CHELHWON KIM

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SUMMARY

I am a computer vision researcher with a wide range of experience in researching and developing computer vision and machine/deep learning algorithms in areas including 3D reconstruction, indoor localization, cross-domain mapping, mixed reality, and multiple cameras calibration. Earned a PH.D. in computer vision and have a strong theoretical background in 3D geometry computer vision. I had 3 years of hands-on experience in developing machine vision manufacturing defect systems to solve real-world problems. Filed 14 patents while working at FXPAL.

- Personal web page: `https://chelhwon.github.io/`

- LinkedIn web page: `https://www.linkedin.com/in/chelhwon-kim-0a4a5428/`

EDUCATION

University of California, Santa Cruz, US   *Sept 2010 - Dec 2016*
PH.D in Electrical Engineering.
Specialties: 3D geometry computer vision, SfM
Thesis: Indoor Manhattan Spatial Layout Recovery from Monocular Videos
Advisor: Prof. Roberto Manduchi

Sungkyunkwan University, Korea   *Mar 2003 - Feb 2005*
M.S. in Computer Engineering (GPA 4.5/4.5)
Thesis: Structured light based depth edge detection for object shape recovery
Advisor: Prof. Juneho Yi

Sungkyunkwan University, Korea   *Mar 1999 - Feb 2003*
B.S. in Computer Engineering (GPA 4.12/4.5, Rank 5/367)

RESEARCH INTERESTS

My research interests include vision-based 3D reconstruction, indoor localization, and mixed reality using deep/machine learning and computer vision technologies.

WORK EXPERIENCE

FX Palo Alto Lab   April 2016 - June 2020
Senior Research Scientist   *CA, US*

- **Face-to-Music Translation Using a Distance-Preserving Generative Adversarial Network with an Auxiliary Discriminator** (Python, Tensorflow)
  Developed a distance-preserving generative adversarial network (GAN) that maps complex visual information captured in an image into a perceptual audio domain.

- **Indoor Localization Using Fusion of Visual Information from Static and Dynamic Cameras** (Python, Tensorflow)
  Developed a conditional deep embedding learning framework that fuses visual information captured from the user's smartphone and the surveillance camera images to enhance robustness to the unexpected environmental changes for the zone-level indoor localization task.

- **A Web-Based Remote Assistance System with Gravity-Aware 3D Hand Gesture Visualization** (Python, JavaScript)

Developed a web-based system that allows users to use a smartphone/smart-glasses to share its camera view with a remote expert. The expert's hand gesture is tracked by the Leapmotion and visualized/re-oriented (i.e. gravity-aware viz.) on the video stream in real-time to provide expressive/intuitive visual guidance on a physical task.

- **Capturing Handwritten Ink Strokes with a Fast Video Camera** (Python, Torch, Tensorflow)
  Developed a camera-based handwritten ink stroke detection algorithm using CNN-LSTM deep learning framework.

Computer Vision Lab, UC Santa Cruz
Research Assistant

Sep. 2012 - April 2016
CA, US

- **Indoor Manhattan Spatial Layout Recovery from Monocular Videos** (C++, Objective-C, iOS)
  Proposed a novel camera pose estimation algorithm using line features from the monocular video. Developed an end-to-end **line feature-based SfM system** based on the proposed algorithm that can estimate the camera poses and reconstruct the layout of the indoor scene by grouping the lines into planes.

FX Palo Alto Lab
Research Intern

Summer 2014
CA, US

- **High-Quality Capture of Documents on a Cluttered Tabletop with a 4K Video Camera** (C++, Arduino)
  Developed a novel system for detecting and capturing paper documents on a tabletop using a 4K video camera mounted overhead on pan-tilt servos.

Nokia Research Center, Berkeley CA
Research Intern

Summer 2013
CA, US

- Implemented SLIC (Simple Linear Iterative Clustering) image segmentation algorithm on highly energy efficient embedded processor platform (Movidius Myriad) in assembly language (C/Assembly language)

FX Palo Alto Lab
Research Intern

Summer 2012
CA, US

- **Dewarping Book Page Spreads Captured with a Mobile Phone Camera** (C++, iOS)
  Developed a system and methods for dewarping books with a mobile phone camera using the keypoint feature based structure from motion technique.

Multi-Dimensional Signal Processing Lab, UC Santa Cruz
Research Assistant

Sep. 2010 - Sep. 2012
CA, US

- **Visual Saliency in Noisy Images** (Matlab)
  Proposed a novel method for estimating saliency based on a nonparametric regression framework for noisy images.

Intelligent Systems Research Center
Research Staff

Jan. 2009 - May 2010
Korea

- **Dependable Statistical Fusion for 3D Object Recognition and Pose Estimation** (C++)
  Developed a novel probabilistic recognition framework (particle filtering) for recognition and pose estimation of 3D objects from 3D point cloud data and 2D line features in the robot application.

Nexteye Machine Vision   Mar. 2005 - May 2008
Research Engineer   *Korea*

- Developed machine vision systems for detecting and classifying manufacturing defects (e.g. defects on mobile phone LCD, bullet cartridge, fuel injector, plastic tube, etc.) (C/C++)

    - Vision based profile monitoring of plastic tube using 6 calibrated camera-laser units (calibrated the camera-laser unit with a stair-step shape calibration tool)

    - Bullet cartridge defect (dent, dirt, smear) detection system with synchronized multi-channel cameras (Matrox camera board).

    - Experienced in setting camera, light, and lens for defect inspection systems

    - Automatic guide system for installation of memory card on the motherboard (used multiple cameras with different fov lens for the multi-scale detection of memory card locations)

    - OCR system for wafers lot number/ID

Computer Vision Lab, Sungkyunkwan University   Mar. 2003 - Feb. 2005
Research Assistant   *Korea*

- **Using Structured Light for Efficient Depth Edge Detection** (Matlab)
  Proposed a novel approach that accurately detects depth edges with cluttered inner texture edges effectively ignored by strategically projecting structured light and exploiting distortion of the light pattern in the structured light image.

TECHNICAL STRENGTHS

Computer Languages	C/C++, Python, JavaScript, Matlab
Software & Tools	Tensorflow, Torch, OpenCV

TEACHING EXPERIENCE

Teaching assistant

CMPE16: Applied Discrete Mathematics	*Winter 2016*
CMPE107: Probability and Statistics for Engineers	*Winter, Spring 2015*
CMPE80A: Universal Access: Disability, Technology, and Society	*Fall 2014*
CMPE12L: Computer Systems and Assembly Language Lab	*Spring 2014*

PUBLICATION

C. Kim, A. Port, and M. Patel, "Face-to-Music Translation Using a Distance-Preserving Generative Adversarial Network with an Auxiliary Discriminator," arXiv preprint, 2020. arXiv:2006.13469

A. Port, **C. Kim**, and M. Patel, "Earballs: Neural Transmodal Translation," arXiv preprint, 2020. arXiv:2005.13291

J. Song, M. Patel, A. Girgensohn, **C. Kim**, "Combining Deep Learning with Geometric Features for Image based Localization in the Gastrointestinal Tract," arXiv preprint, 2020. arXiv:2005.05481

C. Kim, P. Chiu, and Y. Tjahjadi, "A Web-Based Remote Assistance System with Gravity-Aware 3D Hand Gesture Visualization," ACM International Conference on Interactive Surfaces and Spaces (ISS), 2019. Demo Paper.

C. Kim, P. Chiu, J. Pena, L. Denoue, J. Shingu, and Y. Tjahjadi, "Toward Long Distance Hand-Document Telepresence," ACM International Conference on Interactive Surfaces and Spaces (ISS), 2019. Best Poster Paper.

C. Kim, C. Bhatt, M. Patel, D. Kimber, and Y. Tjahjadi, "InFo: Indoor localization using Fusion of Visual Information from Static and Dynamic Cameras," International Conference on Indoor Positioning and Indoor Navigation (IPIN), 2019.

L. Denoue, S. Carter, and **C. Kim**, "CamaLeon: Smart Camera for Conferencing in the Wild," ACM International Conference on Multimedia (MM), 2019. Demo Paper.

P. Chiu, **C. Kim**, and H. Oda, "Recognizing Gestures on Projected Button Widgets with an RGB-D Camera Using a CNN," ACM International Conference on Interactive Surfaces and Spaces (ISS), 2018.

C. Kim, P. Chiu and H. Oda, "Capturing Handwritten Ink Strokes with a Fast Video Camera," International Conference on Document Analysis and Recognition (ICDAR), 2017.

S. Ma, Q. Liu, **C. Kim** and P. Sheu, "Lift: Using Projected Coded Light for Finger Tracking and Device Augmentation," Pervasive Computing and Communications (PerCom), 2017.

C. Kim, R. Manduchi, "Indoor Manhattan Spatial Layout Recovery from Monocular Videos via Line Matching," Computer Vision and Image Understanding, 2016.

T. Dunnigan, J. Doherty, D. Avrahami, J. Biehl, P. Chiu, **C. Kim**, Q. Liu, H. Tang and L. Wilcox, "Evolution of a Tabletop Telepresence System through Art and Technology", ACM Multimedia 2015.

C. Kim, P. Chiu and H. Tang, "High-Quality Capture of Documents on a Cluttered Tabletop with a 4K Video Camera", Proceedings of ACM DocEng 2015.

C. Kim, R. Manduchi, "Planar Structures from Line Correspondences in a Manhattan World", in 12th Asian Conference on Computer Vision (ACCV), 2014.

C. Kim, P. Chiu and S. Chandra, "Dewarping Book Page Spreads Captured with a Mobile Phone Camera," *CBDAR*, August 23, 2013.

C. Kim and P. Milanfar, "Visual Saliency in Noisy Images," *Journal of Vision* 13(4):5, March 11, 2013.

C. Kim and P. Milanfar, "Finding Saliency in Noisy Images," *SPIE Conference on Computational Imaging (8269)*, January 2012, Burlingame, CA

J. Y. Park, **C. H. Kim**, J. K. Na, J. H. Yi, and M. Turk, "Using structured light for efficient depth edge detection," *Image and Vision Computing*, Vol. 26, Issue 11, pp 1449 1550, 2008.

J. Y. Park, **C. H. Kim**, J. H. Yi, and M. Turk, "Efficient depth edge detection using structured light," *Lecture Notes in Computer Science*, Vol. 2869, pp. 413-420, 2005.

C. H. Kim, J. Y. Park, J. H. Yi, and M. Turk, "Structured light based depth edge detection for object shape recovery," *IEEE CVPR Workshop on Projector-Camera Systems*, 2005.

J. H. Yi, D. Y. Lee, **C. H. Kim**, "A 2D plane of RGB color space for color histogram based skin color segmentation," *6th Asian Conference on Computer Vision*, pp 926 930, 2003.