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Meta-Labeling - A Novel Machine Learning Approach to Improve Algorithmic Trading Strategies

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Abstract

In 2018, Marcos Lopez de Prado proposed a novel machine-learning concept to improve algorithmic trading strategies, called meta-labeling. Meta-labeling essentially refers to (1) assigning a binary label to past trades of a trading system based on their outcome (win or loss), (2) constructing a set of time-series features that temporally align with the labels, and (3) fitting a machine learning classification model to the features and the labels. (4) Subsequently, the trained classifier is used to estimate the probability of profitability for every new, unopened trade. (5) The position size for each new trade is then determined based on its corresponding probability estimate before the trade is opened. The goal is to assign larger position sizes to trades with a high estimated probability of being profitable. The purpose of this thesis is to investigate if meta-labeling does indeed improve trading performance when applied to real trading systems and to derive essential conclusions regarding the concept's practical implementation. Four profitable trading systems are meta-labeled using an all-or-nothing scheme for position sizing. As a result, the performances of three systems improve. Further, it is found that (1) combining several classifiers into an ensemble model improves meta-labeling results, that (2) meta-labeling's effect is not any different on a portfolio level, and that (3) incorporating feature selection into the procedure does not provide a meaningful benefit. The results demonstrate that meta-labeling does indeed improve trading system performance, and thus it should be of relevance to any trader.