Daewon Seo

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Research Interests

My research interests lie primarily in deep learning theory and social learning. 1) Deep neural networks (DNNs) have shown great success in various fields, while why they work is largely open. My goal is to design efficient and provable algorithms for deep neural networks. 2) Another goal is to design optimal inference and data-generation strategies in social networks from a learning perspective. Specifically, I am interested in the case where true models are unknown or incorrectly known (learning perspective), which is closely related to human irrationality. A few selected related works are:

- A bound on VC dimension of general DNNs and its verification [Pre1]
- RepGAN: A new conditional GAN outperforming prior GANs in diverse settings [Pre2]
- Local decision making with human's perception bias is optimal for learning or social learning [J4, Pre3]

Education

Ph.D. in Electrical & Computer Engineering, Aug. 2014–Aug. 2019
University of Illinois at Urbana-Champaign, IL, USA
Advisor: Lav R. Varshney
Thesis: Information-theoretic analysis of human-machine mixed systems
Thesis Committee: Lav R. Varshney, Pierre Moulin, Rayadurgam Srikant, Venugopal V. Veeravalli

M.S. in Electrical Engineering, Feb. 2010
KAIST (Korea Advanced Institute of Science and Technology), Daejeon, South Korea
Advisor: Sae-Young Chung, Junmo Kim (co-advisor)
Thesis: Achievable schemes on Z-interference channels with finite conferencing link
Thesis Committee: Sae-Young Chung, Junmo Kim, Jeongseok Ha

B.S. in Electrical Engineering *(summa cum laude, 2nd rank in EE dept.)*, Feb. 2008
KAIST (Korea Advanced Institute of Science and Technology), Daejeon, South Korea
Advisor: Sae-Young Chung

Work Experience

University of Wisconsin–Madison, WI, USA, Jan. 2020–present
Postdoctoral Researcher, hosted by Prof. Kangwook Lee
- Deep learning theory / GANs

University of Southern California, CA, USA, Sep. 2019–Dec. 2019
Postdoctoral Researcher, hosted by Prof. Urbashi Mitra
- Mathematical modeling for microbiology / Molecular communication

LG Electronics, Seoul, South Korea, Oct. 2011–May 2014

- 3GPP LTE-Advanced RAN1 (physical) standardization

KAIST Institute, Daejeon, South Korea, Mar. 2010–Sep. 2011

- Near-field communication HW and SW / Wireless power transfer systems

Publications

Preprints / Submitted

[Pre1] **Daewon Seo**, Hongyi Wang, Dimitris Papailiopoulos, Kangwook Lee, "VC Dimension of DNNs and the Number of Per-Layer Learnable Parameters," submitted to International Conference on Machine Learning (ICML) 2021

[Pre2] ∗Tuan Dinh, ∗**Daewon Seo**, Zhixu Du, Liang Shang, Kangwook Lee (*:equal contribution), "Learning Conditional GANs via Reprogramming Unconditional GANs," submitted to International Conference on Machine Learning (ICML) 2021

[Pre3] **Daewon Seo**, Ravi Kiran Raman, Lav R. Varshney, "Decision Making in Star Networks with Incorrect Beliefs," submitted to IEEE Transactions on Signal Processing (`arXiv:1912.12284`)

[Pre4] **Daewon Seo**, Lav R. Varshney, "The CEO problem with rth Power of Difference and Logarithmic Distortions," submitted to IEEE Transactions on Information Theory (`arXiv:1812.00903`)

Journal Articles

[J1] Mustafa Can Gursoy, **Daewon Seo**, Urbashi Mitra, "A Concentration-Time Hybrid Modulation Scheme for Molecular Communications," IEEE Transactions on Moleclar, Biological, and Multi-scale Communications, accepted (`arXiv:2010.02359`)

[J2] **Daewon Seo**, Avhishek Chatterjee, Lav R. Varshney, "On Multiple-Access in Queue-Length Sensitive Systems," IEEE Open Journal of the Communications Society, vol. 1, pp. 1244-1255, August 2020 (`Link`)

[J3] **Daewon Seo**, Anas Chaaban, Lav R. Varshney, Mohamed-Slim Alouini, "Classes of Full-Duplex Channels with Capacity Achieved Without Adaptation," IEEE Transactions on Communications, vol. 68, no. 7, pp. 4141–4149, July 2020 (`Link`)

[J4] **Daewon Seo**, Ravi Kiran Raman, Joong Bum Rhim, Vivek K Goyal, Lav R. Varshney "Beliefs in Decision-Making Cascades," IEEE Transactions on Signal Processing, vol. 67, no. 19, pp. 5103-5117, October 2019 (`Link`)

[J5] **Daewon Seo**, Lav R. Varshney "Information and Energy Transfer with Experimentally-Sampled Harvesting Functions," IEEE Transactions on Communications, vol. 67, no. 6, pp. 4479–4490, June 2019 (`Link`)

[J6] *Avhishek Chatterjee, ***Daewon Seo**, *Lav R. Varshney, (*:alphabetic) "Capacity of Systems with Queue-Length Dependent Service Quality," IEEE Transactions on Information Theory, vol. 63, no. 6, pp. 3950–3963, June 2017 (`Link`)

[J7] **Dae-Won Seo**, Sangwoon Jeon, Sae-Young Chung, Junmo Kim, "Rate Enhancement for the Gaussian Z-interference Channel with Transmitter Cooperation," IEEE Communications Letters, vol. 14, no. 9, pp. 821–823, September 2010 (`Link`)

Conference Proceedings

[C1] Sourya Basu, **Daewon Seo**, Lav R. Varshney, "Hypergraph-based Coding Schemes for Two Source Coding Problems under Maximal Distortion," in Proceedings of the 2020 IEEE International Symposium on Information Theory (ISIT), Los Angeles, California, 21–26 June 2020, pp. 2426–2431 (Link)

[C2] **Daewon Seo**, Ravi Kiran Raman, Lav R. Varshney, "Social Learning with Beliefs in a Parallel Network," in Proceedings of the 2020 IEEE International Symposium on Information Theory (ISIT), Los Angeles, California, 21–26 June 2020, pp. 1265–1270 (Link)

[C3] Mustafa Gursoy, **Daewon Seo**, Urbashi Mitra, "Concentration and Position-Based Hybrid Modulation Scheme for Molecular Communications," in Proceedings of the IEEE International Conference on Communications (ICC), Dublin, Ireland, 7–11 June 2020 (Link)

[C4] Sourya Basu, **Daewon Seo**, Lav R. Varshney, "Functional Epsilon Entropy," in Proceedings of the IEEE Data Compression Conference (DCC), Snowbird, Utah, 24–27 March 2020, pp. 332–341 (Link)

[C5] **Daewon Seo**, Lav R. Varshney, "The CEO problem with rth Power of Difference Distortion," in Proceedings of the 2019 IEEE International Symposium on Information Theory (ISIT), Paris, France, 7–12 July 2019 pp. 2034–2038 (Link)

[C6] **Daewon Seo**, Lav R. Varshney "Information and Energy Transfer with Experimentally-Sampled Harvesting Functions," in Proceedings of the 2019 IEEE International Symposium on Information Theory (ISIT), Paris, France, 7–12 July 2019, pp. 126–130 (Link)

[C7] **Daewon Seo**, Avhishek Chatterjee, Lav R. Varshney, "On Multiuser Systems with Queue-Length Dependent Service Quality," in Proceedings of the 2018 IEEE International Symposium on Information Theory (ISIT), Vail, Colorado, 17–22 June 2018, pp. 341–345 (Link)

[C8] **Daewon Seo**, Ravi Kiran Raman, Lav R. Varshney, "Probability Reweighting in Social Learning: Optimality and Suboptimality," in Proceedings of the 2018 IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Calgary, Canada, 15–20 April 2018, pp. 6966–6970 (Link)

[C9] **Daewon Seo**, Lav R. Varshney, "Information-Theoretic Limits of Algorithmic Noise Tolerance," in Proceedings of the 2016 IEEE International Conference on Rebooting Computing (ICRC), San Diego, California, 17–19 October 2016 (Link)

[C10] Avhishek Chatterjee, **Daewon Seo**, Lav R. Varshney (alphabetic), "Capacity of Systems with Queue-Length Dependent Service Quality," in the Proceedings of the International Symposium on Information Theory and Its Applications (ISITA), Monterey, California, 30 October–2 November 2016, pp.552–556 (Link)

[C11] Sang-Woon Jeon, Sung Hoon Lim, Bangchul Jung, **Dae-Won Seo**, "Opportunistic Noisy Network Coding for Fading Parallel Relay Networks," in the Proceedings of the IEEE Global Communications Conference (GLOBECOM), Houston, Texas, 5–9 December 2011 (Link)

International patents

US patents: 20 granted, 3 pending applications

[IP1] US 10,420,050 B2, Hakseong Kim, Inkwon Seo, Hanbyul Seo, **Daewon Seo**, Youngtae Kim, Hyukjin Chae, "Method for transmitting/receiving synchronization signal for D2D communication in wireless communication system, and apparatus therefor"

[IP2] US 10,321,475 B2, Youngtae Kim, Hanbyul Seo, Jihyun Lee, Seungmin Lee, Myoungseob Kim, **Daewon Seo**, Hyukjin Chae, Kijun Kim, Inkwon Seo, "Method and apparatus for retransmitting scheduling assignment information in wireless communication system supporting device to device (D2D) communication"

[IP3] US 10,263,825 B2, **Daewon Seo**, Hanbyul Seo, Hakseong Kim, "Method and device for transmitting synchronization signal for D2D (device to device) communication in wireless communication system"

[IP4] US 10,187,902 B2, Myoungseob Kim, Hanbyul Seo, **Daewon Seo**, "Method and apparatus for performing device-to-device direct communication between devices in wireless communication system"

[IP5] US 10,075,927 B2, **Daewon Seo**, Hakseong Kim, Hanbyul Seo, "Method for transmitting and receiving control information and apparatus for same"

[IP6] US 10,064,041 B2, **Daewon Seo**, Hakseong Kim, Hanbyul Seo, "Method for setting cyclic prefix for D2D (device-to-device) communication in radio communications system and apparatus therefor"

[IP7] US 9,999,015 B2, **Daewon Seo**, Hanbyul Seo, Byounghoon Kim, "Method for synchronization between user equipment for device-to-device (D2D) communication in wireless communication system and apparatus for same"

[IP8] US 9,967,842 B2, **Daewon Seo**, Hanbyul Seo, Hakseong Kim, "Method for detecting synchronization signal for device-to-device (D2D) communication in wireless communication system and apparatus therefor"

[IP9] US 9,924,478 B2, **Daewon Seo**, Hanbyul Seo, "Method for transmitting sync signals for Device-to-Device (D2D) communication in wireless communication system and apparatus therefor"

[IP10] US 9,769,800 B2, **Daewon Seo**, Hakseong Kim, Hanbyul Seo, "Method and apparatus for allocating control channel for transceiving data between devices in wireless access system"

[IP11] US 9,768,939 B2, **Daewon Seo**, Inkwon Seo, Hanbyul Seo, "Signal transmission/reception method and apparatus therefor"

[IP12] US 9,756,609 B2, **Daewon Seo**, Seungmin Lee, Hakseong Kim, Byounghoon Kim, "Multimedia broadcast/multicast service method and apparatus for device-to-device (D2D) communication in wireless communication system"

[IP13] US 9,730,174 B2, **Daewon Seo**, Hanbyul Seo, Myoungseob Kim, "Method of transmitting a scheduling assignment signal for device-to-device communication in a wireless communication system, and an apparatus thereof"

[IP14] US 9,699,806 B2, **Daewon Seo**, Hanbyul Seo, "Method and device for retransmitting uplink data in wireless communication system"

[IP15] US 9,538,518 B2, **Daewon Seo**, Hanbyul Seo, Seungmin Lee, Jihyun Lee, "Method for detecting downlink control channel in wireless communication system and apparatus for same"

[IP16] US 9,516,638 B2, **Daewon Seo**, Hanbyul Seo, "Signal transmission/reception method and apparatus therefor"

[IP17] US 9,516,608 B2, **Daewon Seo**, Hakseong Kim, Hanbyul Seo, "Power control method for device-to-device (D2D) communication in wireless communication system and apparatus therefor"

[IP18] US 9,504,033 B2, **Daewon Seo**, Suckchel Yang, Seungmin Lee, Hakseong Kim, Hanbyul Seo, "Method and apparatus for allocating channels related to uplink bundling"

[IP19] US 9,480,060 B2, **Daewon Seo**, Hakseong Kim, Hanbyul Seo, "Method by which a terminal receives enhanced downlink control channel in wireless communication system and apparatus for same"

[IP20] US 9,474,059 B2, **Daewon Seo**, Hakseong Kim, Hanbyul Seo, "Method for receiving downlink control signal, user equipment, method for transmitting downlink control signal and base station"

Scholarships for Academic Excellence

- Jeong Song cultural foundation scholarship, August 2014–May 2017 ($<$10 students across all areas)
- Prof. Un, Chong Kwan scholarship, April 2008 (graduate entrance exam excellence, 2 MS students in EE, KAIST)
- Korea Semiconductor Industry Association (KSIA) scholarship, October 2006 (academic excellence, 1 BS student in EE, KAIST)

Programming Skills

Python, MATLAB, C, C++, Java, Verilog

References

- Lav R. Varshney (varshney@illinois.edu), University of Illinois at Urbana-Champaign, Associate Professor, +1-217-244-8042, Ph.D. advisor
- Kangwook Lee (kangwook.lee@wisc.edu), University of Wisconsin-Madison, Assistant Professor, +1-608-265-4841, Postdoc host
- Avhishek Chatterjee (avhishek@ee.iitm.ac.in), Indian Institute of Technology Madras, Assistant Professor, +91-44-2257-4452, Co-author of two papers