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# TAE SOO KIM

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## EDUCATION

*Johns Hopkins University*,
*Whiting School of Engineering*, Baltimore, MD
**Ph.D. in Computer Science** **2015 – Present**
Advisor: Dr. Gregory Hager
Research topics: Computer vision, machine learning, deep learning, activity recognition, surgical video analysis, simulation

*Johns Hopkins University*,
*Whiting School of Engineering*, Baltimore, MD
**M.S.E. in Computer Science** **May 2015**
Advisors: Dr. Russell Taylor and Dr. Austin Reiter

*Johns Hopkins University*,
*Whiting School of Engineering*, Baltimore, MD
**B.S in Computer Science**
Graduated with general honors **May 2014**
Minor: Robotics

## RESEARCH EXPERIENCE

Johns Hopkins University, Baltimore, MD
**Graduate Research Assistant** **01/2018 –**
The Deep Intermodal Video Analytics (DIVA) program is funded by IARPA for research in developing high performance vision-based surveillance systems. My main objective of the project involves research and development of high-performance activity detection systems. Intelligent activity detection models are learned through analysis by synthesis framework driven by visual virtual worlds. Research topics include: fine-grained activity analysis, compositional modeling of activities, explainable deep learning, visual virtual worlds for data synthesis.

Johns Hopkins University, Baltimore, MD
**Graduate Research Assistant** **01/2017 – 12/2017**
Research and development of a machine learning approach for surgical phase recognition and skill assessment in cataract surgery. This includes development of a custom crowd-sourcing architecture for data collection in surgical video, deep convolutional neural network based approach for modeling long time-series data and representation learning to extract skill in video.

Johns Hopkins University, Baltimore, MD
**Graduate Research Assistant** **06/2015 – 12/2015**
As a funded project by Intuitive Surgical (Sunnyvale, CA), developed an object search and retrieval system in surgical endoscopic videos. Given a query image of interest, the implemented visual search system learns to recognize and localize all occurrences of the query in a given video. Unsupervised learning approach extracts convolutional neural network features specific for visual object retrieval in surgical videos.

Johns Hopkins University, Baltimore, MD
**Master's Thesis Project** **09/2014 – 06/2015**
Under the supervision of Dr. Russell Taylor and Dr. Austin Reiter, developed a novel yet inexpensive system for accurate 3D reconstruction of a target scene using a flexible endoscope and a laser. The new system aims to achieve a dense 3D reconstruction of a scene using a structured light pattern generated by laser and endoscopic camera. The target scene of choice is, but not limited to, the larynx. The proposed method is currently patent-pending: (Application Number: 14/548,948)

## PROFESSIONAL EXPERIENCE

Siemens Corporate Research, Princeton, NJ
**Summer Research Intern** **06/2016 – 09/2016**
As a research intern in the Bone Removal Project team, designed and developed a deep learning approach for identifying all bone-voxels in a given computed tomography volume. For immediate deployment to real clinical applications, the system was required to be both very accurate and highly optimized. The proposed novel

architecture is in clinical use and is under patent review (Docket No. 2016P22444 US01).

Hyundai Heavy Industries, Medical System Department, Seoul, Korea
**Undergraduate Summer Intern** **06/2012 – 09/2012**
Developed a three-dimensional segmentation/detection algorithm that successfully detected malignant/benign masses and cysts in breast ultrasound image volumes. Primary task was to implement and test the set of state-of-the-art detection algorithms on the dataset and develop an efficient system for deploying such machine learning algorithms in clinical settings.

## TEACHING EXPERIENCE

Johns Hopkins University, Baltimore, MD
**Head Teaching Assistant – to Dr. Austin Reiter's "Computer Vision"** **Fall 2016, 2015**
The course exposes students to fundamental methods in computer vision from a computational perspective. Topics studied include: camera modeling, computation of 3D geometry from stereo, structure from motion, object recognition to modern deep learning approaches. Developed syllabus, overall course structure and administered grades.

Johns Hopkins University, Baltimore, MD
**Head Teaching Assistant – to Dr. Nassir Navab's "Augmented Reality"** **Spring 2016**
Students are introduced to mathematical methods used for calibration, tracking, multi-modal registration, advanced visualization and medical augmented reality applications. Developed syllabus, overall course structure and administered grades.

Johns Hopkins University, Baltimore, MD
**Head Teaching Assistant – to Dr. Sara More's "Intro. Programming"** **Summer 2015**
This course introduces fundamental structured and object-oriented programming concepts using Java.

Johns Hopkins University, Baltimore, MD
**Head Teaching Assistant – to Dr. Sara More's "Data Structures"** **Spring 2015**

This course covers the design and implementation of fundamental data structures including arrays, stacks, queues, linked lists, binary trees, heaps, balanced trees and graphs. Developed syllabus, overall course structure and administered grades.

## PUBLICATIONS, PATENTS AND PAPERS

* - Joint authorship

### Computer Vision and Machine Learning

**Kim TS**, Zhang Y, Xiao Z, Peven M, Qiu W, Bai J, Yuille A, Hager GD. "SAFER: Fine-grained Activity Detection by Compositional Hypothesis Testing". *In Submission: International Conference on Computer Vision (ICCV), Seoul, South Korea* **2019**

**Kim TS**, Peven M, Qiu W, Yuille A, Hager GD. "Synthesizing attributes with Unreal Engine for fine-grained activity analysis". *2019 IEEE Winter Applications of Computer Vision (WACV) Workshops (Human Activity Detection in Multi-Camera, Continuous, Long-Duration Video), Hawaii.* **2019**

**Kim TS***, Hou J*, Reiter A. "Train, diagnose and fix: Interpretable approach for fine-grained action recognition". *Arxiv* **2018**

Qiu W, Zhong F, Zhang Y, Qiao S, Xiao Z, **Kim TS**, Wang Y "Unrealcv: Virtual worlds for computer vision*". Proceedings of the 25th ACM international conference on media*. 1221-1224 **2017**

**Kim TS**, Reiter A. "Interpretable 3d human action analysis with temporal convolutional networks*". Computer Vision and Pattern Recognition (CVPR) Workshops, Honolulu, Hawaii* **2017**

Olds K.C, **Kim TS**, Taylor R.H, Reiter A. "System for stereo reconstruction from monoscopic endoscope images". US Patent Application No. 14/548,948, 20 November 2014. **2014**

## Surgical Data Science

Yu F*, Silva Croso G*, **Kim TS***, Song Z, Parker F, Hager GD, Reiter A, Vedula S, Ali H, Sikder S. "Assessment of Automated Identification of Phases in Videos of Cataract Surgery Using Machine Learning and Deep Learning Techniques." *JAMA Network Open.* 2019;2(4) **2019**

**Kim TS**, O'Brien M, Zafar S, Hager GD, Sikder S, Vedula S. "Objective Assessment of Intraoperative Technical Skill in Capsulorhexis using Videos of Cataract Surgery". *International Journal for Computer Assisted Radiology and Surgery (IJCARS).* 2019; **2019**

**Kim TS**, Malpani A, Reiter A, Hager GD, Sikder S, Vedula S. "Crowdsourcing Annotations of Surgical Instruments in Videos of Cataract Surgery". *International Conference on Medical Image Computing and Computer Assisted Intervention Workshops (MICCAI Labels), Granada, Spain.* **2018**

Kim TK, Yi PH, **Kim TS**, Hager GD, Lin C. "Development and Visual Assessment of a Deep Learning System for Automated Tuberculosis Screening Using Chest Radiographs." Poster Presentation (RSNA R&E Grant AI/ML Highlight) *Radiological Society of North America 103rd Scientific Assembly and Annual Meeting, Chicago, IL.* **2018**

Yi PH, Wei J, Kim TK, Shin J, Barnoy Y, **Kim TS**, Hager GD, Sair H, Lin C, Hui FK, Fritz J. "Deep Learning for Detection of Hip, Knee, and Shoulder Arthroplasty Dislocations and "Transfer Learning" to Native Joint Dislocations". Poster presentation, *Radiological Society of North America 103rd Scientific Assembly and Annual Meeting, Chicago, IL.* **2018**

Chen M, **Kim TS**, Zhou S, Schoebinger M, Xu D, Xu Z, Yang D, Zheng Y, Comaniciu D. Bone Removal in CT Angiography Using

Deep Image-to-Image Network with Transfer and Multi-Task Learning. *Arxiv 2017* **2017**