

# Leron K. Julian

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## Research Area

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My research interest lies in the intersection of computer vision, image processing, and computational photography.

## Education

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### Carnegie Mellon University

2019 - Present

- *Doctorate of Philosophy* in Electrical and Computer Engineering
- Advised by Prof. Aswin Sankaranarayanan (ECE, CMU)
- Graduate Research Assistant in the Image Science Lab at CMU

### Morehouse College

2015 - 2019

- *Bachelor of Science* in Computer Science
- Ronald E. McNair Scholar, Bonner Scholar, Microsoft Scholarship Recipient
- Research Assistant in the Culturally Relevant Computing Lab at Morehouse College

## Internships & Experience

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### Image Science Lab at CMU, Pittsburgh, Pennsylvania

Summer 2020/2021

Graduate Research Assistant

- Developing deep-learning solutions to forecast the trajectory of clouds in sky-image video sequence frames using various motion tracking methods such as optical flow and activity forecasting.
- Developing un-distortion algorithms for wide-angle FOV fisheye images to preserve spatial resolution at periphery.
- Fabrication of wide-angle fisheye lenses/mirrors.

### Idaho National Laboratory, Idaho Falls, Idaho

Summer 2019

Nuclear Power Plant Data Analyst Intern

- Analyzed data of vibration signals to automate the manual actions of checking on the status of the nuclear sensors.
- Using Artificial Neural Networks (ANN) and Data Science, developed a model to predict crack length in various aluminum specimens given piezoelectric (PZT) sensor data and constant fatigue loading profiles.
- Assisted in developing the model for the online monitoring (OLM) of Nuclear Power Plant assets such as generators using Machine Learning and Data Science.

### NBCUniversal, New York, New York

Summer 2018

Software Engineer Intern

- Used Node.js, JavaScript, GraphQL, MongoDB, and React.js to upgrade and update existing larger scale CNBC website from old technology powered by PHP and MySQL through Agile development.
- Using the same Full-Stack: Began initial development for website for the reboot of the Deal or No Deal show.
- Developed Front-end components using React.js and CSS on dealornodeal.cnbc.com
- Experienced configuring and documenting computer systems and server infrastructures that power web applications, client-server applications and online services using REST APIs.

- Program designed to prepare undergraduate students for doctoral studies through involvement in research and other scholarly activities.
- Developed a conversational agent mentor that uses short message service (SMS) for dialogue as a virtual mentor.
- This was used to mentor undergraduate computer science majors at a Historically Black College (HBCU) who are considering pursuing a graduate degree in computing.
- This research project was developed using JavaScript, Node.js, the Twilio API, and Heorku

## Publications

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- **Leron Julian**, Aswin Sankaranarayanan, "Precise Forecasting of Sky Images Using Spatial Warping". Accepted at Physics Based Vision meets Deep Learning (PBDL) Workshop, IEEE International Conference of Computer Vision (ICCV) 2021.
- **Leron Julian**, Kinnis Gosha, Earl W. Huff Jr., "The Development of a Conversational Agent Mentor Interface Using Short Message Service", ACM SIGMIS, 2018.
- **Leron Julian** and Kinnis Gosha, "Using SMS as an Interface for a Virtual Mentoring System", ACMSE, 2018.

## Projects

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### Note Recognition in Renditions of Piano Instrumentals

Spring 2021

- Using audio from WAV files, trained a classification model to classify notes being played by a piano.
- Visualized the audio waveforms using a spectrogram and extracted features using Linear Discriminant Analysis (LDA).
- Experimented with Logistic Regression, Support Vector Machines (SVM), and Multi-layer Perceptron's as classification models.
- Achieved 95.73% accuracy for the model on test data.

### Precise Forecasting of Sky Images Using Spatial Warping

Spring 2021

- Developed a deep learning solution for forecasting the movement of cloud cover in sky-image video sequence frames captured by a Total Sky Imager (TSI).
- Developed a spatial warping algorithm to achieve uniform apparent motion of clouds both at the zenith and periphery of the wide-angle FOV hemispherical mirror on the TSI to improve optical flow predictions.
- Combats the problem of sharpness in predicted frames by utilizing a combination of loss functions constraints on sharpness and motion when training model.

### Color-Filtered Aperture for Image Depth Segmentation

Fall 2020

- Single-capture depth from objects at varying distances from a camera using a RGB coded aperture.
- RGB coded aperture placed in a certain orientation in camera lens causes a misalignment of each plane leading to a wavelength shift disparity in each color channel in which depth can be computed.

### Semi-Supervised Learning For Image Classification

Spring 2020

- Using PyTorch, investigated the effects that traditional regularization, entropy minimization, and consistency regularization methods had on performance of the self-training semi-supervised learning (SSL).
- Tested model on MNIST and STL-10 Datasets
- Proved that these methods could boost the performance of SSL given ample amount of data.

### Black & White to Color Image Computer Vision Algorithm

Spring 2019

- Using a Convolutional Neural Network (CNN) developed an algorithm to convert black and white images to color.
- Utilized a pre-trained CNN by transfer learning the last layer to a specific category of images.
- Developed in Python using Tensorflow.

### Gender Recognition Algorithm

Fall 2018

- Using K-Nearest Neighbor, developed an algorithm to classify an image of an individual as a male or female using Computer Vision and Machine Learning.
- Developed in Python using OpenCV, Supervised Learning, and other Classification machine learning models.
- Developed a Graphical User Interface (GUI) using Python's Tkinter GUI Interface.

## **Embodied Conversational Agent Virtual Mentor**

Summer 2017

- Conducted and published research as a Ronald E. McNair Scholar with aid of Research Mentor Kinnis Gosha, PhD.
- Using Natural Language Processing Techniques, developed a Virtual Mentor Embodied Conversational Agent using Short Message Service and compared the effectiveness of it to a human mentor.
- Used the Twilio API, TwiML, JavaScript, Node.js, and hosted on Heroku application hosting.

## **Skills**

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### **Programming Languages:**

- C++ (Proficient), Python (Proficient), Java, R, MATLAB
- HTML (Proficient), JavaScript, CSS, React.js, Node.js, GraphQL, MongoDB

### **Machine Learning/Computer Vision Related:**

- PyTorch, OpenCV, Pandas

## **Scholastic Achievements**

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- **Recipient of Fritz Family Fellowship, 2020-2021**
- **Recipient of National GEM Consortium Fellowship, 2019-2020**
- **Recipient of Microsoft Tuition Scholarship, 2016-2017**

## **Conferences and Workshops**

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- Invited talk on “Using SMS as an Interface for a Virtual Mentoring System” at the Association of Computer and Information Science/Engineering Departments at Minority Institutions, 2018, held in New Orleans, Louisiana.
- Presented paper on “The Development of a Conversational Agent Mentor Interface Using Short Message Service” at the Association for Computing Machinery Special Interest Group on Management Information Systems, 2018, held in Buffalo – Niagara Falls.
- Presented poster on “Using SMS as an Interface for a Virtual Mentoring System” at the Association for Computing Machinery Southeast, 2018, held in Richmond, Kentucky.

## **Teaching Experience**

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- Teaching Assistant for “Machine Learning for Engineers (18-661)” at CMU Taught by Gauri Joshi & Yuejie Chi, Fall 2020
- Teaching Assistant for “Programming II (CSC 160)” at Morehouse College Taught by Prof. Amos Johnson, Spring 2019
- Instructor for C-SCORE Program teaching Marine ROTC Students Python and Computer Vision, Spring 2019