3219 Overland Ave, Apt 8185
Los Angeles, CA - 90034
Ph: (352) 215-7701
rishabh@utopiacompression.com

Rishabh Singh

R&D Scientist
(UtopiaCompression Corporation)

Web: https://www.rishabsing.com
Github: https://github.com/rish283
linkedin.com/in/rishabh270

I work at UtopiaCompression Corp. to develop intelligent vision systems for object detection, classification and tracking using concepts of machine learning, computer vision and uncertainty quantification (focusing more toward safety frameworks for AI based systems). I completed my PhD in machine learning at the Computational NeuroEngineering Lab at University of Florida (advisor: Jose C. Principe).

EDUCATION

Doctor of Philosophy in Electrical and Computer Engineering (GPA: 3.71/4) **May 2018 - Dec 2022**
University of Florida *Gainesville, USA*
Research Areas: Uncertainty Quantification in Machine Learning, Kernel Methods, Adaptive Filtering, Time-Series Analysis.

Master of Science in Electrical and Computer Engineering (GPA: 3.71/4) **Aug 2016 - May 2018**
University of Florida *Gainesville, USA*
College of Engineering Achievement Award for New Engineering Graduate Students (May 2016 — May 2017)
Coursework: Deep Learning, Big Data Ecosystems, Machine Learning for Time Series, Pattern Recognition, Noise in Linear Systems, Image Processing and Computer Vision, Quantum Information Science.

Bachelor of Science in Electrical and Electronics Engineering (GPA: 8.46/10) **Aug 2010 - May 2014**
Vellore Institute of Technology *Vellore, India*

WORK EXPERIENCE

UtopiaCompression Corporation **Jan 2023 — Present**
Research and Development Scientist: *Los Angeles, USA*

- Performing research and engineering tasks to develop the company's *sense and avoid* (SAA) platform: a lightweight vision-based package for unmanned aircraft systems to navigate in the presence of cooperative and non-cooperative aircraft (for use in both military and civilian theatres) using detection, classification and tracking capabilities.
- My work focuses on developing methods to quantify uncertainty in the results of deep learning (DL) models used in the SAA pipeline (to predict failure probability of deployed AI systems).
- My general responsibilities also include improving the company's current algorithms, writing, evaluating and testing code, and aiding technology transition into US government and commercial markets.

University of Florida **Aug 2017 — Dec 2022**
PhD Candidate and Research Assistant - Computational NeuroEngineering Lab (CNEL): *Gainesville, USA*

- Developed and formulated a novel physics inspired *uncertainty estimation framework* (capable of single-shot estimation of uncertainty) for data and deep learning (neural network) models by leveraging kernel methods. [**paper link**]
- Elucidated, through rigorous experimental analysis, many practical advantages of the framework when implemented on challenging deep learning applications: scene-segmentation for autonomous vision (Models: Segnet, FCN-8, PSP-NET, U-NET. Datasets: CamVid, Cityscapes), classification under test-set *data distributional shifts* (Models: LeNet, ResNet, VGG. Datasets: MNIST, K-MNIST, CIFAR-10), anomaly and adversarial attack detection and transfer learning (UCI time-series database).
- Developed Hierarchical Linear Dynamical System (HLDS) architectures for video game *action sequence segmentation* (DARPA project), *dynamic texture synthesis* and *speech phoneme recognition*.

Aventusoft LLC **May 2020 — Aug 2020**
Research Scientist Intern *Boca Raton, USA*

- Aventusoft LLC is a research startup that develops *medical devices for high-value cardiac assessments* by analyzing heart valve movements. I worked with the *HEMOTAG* device (link), the flagship product of Aventusoft for diagnosing and managing heart failure assessments. My contributions included the following:
- Implemented *deep learning algorithms for detecting anomalies and fiducial points/events in Electrocardiography (ECG)* time-series data as part of a downstream task of arrhythmia detection. The work was incorporated into the HEMOTAG product.
- Tested and validated algorithm's performance on benchmark ECG datasets such as MIT-DB, European ST-T and PhysioNet.
- Collaborated with the research team to discuss and suggest future research work to improve the HEMOTAG technology, specifically to tackle issues involving interpretability of AI algorithms when implemented on medical time-series data.

RELEVANT PUBLICATIONS

- **Singh, R.** & Principe, J.C. (2022). **A Physics inspired Functional Operator for Model Uncertainty Quantification in the RKHS**. under review at IEEE Transactions of Pattern Analysis and Machine Intelligence (PAMI). [**paper link**]
- **Singh, R.** & Principe, J.C. (2021). **Toward a Kernel-based Uncertainty Decomposition Framework for Data and Models**. Neural Computation 2021; 33 (5): 1164–1198. [**paper link**]
- **Singh, R.** & Principe, J.C. (2022). **Quantifying Model Uncertainty for Semantic Segmentation using Operators in the RKHS**. under review.[**paper link**]
- **Singh, R.** & Principe, J.C. (2022). **Robust Dependence Measure using RKHS based Uncertainty Moments and Optimal Transport**. under review.[**paper link**]

- Hssayeni, Murtadha; Andalib, Arash; **Singh, R.**; Pava, Diego; Li, Kan; Chait, Robert & Kale, Kaustubh. (2022). **ECG Fiducial Points Localization Using a Deep Learning Model**. 21st IEEE International Conference on Machine Learning and Applications (ICMLA), pp. 321-328, doi: 10.1109/ICMLA55696.2022.00052.[**paper link**] (related towork done at Aventusoft).
- Principe, J.C. & **Singh, R.** (2022). **Functional Operators in RKHS for Epistemic Uncertainty Quantification in Machine Learning**. LION16: The 16^{th} Learning and Intelligent Optimization Conference.
- **Singh, R.** & Principe, J.C. (2020). **Time Series Analysis using a Kernel based Uncertainty Decomposition Framework**. Conference on Uncertainty in Artificial Intelligence (UAI) 2020. [**paper link**]
- **Singh, R.**; Yu, S., & Principe, J.C. (2020). **Composite Dynamic Texture Synthesis using Hierarchical Linear Dynamical System**. 2020 IEEE International Conference on Acoustics, Speech and Signal Processing. [**paper link**]
- **Singh, R.** & Principe, J.C. (2019). **A New Uncertainty Framework for Stochastic Signal Processing**. arXiv preprint arXiv:1904.13038 (2019). [**paper link**]
- **Singh, R.** & Principe, J.C. (2018). **Correntropy Based Hierarchical Linear Dynamical System for Speech Recognition**. In proceedings of 2018 International Joint Conference on Neural Networks (IJCNN).[**paper link**]
- **Singh, R.**; Li, K. & Principe, J.C. (2018). **Nearest-Instance-Centroid-Estimation Linear Discriminant Analysis**. In proceedings of 2018 IEEE International Conference on Acoustics, Speech and Signal Processing.[**paper link**]

INDUSTRY POSITIONS

Research & Development Scientist **Jan 2023 - Present**
UtopiaCompression Corporation *Los Angeles, USA*

- Development of sense-and-avoid intelligent vision platform using machine learning and uncertainty quantification.

Research Scientist Intern **May 2020 - Aug 2020**
Aventusoft LLC *Boca Raton, USA*

- Fiducial point detection in Electrocardiography (ECG) time-series data using deep learning for arrhythmia detection.

Assistant Manager **Aug 2014 - May 2016**
Tata Motors Limited *Pune, India*

- Oversaw and improved vehicle *assembly line automation systems* with respect to safety, maintenance and productivity.
- Achieved top 10% employee performance rating in my department.

ACADEMIC POSITIONS

Research Assistant **Aug 2017 — Dec 2022**
Computational NeuroEngineering Lab (CNEL), University of Florida *Gainesville, USA*

- Job: Uncertainty quantification in machine learning, Grants: DARPA - FA9453-18-1-0039, ONR - N00014-21-1-2345.

Teaching Assistant **Jan 2022 - May 2022**
Department of Electrical and Computer Engineering, University of Florida *Gainesville, USA*

- Course: *Machine Learning for Time Series (Instructor: Jose C. Principe)* - Theory of adaptation with stationary signals, LMS/RLS algorithms, performance measures. Helped clarify concepts, grade assignments, develop curriculum and deliver lectures.

SKILLS

Programming	Python, ROS (robot operating system), MATLAB, LaTeX, Linux Command Line.
Python Libraries	Scikit-learn, Pandas, NumPy, Keras, TensorFlow.
Skills	Data structures & algorithms, ML/DL algorithms, Bayesian & ensemble methods, kernel methods.

TALKS

- **Invited Talk:** A Functional Operator for Model Uncertainty Quantification in the Reproducing Kernel Hilbert Space: *Machine Learning Group, UIT Arctic University of Norway*.
- **Contributed Talk:** A Quantum Theory Inspired Framework for Uncertainty Quantification: *IEEE International Conference on Data Science and Advanced Analytics (DSAA).* Speaker: Jose C. Principe (Distinguished Professor, University of Florida).
- **Contributed Talk:** Making Deep Neural Networks Transparent by Information Theory: *Presentation at Microsoft.* Speaker: Shujian Yu (Associate Professor, UIT Arctic University of Norway).
- **Conference Presentation:** Time Series Analysis using a Kernel based Uncertainty Decomposition Framework: *Conference on Uncertainty in Artificial Intelligence (UAI) 2020*.
- **Conference Presentation:** Composite Dynamic Texture Synthesis Using Hierarchical Linear Dynamical System: *ICASSP 2020*.

REVIEWER SERVICE

- IEEE Transactions on Neural Networks and Learning Systems.
- Journal of the Franklin Institute.
- Chemometrics and Intelligent Laboratory Systems (Elsevier).
- IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP).
- International Conference on Artificial Intelligence and Statistics (AISTATS)