MARC MALIAR

marcmaliar.wixsite.com/profile

EDUCATION

THE UNIVERSITY OF CHICAGO Chicago, IL
Expected graduation June 2022

- Double major in mathematics and computer science
- GPA 3.684
- GRE Quantitative 169/170, Verbal 164/170, Essay 5/6 (September 2021)
- Dean's Scholar
- Dean's List 2018-2019
- Relevant coursework: Honors Calculus, Real Analysis, Abstract Algebra, Complex Analysis, Computer Architecture, Databases, Functional Programming, Algorithms, Parallel Programming.
- Programming languages: Java, C++, C, Haskell, JavaScript, MATLAB, Python, Scheme.
- Extensive experience with AI and deep learning libraries: TensorFlow, Pandas, Git, PyTorch.
- Very experienced with Linux systems and computer architecture.
- Trilingual (English, Spanish, Russian); fluent in French; basic knowledge of German, Ukrainian, Catalan.

HENRY M. GUNN HIGH SCHOOL Palo Alto, CA
June 2018

- Unweighted GPA 4.00, Weighted GPA 4.40
- SAT Reasoning Test 1580/1600, SAT Math II 800/800, SAT Physics 800/800
- National AP Scholar

RESEARCH EXPERIENCE

UNIVERSITY OF CHICAGO MATH REU Chicago, IL
Researcher June. 2019 - July 2019

- This is a selective NSF-funded research program organized by the university math department.
- Wrote a paper on algebraic geometry under the direction of Dr. Peter May.

HIROSHIMA UNIVERSITY MACHINE LEARNING INTERSHIP Hiroshima, Japan
Intern July. 2019 - August 2019

- Wrote machine learning in TensorFlow for software-reliability applications.

AGILONE Sunnyvale, CA
Intern July. 2017 - August 2017

- AgilOne is a Silicon Valley startup that collects customer data, analyzes them and recommends marketing strategies by using machine learning. I worked with software that manipulates the customer data and defines functions that marketers can use to interact with the data. I wrote over 5000 lines of Java code.

RESEARCHER ON AI PROJECTS New York, NY
August 2019-PRESENT

- I worked on designing and implementing a TensorFlow code for solving dynamic stochastic models with a large number of heterogeneous agents analyzed in the article *"Deep learning for solving dynamic economic models"* by Lilia Maliar, Serguei Maliar and Pablo Winant, *Journal of Monetary Economics 122, pp* 76-101, https://web.stanford.edu/~maliars/Files/JME2021.pdf

- I worked on designing and implementing a TensorFlow code for estimating and testing an econometric model of car insurance with asymmetric information analyzed in the article "Testing for Asymmetric Information with Neural Networks", by Serguei Maliar and Bernard Salanie (2020).

DEEPECON.ORG TOOLBOX

I designed and implemented an AI machine-learning toolbox called *DeepEcon.org* for solving dynamic economic models with large number of heterogeneous agents. The novel feature of my *DeepEcon.org* toolbox is that it ameliorates the curse of dimensionality by using the-state-of-the-art techniques from modern data science. First, I use deep neural network to perform model reduction by condensing information from many input state variables into a smaller set of features in hidden layers. Second, deep neural networks are robust to multicollinearity which helps me dealing with ill conditioning. To reduce the cost of function evaluations, I employ stochastic optimization. To construct expectation functions, I use low cost asymptotically unbiased Monte Carlo integration.

My toolbox is written in TensorFlow and PyTorch - the Google and Facebook data platforms that facilitate most remarkable data science applications such as image and speech recognition, self-driving cars, etc. Finally, I make use of GPU parallel computing to achieve further reduction in cost. Taken together, these techniques allow me to solve models with thousands of state variables.

RESEARCH PAPERS

- *Marc Maliar (2021), "DeepEcon: An artificial intelligence toolbox for solving dynamic economic models",* available from http://deepecon.org
  Abstract: In this paper, I introduce DeepEcon.org--an abstract, powerful, intuitive, and extensible toolbox for solving dynamic stochastic heterogenous economic models. The toolbox is written in a simple and intuitive way that enables users to easily apply it for solving their own models and applications. A researcher just updates model parameters, neural networks, transition equations and the code run. The toolbox is written in PyTorch the deep-learning framework that most industry experts are moving towards to.

- *Marc Maliar (2019), "A bottom-up approach to Hilbert's Basis Theorem", download from University of Chicago Math department website* http://math.uchicago.edu/~may/REU2019/REUPapers/Maliar.pdf
  Abstract: In this expositional paper, we discuss commutative algebra—a study inspired by the properties of integers, rational numbers, and real numbers. In particular, we investigate rings and ideals, and their various properties. After, we introduce the polynomial ring and the fundamental relationship between polynomials and sets of points. We prove some results in algebraic geometry, notably Hilbert's Basis Theorem.

- *Maliar (2018), "How Machine (Deep) Learning Helps Us Understand Human Learning: the Value of Big Ideas", manuscript,* download from arXiv https://arxiv.org/abs/1903.03408
  Abstract: A deep learning neural network, referred to as a teacher, is trained to solve a classification problem. Another deep learning neural network, referred to as a student, learns to reproduce the output of the first network. I asked four questions: First, would the learning process be most effective when the student learns from the teacher network or from raw, real-world data? Second, how effective is the learning process depending on sample selection bias? Third, how does the learning process differ for high- and low-ability students characterized by differing learning rates? Finally, how does the learning outcome depend on the teacher's ability to identify and transmit general trends in the data? I address these questions in the context of an image recognition problem, namely, classification of handwritten numbers. My numerical results indicate that with unbiased samples and an unbiased teacher, a student learning from the teacher performs better than the one learning from the data directly, however, this tendency may reverse in the presence of sample selection bias. My codes are written in MATLAB and will be made publicly available.

MUSIC

Activities

- *Piano:* 2008-PRESENT, *Saxophonist: 2010-PRESENT*, *Composer:* 2010-PRESENT

Certifications

- *Associated Board of the Royal Schools of Music (ABRSM):* 8 Grades of Music Theory, graduated in 2016 and 8 Grades of Piano with distinction, graduated in 2015
- *Music Teachers' Association of California (MTAC):* Certificate of Merit (CM) in Advanced Piano Category with distinction

Awards

- *United States Open Music Competition:* 1st place Treasury of U.S.A. Composers Senior Difficulty 2015 - Special prize for the top performance among the 1st place winners of the 2015 competition
- *California Association of Professional Music Teachers:* 1st place 2016 Contemporary Music Festival
- *Heritage Music Festival Award in Hawaii:* Best soloist award (tenor saxophone)

SPORTS

Played soccer since 7; Joined the Stanford Soccer Club in 2011; Became team captain of Stanford Soccer Club in 2016. Practice karate, judo, and capoeira, dance Brazilian ginga and play berimbau (a bow-like musical instrument played with a stick and rock). Play tennis, basketball, and soccer. Completed triathlons (running, swimming, biking).