Hyukpyo Hong

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Employment	University of Wisconsin - Madison, Madison, WI, United States				
	Department of Mathematics, Van Vleck Assistant	nt Professor Aug. 2023 –			
Education	KAIST , Daejeon, South Korea				
	Ph.D. in Mathematical Sciences Advisor: Jae Kyoung Kim (jaekkim@kaist.ac.kr)	Mar. 2018 – Aug. 2023			
	B.S. in Mathematical Sciences with $\ensuremath{\mathit{Cum}}\xspace$ Laude	Mar. 2013 – Feb. 2018			
	Chungbuk Science High School, Cheongju, So	uth Korea Mar. 2011 – Feb. 2013			
Research Interests	My research focuses on the accurate reduction of stochastic models (i.e., continuous-time Markov chain) for biochemical systems and the Bayesian method to infer parameters of reduced Markovian or non-Markovian models. I have investigated a rigorous validity condition for a stochastic model reduction and a likelihood function for non-Markovian models with hidden components. Beyond the mathematical and statistical topics, I work closely with biologists and medical doctors to solve biological problems related to cognitive impairment or COVID-19.				
Papers	†: (co-)1st author, *: (co-)corresponding author.One can enter the article web page by clicking the underlined title of a paper.				
	1. Hyeontae Jo [†] , Hyukpyo Hong [†] , Hyung Ju Hwang, Won Chang, Jae Kyoung Kim [*] , <u>Density</u> physics-informed neural network identifies sources of cell heterogeneity in signal transduction under antibiotic stress, <i>bioRxiv</i> , 2023				
	2. Yuji Hirono [†] , [*] , Hyukpyo Hong [†] , [*] , Jae Kyoung Kim [†] , [*] , <u>Robust perfect adaptation of reaction</u> fluxes ensured by network topology, <i>arXiv</i> , 2023				
	 Hyukpyo Hong[†], Mark Jayson Cortez, Yu-Yu Cheng, Hang J. Kim, Boseung Choi[*], Krešimir Josić[*], and Jae Kyoung Kim[*], <u>Inferring delays in partially observed gene regulatory networks</u>, <i>bioRxiv</i>, 2022 				
	4. Hyukpyo Hong , Bryan S. Hernandez, Jinsu Kim, and Jae Kyoung Kim [*] , <u>Computational trans-</u> lation framework identifies biochemical reaction networks with special topologies and their long- term dynamics, <i>SIAM Journal on Applied Mathematics</i> , 2023				
	5. Hyukpyo Hong [†] , Ji Yun Noh [†] , Hyojung Lee, Sunhwa Choi, Boseung Choi, Jae Kyoung Kim [*] , Eui-Cheol Shin [*] , Modeling incorporating the severity-reducing long-term immunity: higher viral transmission paradoxically reduces severe COVID-19 during endemic transition, <i>Immune Net-</i> work, 2022				
	6. Dae Wook Kim [†] , Hyukpyo Hong [†] and Jae Kyoung Kim [*] , <u>Systematic inference identifies a</u> <u>major source of heterogeneity in cell signaling dynamics: the rate-limiting step number</u> , <u>Science</u> <u>Advances</u> , 2022				
	7. Yun Min Song [†] , Hyukpyo Hong [†] and Jae Kyoung Kim [*] , <u>Universally valid reduction of mul-</u> <u>tiscale stochastic biochemical systems with simple non-elementary propensities</u> , <i>PLoS Computa-</i> <i>tional Biology</i> , 2021				

- Mark Jayson Cortez[†], Hyukpyo Hong, Boseung Choi^{*}, Jae Kyoung Kim^{*}, and Krešimir Josić^{*}, <u>Hierarchical Bayesian models for inference in biochemical reactions with delays</u>, *Bioinformatics*, 2021
- Jaehyoung Hong[†], Su Jung Choi[†], Se Ho Park, Hyukpyo Hong, Victoria Booth, Eun Yeon Joo^{*}, and Jae Kyoung Kim^{*}, <u>Personalized sleep-wake patterns aligned with circadian rhythm</u> relieve daytime sleepiness, *iScience*, 2021
- Hyukpyo Hong[†], Jinsu Kim[†], M. Ali Al-Radhawi, Eduardo D. Sontag, Jae Kyoung Kim^{*}, Derivation of stationary distributions of biochemical reaction networks via structure transformation, Communications Biology, 2021.
- BOOK CHAPTERS 1. **Hyukpyo Hong**, Boseung Choi, and Jae Kyoung Kim, <u>Beyond the Michaelis-Menten: Bayesian</u> inference for enzyme kinetic analysis, Quentin Vanhaelen (Ed.), *Computational Methods for Estimating the Kinetics Parameters of Biological Systems*, Methods in Molecular Biology, vol 2385. Humana, New York, NY.
- Softwares
- 1. **Hyukpyo Hong**, Boseung Choi, and Jae Kyoung Kim, EKMCMC, CRAN R package, MCMC procedures for estimating enzyme kinetics constants, https://cran.r-project.org/web/packages/EKMCMC
 - 2. Hyukpyo Hong, Boseung Choi, and Jae Kyoung Kim, Computational package for deriving analytical stationary distributions of biochemical reaction networks with network translation., https://github.com/Mathbiomed/CASTANET
 - 3. Dae Wook Kim, **Hyukpyo Hong** and Jae Kyoung Kim, Moment-based Bayesian inference method for inferring cell-to-cell heterogeneity in the non-Markovian signaling process, https://github.com/Mathbiomed/MBI
 - 4. Hyukpyo Hong, Mark Jayson Cortez, Yu-Yu Cheng, Hang J. Kim, Boseung Choi, Krešimir Josić, and Jae Kyoung Kim, Simulation-based Bayesian Markov chain Monte Carlo method for inferring partially observed gene regulatory networks, https://github.com/Mathbiomed/SimMCMC

Honors and Awards

- 2022 SIAM Student Travel Awards, SIAM – It was awarded to student participants who have a strong record of scholarship.
 - 2022 Blood Donor Hall of Fame, Korean Red Cross – It was for 100th blood donation.
 - 2019 2023 Global Ph.D. Fellowship (Full Tuition), NRF
 For five years, this fellowship supports 25,000\$/year. Only five Ph.D. students in mathematics receive this fellowship every year.
 - 2021 KSIAM Conference Poster Presentation Award, KSIAM
 - This award was given top four presenters among \sim 30 poster presenters in the conference.
 - 2017 HAAFOR Challenge for applied/financial math problem 4th place, HAAFOR

- I developed an algorithm to maximize inter-cluster distance and minimize intra-cluster distance for given 10,000 stock price data set.

- 2017 36th National Undergraduate Mathematics Competition Silver Award, KMS The silver award was given to top 15% among the participants.
- 2014 33rd National Undergraduate Mathematics Competition Silver Award, KMS
- 2016 Mirae Asset Global Exchange Scholarship, Mirae Asset Park Hyeon Joo Foundation – For one semester, this scholarship supports 7000\$.
- 2014 Dean's List Award, College of Natural Sciences, KAIST

	May 28, 2022: KSIAM Spring Conference Systematic inference for cell signalling pathways identifies a key determinant of cell-to-cell variability	Daejeon, Korea Special session	
	June 22, 2022: BRIC Webinar Systematic inference for cell signalling pathways identifies a key determinant of cell-to-cell variability	Online	
	Increasing viral transmission paradoxically reduces severe COVID-19 during endemic transition	Special session	
	June 25, 2022: KSMB Appuel Meeting	Voogu Koree	
	October 19, 2022: Global KMS International Conference Systematic inference identifies a major source of heterogeneity in non-Markovian cell signaling dynamics	Seoul, Korea	
	endemic transition	Special session	
	November 21, 2022: Population Approach Group Korea Annual Meeting Seoul, Korea Increasing viral transmission paradoxically reduces severe COVID-19 during		
	December 19, 2022: Mini-workshop on Recent Trends in Pure and Applied Mathematics Inferring delays in partially observed gene regulatory networks	Daejeon, Korea	
	Increasing viral transmission paradoxically reduces severe COVID-19 during endemic transition	Special session	
	May 19, 2023: KSIAM Spring Conference	eongchang, Korea	
	June 27, 2023: The 8th CIJK International Conference on Mathematic and Theoretical Biology Things we have been overlooking in infectious disease modeling	cal Jeju, Korea Minisymposium	
	stochastic reaction networks	Minisymposium	
	July 17, 2023: SMB Annual Meeting Columbus, Co	OH, United States	
Invited talks	August 17, 2023: ICIAM 2023 Satellite Workshop: Stochastic Modeling and Data Analysis for Biological Systems Network translation allows for revealing long-term dynamics of stochastic reaction networks	Daejeon, Korea	
	Abbreviations NRF: National Research Foundation of Korea, KMS: Korean Mathematical Society KSIAM: Korean Society for Industrial and Applied Mathematics KOSAF: Korea Student Aid Foundation,		
	 This award was given to two students with the highest GPA in the semester. 2013 32nd National Undergraduate Mathematics Competition Silver Award, KMS 2013 - 2017 The National Scholarship for Science and Engineering (Full Tuition), KOSAF For four years, this scholarship supports 8,000\$/year. Approximately top 10% students in KAIST receive this scholarship. 		
	This award was given to two students with the highest CDA is the second	r	

	August 27, 2021: KSMB Annual Meeting Inference of stochastic dynamics in biochemical reaction networks	Jeju, Korea Special session
	June 16, 2021: SMB Annual Meeting Inference of stochastic dynamics in biochemical reaction networks	Online Minisymposium
	May 27, 2021: SIAM Conference on Applications of Dynamical Syste Derivation of stationary distributions of stochastic chemical reaction networks	ms Online
	via network translation	Minisymposium
	May 13, 2021: Seminar on the Mathematics of Reaction Networks [lin Derivation of stationary distributions of stochastic chemical reaction networks via network translation.	nk] Online
	October 24, 2020: KMS Annual Meeting Derivation of stationary distributions of biochemical reaction networks via	Online
	structure transformation	Minisymposium
Contributed Talks and	July 14, 2023: Dynamical Systems in the Life Sciences Columbus, Systematic inference identifies a major source of heterogeneity in non Markovian cell signaling dynamics	OH, United States
IUSIERS	in non-warkovian cen signamig dynamics	1 OSTEI
	December 6, 2022: Workshop on Non-equilibrium Phenomena in Physics and Biology Network translation allows for revealing long-term dynamics of stochastic	Gyeongju, Korea
	reaction networks	Poster
	Increasing viral transmission paradoxically reduces severe COVID-19 during endemic transition	Jeju, Korea General session
	October 11, 2022: International Conference on Systems Biology Systematic inference identifies a major source of heterogeneity in non-Markovian cell signaling dynamics: the rate-limiting step number	Berlin, Germany ⁿ Short talk
	July 14, 2022: SIAM Conference on the Life Sciences Systematic inference identifies a major source of heterogeneity in non-Markovian cell signaling dynamics: the rate-limiting step number	Pittsburgh, USA a Contributed talk
	May 17, 2022: SRBR Biennial Conference Personalized sleep-wake patterns aligned with circadian rhythm relieve daytime sleepiness	Jacksonville, USA
	December 17, 2021: KSMB Winter Conference	Jeju, Korea
	Derivation of stationary distributions of stochastic chemical reaction networks via network translation	Poster
	December 04, 2021: KSIAM Annual Conference Derivation of stationary distributions of stochastic chemical reaction networks via network translation	Busan, Korea Poster
	September 28, 2021: Non-equilibrium collective phenomena workshop Derivation of stationary distributions of stochastic chemical reaction networks via network translation	• Gyeongju, Korea Poster
	June 26, 2021: KSIAM Spring Conference Derivation of stationary distributions of biochemical reaction networks via	Gangneung, Korea
	structure transformation	Contributed talk
	November 13, 2020: KSIAM Annual Meeting	Online

	Derivation of stationary distributions of biochemical reaction networks via structure transformation	Poster		
	August 20, 2020: SMB Annual Meeting Derivation of stationary distributions of biochemical reaction networks via	Online		
	structure transformation	Contributed talk		
	July 23, 2019: SMB Annual Meeting Product-Form Stationary Distributions for Non-Complex Balanced Networks	Montreal, Canada Poster		
	July 8, 2019: Chemical Reaction Networks Workshop Product-Form Stationary Distributions for Non-Complex Balanced Networks	Torino, Italy Short talk		
	May 18, 2019: KSIAM Spring Conference Product-Form Stationary Distributions for Non-Complex Balanced Networks	Seoul, Korea Contributed talk		
	May 11, 2019: A3 Workshop on Mathematical Life Science Product-Form Stationary Distributions for Non-Complex Balanced Networks	Beijing, China Student talk		
Teaching Experience	UW-MadisonFall 2023: [Instructor] Linear Algebra and Differential Equations (Math320)			
	 KAIST Spring 2019: [Mentor] Undergraduate Research Program (URP) Mentoring an undergraduate student. Discussed with and guided the student to invest gate the total quasi-steady-state approximation for a competitive system. The student we poster presentation prize at the 2019 KSIAM Spring conference and a prize in the URP fin evaluation. 			
	• Spring 2019: [Teaching Assistant] Differential Equations and Applications (MAS201)			
	• Fall 2018: [Teaching Assistant] Differential Equations and Applications (MAS201)			
	• Spring 2018: [Teaching Assistant] Introduction to Linear Algebra (MAS109), Linear Algebra (MAS212)			
SERVICE	June 13-17, 2021: Support Staff, SMB Annual Meeting Host zoom links of sessions for Asia time zone.	Online		
PEER REVIEW	PLoS Computational Biology			