**Study Plan: Factor-based machine/deep learning strategies for China A-share markets**

By: Prof. Hongsong CHOU

Co-supervisor: Dr. Ling LONG

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1. **Introduction:** There have been a growing number of academic studies on using machine learning and deep learning methodologies to forecast financial assets’ returns over different time periods and to construct optimal portfolios with the goal of achieve risk-balanced investment returns. In this project, we want to stay on the practical side and focus on investment strategies that can leverage such modeling and investment methodologies. Specifically, we focus on:   
     
    (1) with pre-selected weekly/monthly factors, try to apply in-depth several machine/deep learning models to forecast stock forward returns, rigorous in-/out-sample testing shall be used, say k-fold cross validation.   
     
    (2) with step-1 forecasting result, try to construct optimal portfolio for real trading, say using risk-return optimization with limitation on stock-weight exposure, style/industry factor weight exposure.
2. **Study Steps:**
3. Review several articles that focus on using machine learning and deep learning to conduct return forecasting and portfolio construction.
4. With pre-selected factors, predict stock forward-return using mainly xgboost and lstm methodologies, if time allows, other methods are welcome to explore. As for xgboost, both linear/tree based boosters can be tried. Keep in mind to compare in-/out-sample results, say rmse, ic/icir.
5. With the forecast result and pre-calculated stock exposure on barra style/ind factors, construct optimal portfolio for real trading, say using risk-return optimization with limitation on stock-weight exposure, style/industry factor weight exposure, etc. And as a comparison, a simple portfolio, say select top-K stocks at each time T can also be constructed.
6. Write backtest engine to backtest the constructed portfolo in a real-trade fashion, considering transaction-cost, stock-suspension, limit-up/-down, restriction on turnover, etc.
7. If time allows, try to forecast the return of barra style factors, the resul can be directly applied to step (c) to apply time-varying limitation of portfolio exposure on these style factors.