

Mark Kahoush

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EDUCATION

Georgia Institute of Technology – Atlanta, GA

Aug 2022-May 2023

- Master of Science in *Computer Science*

- Concentrations: Machine Learning

Georgia Institute of Technology – Atlanta, GA

Aug 2019-May 2022 (early graduation)

- Bachelor of Science in *Computer Science* - GPA – 3.97/4.0

- Concentrations: Artificial Intelligence, Devices

WORK EXPERIENCE

Co-Founder and CTO of DealDiner/Idea to Prototype (I2P) - Atlanta, Georgia

Sep 2020-Dec 2020

- Researched consumer base and preexisting products
- Computed a web app that budgets users' food, clothing, and books on a weekly schedule for Georgia Tech students
- Collaborated with team members to bring idea into next stages of development
- Technologies used: python, flask, HTML/CSS, Javascript

Georgia Institute of Technology (RICAL lab) w/ GDOT | Machine Learning and Robotics Researcher

Aug 2020-Jan 2022

- Leverage convoluted neural network using Keras to automatically process drone images to detect areas with mowed grass and areas with unmowed grass, as well damage signs or pavements
- Obtained average F1 score of 98%, average precision of 99%, and average recall of 96%
- Technologies used: UAV's, python, keras, OpenCV, Laser scanner, C++, CloudCompare, meshlab

Georgia Institute of Technology (RICAL lab) w/ GDOT | Machine Learning and Robotics Researcher

Aug 2020-Jan 2022

- Use Structure from Motion (SfM) to create dense 3D point clouds from image data
- Leverage deep learning techniques to segment and classify different highway assets
- Point cloud-based temporal change detection is carried out focusing on grass height estimation for monitoring highway mowing operations
- Obtained 93% semantic segmentation accuracy and 6.31 cm root mean square error (RMSE) in grass height estimation
- Technologies used: UAV's, python, keras, OpenCV, Laser scanner, C++, CloudCompare, meshlab

Georgia Institute of Technology (RICAL lab) | Computer Vision Researcher - Atlanta, Georgia

Jan 2020-Aug 2020

- Conducted research on accurate and optimum methods to automatically filling occlusions in point cloud data
- Engineered deep learning model using Tensorflow to detect and predict voxels that appropriately fill in holes
- Obtained average F1 score of 69%, average voxel precision of 78%, and average recall of 63%
- Technologies used: python, TensorFlow, OpenCV, Laser scanner, C++, CloudCompare

Consolidated Contractors Company | IT Support Intern - Athens, Greece

Sept 2017-Mar 2018

- Formatting PCs, installing company policies & generating PCs images; backing and restoring data
- Testing and troubleshooting new PCs; mined data and used database to save them and pull reports from
- Programming languages used: JavaScript, Nodejs, HTML, CSS, and MongoDB

SOFTWARE PROJECTS

2D image to 3D point cloud back projection (Python) – Personal project

2021

- Converts a 2D image back into its 3D point cloud. Uses CloudCompare to register the geo-referenced point cloud, and saves the intrinsic and extrinsic camera properties of the point cloud
- Using the geo registered point cloud and the camera properties it can convert a multiple 2D images into one 3D point cloud
- For optimization duplicate points where filtered and down sampling was applied. Output accuracy of 97%

Co-Labeling images and point clouds (Python, C++) – Group project

2021

- Programmed an algorithm to co-label 2D images from 3D point clouds. Uses a structure-from-motion algorithm to combine information from multiple images and build a 3D point cloud. Then used the camera projection equation to map each 3D point to a 2D pixel

Image-Segmentation using ML(Python) – Group project

2021

- Developed an automated convoluted neural network with Keras used to segment images in 9 different highway related classes. Uses a modified version of U-Net architecture and tested with UAV scanned images

- Model compared with geometry-based methods using OpenCV. Performed 450 times better than geometric methods, yielding an accuracy of 98%

Scene Completion of 3D point clouds (Python, C++) – Group project

2020

- Oversaw the development of a new method for performing point cloud scene completion of building facades using orthographic projection and generative adversarial inpainting methods
- Compared to other state of the art methods, the developed model preformed 11% better. With accuracy of 69%

DealDiner (Python, HTML, CSS, Flask) – Group Project

2020

- Computed a web app that budgets users' food, clothing, and books on a weekly schedule for Georgia Tech students. App displayed with GUI allowing user to choose what they would like to purchase. Used Georgia Tech's API to successfully display appropriate shops user can go to with their current meal plan, budget, and campus dollars
- Improved schedule of 60% of users who used the application

Youtube-Summarizer (Python, HTML, CSS) – Personal Project

2020

- Developed a YouTube summarizer that uses Youtube API to obtain video transcript and leverage a NLP algorithm to summarize it to 25% of its original size by prioritizing key words in the video. Uses HTML, CSS, and Flask for web framework and GUI to display results
- 80% of non-repeated content displayed in video is displayed accurately by the algorithm

Multi-variable Calculator (MatLab) – Course Project

2018

- Engineered a calculator that takes a multi-variable function from user and using GUI integrates or differentiates the function
- Provides a choice to plot differentiated, integrated or unchanged graph, in a cartesian, surf or mesh form

TECHNICAL SKILLS

Programming: Java, C++/C, Python, Javascript

Web: Java Spring, Python Django, Python Flask

Markup: HTML/CSS, LATEX

Notable Technologies: Docker, PyTorch, Keras, Windows, Linux, Android, Google Cloud

PUBLICATIONS

- Yosuke Yajima, Mark Kahoush, Seongyong Kim, Jingdao Chen, Jisoo Park, Steven Kangisser, Javier Irizarry, and Yong K. Cho **Joint 2D-3D Semantic Segmentation and Change Estimation for Aerial Monitoring of Highway Infrastructure**. ISPRS 2021. (in progress) – First Author *Sep 2021*
 - Yosuke Yajima, Mark Kahoush, Seongyong Kim, Jingdao Chen, Jisoo Park, Steven Kangisser, Javier Irizarry, and Yong K. Cho **AI-driven 3D Point Cloud-Based Highway Infrastructure Monitoring System using UAV**. I3CE 2021 https://www.researchgate.net/publication/353750565_AI-driven_3D_Point_Cloud-Based_Highway_Infrastructure_Monitoring_System_using_UAV – Second author *July 2021*
- Mark Kahoush, Yosuke Yajima, Seongyong Kim, Jingdao Chen, Jisoo Park, Steven Kangisser, Javier Irizarry, and Yong K. Cho **Analysis of Flight Parameters on UAV Semantic Segmentation Performance for Highway Infrastructure Monitoring**. i3CE 2021
https://www.researchgate.net/publication/353817712_Analysis_of_Flight_Parameters_on_UAV_Semantic_Segmentation_Performance_for_Highway_Infrastructure_Monitoring – First author *July 2021*
- Chen, J.; Yi, J.S.K.; Kahoush, M.; Cho, E.S.; Cho, Y.K. **Point Cloud Scene Completion of Obstructed Building Facades with Generative Adversarial Inpainting**. *Sensors* 2020, 20, 5029. <https://doi.org/10.3390/s20185029> – Third author *Sep 2020*
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