ACADEMIC PROFILE
of
Dr. Anup Nandy (JSPS Fellow)

Machine Intelligence and Robotics Laboratory
Research Laboratory: https://mibmnit.in/

Current Affiliation

Dr. Anup Nandy is working as an Associate Professor in Department of Computer Science and Engineering at the National Institute of Technology (NIT), Rourkela, Sundargarh, Odisha-769008, India.

1. Name and full correspondence address: Dr. Anup Nandy, Associate Professor Department of Computer Science and Engineering National Institute of Technology Rourkela, Odisha, PIN- 769 008.

2. E-mail (s) and contact number(s) : nandya@nitrkl.ac.in, nandy.anup@gmail.com
Telephone: +91- 0661-2462370
3. Institute: National Institute of Technology Rourkela
4. Date of Birth: January 14, 1981
5. Gender: Male
6. Category: GEN

7. Academic Qualifications (Undergraduate onwards)

Sl. No.	Degree	Year	Subjects	University/ Institute	Percentage
1	B.Tech	2005	Computer Science and Engineering	West Bengal University of Technology	7.5 (CGPA)
2	M.Tech.	2010	Information Technology	IIIT-Allahabad	9.1 (CGPA)
3	Ph.D.	2016	Information Technology	IIIT-Allahabad	10.0 (CGPA) course work

8. Ph.D Thesis Title : Human Gait Analysis: A Solution for Biometric Identification
Guide Name: Dr. Pavan Chakraborty
Institute: Indian Institute of Information Technology Allahabad
Year of Award: 2016 (April)

9. Work Experience

Sl. No.	Position held	Name of the Institute	From	To	Pay Scale
1	Project Associate	IIIT-Allahabad	March, 2006	July, 2008	10000 (Fixed)
2	Assistant Professor	Lovely Professional University, Punjab.	July, 2010	July, 2011	(15600-39100)
3	Assistant Professor	NIT Rourkela	July, 2015	February 2018	PB 3(15600-39100+AGP 6000/-)
4	Assistant Professor (Gr. II)	NIT Rourkela	February 2018	February 2020	Level 11
5	Assistant Professor (Gr. I)	NIT Rourkela	February 13, 2020	June 30, 2024	Level 12
6	Associate Professor	NIT Rourkela	July 01, 2024	Continue	Level 13A2

10. Professional Recognition /Award/Prize/Certificate, Fellowship received by the applicant

- Nominated candidate for MHRD, Govt. of India, External Fellowship (Japanese Government Scholarship) **MONBUKAGAKUSHO: MEXT** in 2011 as a research student.
- Received MHRD (**Govt. of India**) GATE Scholarship for M.Tech, from July 2008 to June 2010.
- Received MHRD (**Govt. of India**) Scholarship for Ph. D from November 2011 to July 2015.
- Secured **First Rank of** our batch in M.Tech (Robotics) 2008-2010.
- Secured **2'nd winning team** in the **AI-POD** competition held in Effervescence' 2009 at IIIT-Allahabad.
- Received **Young Scientist Award** from Science and Engineering Research Board (SERB), Department of Science and Technology, Govt. of India in 2017.
- Received **NVIDIA GPU Grant** Award in 2018.
- Received **Research Grant** for Indo-Japan Project in 2017
- Received **Research Grant** for India-Korea Project in 2021.
- Received Grant from MHRD for conducting GIAN Course

- Nominated Wait Listed candidate for **ERCIM Alain Bensoussan Fellowship** for doing Postdoc at NTNU, Norway in November 2019 (2nd Call)
- Received **"Very Good"** Grade Award from **SERB, Govt. of India** based on research performance during review meeting held at IIT Madras in early March 2020.
- Selected as **Indian Young Scientist** by Govt. of India, for participating in 5th **BRICS Conclave at Russia** from Sept 21-25, 2020 in the thematic area of **Artificial Intelligence** (Virtual Mode).
- Invited as Speaker at TEDXNIT Rourkela in the Theme: "Learning from the Past" on March 13, 2021.
- Selected to receive prestigious **Japan Society for the Promotion of Science (JSPS)** invitational fellowship 2022 for short term research visit to Waseda University, Japan from May 17-July 15, 2022.
- Elevated to **IEEE Senior Member** in February 2022 with membership Id: 92653123.

11. List of Ongoing/Completed Sponsored Projects:

- Robot-Assisted Automated Monitoring and Behavioural Intervention System for Children with Autism Spectrum Disorder: Funding Agency: SERB **(CRG Grant), Govt. of India**: Duration: January 2022- January 2025: Amount: 30.14L. **[Role: Principal Investigator]**
- Digital Mental Healthcare for Older Adults Via Visually-Induced Hippocampal Activation Therapy: Funding Agency: DST (International Division: **Indo-Korea**): Duration: February 2021- February 2024: Amount: 28.17L. **[Role: Principal Investigator]**
- Human Cognitive State Estimation through Multi-modal Gait Analysis: Funding Agency: **SERB, Govt. of India**: Duration: July 2017- October 2020: Amount: 20.37L. **[Role: Principal Investigator]**
- Development of a Pathological Healthcare System for Early Detection of Neurological Gait Abnormalities: Funding Agency: DST (International Division: **Indo-Japan**): Duration: October 2017- October 2019: Amount: 6.0L **[Role: Principal Investigator].**
- Design and Development of E-learning Platform for Assisting Underprivileged (SC/ST) School Students in Rourkela Region, Odisha by Converging Cable TV Network and Broadband Technology. Funding Agency: MeitY; Duration: June 2020-June 2023; Amount: 38.80L. **[Role: Co-Principal Investigator].**
- Modelling and Simulation of Big Data in Gait Analysis for Detection of Bio-mechanical Abnormalities for Healthcare Applications funded by Technical Education Quality Improvement Programme-III (TEQIP-III), NIT Rourkela. [January 2020 - September 2020] **[Role: Principal Investigator]**

- Integrated Information System for Agriculture Monitoring and Crop Insurance, funded by ISRO, Govt. of India, from January 2022 – January 2024. **[Role: Co-Investigator]**

- Development of AI-controlled Robotic Arm for Sketching Human Faces in Real Time, funded by Ministry of Electronics and Information Technology under Visveswaraya PhD Scheme, from 2023 – 2028 (5 years). **[Role: Principal Investigator].**

- Development of Artificial Intelligence-based Assistive Tool for Assessment of Orthotic Device, funded by DRDO, Govt. of India. Amount: 24.78 L, Duration: 2 years, **[Role: Principal Investigator].**

- Design and Development of Computer based Intervention Model for Enhancing Numerical Cognition of Pupils to Cope with Mathematics Curricula in Primary School, funded by DST, Govt. of India. Amount: 46,80,000/. Durations: 3 years. **[Role: Co-Investigator].**

12. **International Collaboration**

- Prof. Gentiane Venture, Distinguished Professor in Tokyo University of Agriculture and Technology (TUAT) Japan and The University of Tokyo, Japan. [Through India-Japan Bilateral research funded by DST – JSPS]
- Prof. Katsumi Watanabe, Cognitive Science Laboratory, Waseda University, Japan [Through JSPS Fellowship Programme].
- Prof. Sang Ah Lee, Developmental Cognitive Neuroscience Laboratory at Seoul National University, South Korea. [Through India-Korea Bilateral research funded by DST-Ministry of Science and ICT of the Republic of Korea]
- Prof. Trisha Kesar, Department of Rehabilitation Medicine, Emory University, Atlanta, GA, USA [Through Global Initiative of Academic Networks (GIAN) funded by MHRD, Govt. of India]
- Prof. Rainer Bader, Research laboratory for biomechanics and implant technology, Rostock University, Germany. [Through submission of DST-DFG research proposal in IRTG]
- Prof. Dr. Astrid Zech, Department of Human Movement Science and Exercise Physiology, Friedrich Schiller University Jena, Germany [Through submission of DST-DAAD bilateral project].

13. Publications List

2024

1) Sunanda, A. Balmik, and **A. Nandy**, “A novel feature fusion technique for robust hand gesture recognition”, in Multimedia Tools and Applications, Springer, vol. 83, pp. 65815–6583, 2024.

2). S. Biswas, **A. Nandy**, AK. Naskar, R. Saw, “Real time Gesture Recognition using Improved YOLOv5 Model”, in 11th IEEE International Conference on Signal Processing and Integrated Networks (SPIN), pp. 328-333, 2024.

3) M. Ghosh, **A. Nandy**, B. K. Patra, R. Anitha, K. Mohanavelu, “A Comprehensive Gait Abnormality Classification using Deep Neural Network” submitted in The IEEE Region 10 Symposium (TENSYMP), 2024 (**Status: Accepted**).

2023

1) S. Chakraborty, N. Thomas and **A. Nandy**, “Gait Event Prediction of People with Cerebral Palsy using Feature Uncertainty: A Low-Cost Approach” in 25th ACM International Conference on Multimodal Interaction (ICMI 2023), Sorbonne University, Campus Pierre & Marie Curie from October 9-13, 2023 (Accepted). **[CORE Ranking: B]**

2). S. Chakraborty, S. Sambhavi, P. Panda and **A. Nandy**, “An Ensemble Model for Gait Classification in Children and Adolescent with Cerebral Palsy: A Low-Cost Approach”, in Soft Computing for Problem Solving: Proceedings of the SocProS 2022, pp. 73-83, 2023.

3) A. Balmik, S. Bharti and **A. Nandy**, “Novel Error Correction-based Key Frame Extraction Technique for Dynamic Hand Gesture Recognition”, in Neural Computing & Applications, Springer, pp. 1-16, 2023. **[IF: 6.0].**

4) A. Balmik, S. Barik, and **A. Nandy**, “A Robust Object Recognition Using Modified YOLOv5 Neural Network”, in 10th International Conference on Signal Processing and Integrated Networks (SPIN), pp. 462-467, 2023.

5) A. Balmik, S. Barik, M. Jha and **A. Nandy**, “A vision-based litter detection and classification using SSD MobileNetv2”, in 10th International Conference on Signal Processing and Integrated Networks (SPIN), pp. 180-185, 2023.

6). M. Mahapatra, TA. Barbhuiya and **A. Nandy**, “Autoencoder-Based Deep Neural Architecture for Epileptic Seizures Classification”, in Soft Computing for Problem Solving: Proceedings of the SocProS 2022, pp. 109-119, 2023.

7). S. Biswas, A. Nandy and A. Naskar, “Object Detection with YOLO Model on NAO Humanoid Robot”; in 10th International Conference on Pattern Recognition and Machine Intelligence (**PReMI2023**), **ISI Kolkata**, December 12-15, 2023 (**Accepted**).

8). S. Chakraborty, M. Mahapatra, and A. Nandy, “Semi-supervised Video Object Segmentation Using Parallel Coattention Network”; in 10th International Conference on Pattern Recognition and Machine Intelligence (**PReMI2023**), **ISI Kolkata**, December 12-15, 2023 (**Accepted**).

9). S. Biswas, A. Nandy, A. Naskar and R. Saw, “MediaPipe with LSTM Architecture for Real-Time Hand Gesture Recognization”; in 8th International Conference on Computer Vision and Image Processing (**CVIP-2023**), **IIT Jammu**, November 03-05, 2023 (**Accepted**).

10). S.E.Park, M. Mahapatra, S. Chakraborty, A. Nandy, S. A. Lee “Age-related disruption in landmark utilization during spatial navigation is associated with a flattened 1/f spectral slope in scalp EEG”, in The 26th Annual Meeting of the Korean Society for Brain and Neural Sciences (KSBNS), 2023. (Accepted).

11) S. Chakrabarti, M. Mahapatra, and A. Nandy, “A Novel Hybrid Deep Learning Approach for Classification of Cognitive States Using EEG Signals”; in 20th India Council International Conference (INDICON) - 2023, December 14-17, 2023 (**Accepted**).

2022

1.) J. Chakraborty, S. Upadhyay, A. Nandy, “Musculoskeletal Injury Recovery Assessment using Gait Analysis with Ground Reaction Force Sensor,” in Medical Engineering & Physics, Elsevier, vol. 103, pp. 103788, May 2022.

2.) S. Hazra, A. A. Pratap and A. Nandy, "A Novel Probabilistic Network Model for Estimating Cognitive-Gait Connection using Multi-Modal Interface," in **IEEE Transactions on Cognitive and Developmental Systems**, 2022, doi: 10.1109/TCDS.2022.3222087.

3) A . Balmik, A. Paikaray, M. Jha, and A. Nandy,” Motion recognition using deep convolutional neural network for Kinect-based NAO teleoperation”, **Robotica**, vol. 40, issue 9, pp. 3233-3253, 2022. doi:10.1017/S0263574722000169.

4) A. Balmik, M. Jha, A. Nandy, “NAO Robot Teleoperation with Human Motion Recognition”, in Arabian Journal for Science and Engineering, Springer, August, pp. 1137-1146, vol. 47, issue 2, 2022.

5) S. Hazra, M. Pisipati, A. Puhan, A. Nandy, R. Scherer, “Two Novel Methods for Multiple Kinect v2 Sensor Calibration”, in International Conference on Computer Vision and Image Processing, pp. 403-414, 2022.

2021

1.) S. Hazra, A. A. Pratap, D. Tripathy, A. Nandy, “Novel data fusion strategy for human gait analysis using multiple kinect sensors,” in Biomedical Signal Processing and Control, Elsevier, vol. 67, pp. 102512, May 2021.

2.) S. Hazra, A. A. Pratap, O. Agrawal, A. Nandy, “On Effective Cognitive State Classification Using Novel Feature Extraction Strategies" in Cognitive Neurodynamics, Springer, pp. 1-31, June, 2021.

3.) S. Hazra, S. Dutta, A. Nandy, “A Study On Understanding Cognitive States Through Gait Analysis” in Cognitive Systems Research, Elsevier, vol. 69, pp. 41-49, October, 2021.

4.) S. Chakraborty, S. Jain, A. Nandy, G. Venture, "Pathological Gait Detection Based on Multiple Regression Models Using Unobtrusive Sensing Technology", In Journal of Signal Processing Systems, Springer, vol. 93, pp. 1-10, 2021.

5.) A. Balmik, A. Kumar, A. Nandy, “Efficient Face Recognition System for Education Sectors in COVID-19 Pandemic”, in 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), IIT Kharagpur, pp.1-8, 2021.

6.) J. Chakraborty, H. S. Dabbiru, A. Nandy, “Speed Invariant Gait Event Identification using Dynamic Time Warping”, in 18th India Council International Conference (INDICON), pp.1-6, 2021.

7.) M. Pisipati and A. Nandy, “Human Emotion Recognition using EEG Signal in Music Listening”, in 18th India Council International Conference (INDICON), pp.1-6, 2021.

2020

1.) S. Chakraborty and **A. Nandy**, "Automatic Diagnosis of Cerebral Palsy Gait Using Computational Intelligence Techniques: A Low-Cost Multi-Sensor Approach," in **IEEE Transactions on Neural Systems and Rehabilitation Engineering**, vol. 28, no. 11, pp. 2488-2496, Nov. 2020.

2.) J. Chakraborty, **A. Nandy**, "Discrete wavelet transform based data representation in deep neural network for gait abnormality detection", in Biomedical Signal Processing and Control, Elsevier, vol. 62: 102076, September 2020.

3.) S. Chakraborty, T. Yamaguchi, **A. Nandy**, V. Bonnet, G. Venture, “Accuracy of image data stream of a markerless motion capture system in determining the local dynamic stability and joint kinematics of human gait”, in Journal of Biomechanics, Elsevier, vol. 104, pp. 109718 , 2020

4). S. Chakraborty, S. Jain, **A. Nandy**, G. Venture, "Pathological Gait Detection Based on Multiple Regression Models Using Unobtrusive Sensing Technology", In Journal of Signal Processing Systems, Springer, pp. 1-10, 2020

5.) S. Chakraborty, **A. Nandy** and T. Kesar, " Gait Deficits and Dynamic Stability in Children and Adolescents with Cerebral Palsy: A Systematic Review and Meta-analysis" In Clinical Biomechanics, Elsevier, vol. 71, pp.11-23, 2020

6.) S. Dutta and **A. Nandy**, "An Extensive Analysis on Deep Neural Architecture for Classification of Subject-Independent Cognitive States", in 7th ACM IKDD CoDS and 25th COMAD, ISB, Hyderabad, India, pp. 180-184, 5-7 January 2020.

7.) S. Hazra, P. Roy, **A. Nandy** and R. Scherer, "A Pilot Study for Investigating Gait Signatures in Multi-Scenario Applications," in the proceedings of International Joint Conference on Neural Networks (IJCNN), Glasgow, United Kingdom, 2020, pp. 1-10 **[CORE Ranking: A]**

8.) S. Chakraborty, N. Thomas and A. Nandy, "Gait Abnormality Detection in People with Cerebral Palsy using an Uncertainty-based State-space Model" in 20th International Conference on Computational Science, ICCS-2020, 3-5 June, 2020, Amsterdam, Netherlands, pp 536-549.

9.) G. Kumari, J. Chakraborty and A. Nandy, "Effect of Reduced Dimensionality on Deep learning for Human Activity Recognition," in the proceedings of 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT), IIT Kharagpur, India, 2020, pp. 1-7

10.) S. Dutta, S. Hazra and A. Nandy, "A Smart Ambulatory Cognitive State Taxonomy System Through EEG Signal Analysis," in the proceedings of 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT), IIT Kharagpur, India, 2020, pp. 1-7

11.) S. Chakraborty and A. Nandy, "An Unsupervised Approach For Gait Phase Detection," in the proceedings of 4th International Conference on Computational Intelligence and Networks (CINE), Kolkata, India, 2020, pp. 1-5.

12) Letter to editor: Reply to Dr. Sina Mehdizadeh: S. Chakraborty, T. Yamaguchi, A. Nandy, V. Bonnet, G. Venture, "Accuracy of image data stream of a markerless motion capture system in determining the local dynamic stability and joint kinematics of human gait", in Journal of Biomechanics, Elsevier, vol. 105, pp. 109812, 2020.

2019

1.) S. Chakraborty, and **A. Nandy**, " UNSUPERVISED APPROACH FOR GAIT PHASE DETECTION" In 4th International on International Conference on Computational Intelligence and Networks (CINE 2020) 27-29 February, 2020. Indian Statistical Institute, Kolkata, India (Accepted).

2.) S. Chakraborty, R. Mishra, A. Dwivedi, T. Das, and **A. Nandy**, " A Low-Cost Pathological Gait Detection System in Multi-Kinect Environment," In 20th International

Symposium on Optomechatronic Technologies (ISOT 2019) from November 11 - 13, 2019, Goa, India (Accepted)

3.) S. Dutta, and **A. Nandy**, "Data Augmentation For Ambulatory EEG Based Cognitive State Taxonomy System With RNN-LSTM" in 39th SGAI International Conference on Artificial Intelligence (SGAI-2019), Cambridge, England, pp. 468-473, December, 2019 .

4.) J. Chakraborty and **A. Nandy**, "Periodicity Detection of Quasi-periodic Slow-speed Gait Signal using IMU sensor", In 21st International Conference on Human Computer Interaction, **HCII-2019, Florida, USA**, pp. 140-152 , 2019.

5.) S. Dutta, S. Hazra, **A. Nandy**, "Human Cognitive State Classification through Ambulatory EEG Signal Analysis". 18th International Conference on Artificial Intelligence and Soft Computing (ICAISC-2019), pp. 169-181, Zakopane, Poland, June 2019. **[Ranking: CORE 'C'].**

6.) **A. Nandy**, "Statistical methods for analysis of Parkinson's disease gait pattern and classification" in Multimedia Tools and Applications, Springer, vol. 78, no. 14, pp. 19697–19734, 2019. (Impact Factor: 2.101)

2018

1) S. Chattopadhyay and **A. Nandy**, ``Human Gait Modelling Using Hidden Markov Model For Abnormality Detection," in Proceedings of the 2018 IEEE Region 10 Conference TENCON-2018, October 28-31, pp. 0623-0628, 2018. **[Ranking: CORE 'C'].**

2) S. Chakraborty, D. Mondal, **A. Nandy**, "A Study on Human Gait Kinematic Validation in Multi-Kinect v2 Environment", In in Proceedings of the 2018 IEEE Conference INDICON-2018, December 16-18, 2018. (**In Press**).

3) S. Chakraborty and **A. Nandy**, "Comparison of Local Dynamic Stability of Treadmill Gait Data in Three Different Planes through Maximal Lyapunov Exponent", In International Conference on Computing, Power and Communication Technologies (GUCON), pp. 96-100, 2018.

2017

1) **A. Nandy**, P. Chakraborty, "A study on human gait dynamics: Modeling and Simulation on OpenSim Platform", vol. 76, pp. 21365-21400, *Multimedia Tools and Applications*, Springer, 2017. **(Impact Factor: 2.101)**

2016

1) A. Nandy, R. Chakraborty, P. Chakraborty, "Cloth invariant gait recognition using pooled segmented statistical features", vol.191, pp. 117-140, ***Neurocomputing*, Elsevier**, 2016. **(Impact Factor: 4.072)**

2) A. Nandy, A. Pathak, P. Chakraborty, "A study on gait entropy image analysis for clothing invariant human identification", *Multimedia Tools and Applications*, Springer, 2016. **(Impact Factor: 2.101).**

14. Detail of patents (NA)

- Software Copyright: **A. Nandy**, S. Chakraborty, N. Thomas, G. Venture, "A Pathological Gait Detection Tool for Healthcare Application" has been granted with Diary No: 13384/2021-CO/SW, Dated: 11/10/2021
- Software Copyright: **A. Nandy**, J. Chakraborty, "VizGaitAssist: A visualization based assistive tool for clinical human gait analysis" has been granted with Diary No: 8453/2020-CO/SW, Dated: 01/09/2020.

15. Books/Reports/Chapter/General Articles etc.

Authored Book

A. Nandy, S. Chakraborty, J. Chakraborty, G. Venture, "Modern Methods for Affordable Clinical Gait Analysis: Theories and Applications in Healthcare Systems", Academic Press, 2021. https://doi.org/10.1016/C2020-0-02456-4

Edited Book Chapters

- J. Chakraborty and **A. Nandy**, "A Cost-effective Clinical Gait Analysis using Inertial Sensors for Healthcare Applications", in the Book of "Artificial Intelligence and Big Data in Resources Poor Healthcare Systems" **Springer Nature Boo**k series, 2020.

- S. Hazra, **A. Nandy** and S. Dutta, "An Innovative Cognitive State Measurement System through Multi-modal Interface using Machine Learning Techniques," in the Book of "Artificial Intelligence and Big Data in Resources Poor Healthcare Systems" **Springer Nature Boo**k series, 2020.

- S. Hazra, **A. Nandy**, "Biometric Gait Features Analysis using Deep Learning Approaches," in the Book of Deep Learning for Biomedical Applications, CRC Press Publisher, Taylor & Francis Group, 2020.

- S. Chakraborty, **A. Nandy**, "Deep Learning in Gait Abnormality Detection: Principles and Illustrations," in the Book of "Deep Learning for Biomedical Applications", CRC Press Publisher, Taylor & Francis Group, 2020.

- S. Chakraborty, **A. Nandy**, "Deep Learning Techniques for Clinical Gait Analysis", in the Book of "Handbook of Research on Engineering, Business and Healthcare Applications of Data Science and Analytics", IGI GLOBAL, 2020

Research Interest

- Machine Learning
- Artificial Intelligence

- Robotics
- Human Cognition

Teaching @NIT Rourkela [Last Three Years]

- **UG Course:** Data Structure and Algorithm, Discrete Structure, Artificial Intelligence.
- **PG Course:** Machine Learning, Artificial Intelligence

Research Activity @ NIT Rourkela

Ph.D. Supervised: 5

- Title: Effective Clinical Gait Analysis using Supervised Learning Techniques (2021)
- Title: Quantitative Analysis of Gait Disorder using Machine Learning Techniques *(2022.)*
- Title: Cognitive State Classification using Multi-modal Features (2023).
- Title: Vehicular Mobility Analysis Leveraging Historical Spatio-Temporal Data (2024).
- Title: Human Robot Interaction with Motion-based Imitation Mechanism (2024).

Currently Supervising 06 Ph.D. Students.

Administrative Experience @NIT Rourkela

- **Professor-In-Charge** (July 2020 – June 2023), Career Development Centre (Formerly known as Training & Placement Centre)
- Professor-In-Charge (July 2023 – till date) in Centre for Artificial Intelligence and Robotics
- Member of Intellectual Property Innovation Centre (August 2022- till date).
- Member of Pradhan Mantri Kaushal Vikas Yojana (PMKVY 4.0) for Skill development programme in NIT Rourkela (24/02/2023 – Continue)