Murad Megjhani

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Education

2016-2021	Postdoctoral Research Scientist, Department of Neurology, Columbia University, NY
2012-2016	Ph.D., Department of Electrical and Computer Engineering, University of Houston, Houston, TX (3.78/4.0)
2001-2005	B.E., Department of Electrical and Computer Engineering, Chaitanya Bharthi Institute of Technology, Hyderabad, India (4.0/4.0)

Research Interest :

Image analysis, Machine learning, Sparse modelling, Deep learning, Brain computer interface, Computational neuroscience, Multi spectral analysis, Arbor analytics, Behavioral neuroscience, Time series analysis, Neuro-imaging.

Professional Experience

Research Experience

Feb 2021 – Present Associate Research Scientist, Department of Neurology, Columbia University, NY

As an Associate Research Scientist and as a key member of the Program in Healthcare Informatics, I mentor postdoctoral students and research associates, and work with physicians and clinical scientists to build mathematical models that identify and solve various challenges in healthcare, ultimately improving patient outcomes and advancing medical research.

1. Applying and developing sparse model using multi-scale dictionary learning methods, deep learning, survival analysis for discovering the hidden trends in the high frequency physiological dataset acquired from the bedside monitors at Neuro-Intensive Care Unit (NICU) at CUMC.
2. Designing mathematical models to remove artifacts and developed a quantitative model from Intracranial pressure waveform to increase precision in the diagnosis of ventriculitis.
3. Investigate the use of machine-learning and transfer learning paradigm to derive non-invasive intracranial pressure waveform in children and in adults
4. Brain on Music: Assaying neural correlates of different emotions with musical stimuli based on qEEG.

Aug 2016 – Feb 2021 Postdoctoral Research Scientist, Department of Neurology, Columbia University, NY

1. Developing Proxy Variable of Clinical Suspicion using Electronics Medical Records (EMR) like labs and medical data using recent advances in natural language processing.

2. Applying and developing discovering the hidden trends in the high frequency physiological dataset acquired from the bedside monitors at Neuro-Intensive Care Unit (NICU) at CUMC.
3. Developing deep learning models for online detection of Delayed Cerebral Ischemia (DCI)

Jan 2012 – Aug 2016 Research Scientist at Bio-Image Analytics Lab, University of Houston, TX

1. Developed a sparse-coding/dictionary learning algorithm based software to automatically reconstruct and analyze brain cells
2. Worked with an interdisciplinary team of engineers and biologists to design and implement several new modules in the FARSIGHT toolkit (Bio medical Image Analysis toolkit).
3. Incorporated visualization tools allowing doctors and biologists to interact with the system, interpret algorithm outputs, and visualize convergence metrics.
4. Performed exploratory analysis on full brain with over 200,000 cells.
5. Developed dictionary learning based algorithm to un-mix multispectral tumor dataset

Aug 2014 – Aug 2016 Research Scientist at Brain Machine Interface (BMI) lab, University of Houston, TX

1. Brain on Art: Assaying neural individuality and variation in freely behaving people based on qEEG.
    a. Analyzed the EEG data collected from museum goers
    b. Analyzed the performance of different mobile brain and body imaging (MOBI) systems in freely behaving adults
2. Cognitive motor development: Developed algorithms using dictionary-learning methods to identify distinct biomarker from the EEG dataset acquired from the infants ranging from 6 to 24 months.

Industry Experience

Nov 2005 – Jan 2012 : Senior Associate, Cognizant Technology Solutions, San Jose, CA

1. Lead the team to develop software products for insurance technologies using agile methodologies.
2. Designed and developed insurance rating and underwriting rule based engine.
3. Involved in analysis, detailed design to come up with right architecture and implementation of the Business Services.

Teaching Experience

Jan 2013 - May 2013 Teaching assistant - electrical engineering lab at University of Houston, Houston, TX

Aug 2013 – Dec 2013 Teaching assistant – C++, at department of Electrical and Computer Engineering, University of Houston, Houston TX.

Peer Review Activities

2023-	Review Editor on the Editorial Board of Neurocritical and Neurohospitalist Care (Frontiers in Neurology).
2020-	American Heart Association (AHA) Grant Reviewer
2016-	(Journals and Conferences): Machine Learning for Healthcare (MLHC), Neurocritical Care, Entropy, IEEE International Symposium on Biomedical Imaging (ISBI), Neuroinformatics, IEEE Geoscience and Remote Sensing Letters, IEEE Journal Of Biomedical And Health Informatics, Entropy, Plos One, eLife

Awards

2015	Future Faculty Fellowship at University of Houston, TX.
2012-2016	Tuition Fellowship for PhD program at University of Houston.
2005	Distinguished student award. Awarded the state rank for outstanding performance in the curricular activities, Osmania University, Andhra Pradesh, India.

Grants

In Process

- Non-Invasive Intracranial Pressure Waveform Derivation Using Machine Learning Techniques: AHA's Second Century Early Faculty Independence Award **24SCEFIA1259295;** Role: PI, 2024-2027
- A Deep Learning Framework for Deriving Non-Invasive Intracranial Pressure Waveforms: AHA Career Development Award **24CDA1274465;** Role: PI, 2024-2027 (waived)
- Machine Learning to Optimize Management of Acute Hydrocephalus, National Institutes of Health: **R01 NS131606;** Role: Co-Investigator, 2023-2028
- ContinuOuS Monitoring Tool for Delayed Cerebral IsChemia (COSMIC), National Institutes of Health: **R01 NS129760**; Role: Co-Investigator, 2023-2028

Completed

- Machine Learning to Optimize Management of Acute Hydrocephalus Patients, National Institutes of Health: **R21NS113055,** Role: Key Personnel, 2020-2022
- Real-time Detection of Delayed Cerebral Ischemia using Machine Learning, American Heart Association: **20POST35210653,** PI: Murad Megjhani, 2020-2021.
- Multi-parametric Prediction Of Vasospasm After Subarachnoid Hemorrhage, National Institutes of Health: **K01-ES026833,** PI: Soojin Park, 2016-2020 Role: Key Personnel
- Prediction of Delayed Cerebral Ischemia (DCI) using Deep Learning NVIDIA GPU Grant, PI: Murad Megjhani (NVDIA GPU Support).

Publications

Journal Articles

(* contributed equally)

1. Kwon, S., Weinerman, B., Nametz, D., **Megjhani, M.**, Lee I., Habib A., Barry O., Park, S. 2024. Non-invasive pulse arrival time is associated with cardiac index in pediatric heart

transplant patients with normal ejection fraction. *Physiological Measurement, 45(7), p.07NT01.*

2. Ridha, M., **Megjhani, M**., Nametz, D., Kwon, S.B., Velazquez, A., Ghoshal, S., Agarwal, S., Claassen, J., Roh, D.J., Sander Connolly Jr, E. and Park, S., 2023. Suboptimal Cerebral Perfusion is Associated with Ischemia After Intracerebral Hemorrhage. *Neurocritical Care*, pp.1-10.
3. Kwon, S.B., **Megjhani, M**., Nametz, D., Agarwal, S. and Park, S., 2023. Heart rate and heart rate variability as a prognosticating feature for functional outcome after cardiac arrest: A scoping review. *Resuscitation Plus*, *15*, p.100450.
4. **Megjhani, M**., Terilli, K., Kwon, S.B., Nametz, D., Weinerman, B., Velazquez, A., Ghoshal, S., Roh, D., Agarwal, S., Connolly, E.S. and Claassen, J., 2023. Automatic identification of intracranial pressure waveform during external ventricular drainage clamping: segmentation via wavelet analysis. *Physiological Measurement*, *44*(6), p.064002.
5. **Megjhani, M**., Terilli, K., Weinerman, B., Nametz, D., Kwon, S.B., Velazquez, A., Ghoshal, S., Roh, D.J., Agarwal, S., Connolly Jr, E.S. and Claassen, J., 2023. A Deep Learning Framework for Deriving Noninvasive Intracranial Pressure Waveforms from Transcranial Doppler. *Annals of Neurology*, *94*(1), pp.196-202.
6. Kastenholz, N., **Megjhani, M**., Conzen-Dilger, C., Albanna, W., Veldeman, M., Nametz, D., Kwon, S.B., Schulze-Steinen, H., Ridwan, H., Clusmann, H. and Schubert, G.A., 2023. The oxygen reactivity index indicates disturbed local perfusion regulation after aneurysmal subarachnoid hemorrhage: an observational cohort study. *Critical Care*, *27*(1), p.235.
7. Ranard, B.L., Vodovotz, Y., Asgari, S., **Megjhani, M**., Chow, C.C. and Park, S., 2023. Mathematical model of SARS-CoV-2 immunity predicts Paxlovid rebound. Journal of Critical Care, 74, p.154210.
8. **Megjhani, M**., Terilli, K., Weinerman, B., Nametz, D., Kwon, S.B., Velazquez, A., Ghoshal, S., Roh, D.J., Agarwal, S., Connolly Jr, E.S. and Claassen, J., 2023. A Deep Learning Framework for Deriving Non-Invasive Intracranial Pressure Waveforms from Transcranial Doppler. Annals of Neurology.
9. Gomez LA, Shen Q, Doyle K, Vrosgou A, Velazquez A, **Megjhani M**, Ghoshal S, Roh D, Agarwal S, Park S, Claassen J. Classification of Level of Consciousness in a Neurological ICU Using Physiological Data. *Neurocritical care*. 2023 Feb;38(1):118-28.
10. **Megjhani M**, Weiss M, Ford J, Terilli K, Kastenholz N, Nametz D, Kwon SB, Velazquez A, Agarwal S, Roh DJ, Conzen-Dilger C. Optimal cerebral perfusion pressure and brain tissue oxygen in aneurysmal subarachnoid hemorrhage. *Stroke*. 2023 Jan;54(1):189-97.
11. Ranard, B., **Megjhani, M**, Terilli K, Yarmohammadi H, Ausiello J, Park S, Heart rate variability and adrenal size provide clues to sudden cardiac death in hospitalized COVID-19 patients. *Journal of Critical Care,* 2022/10/1.
12. Weiss, M., Albanna, W., Conzen-Dilger, C., Kastenholz, N., Seyfried, K., Ridwan, H., Wiesmann, M., Veldeman, M., Schmidt, T.P., **Megjhani, M**. and Schulze-Steinen, H., 2022. Intraarterial nimodipine versus induced hypertension for delayed cerebral ischemia: a modified treatment protocol. *Stroke*, 53(8), pp.2607-2616..
13. Rubinos, C., Kwon, S.B., **Megjhani, M.**, Terilli, K., Wong, B., Cespedes, L., Ford, J., Reyes, R., Kirsch, H., Alkhachroum, A. and Velazquez, A., 2022. Predicting Shunt Dependency from the Effect of Cerebrospinal Fluid Drainage on Ventricular Size. *Neurocritical Care*, pp.1-8.
14. **Megjhani, M.**, Weiss, M., Kwon, S. B., Ford, J., Nametz, D., Kastenholz, N., ... & Park, S. (2022). Vector Angle Analysis of Multimodal Neuromonitoring Data for Continuous Prediction of Delayed Cerebral Ischemia. *Neurocritical Care*, 1-7.
15. Weiss, M., Albanna, W., Conzen, C., **Megjhani, M**., Tas, J., Seyfried, K., Schubert, G. A. (2022). Optimal Cerebral Perfusion Pressure During Delayed Cerebral Ischemia After Aneurysmal Subarachnoid Hemorrhage. *Critical Care Medicine*, *50*(2), 183-191.

16. **Megjhani M,** Terilli K, Kalaspudi, L, Chen J, Carlson J, Miller S, Badjatia N, Hu P, Velazquez A, Roh D, Agarwal A, Claassen J, ES Connolly, Hu X, Morris N, Park S, “Dynamic Intracranial Pressure Waveform Morphology Predicts Ventriculitis”, *Neurocritical care* (2021): 1-8.
17. Ranard B, **Megjhani M**, Terilli K, Doyle K, Claassen J, Pinsky M, Clermont G, Vodovotz Y, Asgari S, Park S, “Identification of endotypes of hospitalized COVID-19 patients”, *Frontiers in medicine* 8 (2021).
18. **Megjhani M,** Terilli K*, Weiss M, Savarraj S, Chen LH, Alkhachroum A, Roh D, Agarwal S, Connolly ES, Velazquez A, Boehme A, Claassen J, Choi HA, Schubert G, Soojin Park, ”Dynamic Detection of Delayed Cerebral Ischemia: A Study in Three Centers” *Stroke* 52.4 (2021): 1370-1379.
19. **Megjhani M**, Terilli K, Kaplan A, Wallace BK, Alkhachroum A, Hu X, Park S. Use of Clustering to Investigate Changes in Intracranial Pressure Waveform Morphology in Patients with Ventriculitis. *Physiol Meas*. 2019 Jan 18;40(1):015002.
20. Rasulo F, Piva S, Park S, Oddo M, **Megjhani M**, Cardim D, Matteotti I, Gandolfi L, Robba G, Taccone FS, Latronico N, “The Association Between Peri-Hemorrhagic Metabolites and Cerebral Hemodynamics in Comatose Patients With Spontaneous Intracerebral Hemorrhage: An International Multicenter Pilot Study Analysis”, *Frontiers in Neurology*, Sep 2020.
21. Savarraj J, Hergenroeder G, Zhu L, Chang T, Park S, **Megjhani M**, Vahidy F, Zhao Z, Kitagawa R, Choi HA, “Machine learning to predict delayed cerebral ischemia and outcomes in subarachnoid hemorrhage”, *Neurology* (2020).
22. Alkhachroum A*, Terilli K*, **Megjhani M***, Park S, “Harnessing Big Data in Neurocritical Care in the Era of Precision Medicine”. *Current Treatment Options In Neurology*. 2020 Apr 18;22 (5).
23. Stember, J.N., Terilli, K.L., Perez, E., **Megjhani, M.**, Cooper, C.A., Jambawalikar, S. and Park, S., “Surface Point Cloud Ultrasound with Transcranial Doppler: Coregistration of Surface Point Cloud Ultrasound with Magnetic Resonance Angiography for Improved Reproducibility, Visualization, and Navigation in Transcranial Doppler Ultrasound”,. *Journal of Digital Imaging*, pp.1-7, 2020.
24. Alkhachroum A., **Megjhani M.**, Terilli K., Rubinos C., Ford J., Wallace B., Roh D., Agarwal S., Connolly E., Boehme A., Claassen J., Park S., “Hyperemia in subarachnoid hemorrhage patients is associated with an increased risk of seizures”, *Journal of Cerebral Blood Flow & Metabolism* 2019, 0271678X19863028.
25. Claassen J, Doyle K, Matory A, Couch C, Burger K, Velazquez A, Okonkwo J, King JR., Park S., Agarwal S., Roh D., **Megjhani M.**, Eliseyev A., Connolly E., Rohaut B. ,“Detection of Brain Activation in Unresponsive Patients with Acute Brain Injury”, *N Engl. J Med* 2019;380:2497-2505.
26. **Megjhani M.,** Kaffashi F., Terilli K., Alkhachroum A., Esmaeili B., Doyle K., Murthy S., Velazquez A., Connolly E., Roh D., Agarwal S., Loparo K., Claassen J., Boehme A., Park S., "Heart Rate Variability as a Biomarker of Neurocardiogenic Injury after Subarachnoid Hemorrhage." *Neurocrit Care*, 2019
27. Rohaut B., Doyle K., Reynolds A., Igwe K., Couch C., Matory A., Rizvi B., Roh D., Velasquez A., **Megjhani M.**, *et al.*, "Deep structural brain lesions associated with

consciousness impairment early after hemorrhagic stroke." *Scientific reports* 9 (1), 4174, 2019.

28. **Megjhani M.**, Terilli K., Park S., *et al.*, “An active learning framework for enhancing identification of non-artifactual intracranial pressure waveforms”, *Physiol. Measurement*, Dec 2018.
29. Park S., **Megjhani M.**, Claassen J., Elhadad N., “Predicting Delayed Cerebral Ischemia after Subarachnoid Hemorrhage Using High Frequency Physiological Data”, *Journal of Clinical and Medical Computing*, 2018; pp 1–11.
30. **Megjhani M.**, Terilli K., Classen J., Elhadad N., Park S., “Incorporating High Frequency Physiologic data Using Computational Dictionary Learning Improves Prediction of Delayed Cerebral Ischemia Compared to Existing Methods”, *Frontiers in Neurology*, February, 2018.
31. **Megjhani M.**, Terilli K., Martin A., Velazquez A., Claassen J., Park S., “Deriving the PRx and CPPopt from 0.2-Hz Data: Establishing Generalizability to Bedmaster Users”, In: Heldt T. (eds) *Intracranial Pressure & Neuromonitoring XVI. Acta Neurochirurgica Supplement*, vol 126. Springer, Cham, 2018.
32. Cruz-Garza J., Brantley J., Nakagome S., Konston K., **Megjhani M.**, Vidal J.C., “Deployment of Mobile EEG Technology in an Art Museum Setting: Evaluation of Signal Quality and Usability”, *Frontiers in human neuroscience*, November, 2017.
33. **Megjhani M.**, Roysam B., “Morphological Constraint Spectral Unmixing of Biological tissues using confocal microscopy” *Bioinformatics,* (2017), March 2017
34. Barton E., Lu Y., **Megjhani M.**, Maynard M., Kulkarni P., Roysam B., Leasure J.L., “Binge Alcohol Alters Exercise-Driven Neuroplasticity”, *Neuroscience* 343, February 2017.
35. **Megjhani M.** *,Kontson K.*, Cruz-Garza JG., Brantley JA., Robleto D., Contreras-Vidal JL. “ Your Brain on Art: Emergent Cortical Dynamics During Aesthetic Experiences”. *Frontiers in Human Neuroscience,* Nov. 2015
36. **Megjhani M.**, Rey-Villamizar N., Merouane A., Lu Y., Mukherjee A., Trett K., Chong P., Harris C., Shain W., and Roysam B., “Population-scale Three-dimensional Reconstruction and Quantitative Profiling of Microglia Arbors.,” *Bioinformatics,* 31 (2015), pp. 2190–2198, Feb. 2015
37. Xu Y., **Megjhani M.**, Shain W., Roysam B. and Han Z., “Unsupervised Profiling of Microglial Arbor Morphologies and Distribution using a Nonparametric Bayesian Approach”, *IEEE Journal of Selected Topics in Signal Processing,* Jan. 2015
38. Rey N., Somasundar V., **Megjhani M.**, Xu Y., Lu Y., Shain W. and Roysam B., “Large-scale Automated Image Analysis for Computational Profiling of Brain Tissue Surrounding Implanted Neuroprosthetic Devices using Python”, *Frontiers in Neuroinformatics*, vol. 8, no. 39, Apr. 2014

Abstracts/Posters/Conference Papers:

1. Elhussein, A., **Megjhani, M**., Kwon, S.B., Velazquez, A., Nametz, D., Roh, D.J., Claassen, J., Weiss, M. and Agarwal, S., Savarraj, J., Connolly, E.S., Park, S, 2023, December. A generalizable physiological model for detection of Delayed Cerebral

Ischemia using Federated Learning. *In 2023 IEEE International Conference on Bioinformatics and Biomedicine (BIBM) (pp. 1886-1889). IEEE*.

2. Cao, H., Finer, J., **Megjhani, M**., Nametz, D.C., Lorenzi, V., Mamykina, L., Meyers, R., Rossetti, S.C. and Park, S., 2022, March. Machine Learning Model Deployment Using Real-Time Physiological Monitoring: Use Case of Detecting Delayed Cerebral Ischemia. In *2022 IEEE Healthcare Innovations and Point of Care Technologies (HI-POCT)* (pp. 42-45). IEEE.
3. Magid-Bernstein J., **Megjhani M.**, Terilli K., Carlson J., Agarwal S., Roh D., Claassen J., Park S., "The Role of Cerebrospinal Fluid Cell Index in Predicting Shunt Dependence after Intracerebral Hemorrhage", Neurocritical Care Society, 2020.
4. Rosenberg J., Terilli K., Carlson J., **Megjhani M.**, Agarwal S., Roh D., Claassen J., Park S., "Analysis of the relationship between positive end expiratory pressure, intracranial pressure cerebrovascular reactivity in subarachnoid hemorrhage", Neurocritical Care Society, November 2020.
5. Terilli K., **Megjhani M.**, Rubinos C., Kirsch H., Ford J., Alkhachroum A., Velazquez A., Roh D., Agarwal S., Claassen J., Park S., "Evaluating the Cerebral Arterial Time Constant in Vasospasm and Delayed Cerebral Ischemia after Aneurysmal Subarachnoid Hemorrhage", Neurocritical Care Society, November 2019.
6. **Megjhani M.**, Terilli K., Kaplan A., Wallace BK., Alkhachroum A., Hu X., Park S., "Investigating Changes in Intracranial Pressure Waveform Morphology in Patients with Ventriculitis using Hierarchical Clustering", ICP, September 2019.
7. Ford J., **Megjhani M.,** Terilli K., Bohemie A., Park S., "Brain Tissue Oxygenation as an Adjunctive Monitor for Determining Optimal Cerebral Perfusion Pressure in Subarachnoid Hemorrhage Patients", *American Academy of Neurology,* April 2018.
8. **Megjhani M.**, Roysam B., "3-D Cellular-scale Profiling of Brain Tissue Surrounding Implanted Devices", Society for Neuroscience: Neuroscience 2015. October 17, 2015: Chicago, IL.
9. Cruz-Garza JG, Hernandez ZR, **Megjhani M**, Abibullaev B, Tse TW, Caducoy E. Contreras-Vidal JL. "Neural development of social cognition in the first two years of life: Early findings from a cross-sectional study". Society for Neuroscience: Neuroscience 2015. October 17, 2015: Chicago, IL.
10. Cruz-Garza JG, Kontson K, **Megjhani M**, Brantley J, Robleto D, White M, Civillico E, Contreras-Vidal JL. "Your Brain On Art: Bringing Research to Public Settings to Increase Brain Awareness and Acquire Big Data." Society for Neuroscience: Neuroscience 2015. October 17, 2015: Chicago, IL.
11. Kontson K, **Megjhani M.**, Brantley J, Cruz-Garza JG, Nakagome S, Robleto D, White M, Civillico E, Contreras-Vidal JL. "Emergent cortical dynamics during aesthetic experiences." Society for Neuroscience: Neuroscience 2015. October 17, 2015: Chicago, IL.
12. Arenas-Castellanos AJ, Hernandez ZR, Cruz-Garza JG, **Megjhani M.**, Abibullaev B, Maddi SRP, Tse T, Armstrong C, Long W, Contreras-Vidal JL. "A developmental analysis of behavior related to the mirror neuron system in 6-24 months infants". Ninth Biennial Meeting of the Cognitive Development Society. October 7, 2015. Columbus, OH
13. **Megjhani M.**, Y. Lu, "Profiling of Brain Tissue Surrounding Implanted Devices", International Conference on Computational Photography, ICCP 2014, Houston, TX.