Leron K. Julian

PhD candidate in ECE, Carnegie Mellon University

LeronJulian@Hotmail.com | LeronJulian@Github.io

Education

Carnegie Mellon University (PhD)   2019 - Present
- *Doctor of Philosophy* in Electrical and Computer Engineering
- Advised by Prof. Aswin Sankaranarayanan (ECE, CMU)

Carnegie Mellon University (M.S.)   2019 - 2022
- *Master of Science* in Electrical and Computer Engineering

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

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**.

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.

Industry Experience

Samsung Research America, Irvine, California   Summer 2023
Research Intern

- I introduced a proof of concept for a real-time immersive telepresence application involving Neural Radiance Fields (NeRF) for Novel View Synthesis. *Due to the confidentiality of this project, I cannot go into details.

Idaho National Laboratory, Idaho Falls, Idaho   Summer 2019
Nuclear Power Plant Data Analyst Intern

- I analyzed data of vibration signals to automate the manual actions of checking the status of the nuclear power plant sensors.
- Developed machine learning models to predict crack length in various aluminum specimens given piezoelectric (PZT) sensor data and constant fatigue loading profiles.
- Implemented this model in an online monitoring of Nuclear Power Plant assets such as generators.

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.
- Using the same Full-Stack, began initial development for website for the reboot of the Deal or No Deal show.

Ronald E. McNair Scholar, Morehouse College   Summer 2017
Research Assistant
- Developed a conversational agent mentor through short message service (SMS) using natural language processing.
- 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 deployed using Heorku.

Research Projects

Carnegie Mellon University   Fall 2019-Current
PhD Student in Image Science Lab
- I work on increasing the penetration of solar energy into the electricity grid by making the source less intermittent through forecasting. Using computer vision and deep-learning based methods, my work seeks to predict the availability of solar irradiance by imaging the spatial and temporal dynamics of atmospheric conditions such as clouds and aerosols.

Catadioptric Systems for Long-term Forecasting of Sky Images

- I developed a novel hyperboloidal shaped mirror which is used in a catadioptric setup for sky imaging. With this setup and a Vision Transformer based network, I am able to show that we can forecast solar irradiance longer into the future. By using this custom mirror, I combat the limitations of traditional fisheye imagers that result in non-linear motion on the image. By optically warping the sky-images through my hyperboloidal-shaped mirror, I obtain uniform apparent motion on the image plane, thus increasing solar irradiance prediction.

Using Spatial Warping and Spatio-temporal Network to Forecast Sky Images
- I used 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.
- By developing a deep-learning spatiotemporal and flow-based solution, I was able to forecast cloud dynamics and solar irradiance to increase the efficiency of photovoltaic systems over state-of-the-art works within the space.
- My work showed promising results for sky-image forecasting and can be applied to future frame prediction for videos and activity forecasting.

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:
- <u>Shape from distortion</u>: Using a synthetic dataset consisting of background and distorted images.
- <u>Shape refinement</u>: Given a set of depth maps corresponding to camera poses, the 3D scene can be reconstructed using non-linear least squares.
- <u>Virtual camera alignment using NeRF</u>: 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.

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
- 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.

Skills

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

Frameworks:
- PyTorch, 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