Kihwan Kim — *Curriculum Vitae*

CONTACT INFORMATION

NVIDIA Research
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RESEARCH INTERESTS

Dynamic and static scene analysis and reconstruction (structure from motion or any sparse/semi/dense reconstruction), scattered data approximation, real-time rendering, machine learning, augmented/virtual/mixed reality and robotic navigation (tracking and SLAM), Sensor Fusion, object recognition, detection and tracking

EDUCATION

Georgia Institute of Technology — Atlanta, Georgia

Ph.D. in Computer Science, Dec. 2011 — GPA: 3.87/4.0

- Thesis: *Spatio-temporal Data Interpolation for Dynamic Scene Analysis*
- Advisor: Professor Irfan Essa
- Area of Study: Computer Vision and Graphics

M.S. in Computer Science, Aug. 2010 — GPA: 3.87/4.0

- Advisor: Professor Irfan Essa
- Area of Study: Computer Vision and Graphics

Yonsei University — Seoul, South Korea

B.S. in Electrical Engineering, Feb. 2001 — GPA: 3.71/4.0 upper, 3.45/4.0 overall

EMPLOYMENT HISTORY

NVIDIA Research	Santa Clara, California
Senior Research Scientist	Dec. 2014 – Present
NVIDIA Research	Santa Clara, California
Research Scientist	Jan. 2012 – Dec. 2014
Georgia Institute of Technology, College of Computing	Atlanta, Georgia
Graduate Research Assistant	Aug. 2005 – Dec. 2011
Disney Research Pittsburgh	Pittsburgh, Pennsylvania
Visiting Research Associate/Research Intern	Jan. 2009 – Aug. 2009
Samsung IT R&D Center, SDS	Seoul, South Korea
Advisory Engineer	Mar. 2001 – Aug. 2005
Samsung Electronics, Digital Solution Center	Seoul, South Korea
Ubiquitous Task Force	Jun. 2003 – Jan. 2004
Republic of Korea Air Force	Suwon, South Korea
Engineer/Sergeant	Mar. 1996 – Sep. 1998

THESIS

[BSTHESIS01] K. Kim, *Simple Enhanced Block-Matching Algorithm for Intermediate View Reconstruction*, Department of Electrical Engineering, Yonsei University

[PHDTHESIS11] K. Kim, *Spatio-temporal Data Interpolation for Dynamic Scene Analysis*, College of Computing, Georgia Institute of Technology

REFEREED CONFERENCE PUBLICATIONS

[ECCV18a] Z. Lv, K. Kim, A. Troccoli, D. Sun, J. Rehg, J. Kautz, *Learning Rigidity in Dynamic Scenes with a Moving Camera for 3D Motion Field Estimation* , In *Proceeding of 2018 European Conference on Computer Vision, ECCV 2018*

[ECCV18b] B. Eckart, K. Kim, J. Kautz, *Fast and Accurate Point Cloud Registration using Trees of Gaussian Mixtures* , In *Proceeding of 2018 European Conference on Computer Vision, ECCV 2018*

[CVPR18] S. Brahmbhatt, J. Gu, K. Kim, J. Hays, J. Kautz, *Geometry-Aware Learning of Maps for Camera Localization (MapNet)* , In *Proceeding of 2018 IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2018*

[ICCV17a] K. Kim, J. Gu, S. Tyree, P. Molchanov, M. Nießner, J. Kautz, *A Lightweight Approach for On-the-Fly Reflectance Estimation*, In *Proceeding of 2017 IEEE International Conference on Computer Vision, ICCV 2017*

[ICCV17b] R. Maier, K. Kim, M. Nießner, D. Cremers, J. Kautz, *Intrinsic3D: High-Quality 3D Reconstruction by Joint Appearance and Geometry Optimization with Spatially-Varying Lighting*, In *Proceeding of 2017 IEEE International Conference on Computer Vision, ICCV 2017*

[3DV17] V. Golyanik, K. Kim, R. Maier, M. Nießner, J. Kautz, *Multiframe Scene Flow with Piecewise Rigid Motion*, In *Proceeding of 2017 IEEE International Conference on 3D Vision, 3DV 2017*

[CVPR16a] B. Eckart, K. Kim, A. Troccoli, A. Kelly, J. Kautz, *Accelerated Generative Models for 3D Point Cloud Data*, In *Proceeding of 2016 IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2016*

[CVPR16b] P. Molchanov, X. Yang, S. Gupta, K. Kim, S. Tyree, J. Kautz, *Online Detection and Classification of Dynamic Hand Gestures with Recurrent 3D Convolutional Neural Networks*, In *Proceeding of 2016 IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2016*

[IV16] S. Gupta, P. Molchanov, X. Yang, K. Kim, S. Tyree, J. Kautz, *Towards Selecting Robust Hand Gestures for Automotive Interfaces*, In *Proceeding of 2016 IEEE Intelligent Vehicles Symposium, IV 2016*

[3DV15] B. Eckart, K. Kim, A. Troccoli, A. Kelly, J. Kautz, *MLMD: Maximum Likelihood Mixture Decoupling for Fast and Accurate Point Cloud Registration*, In *IEEE 3D Vision, 3DV2015*

[EGSR15] S. U. Mehta, K. Kim, D. Pajak, K. Pulli, J. Kautz, R. Ramamoorthi, *Filtering Environment Illumination for Interactive Physically-Based Rendering in Mixed Reality*, In *Eurographics Symposium on Rendering, EGSR 2015*

[CVPRW15] P. Molchanov, S. Gupta, K. Kim, J. Kautz, *Hand Gesture Recognition with 3D Convolutional Neural Networks*, In *IEEE CVPR 2015 Workshop on Hand Gesture Recognition*

[FG15] P. Molchanov, S. Gupta, K. Kim, K. Pulli, *Multi-sensor System for Drivers Hand-Gesture Recognition*, In *IEEE Automatic Face and Gesture recognition, FG2015*

[RADAR15] P. Molchanov, S. Gupta, K. Kim, K. Pulli, *Short-Range FMCW Monopulse Radar for Hand-Gesture Sensing*, In *IEEE International Radar Conference 2015*

[3DV14] D. Herrera, K. Kim, J. Kannala, K. Pulli, and J. Heikkila , *DT-SLAM: Deferred Triangulation for Robust SLAM*, In *IEEE 3D Vision, 3DV2015*

[SIGGRAPHA13] J. Baek, D. Pajak, K. Kim, K. Pulli, and M. Levoy, *WYSIWYG Computational Photography via Viewfinder Editing*, In *ACM Transactions on Graphics, SIGGRAPH Asia 2013*

[CVPR12] K. Kim, D. Lee, and I. Essa, *Detecting Regions of Interest in Dynamic Scenes with Camera Motions*, In *Proceeding of 2012 IEEE Conference on Computer Vision and Pattern Recognition*

[ICCV11] K. Kim, D. Lee, and I. Essa, *Gaussian Process Regression Flow for Analysis of Motion Trajectories*, In *Proceeding of 2011 IEEE International Conference on Computer Vision*

[CVPR10a] K. Kim, M. Grundmann, A. Shamir, I. Matthews, J. Hodgins, and I. Essa, *Motion Fields to Predict Play Evolution in Dynamic Sports Scenes*, In *Proceeding of 2010 IEEE Conference on Computer Vision and Pattern Recognition*

[CVPR10b] R. Hamid, R. Kumar, M. Grundmann, K. Kim, I. Essa and J. Hodgins, *Player Localization Using Multiple Static Cameras for Sports Visualization*, *In Proceeding of 2010 IEEE Conference on Computer Vision and Pattern Recognition*

[ISMAR09] K. Kim, S. Oh, J. Lee and I. Essa, *Augmenting Aerial Earth Maps with Dynamic Information*, In *Proceeding of 2009 IEEE/ACM International Symposium on Mixed and Augmented Reality*

[ISWC08] K. Kim, J. Summet, T. Starner, D. Ashbrook, M. Kapade and I. Essa, *Localization and 3D Reconstruction of Urban Scenes Using GPS*, In *Proceeding of 2008 IEEE International Conference on Wearable Computers*

[ACMMM06] K. Kim, I. Essa and G. D. Abowd, *Interactive Mosaic Generation for Video Navigation*, In *Proceeding of 2006 ACM International Conference on Multimedia*

REFEREED JOURNAL PUBLICATIONS

[TOG13] J. Baek, D. Pajak, K. Kim, K. Pulli, and M. Levoy, *WYSIWYG Computational Photography via Viewfinder Editing*, In *ACM Transactions on Graphics, Volume 32.*

[VR11] K. Kim, S. Oh, J. Lee and I. Essa, *Augmenting Aerial Earthmaps with Dynamic Information from Videos* , In *Virtual Reality Journal* [Special issue on Augmented Reality], Springer London, 2011 (VR)

[JGT08] B. Kim, K. Kim and G. Turk, *A Shadow Volume Algorithm for Opaque and Transparent Non-Manifold Casters*, In *Journal of Graphics Tools*, A.K. Peters, 2008

OTHER PUBLICATIONS POSTERS, TECH' REPORTS

[STS11][ISMICS 2011] E. Sarin, K. Kim, I. Essa, and W. Cooper, *3-Dimensional Visualization of the Operating Room Using Advanced Motion Capture: A Novel Paradigm to Expand Simulation-Based Surgical Education*

[4GS09] K. Kim, M. Grundmann, I. Essa, *Collaborative Crowd-casting using Mobile devices*, In *4G Symposium*, Las Vegas 2009

[TECH07] B. Kim, K. Kim, G. Turk, *Real-time Shadow of Transparent Casters Using Shadow Volume*, In *Georgia Institute of Technology Technical Report GT-IC-07-04*

[TECH06] K.Kim, J.Summet, T.Starner, D.Ashbrook, M.Kapade and I.Essa, *Localization and 3D Reconstruction of Urban Scenes Using GPS*, 2008 In *Georgia Institute of Technology Technical Report GT-IC-08-06*

[GT-CMU06A] K.Kim, I.Essa and F. Dellaert Augmenting Earth Maps with Dynamic Information Using Vanishing Point Clustering, In 2006 GT-CMU Retreat for Graphics

[GT-CMU06B] B. Kim and K. Kim, *Transparent Shadow Casters and Softened Self-Shadow Using Shadow Volume*, In 2006 GT-CMU Retreat for Graphics

[GT-CMU05] K. Kim and I. Essa, *Multi-scale Photomosaic*, In 2005 GT-CMU Retreat for Graphics

INVITED TALK

[SNU11] K. Kim, *Spatio-temporal Analysis of Videos for Visualization*, Department of Computer Science and Engineering, Seoul National University January.2011

[Google13] K. Kim, *Sparse-to-dense approaches for video analysis*, **Google Tech-talk**, Google Research. 2013.

PATENTS ISF

[P17a] P. Molchanov, X. Yang, S. De Mello, K Kim, S. Tyree, K. Kim *Online detection and classification of dynamic gestures with recurrent convolutional neural networks* US Patent: 15,402,128

[P16a] B. Eckart, K. Kim, A. Troccoli, J. Kautz *Modeling Point Cloud Data - Hierarchies of Gaussian Mixture Models* US Patent.

[P16b] P. Molchanov, S. Gupta, K. Kim, *Multi-Sensor Based User Interface* US Patent: 15,060,525

[P16c] P. Molchanov, S. Gupta, K. Kim, *In-Vehcle Short-range RADAR system for Intelligent UIs* US Patent App.

[P16c] P. Molchanov, S. Gupta, K. Kim, *Radar based user interface* US Patent App: 15,060,545

[P14] K. Kim, D. Pajak, K. Pulli,. *System, Method, and computer program product for performing one-dimensional searches in two-dimensional images* , US Patent: 14/191,332

[P13] K. Kim, A. Shamir, IA Matthews, M. Grundmann, JK. Hodgins, and Irfan Essa. *System and Method for Utilizing Motion Fields to Predict Evolution in Dynamic Scenes*, US Patent: 13,075,947

REVIEWER TC,EDITOR

Reviewer in CVPR, ICCV, BMVC, ACCV, Eurographics, SIGGRAPH, SIGGRAPH ASIA, tPAMI, tIP, HPG, EVC (TC), EVW(TC), IWMV(TC), IEICE (Assc.Editor).

MEDIA COVERAGE

[CNN09] H. Collins, J. Levs, *New technology tracks movement on ground*, CNN *Newsroom*, aired on October 2009

[NS09] V. Venkatraman, *Live video makes Google Earth cities bustle* , NewScientist, September 2009, Magazine Issue 2728

[PS09] S.F. Locke, *Augmented Google Earth Gets Real-Time People, Cars, Clouds* , PopularScience, September 2009

RESEARCH AND PROFESSIONAL PROJECTS INVOLVED

NVIDIA Research Santa Clara, CA USA

Machine Learning and Visual Computing Research Group

- Leading **Sensor-based localization project (autonomous driving)**: mapping and registration **[3DV15][arXiv17b]**.
- Leading **VirtualEye (DARPA)** project: 3D mapping and free view-point video.
- Leading **NVIDIA SLAM**(NVSLAM): for next generation augmented and virtual reality **[3DV14][3DV15][EGSR15][CVPR16a][ICCV17a][ICCV17b] [CVPR18][ECCV18a,b]**.
- Collaboration with Google/ATAP for **Tango** project.

- Conducting a project for **Driver's gesture recognition system** for Advanced Driver Assistant System (ADAS) using multi-modal sensors and Deep Neural Network (CNN) **[FG15][RADAR15][P15-a,b][IV16][CVPRW15][CVPR16b]**
- Conducting tracking and scene reconstruction research for ADAS and autonomous driving project (Sensor fusion: depth-camera, vision, IMU, etc.)
- Conducted an Real-time viewfinder editing project: **[SIGGRAPHA13]**.
- Co-author of a tutorial on OpenCV for native Android: SIGGRAPH13 (mobile)
- Fast Image registration and tracking for mobile vision **[P14]**
- Stochastic Motion field analysis using Gaussian Process **[CVPR12]**

Georgia Institute of Technology Atlanta, Georgia

Dynamic Scene Analysis

- Recognizing traffic patterns and detecting anomalous events using Gaussian Process Regression Flow, and 4th-order moment. Persistent Stare Exploitation and Analysis System (*PerSEAs*) with *Kitware/DARPA*. Published in **[ICCV11]**
- Analysis and prediction of multi-agent motions in dynamic sports scene. (*Microcasting* at *Disney Research*) Spatio-temporal radial basis network for dense flow generation. Tracking ground positions using geometric constraint optimization. Published in **[CVPR10A]** and **[CVPR10B]**
- Video retargeting for automated sports broadcasting. Auto-directed crop region, and its paths are calculated from motion saliency. Submitted to **[S11]**

Dynamic Scene Visualization and Augmented Reality

- City-level visualization of dynamic scenes from distributed videos using spatio-temporal interpolation and analysis. Published in **[ISMAR09]**, **[VR11]**, **[4GS09]** and **[GT-CMU06A]** Media coverage and articles in **[CNN09]**, **[NS09]** and **[PS09]**
- 3D Reconstruction and localization of nearby buildings from the analysis of GPS signals having low signal-to-noise ratio. Published in **[ISWC08]** and **[TECH06]**

Video-based Rendering

- Video-based spatio-temporal view interpolation for Simulating Cardiac Surgery (Emory/Inova Heart Vascular Insitute) Presented in **[STS11]** and **[ISMICS11]**
- Generation of painterly and water-colorized videos using fore-ground segmentation and gradient field (Samsung STAR/SAIT) Fed into mobile NPR project.

Interactive Video and Multimedia System

- Automatic generation of the annotated collection of mosaics for interactive video navigation. (AwareHome/Tunner Studio) **[ACMMM06]** and **[GT-CMU05]**

Real-time Rendering Algorithm

- Generalized Shadow Volume algorithm for the real-time rendering of non-manifold transparent casters. Published in **[JGT08]**, **[TECH07]** and **[GT-CMU06B]**

Disney Research, Pittsburgh Pittsburgh, PA USA

Scene Analysis and Micro-casting

- Conducted a project for detecting important location in the game. Designed and implemented proto-type system for micro-casting. **[CVPR10A]**
- Implemented player tracking algorithm using particle filter and mean-shift , and team classification algorithm for sports visualization. **[CVPR10B]**

Samsung IT R&D Center, SDS, and Samsung Electronics Seoul, South Korea

Face Recognition, Real-time Collaboration System

- Responsible for face detection part. Fisher-face, and statistical skin segmentation were used for ViaFace$^{\mathrm{TM}}$. Appeared in COMDEX 2001 Las Vegas.
- Designed and developed Real-time Collaboration System: Syncbiz$^{\mathrm{TM}}$ (2002 Samsung Best solution award)
- Developed embedded framework for IP-Set top box: LivingWise$^{\mathrm{TM}}$ (fed into Korea Telecommunication's IP-STB services)
- Ubiquitous Home network framework: NEX (framework fed into U-City projects at Samsung SDS): Remote Management system in the home server for U-City.

SOFTWARE AND HARDWARE SKILLS

Languages, Scripts, and Wrappers:

- C, C++, Embedded C, Python, PyTorch, Caffe, Android Native C/C++, Java, JavaScript, MFC, ATL, COM, SQL, MySQL, MATLAB, under various IDE environments
- Libraries for Vision/Graphics/Math : OpenCV, OpenGL, GLSL, DirectX, Lapack, Intel Math Kernel Library

Digital Logic Circuit:

- FPGA and Computer-Aided Design Tools: VHDL, MAX+PLUS, SPICE

Video and Image Editing tools, and Renderer:

- 3D Studio Max, Autodesk Maya, Adobe Photoshop, Premiere, and others
- POV-Ray, Indigo, Blender

LANGUAGES

Fluent in Korean, English and Japanese

REFERENCES

Available in:
http://www.kihwan23.com/jobsearch/docs/reference-list.pdf

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