Chul Lee

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RESEARCH INTERESTS

Image restoration
Power-constrained image/video processing
Computational imaging
High dynamic range (HDR) imaging

PROFESSIONAL EXPERIENCE

Assistant Professor Mar. 2019 –
Department of Multimedia Engineering
Dongguk University, Seoul, Korea

Assistant Professor Oct. 2015 – Feb. 2019
Department of Computer Engineering
Pukyong National University, Busan, Korea

Research Scientist May 2014 – Sep. 2015
Department of Electrical and Electronic Engineering
The University of Hong Kong, Kong Kong
- Advisor: Prof. Edmund Y. Lam

Postdoctoral Scholar Apr. 2013 – Apr. 2014
Department of Electrical Engineering
The Pennsylvania State University, University Park, PA, USA
- Advisor: Prof. Vishal Monga

Research Assistant Sep. 2006 – Feb. 2013
Korea University, Seoul, Korea

H/W and Firmware Development Engineer Sep. 2002 – Jun. 2006
Manufacturing Technology Engineer
Biospace Inc., Seoul, Korea
- Developed medical equipment including body composition analyzers and automatic standiometers

Intern Jul. 2001 – Aug. 2001
Biospace Inc., Seoul, Korea
- Developed a user identification system using RFID

EDUCATION

Ph.D., Electrical Engineering Feb. 2013
- Korea University, Seoul, Korea
- Advisor: Prof. Chang-Su Kim
- Dissertation: Image restoration with MMSE nonlocal means filtering

M.S., Electrical Engineering Aug. 2008
- Korea University, Seoul, Korea
- Advisor: Prof. Chang-Su Kim
- Thesis: Tone mapping and encoding algorithms for HDR video sequences

B.S., Electrical Engineering Feb. 2003

- Korea University, Seoul, Korea

RESEARCH PROJECTS

- "Researches on computational camera-based image processing for visibility enhancement under extreme environments," National Research Foundation of Korea (NRF), ₩425,000,000, 06/2019–02/2022
- "Research on image enhancement algorithms under adverse weather conditions," ₩30,000,000, Electronics and Telecommunications Research Institute (ETRI), 06/2019–11/2019
- "HDR imaging-based high-quality image acquisition," Lisantech Co., Ltd., ₩13,957,000, 06/2019–08/2019
- "Research on dynamic range improvement for high-luminance displays," ₩54,010,000, Samsung Electronics Co., Ltd., 09/2018–02/2019
- "Development of image enhancement algorithms for marine surveillance systems," Korea Technology and Information Promotion Agency for SMEs (TIPA), ₩43,000,000, 12/2017–11/2018
- "Development of HDR image processing algorithms for external luminance measurements of road tunnels," Lisantech Co., Ltd., ₩40,392,000, 08/2017–07/2018
- "Development of tone mapping-based luminance optimization algorithms for dimmed displays," ₩45,100,000, Samsung Electronics Co., Ltd., 07/2017–01/2018
- "Development of real-time image processing algorithms for vehicle and pedestrian detection," Lisantech Co., Ltd., ₩35,112,000, 03/2017–02/2018
- "Single-shot HDR imaging," Pukyong National University, 09/2016–08/2017
- "Researches on real-time image processing for visibility enhancement under extreme environments," National Research Foundation of Korea (NRF), ₩233,000,000, 06/2016–05/2019
- "Development of prototype of IVAS hardware and system software," National Research Foundation of Korea (NRF), ₩30,000,000, 11/2015–10/2016
- "Researches on image-dependent power-constrained RGB-RGBW conversion," Pukyong National University, 10/2015–08/2016
- "Researches on dark image enhancement for mobile cameras," Pukyong National University, 11/2015–02/2016

PAPERS SUBMITTED

[1] Nam Hoang Nguyen, Tu Van Vo, Younghoon Jeong, Youngsu Moon, and **Chul Lee**, "Optimized tone mapping of HDR images via HVS model-based 2D histogram equalization," in preparation, Nov. 2019.

[2] An Gia Vien and **Chul Lee**, "A multi-scale end-to-end convolutional neural network for single-shot high dynamic range imaging," in preparation, Nov. 2019.

[3] Tu Van Vo and **Chul Lee**, "High dynamic range video synthesis using superpixel-based illuminance-invariant motion estimation," in preparation, Nov. 2019.

BOOK CHAPTERS

[1] Raja Bala, Graham Finlayson, and **Chul Lee**, "Computational Color Imaging," in *Handbook of Convex Optimization Methods in Imaging Science*, Ed. Vishal Monga, Springer, pp 43-70, 2017.

JOURNAL PUBLICATIONS

[1] Jun-Tae Lee, **Chul Lee**, and Chang-Su Kim, "Property-specific aesthetic assessment with unsupervised aesthetic property discovery," *IEEE Access*, vol. 7, pp. 114349–114362, Aug. 2019.

[2] Zhenhua Zhou, Edmund Y. Lam, and **Chul Lee**, "Nonlocal means filtering based speckle removal utilizing the maximum a posteriori estimation and the total variation image prior," *IEEE Access*, vol. 7, pp. 99231–99243, Aug. 2019.

[3] Jun-Tae Lee, Han-Ul Kim, **Chul Lee**, and Chang-Su Kim, "Photographic composition classification and dominant geometric element detection for outdoor scenes," *Journal of Visual Communication and Image Representation*, vol. 55, pp. 91–105, Aug. 2018.

[4] **Chul Lee** and Edmund Y. Lam, "Computationally efficient brightness compensation and contrast enhancement for transmissive liquid crystal displays," *Journal of Real-Time Image Processing*, vol. 14, no. 4, pp 733–741, Apr. 2018.

[5] Jaemoon Lim, Minhyeok Heo, **Chul Lee**, and Chang-Su Kim, "Contrast enhancement of noisy low-light images based on structure-texture-noise decomposition," *Journal of Visual Communication and Image Representation*, vol. 45, pp. 107–121, May 2017.

[6] Yuelong Li, **Chul Lee**, and Vishal Monga, "A maximum a posteriori estimation framework for robust high dynamic range video synthesis," *IEEE Transactions on Image Processing*, vol. 26, no. 3, pp. 1143–1157, Mar. 2017.

[7] **Chul Lee** and Vishal Monga, "Power-constrained RGB-to-RGBW conversion for emissive displays: Optimization-based approaches," *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 26, no. 10, pp. 1821–1834, Oct. 2016.

[8] **Chul Lee** and Edmund Y. Lam, "Computationally efficient truncated nuclear norm minimization for high dynamic range imaging," *IEEE Transactions on Image Processing*, vol. 25, no. 9, pp. 4145–4157, Sep. 2016.

[9] **Chul Lee**, Yuelong Li, and Vishal Monga, "Ghost-free high dynamic range imaging via rank minimization," *IEEE Signal Processing Letters*, vol. 21, no. 9, pp. 1045–1049, Sep. 2014.

[10] **Chul Lee**, Jin-Hwan Kim, Chulwoo Lee, and Chang-Su Kim, "Optimized brightness compensation and contrast enhancement for transmissive liquid crystal displays," *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 24, no. 4, pp. 576–590, Apr. 2014.

[11] Chulwoo Lee, **Chul Lee**, and Chang-Su Kim, "Contrast enhancement based on layered difference representation of 2D histograms," *IEEE Transactions on Image Processing*, vol. 22, no. 12, pp. 5372–5384, Dec. 2013.

[12] Seong-Gyun Jeong, **Chul Lee**, and Chang-Su Kim, "Motion-compensated frame interpolation based on multihypothesis motion estimation and texture optimization," *IEEE Transactions on Image Processing*, vol. 22, no. 11, pp. 4497–4509, Nov. 2013.

[13] **Chul Lee** and Chang-Su Kim, "Rate-distortion optimized layered coding of high dynamic range videos," *Journal of Visual Communication and Image Representation*, vol. 23, no. 6, pp. 908–923, Aug. 2012.

[14] **Chul Lee**, Chulwoo Lee, and Chang-Su Kim, "An MMSE approach to nonlocal image denoising: Theory and practical implementation," *Journal of Visual Communication and Image Representation*, vol. 23, no. 3, pp. 476–490, Apr. 2012. **Top 25 hottest article–2012 full year**, **Winner of Best Paper Award**.

[15] Chulwoo Lee, **Chul Lee**, Young-Yoon Lee, and Chang-Su Kim, "Power-constrained contrast enhancement for emissive displays based on histogram equalization," *IEEE Transactions on Image Processing*, vol. 21, no. 1, pp. 80–93, Jan. 2012.

[16] Jae-Kyun Ahn, Dae-Yeon Lee, **Chul Lee**, and Chang-Su Kim, "Automatic moving object segmentation from video sequences using alternate flashing system," *EURASIP Journal on Advances in Signal Processing*, vol. 2010, Article ID 340717, 14 pages, 2010.

CONFERENCE PUBLICATIONS

[1] Junheum Park, **Chul Lee**, and Chang-Su Kim, "Deep learning approach to video frame rate up-conversion using bilateral motion estimation," to appear in *Proc. APSIPA Annual Summit and Conference* (*ASC*), Lanzhou, China, Nov. 2019.

[2] Inho Jeong and **Chul Lee**, "Low-light video enhancement based on optimal gamma correction parameter estimation," in *Proc. International Workshop on Frontiers of Computer Vision* (*IW-FCV*), Gangneung, Korea, Feb. 2019. **Winner of Best Paper Award**.

[3] Thuong Van Nguyen, An Gia Vien, and **Chul Lee**, "Fast image dehazing based on multi-scale guided filtering," in *Proc. International Workshop on Advanced Image Technology* (*IWAIT*), Singapore, Jan. 2019.

[4] Nam Hoang Nguyen, Tu Van Vo, Younghoon Jeong, Youngsu Moon, and **Chul Lee**, "Optimized tone mapping of HDR images via HVS model-based 2D histogram equalization," in *Proc. APSIPA Annual Summit and Conference* (*ASC*), Honolulu, HI, Nov. 2018, pp. 700–704.

[5] Nam Hoang Nguyen, Tu Van Vo, and **Chul Lee**, "HVS model-based tone mapping technique for displaying HDR10 contents," in *Proc. International Meeting on Information Display* (*IMID*), Busan, Korea, Aug. 2018.

[6] Tu Van Vo and **Chul Lee**, "Robust HDR video synthesis using superpixel-based illumination invariant motion estimation," in *Proc. IEEE International Conference on Consumer Electronics-Asia* (*ICCE-Asia*), Jeju, Korea, Jun. 2018, pp. 245–246.

[7] An Gia Vien and **Chul Lee**, "Single-shot high dynamic range imaging via deep convolutional neural network," in *Proc. APSIPA Annual Summit and Conference* (*ASC*), Kuala Lumpur, Malaysia, Dec. 2017, pp. 1768–1772.

[8] Jun-Tae Lee, Han-Ul Kim, **Chul Lee**, and Chang-Su Kim, "Semantic line detection and its applications," in *Proc. IEEE International Conference on Computer Vision* (*ICCV*), Venice, Italy, Oct. 2017, pp. 3229–3237.

[9] An Gia Vien and **Chul Lee**, "Deep learning-based single-shot HDR imaging," in *Proc. International Technical Conference on Circuits/Systems, Computers and Communications* (*ITC-CSCC*), Busan, Korea, Jul. 2017, pp. 857–858.

[10] **Chul Lee**, "Rank minimization-based fast image completion," in *Proc. International Conference on Electronics, Information, and Communication* (*ICEIC*), Phuket, Thailand, Jan. 2017, pp. 839–840.

[11] Jaemoon Lim, Minhyeok Heo, **Chul Lee**, and Chang-Su Kim, "Enhancement of noisy low-light images via structure-texture-noise decomposition," *Proc. APSIPA Annual Summit and Conference* (*ASC*), Jeju, Korea, Dec. 2016.

[12] Myoung-Gyu Seo, Sang-Yeob Kim, Jang-Bok Ju, and **Chul Lee**, "Beat estimation of non-periodic human movements using Kinect," in *Proc. IEEE International Conference on Consumer Electronics-Asia* (*ICCE-Asia*), Seoul, Korea, Oct. 2016, pp. 547–548.

[13] **Chul Lee** and Edmund Y. Lam, "High dynamic range imaging via truncated nuclear norm minimization of low-rank matrix," in *Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing* (*ICASSP*), Shanghai, China, Mar. 2016, pp. 1229–1233.

[14] Yuelong Li, **Chul Lee**, and Vishal Monga, "A MAP estimation framework for HDR video synthesis," in *Proc. IEEE International Conference on Image Processing* (*ICIP*), Quebec City, Canada, Sep. 2015, pp. 2219–2223.

[15] **Chul Lee** and Vishal Monga, "Power-constrained RGB-to-RGBW conversion for emissive displays," in *Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing* (*ICASSP*), Florence, Italy, May 2014, pp. 1205–1209.

[16] Yeong Jun Koh, **Chul Lee**, Jae-Young Sim, and Chang-Su Kim, "Reliable optical flow estimation in motion-blurred regions," in *Proc. IEEE International Workshop on Multimedia Signal Processing* (*MMSP*), Pula (Sardinia), Italy, Sep.–Oct. 2013, pp. 396–401.

[17] Jin-Hwan Kim, **Chul Lee**, Jae-Young Sim, and Chang-Su Kim, "Single-image deraining using an adaptive nonlocal means filter," in *Proc. IEEE International Conference on Image Processing* (*ICIP*), Melbourne, Australia, Sep. 2013, pp. 914–917.

[18] **Chul Lee**, Chang-Su Kim, and Sang-Uk Lee "Probabilistic depth-guided multi-view image denoising," in *Proc. IEEE International Conference on Image Processing* (*ICIP*), Melbourne, Australia, Sep. 2013, pp. 905–908.

[19] **Chul Lee**, Won-Dong Jang, Tae-Young Chung, and Chang-Su Kim, "Complex feature-based logo recognition," in *Proc. International Technical Conference on Circuits/Systems, Computers and Communications* (*ITC-CSCC*), Yeosu, Korea, Jun.–Jul. 2013.

[20] **Chul Lee**, Chulwoo Lee, and Chang-Su Kim, "Contrast enhancement using 2-D to 1-D histogram conversion," in *Proc. International Technical Conference on Circuits/Systems, Computers and Communications* (*ITC-CSCC*), Yeosu, Korea, Jun.–Jul. 2013, pp. 5–7.

[21] Seong-Gyun Jeong, **Chul Lee**, and Chang-Su Kim, "Exemplar-based frame rate up-conversion with congruent segmentation," in *Proc. IEEE International Conference on Image Processing* (*ICIP*), Orlando, Florida, Sep.–Oct. 2012, pp. 845–848.

[22] Chulwoo Lee, **Chul Lee**, and Chang-Su Kim, "Contrast enhancement based on layered difference representation," in *Proc. IEEE International Conference on Image Processing* (*ICIP*), Orlando, Florida, Sep.–Oct. 2012, pp. 965–968.

[23] **Chul Lee**, Jin-Hwan Kim, Chulwoo Lee, and Chang-Su Kim, "Power-constrained backlight scaling and contrast enhancement for TFT-LCD displays," in *Proc. IEEE International Conference on Image Processing* (*ICIP*), Orlando, Florida, Sep.–Oct. 2012, pp. 2793–2796.

[24] Chulwoo Lee, **Chul Lee**, and Chang-Su Kim, "Power-constrained image processing techniques for emissive and non-emissive displays," in *Proc. International Meeting on Information Display* (*IMID*), Seoul, Korea, Oct. 2011.

[25] Chulwoo Lee, **Chul Lee**, and Chang-Su Kim, "Gradient domain contrast enhancement with histogram-guided boundary conditions," in *Proc. IEEE International Conference on Image Processing* (*ICIP*), Brussels, Belgium, Sep. 2011, pp. 3433–3436.

[26] **Chul Lee**, Chulwoo Lee, and Chang-Su Kim, "MMSE nonlocal means denoising algorithm for Poisson noise removal," in *Proc. IEEE International Conference on Image Processing* (*ICIP*), Brussels, Belgium, Sep. 2011, pp. 2561–2564.

[27] Yeong Jun Koh, Sang-Hwan Kim, **Chul Lee**, and Chang-Su Kim, "Spatial video summarization using multi-camera based background subtraction," in *Proc. International Technical Conference on Circuits/Systems, Computers and Communications* (*ITC-CSCC*), Gyeongju, Korea, Jun. 2011, pp. 103–104.

[28] Chulwoo Lee, **Chul Lee**, and Chang-Su Kim, "Power-constrained contrast enhancement for OLED displays based on histogram equalization," in *Proc. IEEE International Conference on Image Processing* (*ICIP*), Hong Kong, Sep. 2010, pp. 1689–1692.

[29] Dae-Youn Lee, Jae-Kyun Ahn, **Chul Lee**, and Chang-Su Kim, "High quality video acquisition and segmentation using alternate flashing system," in *Proc. Pacific-Rim Conference on Multimedia* (*PCM*), Shanghai, China, Sep. 2010, pp. 452–461.

[30] **Chul Lee** and Chang-Su Kim, "Rate-distortion optimal bit allocation for high dynamic range video compression," in *Proc. International Workshop on Advanced Image Technology* (*IWAIT*), Seoul, Korea, Jan. 2009.

[31] **Chul Lee** and Chang-Su Kim, "Rate-distortion optimized compression of high dynamic range videos," in *Proc. European Signal Processing Conference* (*EUSIPCO*), Lausanne, Switzerland, Aug. 2008.

[32] **Chul Lee** and Chang-Su Kim, "Gradient domain tone mapping of high dynamic range videos," in *Proc. IEEE International Conference on Image Processing* (*ICIP*), San Antonio, Texas, Sep. 2007, pp. 461–464.

DOMESTIC PUBLICATIONS

Journal: 5 papers, Conference: 29 papers (in Korean)

PATENTS

[1] Su Bin Lee, **Chul Lee**, Thuong Van Nguyen, and An Gia Vien, "Method for removing fog and apparatus therefor," Appl. No. 10-2019-0050319, Apr. 30, 2019.

[2] Younghoon Jeong, Nam Hoang Nguyen, **Chul Lee**, Joseph Kim, Jaemoon Lim, and Tu Van Vo, "Electric device and control method thereof," Appl. No. PCT/KR2019/001589, Feb. 8, 2019.

[3] Younghoon Jeong, Nam Hoang Nguyen, **Chul Lee**, Joseph Kim, Jaemoon Lim, and Tu Van Vo, "Electric device and control method thereof," Appl. No. 10-2018-0110539, Sep. 14, 2018.

[4] Myoung-Gyu Seo, Sang-Yeob Kim, Jang-Bok Ju, and **Chul Lee**, "A method for estimating the frequency of human movement," Patent No. 10-1864437, May 29, 2018.

[5] **Chul Lee** and Edmund Y. Lam, "Apparatus for processing high dynamic range imaging," Patent No. 10-1740647, May 22, 2017.

[6] **Chul Lee** and Edmund Y. Lam, "Efficient low power contrast enhancement apparatus and method for transmissive LCDs," Appl. No. PCT/KR2016/012499, Nov. 2, 2016.

[7] **Chul Lee** and Edmund Y. Lam, "Efficient low power contrast enhancement apparatus and method for transmissive LCDs," Patent No. 10-1980826, May 15, 2019.

[8] Jong-Hoon Won, Kazuhiko Sugimoto, Masataka Hamada, Chang-Su Kim, Yeong-Jun Koh, Dae-Youn Lee, and **Chul Lee**, "Apparatus, method, and processor for measuring change in distance between a camera and an object," Patent No. US 9,798,951 B2, Oct. 24, 2017.

[9] Jong Hoon Won, Kazuhiko Sugimoto, Masataka Hamada, Chang-Su Kim, Yeong Jun Koh, Dae-Youn Lee, and **Chul Lee**, "Method for measuring changes of distance between the camera and the object using object tracking, Computer readable storage medium of recording the method and a device measuring changes of distance," Appl. No. 10-2013-0122215, Oct. 14, 2013.

[10] Chang-Su Kim, Chulwoo Lee, and **Chul Lee**, "Apparatus and method for providing image," Pub. No. WO2012/086900, Jun. 28, 2012.

[11] Chulwoo Lee, Chang-Su Kim, and **Chul Lee**, "Apparatus and method for providing image," Patent No. 10-1182637, Sep. 7, 2012.

[12] Chang-Su Kim, Dae-Youn Lee, Jae-Kyun Ahn, and **Chul Lee**, "Apparatus and method for improving image quality using flash device," Patent No. 10-1004623, Dec. 22, 2010.

[13] Geun-Yeung Jea, Chang-Su Kim, and **Chul Lee**, "Apparatus for treatment of animation and method for improvement of animation quality," Appl. No. 10-2007-0092771, Sep. 12, 2007.

[14] Ki-Chul Cha, Woo-Jae Lee, Byoung-Nyoun Kim, and **Chul Lee**, "Apparatus for measurement of height," Patent No. 10-0616059, Aug. 18, 2006.

INVITED TALKS

[1] "Recent trends in deep learning-based HDR imaging," *Korea Information Processing Society (KIPS) Fall Conference*, Nov. 2018.

[2] "HVS model-based tone mapping technique for displaying HDR10 contents," Samsung Display Co., Ltd., Oct. 2018.

[3] "Computationally efficient truncated nuclear norm minimization with applications to HDR imaging," *Workshop on Image Processing and Image Understanding (IPIU2016)*, Feb. 2016.

SUPERVISION

List of (Co-)supervising Students

- Mai Thanh Nhat Truong (Ph.D. student), Dongguk University Sep. 2019 –
- An Gia Vien (Ph.D. student), Dongguk University Sep. 2019 –
- Inho Jeong (Undergraduate student), Pukyong National University Mar. 2018 –
- Thuong Van Nguyen (M.S. student), Dongguk University Mar. 2018 –
- Nam Hoang Nguyen (M.S. student), Pukyong National University Mar. 2017 – Feb. 2019
- An Gia Vien (M.S. student), Pukyong National University Sep. 2016 – Feb. 2019
- Tu Van Vo (M.S. student), Pukyong National University Sep. 2016 – Feb. 2019
- Yuelong Li (Ph.D. student), Pennsylvania State University, USA Sep. 2013 – Mar. 2017

Ph.D. Committee Membership Mompleted

- Taehoon Koh (Pukyong National University), defended in Nov 2018, now with SUNCOM Co. Ltd.
- Se-Ho Lee (Korea University), defended in May 2018, now with Samsung Advanced Institute of Technology (SAIT)
- Yeong Jun Koh (Korea University), defended in Nov. 2017, now Assistant Professor, Chungnam National University
- Won-Dong Jang (Korea University), defended in Nov. 2017, now Postdoctoral Fellow, Harvard University

PROFESSIONAL ACTIVITIES

Society Activities

- Member of IEEE
- Technical Committee Member, Image, Video, and Multimedia Technical Committee (IVM-TC), APSIPA, 2019–2021

Associate Editor

- Journal of Visual Communication and Image Representation Jan. 2017 –

Conference Committee Member

- APSIPA Annual Summit and Conference (ASC), 2019
- IEEE/IEIE International Conference on Consumer Electronics (ICCE)-Asia, 2020

Reviewer for Journals

- IEEE Transactions on Image Processing
- IEEE Transactions on Circuits and Systems for Video Technology
- IEEE Transactions on Multimedia
- IEEE Transactions on Signal Processing
- IEEE Transactions on Neural Networks and Learning Systems
- IEEE Transactions on Circuits and Systems II: Express Briefs

- IEEE Transactions on Cybernetics
- IEEE Journal of Selected Topics in Signal Processing
- IEEE Signal Processing Magazine
- IEEE Signal Processing Letters
- IEEE/OSA Journal of Display Technology
- IEEE Access
- Journal of Visual Communication and Image Representation
- Journal of Signal Processing Systems
- SPIE Journal of Electronic Imaging
- SPIE Optical Engineering
- Displays

Reviewer for Conferences

- IEEE International Symposium on Circuits and Systems (ISCAS), 2017
- IEEE International Midwest Symposium on Circuits and Systems (MWSCAS), 2017, 2019
- IEEE International Symposium on Intelligent Signal Processing and Communication Systems (ISPACS), 2017
- APSIPA Annual Summit and Conference (ASC), 2015, 2018, 2019

HONORS AND AWARDS

- Best Paper Award, International Workshop on Frontiers of Computer Vision (IW-FCV), Feb. 2019.
- Best Paper Award, Journal of Visual Communication and Image Representation, Sep. 2014.
- Best Student Paper Award, Korean Society of Broadcasting Engineers (KOSBE) Conference, Nov. 2011
- Outstanding Research Award, Research Institute for Information and Communication Technology, Korea University, Feb. 2011
- Prize of the Year, Biospace Inc., Jul. 2003
- First Prize, 8051 Microcontroller Application Contest for university students, sponsored by MDS Technology Corporation and Institute of Electronics Engineers of Korea, Feb. 2003
- Second Prize, Robot Soccer Central League, Oct. 2001

COMPUTER SKILLS

Languages

- Strong C/C++, MATLAB, LaTeX

Hardware Platforms

- x86, ARM, 8051, AVR, dsPIC

REFERENCES

Available upon request

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