Leron K. Julian

PhD candidate in ECE, Carnegie Mellon University

LeronJulian@Hotmail.com | LeronJulian@Github.io

Research Interest

My research interest broadly lies within the intersection of **computer vision** and **deep learning** for various applications including but not limited to: **forecasting**, **novel-view synthesis**, and **image generation**.

Education

Carnegie Mellon University (Ph.D.) 2019 - 2024

- *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

Carnegie Mellon University (M.S.) 2019 - 2022

- *Master of Science* in Electrical and Computer Engineering
- Completed as a part of "Masters on the way to PhD" course requirement.

Morehouse College (B.S.) 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

Publications

- **Leron Julian**, Aswin Sankaranarayanan, "Precise Forecasting of Sky Images Using Spatial Warping".
  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 Conference on Computers and People Research, 2018.
- **Leron Julian** and Kinnis Gosha, "Using SMS as an Interface for a Virtual Mentoring System".
  ACMSE, 2018.

Internships & Experience

Samsung Research America, Irvine, California Summer 2023
Research Intern

- Introduced a proof of concept for a real-time immersive telepresence application involving Neural Radiance Fields (NeRF) for Novel View Synthesis.

Image Science Lab at CMU, Pittsburgh, Pennsylvania Fall 2019-Current
Graduate Research Assistant

- Using computer vision and learning-based methods to study the spatial distribution of clouds and their absorption properties along with the physical process that governs the creation and extinction of them.
- Developing deep-learning spatiotemporal and flow-based solutions to forecast cloud dynamics and solar irradiance to increase the efficiency of photovoltaic systems.
- Fabricated wide-angle fisheye lenses/mirrors using computer numerical control (CNC) machines.
- Developed un-distortion algorithms for wide-angle FOV fisheye images to preserve temporal resolution at periphery.

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.
- Developed machine learning models 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.

Ronald E. McNair Scholar, Morehouse College — Summer 2017
Research Assistant

- 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

Projects

Enhanced Interaction Using Eye-Tracking For Virtual Reality Scene — Fall 2023

- Using eye-tracking in the Meta Quest Pro headset, developed methods to improve interaction between user and objects within virtual and mixed reality scenes.
- Interactions included accurate throwing, reaching, and touching objects within the scene.
- Developed using Unity and C# programming language.

Dynamic Graphs For Point Cloud Completion — Spring 2022

- Tackled the problem of point cloud completion (inpainting) using a deep learning approach.
- Investigated how adding dynamic graphs into the learning pipeline better helps the model understand the overall structure of the input and leads to a more accurate reconstructed point cloud.
- Utilized k-NN as dynamic graph as a loss function and evaluation metric.
- Trained and tested on ShapeNet dataset and real-world data from iPhone 13 Pro LiDAR camera.
- Used PyTorch and PyTorch3D

Novel View Synthesis of Transparent Objects using NeRF — Fall 2021

- Improve traditional Neural Radiance Fields (NeRF) for novel view synthesis of transparent objects using 3 proposed solutions:
- Shape from distortion: Using a synthetic dataset consisting of background and distorted images.
- Shape refinement: Given a set of depth maps corresponding to camera poses, the 3D scene can be reconstructed using non-linear least squares.
- Virtual camera alignment using NeRF: Fix the camera poses for the object scene, and compute corresponding backgrounds through virtual cameras.

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 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 Classification models.
- Developed a Graphical User Interface (GUI) using Python's Tkinter GUI Interface.

Embodied Conversational Agent Virtual Mentor Summer 2017

- 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

Programming Languages:

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

Machine Learning/Computer Vision Related:

- PyTorch, OpenCV, Pandas, Blender, Unity

Scholastic Achievements

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

Conferences and Workshops

- Oral Presentation on "Precise Forecasting of Sky Images Using Spatial Warping" at the ICCV Physics Based Vision Meets Deep Learning Workshop, 2021, held Virtually.

- 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

- 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

Graduate Coursework

- 18-453 Intro to XR systems
- 33-353 Intermediate Optics
- 18-738 Sports Technology
- 16-889 Learning Based Methods For 3D Computer Vision
- 16-822 Geometry-Based Vision
- 18-752 Estimation, Detection & Learning
- 15-862 Computational Photography
- 10-701 Machine Learning
- 10-725 Convex Optimization
- 16-720 Computer Vision
- 18-793 Image & Video Processing