H Pallab Jyoti Dutta

· AI Scientist, Ziroh Labs

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Objectives

- Highly motivated and organized researcher in the field of Computer Vision and Deep Learning with the intent to utilize the knowledge and skills in exploring solutions to AI challenges/problem statements.
- Passionate about investigating robust ways to address industry-related problems to fulfill organizational goals and hone research skills.

Education

Ph.D. *Jul 2018- Dec 2024*

Indian Institute of Technology, Guwahati

- CPI: 8.5 (course work CPI).
- Research Topic: **Hand Gesture Detection and Recognition for Gesture-based Patient Rehabilitation and Assistance Systems.**

M.Tech. *Jul 2016-Jun 2018*

Gauhati University, Guwahati

- CGPA: 9.03
- M.Tech. Project: **Automatic Segmentation of different retinal layers in an OCT image for disease analysis.**

Bachelor of Engineering (B.E.) *Jul 2012-Jun 2016*

Jorhat Institute of Science and Technology, Jorhat

- Percentage: 85.04%.

Higher Secondary (H.S./ 12th standard) *2010-2012*

Salt Brook Academy, Dibrugarh

- Percentage: 87.6%.

High School Leaving Certificate (H.S.L.C./ 10th standard) *2010*

Don Bosco High School, Jorhat

- Percentage: 87%.

Skills and Recognition

- **Python, PyTorch, Keras, Tensorflow, Pandas, Scikit-learn, Matplotlib, Huggingface, OpenCV, Matlab, Latex, HTML, CSS, GIT, and GitHub.**
- Awarded Scholarship for Ph.D. by MoE, Govt. of India.
- Developed a virtual convocation platform for 22nd Convocation of IIT Guwahati. LINK1, LINK2

Work Experience

AI Scientist *Jul 2024 - Present*

Ziroh Labs, Bengaluru

- **Role**: Develop a platform for inference, fine-tuning, and distillation of large language models (LLMs) optimized for CPU execution without relying on GPUs.
- **Product Name**: Kompact.AI LINK1, LINK2, LINK3, LINK3
- **Models (text-based) implemented**: Llama 2, Llama 3, Phi 3, Qwen 2.5, Deepseek v3, Deepseek R1 distilled Llama 8B, Mistral, BERT, RoBERTa, ModernBERT, and T5.

Research Intern *Aug 2021 - Oct 2021*

Kaliber.ai, Guwahati

- **Role**: Processing and classifying Knee Arthoscopy videos.

Research Scholar *Jul 2018 - Dec 2024*

Dept. of EEE, IIT Guwahati

- **Novel Hand Segmentation Architectures**: Developed state-of-the-art deep neural models for hand segmentation in images, incorporating a novel loss function that enhanced accuracy and robustness in diverse scenarios.
- **Efficient Attention Mechanisms**: Proposed an attention mechanism that linearized the quadratic dependencies of the self-attention mechanism on the spatial dimensions of feature maps, improving computational efficiency without compromising accuracy
- **Simultaneous Localization and Classification**: Integrated detection transformers for the first time in hand gesture recognition, enabling simultaneous localization and classification of hand gestures in images.
- **Multiscale Keypoint Detection**: Proposed a multiscale hand keypoint detection method that, when combined with gesture detection, facilitated the development of interfaces for vision-based hand rehabilitation and patient assistance systems. These systems enabled seamless communication with medical staff and supported users in recovery and daily interactions.

* Research Interests include **Hand Gesture Recognition, Object Detection, Deep Neural Networks, Image processing, Natural Language Processing, Large Language Models**, and **HCI applications**.

* Experience of working with deep neural models like **VGG16, ResNet**, etc. for recognition, **YOLOv3, RetinaNet, Transformers** for detection, **UNET, TransUNET, Attention UNET, Recurrent Residual UNET, Deeplabv3**, etc. for segmentation, **encoder-decoder network based on ResNeXT** for depth estimation.

Publications

- **H. P. J. Dutta**, M. K. Bhuyan, D. R. Neog, K. F. MacDorman and R. H. Laskar, "Patient Assistance System Based on Hand Gesture Recognition," in IEEE Transactions on Instrumentation and Measurement, vol. 72, pp. 1-13, 2023, Art no. 5018013, doi: 10.1109/TIM.2023.3282655.
- **H. P. J. Dutta**, M. K. Bhuyan, D. R. Neog, K. F. MacDorman and R. H. Laskar, "A Hand Gesture-operated System for Rehabilitation using an End-to-End Detection Framework," in IEEE Transactions on Artificial Intelligence, vol. 5, no. 2, pp. 698-708, Feb. 2024, doi: 10.1109/TAI.2023.3251309.
- **H. P. J. Dutta**, M. K. Bhuyan, D. R. Neog, K. F. MacDorman and R. H. Laskar, "Efficient hand segmentation for rehabilitation tasks using a convolution neural network with attention," in Expert Systems with Applications, Elsevier, vol. 234, 121046, 2023, doi: doi.org/10.1016/j.eswa.2023.121046.
- **H. P. J. Dutta**, M. K. Bhuyan, R. K. Karsh, S. Alfarhood and M. Safran, "Multiscale Attention-based Hand Keypoint Detection," in IEEE Transactions on Instrumentation and Measurement, vol. 73, pp. 1-11, 2024, Art no. 5022811, doi: 10.1109/TIM.2024.3413196.
- **H. P. J. Dutta** and M. K. Bhuyan, "Attention-Based 2-D Hand Keypoints Localization," in IEEE Sensors Letters, vol. 8, no. 9, pp. 1-4, Sept. 2024, Art no. 6011104, doi: 10.1109/LSENS.2024.3443072.
- D. Sarma, **H. P. J. Dutta**, K.S. Yadav et al. "Attention-based hand semantic segmentation and gesture recognition using deep networks," Evolving Systems, 15, pp. 185–201, 2023, doi: https://doi.org/10.1007/s12530-023-09512-1
- **H. P. J. Dutta**, D. Sarma, M. K. Bhuyan and R. H. Laskar, "Semantic Segmentation based Hand Gesture Recognition using Deep Neural Networks," 2020 National Conference on Communications (NCC), 2020, pp. 1-6, doi: 10.1109/NCC48643.2020.9055990.
- S. Sharma, **H. P. J. Dutta**, M. K. Bhuyan and R. H. Laskar, "Hand Gesture Localization and Classification by Deep Neural Network for Online Text Entry," 2020 IEEE Applied Signal Processing Conference (ASPCON), 2020, pp. 298-302, doi: 10.1109/ASPCON49795.2020.9276713.
- **H. P. J. Dutta**, D. R. Neog, B. M. K., M. Das and L. R. H., "Two-Stage Hand Gesture Recognition based on Hand Keypoints Localization," 2022 International Conference on Wireless Communications Signal Processing and Networking (WiSPNET), Chennai, India, 2022, pp. 110-114, doi: 10.1109/WiSPNET54241.2022.9767161.
- **H. P. J. Dutta**, K. Manivas, M. Bhuyan and M. K. Bhuyan, "An End-to-end Anchorless Approach to Recognize Hand Gestures using CenterNet," 2023 IEEE International Conference on Industry 4.0, Artificial Intelligence, and Communications Technology (IAICT), BALI, Indonesia, 2023, pp. 1-6, doi: 10.1109/IAICT59002.2023.10205726.

For the complete publication list, please refer to Google Scholar.

Professional Activities

- Speaker/Resource person of a workshop session on "**Deep Learning based biomedical systems: Design Challenges and Future Directions**" organized by **IIT Patna** in December 2022.
- Speaker/Resource person of a workshop session on "**Machine Learning and Deep Learning Techniques with Applications**" organized by **IIT Guwahati** in January 2023.
- Speaker/Resource person of a workshop session on "**AI in healthcare**" organized by **Cotton University** in June 2023.
- Speaker/Resource person of a Summer School session on "**Machine Learning and Deep Learning**" organized by **IIT Guwahati** in July 2023.
- Speaker/Resource person of a Summer Internship session on "**Python Programming for Biomedical Image Processing and Research**" organized by **Gauhati University** in July 2023.
- TA to the **NPTEL course** "**Computer Vision and Image Processing - Fundamentals and Applications**" during the January-April session for the years 2021, 2022, and 2023.
- TA to the **NPTEL course** "**Machine Learning and Deep Learning - Fundamentals and Applications**" during the July-October session for the year 2023. Also, **delivered two lectures** for the course. Lec1, Lec2

Extracurricular Activity

- Coordinator of the magazine committee of the techno-cultural festival of Jorhat Institute of Science and Technology.
- One of the executive members of the RSF-EEE team (2021-2022).
- Hobbies: Badminton, Guitar
- Participated in sports like Relay race, Long jump, Basketball, etc. in intra-departmental annual sports activity at the University.
- Secured second place in an intra-department badminton competition organized by RSF-EEE (a research scholar forum of IIT Guwahati). Also, represented the Department of Electronics and Electrical Engineering badminton team in inter-department research scholars' badminton tournament.