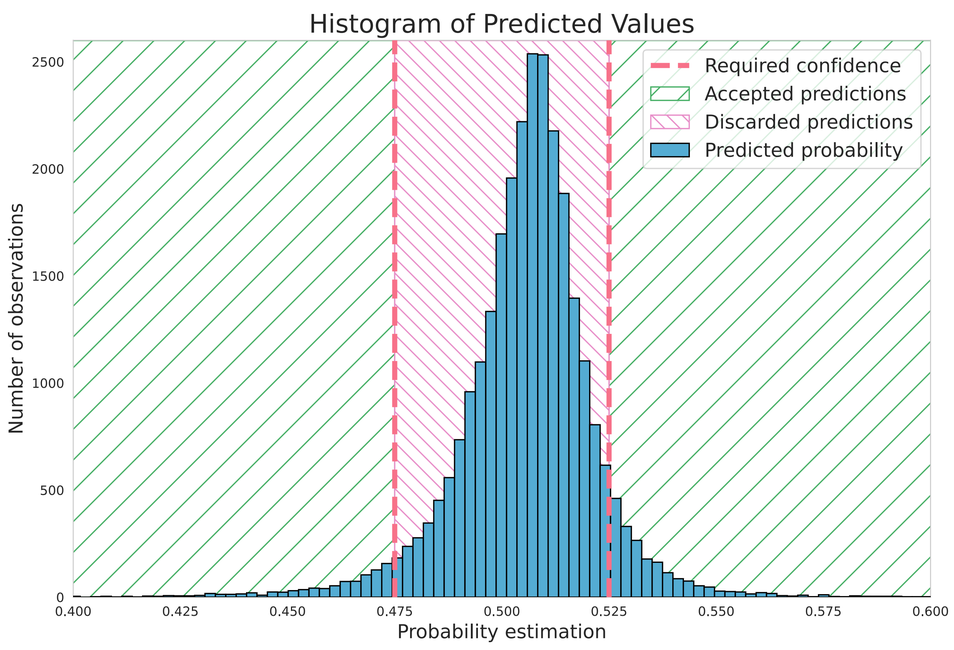

Figure 1: Example of confidence thresholds applied to distribution of predictions.

2 Methods

The study utilizes financial data spanning approximately 20 years, with observations recorded at 60-minute intervals. Datasets encompass a diverse range of 83 financial instruments, including currency pairs, stocks, commodities, and indexes.

Each observation was described with four features designed to reflect behaviour of the market in last period. The features represented basic statistics like price volatility, change in volatility, and recent changes in price.

Logistic Regression, Naive Bayesian Classifier and Gaussian Mixture Model were employed to forecast whether the price of a financial asset would increase or decrease in the subsequent 5-hour period.

To establish a confidence threshold for predictions we have used training dataset. The threshold was set by determining what level of confidence would result in retaining a specific percentage of observations as classified. In other words, the threshold was optimized to maximize accuracy while still providing a meaningful number of predictions. Observations with confidence lower than required were discarded what is illustrated in the Figure **??**. The model's performance was primarily assessed based on its classification accuracy. To further evaluate the efficacy of discarding low-confidence predictions, we compared the accuracy before and after applying the established threshold. This enabled us to quantify the improvement in classification accuracy and, consequently, the potential effectiveness of a trading strategy relying on these high-confidence predictions over a 5-hour forecasting window.

3 Results

With increase in required certainty of the model, we have observed meaningful improvement in classification accuracy what can be seen in the Figure 2.

It has to be noted that with increase in required confidence the number of observations we have classified decreased what led to greater variance in accuracy between models and financial instruments. We have confirmed statistical significance of the increase in the accuracy using Kolmogorov–Smirnov test. Estimated p-values were between 10^{-11} and 10^{-5} depending on the threshold. Mean effect size reached $3\%p$ in reasonable required confidence ranges (up to one set to discarding 99% of train set).

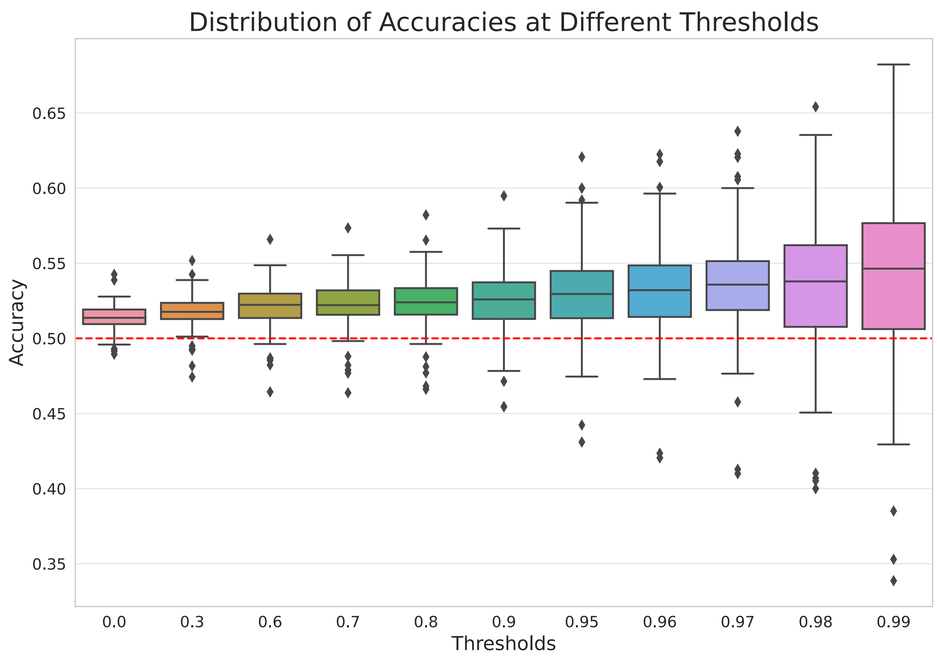

Figure 2: Impact of confidence threshold on accuracy.

4 Conclusion

This study set out to investigate the impact of discarding uncertain predictions on the classification accuracy of a probabilistic model in a financial forecasting context. Our results indicate that applying such a threshold led to a noticeable improvement in classification accuracy.

In further research we aim to examine the effect of this method on simple investments strategies. We expect to implement more sophisticated probabilistic models and research the possibility of dynamic estimation of optimal confidence threshold.

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