
Dongyoung Kim, Ph.D.

Artificial intelligence for science and engineering

Date of birth: 1987.05.26

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EXPERIENCE

2017 – Current	Institute for Basic Science , South Korea Research Fellow, Advisor: Prof. Yoon-Kyung Cho (Ulsan National Institute of Science and Technology).
2012 – 2016	Texas A&M University , U.S.A. Research Assistant, Advisor: Raimund Ober (Texas A&M University).
2010 – 2012	The University of Southwestern medical center , U.S.A. Research Assistant,
2010 – 2012	The University of Texas at Dallas , U.S.A. Research Assistant
2010 – 2010	EOS Australia , Sydney, Australia Intern
2009 – 2010	Embedded software research center , South Korea Research Assistant

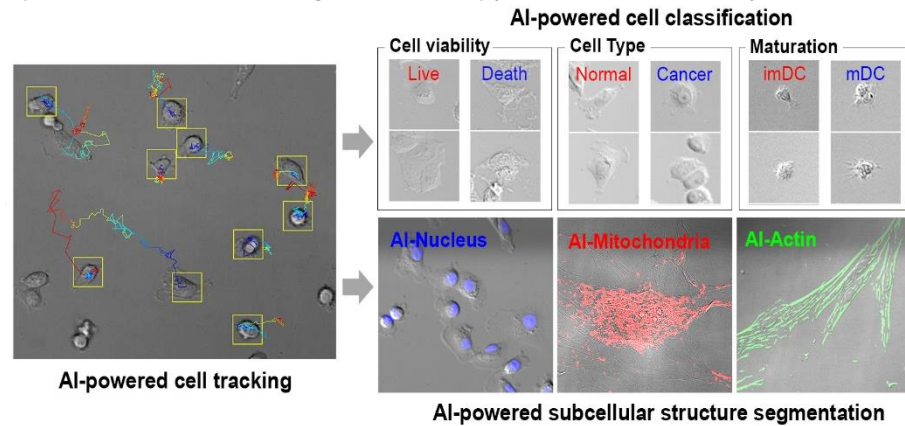
EDUCATION

2012 – 2016	Ph.D., Biomedical Engineering , Texas A&M University College station, Texas, USA
2010 – 2012	B.S., Electrical engineering and computer science The University of Texas at Dallas Richardson, Texas, USA
2006 – 2012	B.S. Electrical engineering and computer science Kyungpook National University Daegu, South Korea

PROJECTS

2017– 2019

AI-powered transmitted light microscopy for functional analysis of live cells.



- Transforming a transmitted light microscopy image into a fluorescence microscopy equivalent image (or information) using unsupervised machine learning and supervised semantic segmentation.
- Real-time monitoring of living cell property and status from transmitted light microscopy video using region proposal convolutional neural network and convolutional neural network.
- Living cell tracking in time-lapse video using complementary learning of object shape and colors online.

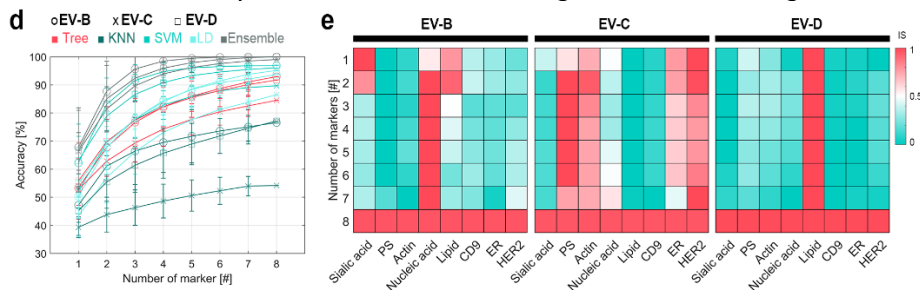
*Two Korea patents filed (2019).

- 김동영, 민유홍, 조윤경, 인공지능망을 이용한 특수 현미경 영상 생성 방법 및 영상 처리 장치 (1). 특허출원 10-2019-0001740 호, 한국특허출원, 2019,
- 김동영, 민유홍, 조윤경, 인공지능망을 이용한 세포 영상 분석 방법 및 세포 영상 처리 장치 (2). 특허출원 10-2019-0001741 호, 한국특허출원, 2019.)

*Kim, D., Min, Y., Oh, J.M. et al. AI-powered transmitted light microscopy for functional analysis of live cells. Sci Rep 9, 18428 (2019) doi:10.1038/s41598-019-54961-x

2017 – 2019

Find cancer-related particles from blood using machine learning

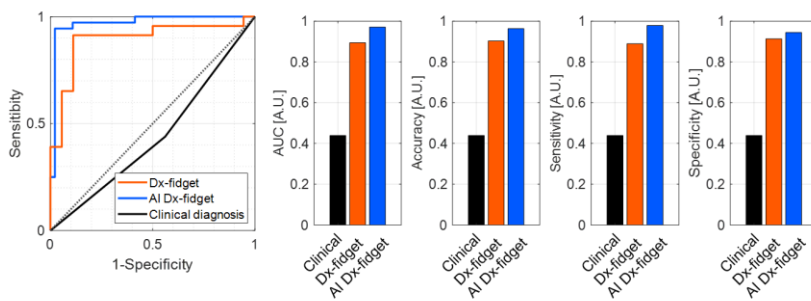


- Cancer prediction from blood born particle using machine learning classification.

* Kim, D., Woo H., Lee C., Min Y., Cho Y. **Unveiling tumor specific extracellular vesicles by size fractionation and single vesicle analysis.** Analytical chemistry 2019 (under review).

2017 – 2019

Point-of-care-testing urinary tract infection diagnosis using deep neural network



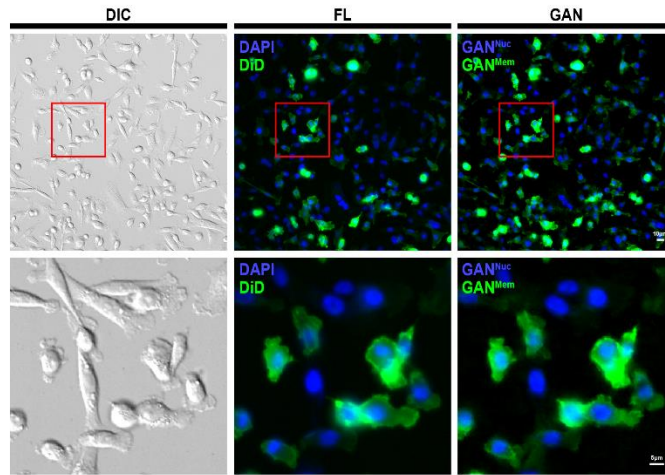
- Urinary tract infection diagnosis from a cell phone photograph of a testing kit using convolutional neural network.

*A Korea patents filed (2018).

- 김동영, 미카엘아이작, 기동엽, 조윤경, 원심력 기반 무전원 입자 농축장치 및 입자 농축방법. 특허출원 제 10-2018-113085 호, 한국특허출원, 2018.

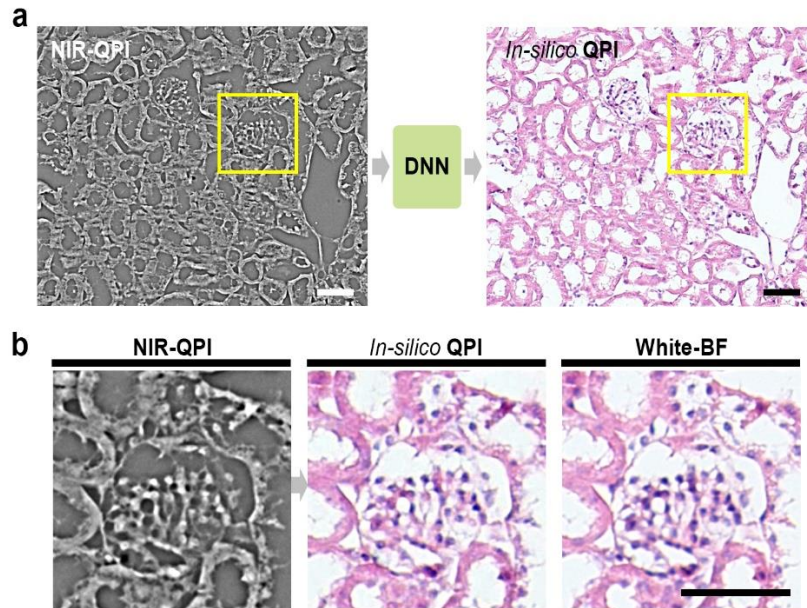
* Kim, D. Michael I, Oleksandra G., Kuimar S., Clara, J., Ki D., Cho Y. **Dx-Fidget Spinner: A Pocket-Sized Low-Cost Hand-Powered Medical Diagnostic Tool.** Nature Biomedical Engineering, 2019 (Accepted).

2019 – Current In-silico fluorescence staining using generative adversarial network.



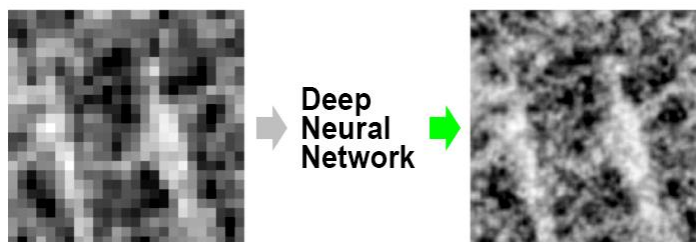
*Manuscript under preparation (2019).

2019 – Current In-silico histology staining using generative adversarial network.



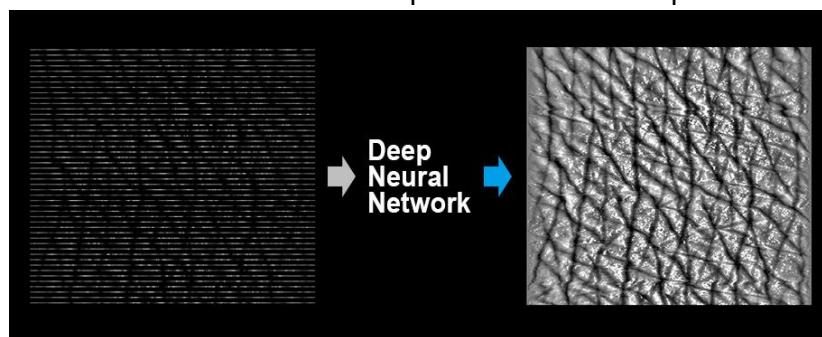
*Manuscript under preparation (2019).

2019 – Current Generative adversarial network for high definition medical image recovery.



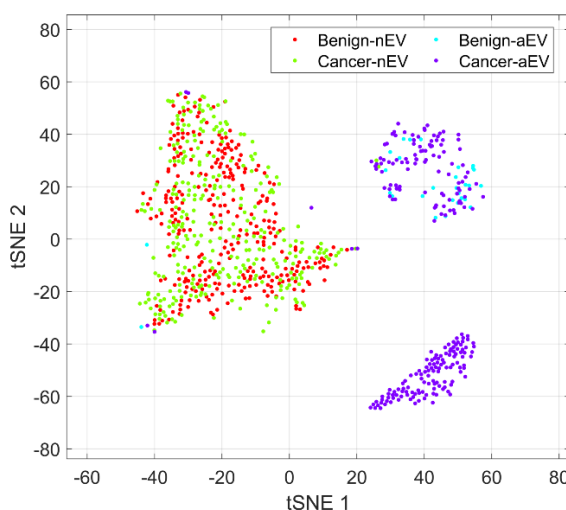
*Manuscript under preparation (2019).

2019 – Current Generative adversarial network for rapid medical data acquisition.



*Manuscript under preparation (2019).

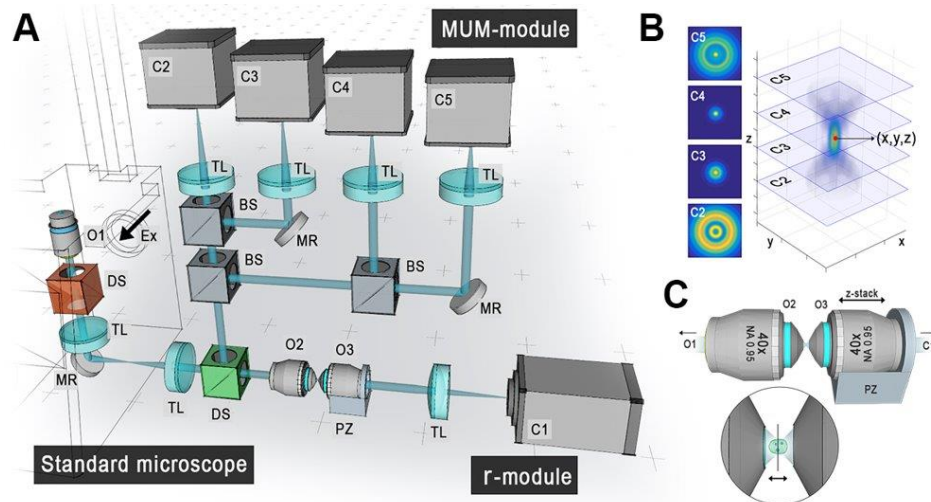
2019 – Current Searching extreme rare cancer extracellular vesicle in blood plasma using generative adversarial network.



*Manuscript under preparation (2019).

2014 – 2016

Remote focusing multifocal plane microscopy for the imaging of 3D single molecule dynamics with cellular context



- A microscopy modality to visualize three-dimensional single molecule trajectory in a context of three-dimensional and multicolor cellular structures and compartments over time
- Estimating three-dimensional single molecule location in ~ 10 nm accuracy.
- Imaging three-dimensional cellular structures from an optical replica using relay optics.

*A US patent has filed

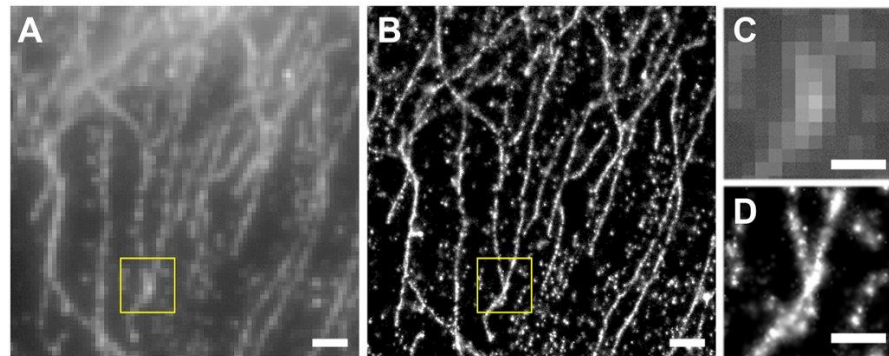
- Kim D., Ober R.J, **Advanced multi-dimensional microscopy system for single particle & structure imaging.** U.S. Patent, 2017.)

*Kim, D., Chao, J., Velmurugan, R., You, S., Ward, E. S., and Ober, R. J. **Remote focusing multifocal plane microscopy for the imaging of 3D single molecule dynamics with cellular context.** Proceedings of the SPIE, Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XXIV, 10070: 2017.

*Kim D, You S, Ward E.S., Ober R.J, **Imaging of three-dimensional single molecule dynamics with cellular context: Antibody trafficking and interaction with cell membrane and sorting endosomes.** ASCB, San Fransisco, CA. 2016.

2012 – 2015

Three-dimensional super resolution microscopy



- An optical microscopy technique resolving fluorescently labeled features in ~ 5 nm resolution.
- Multifocal plane microscopy enables three-dimensional super-resolving imaging.
- Multicolor imaging and super-precision chromatic/spatial registration are capable.

*Cohen E. A. K., Kim D., Ober R.J, Cramer-Rao Lower Bound for Point Based Image Registration with Heteroscedastic Error Model for Application in Single Molecule Microscopy. IEEE Transactions on Medical Imaging 2015

*Ram S, Kim D, Ober RJ, Ward ES. 3D Single Molecule Tracking with Multifocal Plane Microscopy Reveals Rapid Intercellular Transferrin Transport at Epithelial Cell Barriers. Biophysical Journal 2012

PATENTS

Kim D., Min Y., Cho Y., Analyzing method for cell image using artificial neural network and image processing apparatus for cell image. Patent filed #10-2019-0001740, South Korea, 2019.

Kim D., Min Y., Cho Y., Generating method for specialized microscope images using artificial neural network and image processing apparatus. Patent filed #10-2019-0001741, South Korea, 2019.

Kim D., Micheal I., Ki D., Cho Y., Centrifugal force based non-powered particle filtration apparatus and method of particle filtration. Patent filed #10-2018-113085, South Korea, 2018.

Kim D., Ober R.J, Advanced multi-dimensional microscopy system for single particle & structure imaging. U.S. Patent pending, 2017.

HONORS & AWARDS

2018	1 st place at Shark Tank Competition. The 22nd International Conference on Miniaturized Systems For Chemistry And Life Sciences
2016	1 st place at 3D single molecule localization microscopy SMLMS Challenge, EPFL, Switzerland. *Software developed using MATLAB
2014 – 2016	Scholarship, Texas A&M University, U.S.A.
2012 – 2014	Scholarship, The University of Texas at Dallas, U.S.A.
2011 – 2011	Scholarship, The University of Texas at Dallas , U.S.A.
2011 – 2011	2 nd place for Senior Design Project, The University of Texas at Dallas
2010 – 2012	Scholarship, The University of Texas at Dallas, U.S.A.

LANGUAGES

English, Korean

SKILLS

Artificial Intelligence	Supervised/unsupervised machine learning, Deep neural network design, generative adversarial network design.
Programming	MATLAB, Python, C, C++, JAVA.
Data science	Big data analysis, Optimization based data processing.
Electrical system architecture	NI LabWindows/CVI, NI LabView.
Optical system architecture	Zemax based optical system design, Multimodal optical system configuration.
Microscope	Epifluorescence, TIRF microscopy, Confocal microscopy Super-resolution microscopy Single molecule microscopy Transmitted/scanning electron microscopy

LECTURES

BME21101 Introduction to biomedical engineering (Introduction to artificial intelligence for biomedical engineering / Introduction to deep learning), 2019, Ulsan National Institute of Science and Technology (UNIST).

PUBLICATIONS

Kim, D., Min, Y., Oh, J.M. et al. AI-powered transmitted light microscopy for functional analysis of live cells. Sci Rep 9, 18428, 2019

Kim, D., Woo H., Lee C., Min Y., Cho Y. Unveiling tumor specific extracellular vesicles by size fractionation and single vesicle analysis. Analytical chemistry 2019 (under review).

Kim, D. Michael I, Oleksandra G., Kuimar S., Clara, J., Ki D., Cho Y. Dx-Fidget Spinner: A Pocket-Sized Low-Cost Hand-Powered Medical Diagnostic Tool. Nature Biomedical Engineering, 2019.

Sunkara, V., Kim C., Park J., Woo H., Kim D., Ha H., Kim M., Son Y., Kim J., Cho Y., Fully automated, label-free isolation of extracellular vesicles from whole blood for cancer diagnosis and monitoring. Theranostics, 2019.

Michael I, Kumar S., Oh J., Kim D, Kim J., Cho Y. Surface Engineered Paper Hanging Drop Chip for 3D Spheroid Culture and Analysis. ACS applied materials & interfaces, 2018.

Li, R., Chiguru, S., Li, L., Kim, D., Velmurugan, R., Kim, D., Tian, H., Schroit, A., Mason, R., Ober, R. J. and Ward, E. S. Targeting phosphatidylserine with calcium-dependent protein-drug conjugates for the treatment of cancer. Molecular Cancer Therapeutics, 2018.

Devanaboyina, S. C., Khare, P., Challa, Kim, D., Ober, R. J., and Ward, E. S. Engineered clearing agents for the selective depletion of antigen-specific antibodies. Nature Communications, 2017.

Kim, D., Chao, J., Velmurugan, R., You, S., Ward, E. S., and Ober, R. J. Remote focusing multifocal plane microscopy for the imaging of 3D single molecule dynamics with cellular context. Proceedings of the SPIE, Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XXIV, 10070: 2017.

Vahid, M. R., Chao, J., Kim, D., Ward, E. S., and Ober, R. J. State space approach to single molecule localization in fluorescence microscopy. Biomedical Optics Express, 2017

Poovasery J.S., Kang J.C., **Kim D**, Ober R.J, Ward E.S. **Antibody targeting of HER2/HER3 signaling overcomes heregulin-induced resistance to PI3K inhibition in prostate cancer.** International Journal of Cancer 2017

Kim D, You S, Ward E.S., Ober R.J, **Imaging of three-dimensional single molecule dynamics with cellular context: Antibody trafficking and interaction with cell membrane and sorting endosomes.** ASCB, San Fransisco, CA. 2016.

Cohen E. A. K., **Kim D.**, Ober R.J, **Cramer-Rao Lower Bound for Point Based Image Registration with Heteroscedastic Error Model for Application in Single Molecule Microscopy.** IEEE Transactions on Medical Imaging 2015

Ram S, **Kim D**, Ober RJ, Ward ES. **The level of HER2 expression is a predictor of antibody-HER2 trafficking behavior in cancer cells.** mAbs 2014

Devanaboyina SC, Lynch SM, Ober RJ, Ram S, **Kim D**, Puig-Canto A, Breen S, Kasturirangan S, Fowler S, Peng L, et al. **The effect of pH dependence of antibody-antigen interactions on subcellular trafficking dynamics.** mAbs 2013

Ram S, **Kim D**, Ober RJ, Ward ES. **Microscopy in Polarized Epithelia Reveals a Novel Cellular Process of Intercellular Transfer.** Biophysical Journal 2013

Ram S, **Kim D**, Ober RJ, Ward ES. **3D Single Molecule Tracking with Multifocal Plane Microscopy Reveals Rapid Intercellular Transferrin Transport at Epithelial Cell Barriers.** Biophysical Journal 2012

Kim D, Ram S, Ober RJ, Ward ES. **3D single molecule tracking of rapid intracellular trafficking imaged by multifocal plane microscopy** Microscopy and Microanalysis 2012.
