Megh Bhalerao

MS ECE Student, University of Washington, Seattle

Education

University of Washington, Seattle — *2022 - 2024 (expected)*
MS, Electrical & Computer Engineering (Advisor: Prof. Jeff Bilmes) — *GPA: 3.91/4*
National Institute of Technology, Karnataka — *2016 - 2020*
B.Tech, Electrical & Electronics Engineering (Advisor: Prof. Krishnan CMC) — *GPA: 9.5/10*

Programming

Python, PyTorch, Tensorflow, OpenCV, MATLAB, Java, C/C++, Git, Bash, LT-Spice, LaTeX

Publications

7. Arnav Das*, Gantavya Bhatt*, **Megh Bhalerao**, Vianne Gao, Rui Yang, Jeffrey Bilmes. *Accelerating Batch Active Learning using Continual Learning Techniques. Transactions on Machine Learning Research (**TMLR**)*, and ***ICML** workshop on Data-Centric Machine Learning, 2023.*
6. Hanwen Xu*, Jiayou Zhang*, Zhirui Wang*, Shizhuo Zhang, **Megh Bhalerao**, Yucong Liu, Dawei Zhu, Sheng Wang. *GraphPrompt: Graph-based Prompt Templates For Biomedical Synonym Prediction. Association for Advancement of Artificial Intelligence (**AAAI**), 2023.*
5. **Megh Bhalerao***, Anurag Singh*, and Soma Biswas. *Pred&Guide: Labeled Target Prediction for Guiding Semi-Supervised Domain Adaptation. **arXiv 2023**.*
4. Sarthak Pati, Siddhesh Thakur, Ibrahim Ethem Hamamci, Ujjwal Baid, Bhakti Baheti, **Megh Bhalerao**, (+ other authors), Christos Davatzikos and Spyridon Bakas. *GaNDLF: A Generally Nuanced Deep Learning Framework for Scalable End-to-End Clinical Workflows in Medical Imaging. **Nature Communications Engineering**, 2023.*
3. Rhea Chitalia*, Sarthak Pati*, **Megh Bhalerao**, Siddhesh Thakur, Despina Kontos and Spyridon Bakas. *Expert Tumor Annotations and Radiomic Features for the iSPY data. **Nature Scientific Data***, 2022.
2. Anurag Singh*, Naren Doraiswamy*, Sawa Takamuku, **Megh Bhalerao**, Titir Dutta, Soma Biswas, Aditya Chepuri, Balasubramanian Vengatesan, Naotake Natori. *Improving Semi-Supervised Domain Adaptation Using Effective Target Selection and Semantics. **CVPR** workshop on Learning from Limited and Imperfect Data, 2021.*
1. **Megh Bhalerao** and Siddhesh Thakur. *Brain Tumor Segmentation Based on 3D Residual U-Net. Medical Image Computing & Computer Assisted Intervention (**MICCAI**), Brainlesion Workshop, 2019. Book Chapter In: Crimi A., Bakas S., Kuijf H., Menze B., Reyes M., Lecture Notes in Computer Science (**LNCS**).*

Research Experience

Electrical & Computer Engineering, University of Washington — *March 2022 - present*
Research Assistant in Melodi Lab. Advisor: Prof. Jeff Bilmes

- Implemented Submodular selection based algoroithms for coreset selection problems, and achieved consistent $\approx 3\%$ accuracy improvement over baselines. Manuscript in preparation. [PPT]
- Investigating improving efficiency of **data distillation** by using diversity-inspired traditional clustering techniques.
- Accelerated active learning on medical imaging datasets using continual learning inspired ideas and achieved **3-4$\times$ training speedup** with less than 1% accuracy drops.

Paul Allen School of Computer Science & Engineering, University of Washington — *August 2021 - March 2022*
Research Student in Wang Group, UW CSE
Advisor: Prof. Sheng Wang

- Implemented various versions of **biomedical entity normalization** baselines on an unexplored graph-based biomedical entity ontology.
- Achieved 30% improvement over SOTA biomedical entity normalization algorithms by integrating graph structure of entity normalization datasets into natural language **prompt templates**.

Indian Institute of Science, Bangalore — *May 2020 - July 2021*
Project Assistant at Image Analysis & Computer Vision Lab, Electrical Engineering Dept. — *(funded by AISIN Seiki, Japan)*
Advisor: Prof. Soma Biswas

- Developed **Graph Convolutional Networks** based algorithm for cross-domain facial expression recognition using previously unexplored semi-supervised domain adaptation (SSDA) algorithms.
- $4-5\%$ accuracy improvement over previous SSDA algorithms by imtegrating weakly-supervised learning (**Self-Training/Consistency Regularization** *etc.*) with DA.
- Worked on the **Class Imbalance** Problem for **Domain Adaptation** for Image Classification. Implemented Class Balanced Focal Loss, Semantic Initialization & Regularization, and a **Novel Uncertainty Loss** on target domain for Handling Class Imbalance resulting in $2-3\%$ accuracy improvement.

University of Pennsylvania, USA — *May - December, 2019*
Research Intern at Center for Biomedical Image Computing & Analytics — *Part-time, June 2020 - March 2021*
Advisor: Dr. Spyridon Bakas

- Implemented **end-to-end training** pipelines for Automatic MRI (Brain & Breast) **Semantic Segmentation** using 3D - Residual U-Net, Vanilla U-Net, Inception U-Net, Fully Convolutional Net.
- Contributed in integrating the pipelines, **iterative label fusion** approaches & few BraTS methods (from dockerhub) into an open source platforms **Federated Tumor Segmentation** (FeTS) and **GaNDLF**. FeTS will be used for training models on **multi-institutional data**, subsequently assisting **radiologists** for segmenting anomalies from MRI scans.

Indian Institute of Technology, Bombay — *May - July, 2018*
Research Fellow at Vision & Image Processing Lab, Electrical Engineering Dept.
Advisor: Prof. Subhasis Chaudhuri

- Implemented **Mahalanobis Distance Metric Learning** (ML preprocessing) on two **Haptic** datasets - **Braille Character** Dataset & **Haptic Acceleration Response** Dataset (confusion matrix provided, feature vectors extracted for both).
- Metric Learning formulated as **Constrained Convex Optimization** problems and solved using **CVX package** on MATLAB. Data Clustered by projecting datapoints into a new vector space defined using the **learned distance metric**. In case of the braille character dataset the confusion matrix was re-estimated using the learned distance metric along with corresponding feature vectors.

Selected Research Projects

Submodular Summarization *Oct 2022 - Nov 2022*
Advisor: Prof. Jeff Bilmes - *ECE Dept, UW*
- Achieved 84% and 85% diversity scores on AirBNB Image and 20Newsgroups text datasets on a summarization task.
- Applied various submodular functions for the summarization task with wide range of feature extraction methods.

Efficient DNNs via Pruning and Quantization *Mar 2022 - Jun 2022*
Advisor: Prof. Eli Shlizerman - *ECE Dept, UW*
- Achieved **3**× and **8**× reduction in memory requirements (by pruning) and inference time (by quantization) respectively for Resnet-50 with minimal drop in classification accuracy.
- Implemented magnitude pruning and **FP32 to INT8** quantization on PyTorch.

Lip Reading using Cross Audio-Visual Recognition *Aug 2018 - Apr 2019*
Advisor: Prof. Krishnan CMC - *EE Dept, NITK*
- Developed **Audio (Spectrogram) & Video (Histogram of Gradients)** processing methods for classifying lip-movements into a word based on consecutive video frames coupled with the audio signal corresponding to the word.
- Two separate 3D CNNs were trained on the processed audio and video (one each audio and video), with a **common contrastive loss function** with gradients back-propagated individually through the networks.

Teaching Experience

CSE 417, Computer Science & Engineering, University of Washington *Fall 2023*
Algorithms & Complexity *with* Prof. Richard Anderson
- Conducted weekly office hours to help students solve assignments, assisted in preparing course assignments, graded assignments and exams.

EE 233, Electrical & Computer Engineering, University of Washington *Spring 2023*
Circuit Theory *with* Prof. Mahmood Hameed
- Led lab sections and assisted students in building electronic circuits and handling lab equipment like digital oscilloscopes, waveform generators etc. Conducted weekly office hours to support students with homework and labwork.

EEP 563, Electrical & Computer Engineering, University of Washington *Winter 2023*
Analog Circuits for Sensor Systems *with* Prof. Mahmood Hameed
- Conducted biweekly office hours to assist students in solving assignments, helping with LT Spice simulations. Graded weekly homework assignments.

EE 215, Electrical & Computer Engineering, University of Washington *Spring 2022, Fall 2022*
Fundamentals of Electrical Engineering *with* Prof. Georg Seelig and Prof. Mahmood Hameed
- Led lab sections and assisted students in building basic electrical systems. Led review sections and office hours for solving practise problems to clarify doubts and revise concepts that were taught in class. Graded labs, exams and proctored exams.

Academics

Graduate Coursework: Machine Learning, Deep Learning, Algorithms & Complexity, Submodular Functions & Optimization. *Seminar*: Information Theory, Theoretical Deep Learning, Differential Geometry.
Undergraduate Coursework: Neural Networks, Probability Theory, Linear Algebra, Digital Signal Processing, Operating Systems, Advanced Control Systems, Network Analysis & Synthesis, Digital System Design.

Scholastic Achievements:
- University of Southern California Dean Merit Scholarship ($10000) and Information Sciences Institute 2-year Rising Star Internship (Declined).
- **Summer Research Fellowship** 2018 for Research Internship at IIT-Bombay from the **Indian Academy of Sciences**.
- **Japanese Government JASSO Scholarship** to present Summer-2018 research at Kumamoto University, Japan.
- Top 5.6% amongst 150,000+ in JEE-Advanced 2016, 0.5% amongst 1,250,000+ in JEE-Main 2016, 0.14% amongst 170,000+ in K-CET 2016.

Reviewer: WACV 2021, 2024.

Co-Curricular Activities

- Participated in the **International Brain Tumor Segmentation Challenge (BraTS)**, for comparison and validation of segmentation results, achieved average testing dice of 0.77.
- Developed a contact manager smartphone app (extensive application of OOP concepts), as a part of **Android Programming Workshop by Google** in freshman year, with a team of 4.
- Implemented (in keras) MNIST digit generation using **Generative Adversarial Networks** to generate handwritten-like images, as a part of **Student Chapter of IEEE-NITK**.
- **Frequency Note Detection using Arduino Atmega**. Input taken from electret microphone, amplified & fed to Arduino. **Fast fourier transform (FFT)** implemented on Arduino & frequency component with max amplitude taken.
- Two-colour LED control using **MSP430** microcontroller programmed on **Embedded-C** & **TLC5916** constant current driver shift registers. Two **piezoelectric** sensors generated interrupts fed to MSP. Player who drives the LEDs first (along a path), by stamping the piezo sensor wins.
- Constructed **Radio Signal Receiver** for locating the transmitting location using **EM Wave to Audio** conversion PCB - output was connected to audio jack. Resonant frequency tuned to transmitting signal frequency by modifying the PCB by modifying capacitors and inductors.