Economic Machine Learning (EML) Lab Introduction

Yoosoon Chang

Executive Director, EML Lab
Indiana University

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Executive Director of EML Lab: Introducing Myself

Short Bio

Current Position
- ▸ Professor of Economics, Indiana University
- ▸ Adjunct Researcher, BI Norwegian Business School
- ▸ Advisor, Stone Center for Wealth Inequality & Mobility, University of Chicago

Previous Positions: Rice, Texas A&M

Education
- ▸ Ph.D. in Economics, Yale: Time Series Econometrics (Phillips, Sims) & Finance (Ross)
- ▸ B.S. in Economics & Mathematics, University of Maryland

Professional Career
- ▸ Started as a theoretical econometrician, recently became emprical applying functional data, regime switching and machine learning methods to empirical macro-finance, inequality & mobility, energy & climate change.

Academic Credentials

Honor

- Elected as Fellow of Journal of Econometrics in 2012
- Elected as Fellow of International Association of Applied Econometrics in 2021
- Distinguished Fellow, Samsung Global Research, 2022-24

Awards & Grant

- Maekyung Economist Award, 2022
- National Science Foundation Grants: 2002-2003, 2005-2010
- Teaching Awards: Texas A&M (2007), Indiana (2023)

Professional Leadership

- Director/Coordinator, Midwest Econometrics Group (MEG) since 2015
- Co-organizer, International Symposium of Econometric Theory & Applications (SETA) since 2019
- President, Korea America Economic Association (KAEA), 2022 and 2024

EML Lab:
Our Foundation

Why We Established EML Lab

The Challenge
- ‣ Economics in the age of big data and AI
- ‣ Traditional econometric methods struggle with large dimensional datasets
- ‣ Standard ML tools aren't designed for economic data
  - ‣ Economic relationships: weak signals amid high noise
  - ‣ Data shaped by human behavior, institutions, and policies
  - ‣ Inherently stochastic and evolving systems
- ‣ Gap between economic theory and modern computational methods

The Opportunity
- ‣ Leverage deep econometric expertise to customize ML tools
- ‣ Develop methodologies specifically for economic applications
- ‣ Train next generation in this hybrid approach
- ‣ Bridge academic research with practical industry applications

Our Vision

The EML Lab envisions a future where empirical economics and finance research is enhanced through innovative methodological approaches, supported by rigorous theories and implemented by efficient procedures.

We aim to develop and disseminate novel frameworks – with relevant theories and methodologies – for machine learning designed specifically to analyze large-dimensional economic and financial data effectively.

Our Core Mission

The EML Lab serves as a hub for:

Research

- ▸ Developing ML methods for effective analysis of large dimensional economic and financial data
- ▸ Creating relevant theories and implementation procedures
- ▸ Advancing both methodology and application

Education

- ▸ Training students at all levels in ML methodologies
- ▸ Teaching background theories applicable to economic and financial data analysis
- ▸ Equipping the IU community with practical skills

Knowledge Exchange & Collaboration

- ▸ Fostering collaboration between academia and industry
- ▸ Solving practical problems in decision-making and predictions
- ▸ Bridging the gap between graduate training & industry needs

EML Lab Standing & Visibility

Recent Keynote Presentations

2025

- ▸ Bristol Econometric Study Group Conference (Yoosoon)
- ▸ World Knowledge Forum, Seoul - invited talk and moderated session with James Robinson, 2024 Nobel Laureate (Yoosoon)
- ▸ Midwest Econometrics Group (MEG) Meeting (Joon)
- ▸ European Conferences of Economics Community (Yoosoon)

2024

- ▸ Society for Financial Econometrics (SoFiE) Annual Conference (Yoosoon)
- ▸ Workshop on Models with Functional Variables, City University of London (Joon & Yoosoon)

These presentations showcase our credibility, capability, and visibility in the profession.

Current Projects & Future Directions

Education & Training

Workshop: Machine Learning in Economics (August 2024)

- ▸ Topics: PCA, Ridge, Lasso, RKHS kernel methods, SVMs, random forests, neural networks
- ▸ Morning session: Theoretical foundations
- ▸ Afternoon session: Practical applications

Student Fellowship Program

- ▸ Ralph Fernando, Sangmyung Ha, Kwanpyo Ko, Ali Zarifhonarvar

Ongoing Consultation

- ▸ For faculty and students working with large-dimensional data

Collaborative Research Projects

- ▸ Finance (Soohun Kim, KAIST): Market Returns Dormant in Option Panels

- ▸ Macroeconomic Forecasting (Michael McCracken, St. Louis Fed): Growth and inflation forecasting using customized cutting-edge ML tools

- ▸ Inequality & Mobility (Steven Durlauf, U Chicago): A Markov Chain Model for Intergenerational Income Mobility

- ▸ Energy (Yongok Choi, Chung-Ang Univ): Using ML to Identify Climate-Driven Fluctuations in Peak Electricity Demand

- ▸ Health Economics (Kosali Simon, IU O'Neil School): COVID Mortality Prediction Pre and Post Vaccine Availability

- ▸ ML Methodology (Doyeon Pyun, Indiana, Guo Yan, U Melbourne): Econometrics of Machine Learning

Trading Strategy Development

- ▸ Showcase real-time performance via Finance Quant Board

- ▸ Apply finance theories, advanced econometrics & customized ML tools

- ▸ Focus on technical trading approaches

- ▸ Joon will present detailed methodologies and performance this afternoon

Future Directions

Expanding Research

- ▸ Continue developing innovative ML methodologies customized for economic & financial data
- ▸ Disseminate findings in both academic and practical circles
- ▸ Collaborate across multiple domains in economics and finance

Strengthening Industry-Academia Bridge

- ▸ Develop partnerships that benefit both sectors
- ▸ Produce workforce-ready talent with econometrics + ML expertises
- ▸ Reduce training time for companies hiring our graduates
- ▸ Companies get hires who can contribute meaningfully from day one

Future Directions (continued)

Real-Time Performance Display

- ▸ Macro Forecasts: Growth and inflation (also on St. Louis Fed website)
- ▸ Finance Quant Board: Investment strategy performance
- ▸ Energy Forecasting: Electricity and natural gas demand across multiple time horizons

Community Building

- ▸ Organize conferences and workshops regularly
- ▸ Foster dialogue between researchers and practitioners
- ▸ Expand fellowship programs and training opportunities
- ▸ Today's conference is the first of many!

EML Lab Team

Lab Directors
- Yoosoon Chang, Executive Director
- Joon Park, Research Director

Visiting Scholars
- Haklim Shin (SKKU, iRAM)
- Moto Shintani (University of Tokyo, Bank of Japan)

Research & Student Fellows
- Doyeon Pyun
- Sangmyung Ha, Ralph Fernando, Kwanpyo Ko, Ali Zarifhonarvar

Key External Collaborators
- Yongok Choi (Chung-Ang), Steven Durlauf (Chicago), Soohun Kim (KAIST), Michael McCracken (St. Louis Fed), Kosali Simon (IU O'Neil School), Guo Yan (Melbourne)

Our Supporters

Institutional Supporters
- ▸ College of Arts + Sciences, Indiana University
- ▸ Department of Economics, Indiana University Bloomington

Individual Supporters
- ▸ Ken & Dawn Weakley Foundation

Industrial Collaborators
- ▸ Those invited today & many others who are interested in working with us are potential collaborators

We are actively seeking additional partnerships and philanthropic support to expand our initiatives. Mostly preferrably, collaborations with industry partners

Bridge to Afternoon Session

This afternoon, Joon will demonstrate exactly how we implement our speciality in developing trading strategies.

You'll see how we combine

- Advanced econometric methods
- Customized ML tools

to effectively deal with financial data.

This dual approach—which Joon will explain in detail—is what distinguishes EML Lab's methodology and makes our strategies effective in real-world financial markets.