Ritik Raina

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Education

- **UC San Diego** — La Jolla, CA
  B.S. in Cognitive Science with Specialization in Machine Learning and Neural Computation — *09/2018 – 06/2022*
  - **Research directions:** Cognitively-inspired deep learning for computer vision, robust representation learning.

Research Experience

- **UC San Diego** — **02/2021 - Present**
  Pre-doctoral Researcher, de Sa Lab
  Advisors: *Vijay Veerabadran, Dr. Virginia R. de Sa*
  - Worked on developing a novel bio-inspired convolutional network called DivNormEI that was able to perform divisive normalization, along with lateral inhibition/excitation interactions, tailored for integration into modern deep neural networks. This research is supported by the Sony Research Award Program.
  - Papers summarizing our findings accepted in Shared Visual Representations in Human & Machine Intelligence (SVRHM) Workshop at NeurIPS 2021, and Vision Sciences Society (VSS) 2022.
  - Leading the development of a contrastive self-supervised neural architecture to learn facial expression movements across various facial colors and morphologies.
  - Paper summarizing the exploration of biases across facial expression analysis models was accepted to the NeurIPS 2022 Workshop on Synthetic Data for Empowering ML Research.

- **Intel Corporation** — **01/2022 - Present**
  Student Researcher
  Academic Mentor: *Dr. Virginia R. de Sa*
  Industry Mentors: *Dr. Jamel Tayeb, Dr. Farnaz Abdollahi, Dr. Bijan Arbab*
  - Worked with Jamel Tayeb, Farnaz Abdollahi, and Bijan Arbab in the Happiness Project team on studying the relationship between visual facial frustration and PC performance metric anomalies.
  - Developed a Bi-LSTM based PC anomaly detection system used for in-line deployment on Intel hardware.
  - Led user studies to exploit facial images in capturing frustration before detecting the anomalous behaviour.

- **IBM-CMI AI Horizons Network** — **07/2020 - 04/2021**
  Undergraduate Researcher - Machine Learning
  Academic Mentor: *Dr. Yoshiki Vasquez Baeza*
  Industry Mentors: *Dr. Niina Haiminen, Dr. Laxmi Parida, Dr. Ho-Cheol Kim*
  - Worked with the Artificial Intelligence for Healthy Living (AIHL) team to make microbial ontology classification scale efficiently.
  - Developed CostaClassifier, a Hybrid BioBERT-RF Model that predicts hierarchical ontologies using data corresponding to both metagenomic and metadata profiles.
  - Finetuned BioBERT for biomedical text-mining tasks under metagenomics profiles.
  - Evaluated strategies to optimize memory and GPU utilization while deploying models at scale.

Employment

- **STAR Capital** **07/2019 - 09/2019**
  Research Intern
  Mentor: *Dr. Tony Liu*
  - Worked with the Data Science team to research and develop a deep learning based system for long-term face tracking from propitiatory databases.
  - Applied a Cascade-CNN model with the utilization of a VGG16 network for face detection/verification.
  - Deployed further improvements such as applying a multi-patch tracking for tracking faces in consequent frames.
  - Developed a QT desktop application to utilize my model and further populate the facial database.

Scientific Peer-Reviewed Publications

- **Bio-inspired divisive normalization improves object recognition performance in ANNs**
  Veerabadran, V., **Raina, R.**, de Sa, V.R.
  Journal of Vision 2022;22(14):3592
  December 2022. [Paper link]

- **Exploring Biases in Facial Expression Analysis using Synthetic Faces**
  Raina, R., Monares, M., Xu, M., Fabi, S., Xu, X., Li, L., Sumerfield, W., Gan, J., de Sa, V.R.
  Synthetic Data for Empowering ML Research (SyntheticData4ML) Workshop @ NeurIPS.
  New Orleans, LA. December 2022. [Paper link]

- **Bio-inspired learnable divisive normalization for ANNs**
  Veerabadran, V., **Raina, R.**, de Sa, V.R.
  Shared Visual Representations in Human and Machine Intelligence (SVRHM) Workshop @ NeurIPS.
  Virtual. December 2021. [Paper link]

Select projects / code

- **Bio-inspired Model Benchmarking** **02/2021 - Present**
  https://github.com/rainarit/segmentation_benchmark
  - Research project based upon the task of developing and testing bio-inspired models in robust semantic segmentation, object recognition tasks. This is done in PyTorch.

- **Facial Expression Analysis** **07/2022 - Present**
  https://github.com/rainarit/pain
  - A framework designed for modelling and evaluating facial expression analysis models on synthetic facial data.

Honors & Awards

- Financial grants awarded for supporting my research:
  IBM-UCSD Research Collaboration (07/2020 - 04/2021)
  UCSD-HDSI & Intel DCA Collaboration (01/2022 - Present)

Selected Coursework

- COGS 188 (Prof. Anjum Gupta). Artificial Intelligence Algorithms
- COGS 118A (Prof. Jason Fleischer). Intro to Machine Learning I (Supervised Learning)
- COGS 118B (Prof. Virginia de Sa). Intro to Machine Learning II (Unsupervised Learning)
- CSE 152A (Prof. Hao Su). Intro to Computer Vision I
- BGGN 246A (Prof. Terrence J. Sejnowski). Computational Neurobiology
- NEUG 221 (Prof. Chu-nan Hsu). Deep Learning in Neuroscience
- NEUG 240 (Prof. Maxim Bazhenov). Mathematical Foundations for Computational Neuroscience

Invited Talks

- Barts and The London School of Medicine and Dentistry March 2021

Programming Skills

- **Languages**: Python, Java, C/C++, C#, Matlab, Swift
- **Frameworks**: PyTorch, Tensorflow, Caffe, scikit-learn
- **Miscellaneous**: Kubernetes, Mechanical Turk, Google Cloud, OpenVINO