Developments of Trading Strategies at Economic Machine Learning (EML) Lab

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Quant at EML Lab:
Introducing Myself

Short Bio

Current Position
▸ Professor of Economics, Wisnewsky Professor of Human Studies, and Adjunct Professor of Statistics, Indiana University.

Previous Positions
▸ Cornell, Rice, SKKU, SNU, Texas A&M, Toronto

Education
▸ Ph.D. in Economics from Yale
▸ Educated and trained as a theoretical econometrician

Professional Career
▸ Regarded by others as a time series econometrician and recently more as an econometrician in machine learning.
▸ Believed by himself to understand econometrics as broadly as and as deeply as anybody.

Finance Related Careers

Educational

- ▸ 2002-2005: Taught an undergraduate course in financial engineering at Rice.
- ▸ 2006-2022: Offered a Ph.D. topics course in financial econometrics at Texas A&M and Indiana.

Professional

- ▸ 2017-2019: Advisor, Economic Research Institute, Bank of Korea.
- ▸ Currently serving as Research Director of EML (Economic Machine Learning) Lab at Indiana University.

Industrial

- ▸ 1999-2002: Partner, Korea Fixed Income Research Institute.
- ▸ 2019-Present: Cofounder and the 'advising' CEO of a venture, iRAM (Robot Asset Management), in Korea.

Academic Credentials

Honor

▸ Elected as Fellow of Econometric Society in 2002.

Award

▸ SNU Alumni Award ($100,000), Cho-Rak-Kyo Economics Award ($50,000), Korea Economic Daily Award ($50,000), Maeil Business Newspaper Award ($30,000).

▸ Teaching Awards from Yale and Indiana.

Professional Recognition

▸ Essays in Honor of Joon Y. Park, *Advances in Econometrics*, Volumes 45A and 45B, Emerald Publishing Limited, 2023.

Main Collaborators

Yoosoon Chang
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Executive Director, EML Lab
Indiana University

Sangmyung Ha
Ph.D. Candidate in Economics
Indiana University

Soohun Kim
Professor of Finance
Korea Advanced Institute of Science and Technology

Haklim Shin
Partner & Ph.D. Candidate in Economics
iRAM & SKKU

Quant at EML Lab:
Specialty

Bases of Investment Strategies

There are three bases of investment strategies.

Intuition (I)

▸ Trusting the judgement of an investor made without reference to any specific knowledge or private information.

Finance (F)

▸ Using an asset pricing model backed by a finance theory, such as the factor pricing model, together with diverse firm characteristics.

Mathematics (M)

▸ Relying on various patterns in realized sample paths of traded asset prices, which can be more clearly identified by a more efficient methodology.

Characterization of Quant at EML Lab

We may characterize Quant at EML Lab by the proportions of I/F/M and compare them with others.

Warren Buffett

- I/F/M $= 50/50/0$

Jim Simons

- I/F/M $= 0/0/100$

Quant at EML Lab

- I/F/M $= 0/25/75 \sim 0/33/67$

We will focus on technical trading using our knowledge and skill in econometrics and machine learning. Therefore, we will not rely on any intuition. However, we already know too much finance to follow Jim Simons, although we are close to him in terms of skills and spirit.

Focus of Quant at EML Lab

The goal of Quant at EML Lab is to

- ▸ recognize patterns in financial markets such as trends and cycles
- ▸ analyze determinants of returns given by functions of various firm characteristics
- ▸ extract extra returns not spanned by the loadings of financial factors

and develop profitable investment strategies at all frequencies.

EML Lab claims its specialty in the knowledge and skill required to implement

- ▸ advanced econometric methods
- ▸ customized machine learning tools

which we believe is essential to achieve the goal.

Quant at EML Lab: Methodology

Methodology Used in EML Lab

The methodology used at EML Lab consists of

Advanced Econometric Methods

- ‣ Usually, simple methods such as regressions are used widely in financial data analysis.
- ‣ Mostly, advanced econometric methods are used at EML Lab to allow for various nonstandard features in financial data.

Customized Machine Learning Tools

- ‣ Typically, off-the-shelf ML tools are used to fit financial data without any special tailoring.
- ‣ Mostly, customized ML tools with strong regularization are used at EML Lab to analyze financial data more effectively.

Econometric Methods

Econometrics

▸ More appropriate to analyze relationships that are simple yet weak, with the presence of nonnegligible error terms that often need to be further diagnosed.

▸ If used to fit complex relationships, the commonly used econometric methods generally yield highly biased and misleading outcomes.

Advantages in Practical Finance

▸ Relationships exploited in financial practice are extremely weak, presumably with a large amount of noise generated from many different sources, yet highly complex.

The EML Lab uses econometric methods to take their advantage of allowing weakness, but only at a very advanced level to accommodate complexity of the underlying relationships.

Machine Learning Tools

Machine Learning

- ▸ More appropriate to analyze relationships that are complex yet strong, for which we need to adopt a flexible methodology to have a good fit.
- ▸ If used to fit weak relationships, the existing ML tools generally yield highly unstable and uninterpretable outcomes.

Advantages in Practical Finance

- ▸ Relationships exploited in financial practice are highly complex, due to the presence of many nonstandard features, yet extremely weak.

The EML Lab uses ML tools to take their advantage of accommodating complexity, but only relies on their customized versions to allow weakness in the underlying relationships.

Summary

Nature of Target Relationships

▸ Relationships to be exploited in developing trading strategies are extremely weak and highly complex.

Required Methods and Tools

▸ Econometric methods are preferred to deal more effectively with weakness in relationships.

▸ ML tools are preferred to deal more effectively with complexity of relationships.

EML Lab Solutions

▸ Advanced econometric methods are used to deal with weakness while least compromising complexity.

▸ Customizing ML tools are used to deal with complexity while least compromising weakness.

Econometrician's View on ML and AI

Machine Learning (ML)

- ▸ Generally defined as complex tools, given as black boxes, which can be used to solve complicated problems with minimal human interventions.

- ▸ Econometrically defined as flexible tools, given as transparent boxes, which can be used to solve complicated problems with appropriate regularization.

Artificial Intelligence (AI)

- ▸ Generally defined as systems trained by ML tools in a form that could perform intelligent tasks instantaneously and automatically.

- ▸ Econometrically defined as models estimated by ML tools in a form that could relate target variables and their covariates instantaneously and automatically.