# 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*. ***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. Jeffrey Bilmes

- Implemented Submodular selection based algoroithms for coreset selection problems, and achieved consistent $\approx 3\%$ accuracy improvement over baselines. Manuscript in preparation.
- 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× 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.

## Academics

**Graduate Coursework**: Machine Learning, Deep Learning, Algorithms & Complexity, Submodular Functions & Optimization. *Seminar*: 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.

**Teaching Experience** (at UW): EE233 Circuit Theory in Spring 2023, EEP 538 Analog Circuits for Sensor Systems in Winter 2023, EE215 Fundamentals of Electrical Engineering in Spring, Fall 2022.

**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 2022, 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.