

# Subhash Nerella

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Engineer, Researcher in Deep/Machine Learning  
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## Professional Summary

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I'm an Engineer and Researcher focused on Deep/Machine Learning, holding a Ph.D. in Biomedical Engineering. My work involves creating advanced solutions at the intersection of diverse fields like generative AI and human facial behavior analysis. With a background in software development, I offer a mix of academic and industry expertise. I'm passionate about learning and make it a point to stay updated on the latest advancements in my field. Currently seeking full-time job opportunities where I can collaborate with and learn from other talented professionals.

## Skills

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- **Machine learning frameworks:** PyTorch, Lightning, Keras, Chainer, TensorFlow, Scikit Learn
- **Deep Learning Architectures:** Convolutional Neural Networks, Recurrent Neural Networks, Transformers
- **Data Science:** Data Visualization, Statistical Analysis, Pattern Recognition, Feature Engineering
- **Programming:** Python, R, C++, C, MATLAB, Shell Scripting
- **Database Systems:** SQL, MongoDB
- **Tools & OS:** Linux, Windows, Git, Docker, Jupyter, VS Code, Google Cloud Platform
- **Languages:** English, Telugu, Hindi

## Research Experience

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### Graduate Research Assistant

Aug 2018 – Dec 2023

### Intelligent Health Systems Lab, Gainesville, FL

- Trained a **Latent Diffusion (Stable Diffusion) Generative AI model** for synthetic face generation conditioned on facial action units. Designed multi-class embedder to incorporate action unit labels into generative model. The trained model with **half a billion parameters** can synthesize a face or in-paint masked face with given input action units present.
- **Facial action unit (AU) detection in critically ill patients**
  - Trained a **SWIN-Transformer** model on patient facial images obtained from ICUs to detect facial action units. Achieved an average 0.77 F1- score on 18 AUs.
  - A **linear mixed effects model** is used to identify the association between action units against the clinical outcomes pain, patient brain dysfunction status, patient acuity.
  - Developed **real-time facial AU detection** by running a trained **SWIN-Transformer** model using **ONNX** runtime in **NVIDIA Jetson Orin** developer kit.
- **Human Activity Recognition on Depth images collected in ICU:** Patient mobility assessment in ICU using computer vision algorithms. Trained a Faster-RCNN based model to perform patient posture detection in depth images collected in ICU. Used a YOLO v5 model to detect the number of people in each frame.
- **Intelligent ICU system architecture:** Lead a team of four engineers to develop data handling pipelines to manage and store confidential patient data and annotations. The pipelines automate the data transfer to a secure server, data curation, and data quality checks for multiple modalities of data collected in ICUs.

- **Physical activity recognition using accelerometry data:** Trained a hybrid CNN-LSTM on raw accelerometer data collected from 145 participants to recognize physical activity type. The model achieved an average F1-score of 0.86 on sedentary, locomotion, and lifestyle activities.
- **Ecological momentary assessment of pain with GPS data:** Strategized features and developed feature extraction code for a statistical temporal association between ecological momentary assessments of pain and GPS metrics in older adults. Integrated Google maps API into KNN algorithm to compute distance-based features from travel patterns of study participants.
- **Ultrasound image segmentation for guided anesthesia:** Developed a hybrid U-net architecture with residual connections to perform medical image segmentation on Ultrasound images of Brachial Plexus nerve for ultrasound-guided anesthesia application.

## Industry Experience

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### Software Development Engineer Dassault Systèmes, Pune, India

July 2013 – July 2016

- Implemented functionalities to coexist the data on multiple releases of the Software and to migrate the customer data to the latest releases.
- Achieved >80% code coverage on production code by implementing code functionality test cases.
- Developed data visualization dashboard for data migration summary, progress, and errors occurred.

## Education

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### Ph. D in Biomedical Engineering

University of Florida, Gainesville, FL

Aug 2018 – Dec 2023

### Master's degree in mechanical engineering

University of Florida, Gainesville, FL

Aug 2016 – May 2018

### Bachelor of Technology in Mechanical Engineering

National Institute of Technology, Rourkela

Aug 2009 – May 2013

## Teaching

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- **Artificial Intelligence/Machine learning Bootcamp – Master level, Instructor – Summer 2022**  
Introduction to python, machine learning, and data science
- **Student Science Training Program - High School level, Instructor – Summer 2022**  
Introduction to machine learning, Convolutional networks, and scikit-learn.
- **Computer Applications for Biomedical Engineering – Undergraduate level, Teaching Assistant – Fall 2020**  
Machine learning, Image processing, and Signal processing with MATLAB
- **Biomedical Data Science – Master level, Teaching Assistant – Fall 2019**  
Machine/Deep learning, Python, Pytorch, TensorFlow

## Professional Service

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IEEE Journal of Biomedical Health and Informatics - Reviewer 2021-2023

IEEE Connected Health Applications, Systems and Engineering Technologies - Reviewer 2022

IEEE Computers, Software & Applications in an Uncertain World - Reviewer 2022

## Publications

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Nerella, Subhash, Sabyasachi Bandyopadhyay, Jiaqing Zhang, Miguel Contreras, Scott Siegel, Aysegul Bumin, Brandon Silva et al. "Transformers in healthcare: A survey." *arXiv preprint arXiv:2307.00067* (2023). Nerella, Subhash, Kia Khezeli, Andrea Davidson, Patrick Tighe, Azra Bihorac, and Parisa Rashidi.

Nerella, Subhash, Ziyuan Guan, Andrea Davidson, Yuanfang Ren, Tezcan Baslanti, Brooke Armfield, Patrick Tighe, Azra Bihorac, and Parisa Rashidi. "Detecting Visual Cues in the Intensive Care Unit and Association with Patient Clinical Status." *arXiv preprint arXiv:2311.00565* (2023).

Nerella, Subhash, Kia Khezeli, Andrea Davidson, Patrick Tighe, Azra Bihorac, and Parisa Rashidi. "End-to-End Machine Learning Framework for Facial AU Detection in Intensive Care Units." *arXiv preprint arXiv:2211.06570* (2022).

Nerella, S., Cupka, J., Ruppert, M., Tighe, P., Bihorac, A., & Rashidi, P. (2021, July). Pain Action Unit Detection in Critically Ill Patients. In *2021 IEEE 45th Annual Computers, Software, and Applications Conference (COMPSAC)* (pp. 645-651). IEEE.

Subhash Nerella, Kevin Vega Gonzalez, Julie Cupka, Matthew Ruppert, Tyler Loftus, Azra Bihorac, Parisa Rashidi. *Sensors in Hospitals*. Elsevier 2022, ISBN 9780128012383, <https://doi.org/10.1016/B978-0-12-822548-6.00123-0>.

Subhash Nerella, Julie Cupka, Patrick Tighe, Azra Bihorac, Parisa Rashidi. Facial Action Unit Detection on Critically ill ICU Patients [abstract]. In *International Workshop on Applications of Medical AI (AMAI)*; September 18, 2022; Singapore: MICCAI; Abstract nr 37

Subhash Nerella, Ziyuan Guan, Azra Bihorac, Parisa Rashidi. Mobi-DiQ: A Pervasive Sensing System for Delirium Risk Assessment in Intensive Care Unit [abstract]. *International Conference on Pervasive Healthcare Systems and Technologies*; August 08-09, 2022; New York, United States: ICPHST 2022.

Miyatake, Mizuki, Subhash Nerella, David Simpson, Natalia Pawlowicz, Sarah Stern, Patrick Tighe, and Parisa Rashidi. "Automatic Ultrasound Image Segmentation of Supraclavicular Nerve Using Dilated U-Net Deep Learning Architecture." *arXiv preprint arXiv:2208.05050* (2022).

Mardini, M. T., Nerella, S., Kheirhahan, M., Ranka, S., Fillingim, R. B., Hu, Y., ... & Manini, T. M. (2021). The temporal relationship between ecological pain and life-space mobility in older adults with knee osteoarthritis: a smartwatch-based demonstration study. *JMIR mHealth and uHealth*, *9*(1), e19609.

Mardini, M. T., Nerella, S., Wanigatunga, A. A., Saldana, S., Casanova, R., & Manini, T. M. (2020). Deep CHORES: estimating hallmark measures of physical activity using deep learning. In *AMIA Annual Symposium Proceedings* (Vol. 2020, p. 803). American Medical Informatics Association.

Laborde, C. R., Cenko, E., Mardini, M. T., Nerella, S., Kheirhahan, M., Ranka, S., ... & Manini, T. (2021). Satisfaction, Usability, and Compliance With the Use of Smartwatches for Ecological Momentary Assessment of Knee Osteoarthritis Symptoms in Older Adults: Usability Study. *JMIR aging*, *4*(3), e24553.