VINAY KUMAR

3206, Avent Ferry Rd., Raleigh, NC-27606

(919) 522-3632 | vkumar24@ncsu.edu | github.com/imflash217 | linkedin.com/imflash217

EDUCATION :

North Carolina State University (01/2020 – 12/2021)

Masters of Science in Electrical Engineering; (GPA = 4.0)

Thesis: "AOGTransformers: And-Or-Grammar based Transformers for NLP tasks using Grid Cells"

Advisor: Dr. Tainfu Wu [iVMCL Lab]

Indian Institute of Technology Hyderabad (06/2014)

Bachelor of Technology (B. Tech) in Electrical Engineering

Advisor: Dr. K. Sri Rama Murty

PUBLICATIONS:

1. Vijayan, Karthika / **Kumar, Vinay** / Murty, K. Sri Rama (2014): "*Feature extraction from analytic phase of speech signals for speaker verification*", In INTERSPEECH-2014, 1658-1662.
2. Vijayan, K., **Kumar, V.** and Murty, K.S.R., 2014, June. *Allpass modelling of Fourier phase for speaker verification*. In Odyssey.

SKILLS:

Languages: Python, Swift, C++, Matlab, HTML, CSS

ML libraries: PyTorch, FastAI, TensorFlow [v1.0+, v2.0+], HuggingFace, fairseq, NLTK, scikit-learn, numpy, pandas, matplotlib, seaborn, OpenAI Gym

ML architectures: CNN, DNN, AOGNets, BERT, ULMFiT, RNN, LSTM, GRUs, Faster R-CNN, UNet, ResNet, DenseNet, Random Forests, Linear/Logistic Regression, k-Nearest Neighbors, SVM, GANs

WORK EXPERIENCE :

02/2020 - present **Research Assistant**
iVMCL Lab, NC State University (funded by NSF Grant)

- Designed And-Or-Grammar based Transformer models with less than 100M parameters for NLP tasks while achieving SOTA accuracy on SQUAD v2 dataset.
- Implemented Grid Cells structures in neuroscience for improved BERT positional encoding in both TF1 and PyTorch.

05/2020 - 07/2020 **Research Intern**
AROS Lab, NC State University

- Designed energy-based filters for removing the high-frequency noises from noisy Fetal PCG.
- Applied LPC residual filtering to capture the S1, S2 wave in a heat-beat with 80% accuracy.
- Implementation of LSTM based keyword-spotting architectures to detect the peak of heart-beats using PyTorch and fastAI trained on data from 30 patients.

07/2019 - 01/2020 **Machine Learning Engineer**
Springboard Inc.

- Mentored over 17 students in Machine Learning and Data Science Specialization Course.
- Optimized implementation of Linear/Logistic Regression, Random Forest, CNNs, RNNs, LSTMs, GANs in PyTorch for both training on only-CPU and multi-GPU CUDA hardware.

06/2018 - 07/2019 **Senior DSP Engineer**
Meeami Technologies Pvt. Ltd.

- Designed UNet architecture for noisy Multi-Channel Audio Source Separation on MUSDB18 dataset and museval metrics; achieving 6.3 SDR. Reduced the memory footprint of the model by 30% to 102 MB using network pruning post-training and deployed on an xmos array.

- Implementation of low footprint TDNN architecture for multi-keyword spotting in babble & kitchen noisy environments. Tested and deployed on Qualcomm xmos array using PyTorch C++ API. Leading a team of 4 members for design, implementation and deployment in PyTorch & C++.

07/2017 - 06/2018 **Deep Learning Engineer**
Self Employed "My Own Startup Idea"

- Building an algorithm to perform segmentation in satellite images using neural networks.
- Using CNNs with Transfer Learning to do detection and segmentation analysis for plastic bags using satellite images. I was trying to solve garbage accumulation in big cities by building an automated system that analyzes satellite images and locates areas with large unattended garbage.

06/2014 - 07/2017 **Associate Engineer**
Cognizant Technologies Solutions

- An autonomous navigation solution for indoor environments. It uses SLAM, spatial mapping and localization to understand the environment and localize itself later without using GPS. I developed a corresponding android app for Project-Tango devices and MS Hololens app.
- Designed an algorithm which generates a 3D reconstructed scene from a 2D image stream. It uses detected edges from various images and binds them together to generate a 3D scene. The aim was to use easily available 2D x-ray images and convert them into 3D models.
- An image classifier for accurately detecting the fingernail region from a given image or a video stream. It uses OpenCV for training the classifier on over 1000 fingernail images with varying skin color. It produced an accuracy of 94% when tested over our dataset collected from YouTube videos.

COURSE PROJECTS:

08/2020 - 11/2020 **Fulcrum-point estimates: A novel approach for word-level sentiment analysis with BERT model.**
CSC-791 [NLP] Course, NC State University

08/2020 - 11/2020 **Designing a traffic safety prediction system trained on tabular traffic data.**
ECE-792(042) [Stats ML] Course, NC State University

01/2020 - 04/2020 **Implementation of AdaBoost Algorithm for Face Recognition.**
ECE-763 [Computer Vision] Course, NC State University

01/2020 - 04/2020 **Implementing Gaussian mixture, t-distribution and t-factor analyzer for Face Detection.**
ECE-763 [Computer Vision] Course, NC State University

01/2020 - 04/2020 **Training Reinforcement Learning agents to understand & play Hide-&-Seek game.**
CSC-584 [GameAI] Course, NC State University

- Training a RL agent to learn an unknown game of Hide-&-Seek. There are two different types of agents which are adversarial to each other.
- Designed the agent training schedule in OpenAI-Gym, Tensorflow-v1 and the gameplay is simulated in Mujoco-2.0 software.

01/2013 - 04/2014 **Real-time PQRST complex detection in ECG signals.**
Advisor: Dr. Amit Aacharya, IIT-Hyderabad

- Designed an indigenous algorithm to detect PQRST complex in a real-time stream of ECG signals. ASIC design of the algorithm is also implemented.
- The algorithm takes in real-time ECG signals captured from the patient's body and outputs segmented PQRST complexes which are processed to determine the health of the patient's heart.