Tae Soo Kim

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Objective

I am a machine learning and computer vision researcher passionate about building models that can generalize to challenging real world problems. Currently, I am a research scientist at Lunit where I am part of a group whose mission is to conquer cancer through artificial intelligence. My research has been applied to a wide range of applications including video surveillance, surgical data science and healthcare. I thrive under a team environment and value diverse perspectives.

Education

Johns Hopkins University — Baltimore, MD
Ph.D. in Computer Science, Advisor: Dr. Gregory D. Hager — 2015–2021

- Thesis: "Model-driven and Data-driven Methods for Recognizing Compositional Interactions from Videos"

Johns Hopkins University — Baltimore, MD
M.S. in Computer Science, Advisor: Dr. Russell Taylor and Dr. Austin Reiter — 2014–2015

- Thesis: "3D Reconstruction System using a Flexible Endoscope and a Laser"

Johns Hopkins University — Baltimore, MD
B.S.E in Computer Science — 2010–2014

- Graduated with general honors
- Minor: Robotics

Professional Experience

Lunit — Seoul, Korea
Research Scientist and Team Lead — Summer 2021 - Current

- **AI Research: Chest X-ray Team**
- The chest X-ray team at the Lunit AI Research department is in charge of developing core deep learning algorithms used in the Lunit INSIGHT CXR^{TM} product line.
- As the main commercial product of Lunit, the Lunit INSIGHT CXR^{TM} detects more than 10 lesions in a chest X-ray image with accuracies up to $97 - 99\%$.
- As a research scientist and team lead, I contribute to the product by optimizing the vision model for lesion detection, adding new detectable lesions to the model and by developing new methods to increase the model's ability to generalize across different populations.

Siemens Healthineers (Siemens Corporate Research) — Princeton, NJ
Graduate Research Intern: hosted by Dr. Shaohua Kevin Zhou — Summer 2016

- **Bone Removal Project**
- The Bone Removal project developed deep learning algorithms to remove voxels representing bones in a computed tomography angiography volume.
- As an integrated software for immediate deployment in products, the bone removal software was required to be highly precise, efficient and fast.
- As a graduate research intern, I developed a novel 3D convolutional neural network architecture with separable convolutions for bone removal.

- My approach increased accuracy and precision while decreasing memory usage and inference time. The developed bone removal model was successfully deployed to commercial products. (See patents: [11], [12]).

Hyundai Heavy Industries, Medical Systems Department Seoul, Korea
Undergraduate Research Intern Summer 2012

- **Medical Robotics Project**
- The project aimed to build a minimally invasive surgical robot to remove malignant masses from breast cancer patients.
- As part of the computer vision team, I developed an algorithm for recognizing malignant/benign masses and cysts from breast ultrasound images. My main task involved data curation and implementation of state of the art machine learning algorithms.

Research Experience

Johns Hopkins University Baltimore, MD
Graduate Research Assistant 2018-2021

- **The Deep Intermodal Video Analytics (DIVA) project by funded by IARPA**
- The DIVA program is a US government funded multi-institutional research program that aims to develop a robust automated activity detection system for multi-camera video surveillance applications.
- As a senior Ph.D student of the JHU DIVA team, I assumed a leadership role in the team's research, development and deployment of system deliverables to the program.
- I developed a zero-shot action recognition system that requires no labeled training examples of the test activities. (See publications: [3], [6])
- I developed a simulation software for synthesizing human activities from economic motion capture systems. We use the generated dataset to train activity recognition systems. (See publications: [1], [4], [9])

Johns Hopkins University Baltimore, MD
Graduate Research Assistant 2016-2018

- **Language of Surgery project funded by the Johns Hopkins Wilmer Eye Institute**
- In collaboration with the surgeons from the Johns Hopkins Wilmer Eye Institute, the project aimed to build intelligent tools to automatically analyze videos of cataract surgery.
- The goal is to build an intelligent system that provides actionable feedback to trainees by reviewing their surgical performance from video recordings.
- I showed that videos of cataract surgery can be annotated accurately at scale using crowd-sourced workers. (See publication: [8])
- As a machine learning and computer vision lead in the team, I developed deep learning algorithms to automatically recognize surgical phases from videos. (See publications: [7])
- I developed a deep learning model that provides objective assessment of surgical technical skill from cataract surgery videos. (See publication: [5])

Johns Hopkins University Baltimore, MD
Masters Thesis Research 2014-2015

- **System for stereo reconstruction from monoscopic endoscope images**
- In collaboration with the department of head and neck surgery of the Johns Hopkins hospital, the project aimed to develop an economic solution for an endoscope capable of accurate 3D reconstruction of organs.
- I developed an active stereo vision system using a pattern generating laser inserted into a working channel of an endoscope.
- With a solution costing under a 100 dollars added to the endoscope, I developed a system capable of accurate 3D reconstruction using monoscopic endoscope images. (See patent: [13])

Teaching

- **Head Teaching Assistant** at Johns Hopkins University — Fall 2015,2016
  Computer vision *(Dr. Austin Reiter)*
- **Head Teaching Assistant** at Johns Hopkins University — Spring 2016
  Augmented Reality *(Dr. Nasir Navab)*
- **Head Teaching Assistant** at Johns Hopkins University — Summer 2015
  Intro. Programming *(Dr. Sara More)*
- **Head Teaching Assistant** at Johns Hopkins University — Spring 2015
  Data Structures *(Dr. Sara More)*

Skills

- **Machine Learning/Computer Vision:** Python, Pytorch, Keras, Tensorflow, Opencv, Matlab, Docker
- **Simulation:** UnrealEngine, UnrealCV, Axis-Neuron, ROS
- **Other:** Html, Php, Javascript, Java, SQL, Android-Studio, Confluence

Languages

- **Korean:** Native
- **English:** Bilingual

Service

- **President** of Korean Graduate Students Association at JHU — 2018–2019
  As an elected leader of the Korean graduate student body, I served to provide constructive support, opportunities as well as entertainment to members of the Korean community at JHU.
- **Vice president** of Korean Graduate Students Association at JHU — 2017–2018
  As a VP of the largest Korean student group at JHU, my main responsibility involved networking with industry representatives for on-campus recruitment events and information sessions for Korean graduate students at JHU.
- **Reviewer** — 2015–current
  for CVPR, ICCV, ECCV, AAAI, MICCAI, IPCAI, TMI

Publications

[1] **T.S. KIM**, B. Shim, M. Peven, W. Qiu, A. Yuille, and G. D. Hager, “Learning from synthetic vehicles”, in *WACV-W Real World Surveillance*, 2022.

[2] **T.S. KIM**, J. Jones, and G. D. Hager, “Motion guided attention fusion to recognize interactions from videos”, in *ICCV*, 2021.

[3] **T.S. KIM***, J. Jones*, M. Peven*, Z. Xiao, J. Bai, Y. Zhang, W. Qiu, A. Yuille, and G. D. Hager, “Daszl: Dynamic action signatures for zero-shot learning”, in *AAAI*, 2021.

[4] **T.S. KIM**, Michael, W. Qiu, A. Yuille, and G. D. Hager, “Synthesizing attributes with unreal engine for fine-grained activity analysis”, in *WACV-W*, 2019.

[5] **T.S. KIM**, M. O’Brien, S. Zafar, A. Malpani, G. D. Hager, S. Sikder, and S. Vedula, “Objective assessment of intraoperative technical skill in capsulorhexis using videos of cataract surgery”, in *IJCARS*, 2019.

[6] **T.S. KIM**, Y. Zhang, Z. Xiao, M. Peven, W. Qiu, J. Bai, A. Yuille, and G. D. Hager, “Safer: Fine-grained activity detection by compositional hypothesis testing”, in *arxiv*, 2019.

[7] **T.S. KIM***, F. Yu*, G. S. Croso*, Z. Song, F. Parker, G. D. Hager, A. Reiter, S. Vedula, H. Ali, and S. Sikder, “Assessment of automated identification of phases in videos of cataract surgery using machine learning and deep learning techniques”, in *Jama Network Open*, 2019.

[8] **T.S. KIM**, A. Malpani, A. Reiter, G. D. Hager, S. Sikder, and S. Vedula, “Crowdsourcing annotation of surgical instruments in videos of cataract surgery”, in *MICCAI-W*, 2018.

[9] W. Qiu, F. Zhong, Y. Zhang, S. Qiao, Z. Xiao, **T.S. KIM**, Y. Wang, and A. Yuille, “Unrealcv: Virtual worlds for computer vision”, in *ACM-MM*, 2017.

[10] **T.S. KIM** and A. Reiter, “Interpretable 3d human action analysis with temporal convolutional networks”, in *CVPR-W*, 2017.

[11] S. K. Zhou, M. Chen, H. Ding, B. Georgescu, M. A. Gulsun, **T.S. Kim**, A. P. Kiraly, X. Lu, J.-h. Park, P. Sharma, S. Sun, D. Xu, Z. Xi, and Y. Zheng, “Method and system for artificial intelligence based medical image segmentation”, in *US Patent Application Number 62/414,913*, 2017.

[12] M. Chen, **T.S. Kim**, J. Kretschmer, S. Seifert, S. K. Zhou, M. Schobinger, D. Liu, Z. Xu, S. Grbic, and H. Zhang, “Deep learning based bone removal in computed tomography angiography”, in *US Patent 10,852,907*, 2019.

[13] K. C. Olds, **T.S. KIM**, R. H. Taylor, and A. Reiter, “System for stereo reconstruction from monoscopic endoscope images”, in *US Patent 10,368,720*, 2019.