Meta-Labelling:
a key machine learning tool

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What is Meta-Labelling*?

- Given known base trade time and direction
  - Should we take this trade? Or the opposite?
  - How much leverage should be applied?
- Base trade could be due to
  - Fundamental / discretionary strategy.
  - Traditional quantitative strategy*.
  - A different machine learning strategy!

*Marcos López de Prado, 2018.

*(with small number of predictors.)

Classification problem

- Classify each base trade based on sign(return).
- Leverage = function(probability of predicted class)
  - Can be zero or negative!
- Probability of predicted class = function(Random forest) or function(Neural network) etc.

Example applications

- Global macro strategy: go long stock index whenever non-farm payroll increases and hold for a month.
  - How many times was this trade profitable?
- Create features that are *not used* in based strategy.
    - Technical indicators: weekly SPX return, etc.
    - Fundamental indicators: bond yields, etc.
    - Alternative data: news sentiment, etc.

Global macro example

- Use these features and known outcome (profit or not?) of base strategy → train random forest for classification.
- Live trading: given current indicators, random forest predicts **probability** of profit is
  - <55% : Do not go long. (Risk management)
  - 55%-60% : Go long with 50% of capital. (Asset allocation)
  - >60% : Go long with 100% of capital.

Quant strategy example

- We have a base intraday quantitative FX mean reversion trading strategy traded since 2010.
- Created meta-label model using wide variety of risk measures including
  - implied volatilities
  - correlations with other markets
  - longer term statistics
- Out-of-sample Sharpe improved 16% over base model.

ML strategy example

- Use a “shallow” machine learning strategy such as LASSO logistic regression as base model.
- Use a “deep” neural network such as LSTM, with **same** or **different** features, to apply meta-labels.
- “… very successful in practice… blending deep learning with shallow learning.” – François Chollet, creator of *Keras*.

ML strategy example

- This blending of shallow and deep models also called “ensemble” methods.
- Similar to “boosting”.
  - Boosting uses same set of features and iteratively try to minimize prediction errors.
  - Metalabelling uses different set of features to minimize prediction errors.

Advantages

- Transparency: we know rationale for base trades.
- “Second expert opinion”: machine is using a different set of features to give second opinion.
- Machine learning can generate probabilities, traditional quant models typically can’t.
- Can be outsourced to third party researchers without loss of intellectual property.

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