RAJU PAL, Ph.D.

Computer Vision · Machine Learning
Artificial Intelligence · Data Analytics
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Objective

Seeking a challenging position in a reputed organization with an opportunity to use academic and practical skills and contribute positively to the organization's professional development, with a focus on advancing the fields of Artificial Intelligence and Machine Learning.

Research Projects

Science and Engineering Research Board (SERB), India *Rs. 28,18,178/-*

- *Design and Development of a Cognitive System for Leukocytes Identification in Hematoxylin and Eosin Stained Rat Skin Images.* ***Co-Principal Investigator*** *March, 2017 – 2020*
  - Worked on automating the identification of leukocytes which includes three phases, namely classification of leukocyte images, segmentation of leukocytes, and quantification of the identified leukocytes.

Alpha Design Technologies Pvt Ltd., New Delhi

- *Real-time Objection-Detection Through UAV to cater army operations in War-like Scenarios. Mar., 2022 – Aug.,2022* ***Computer Vision Consultant***
  - Worked on design, development, and testing of an object detection model that run on Nvidia jetson-enabled UAV catered to army operations during war-like scenarios.

Work Experience

- **Assistant Professor** Feb., 2024 - Current
  Gautam Buddha University *Greater Noida, India*
- **Global Professor of the Practice** Jun., 2024 - Current
  Golden Gate University *San Francisco, United States*
- **Assistant Professor (Sr. Grade)** Jan., 2020 - Feb. 2024
  Jaypee Institute of Information Technology *Noida, India*
- **Assistant Professor (Grade-II)** April, 2015 - Dec, 2019
  Jaypee Institute of Information Technology *Noida, India*
- **Assistant Professor (Grade-I)** Feb., 2013 - March, 2015
  Jaypee Institute of Information Technology *Noida, India*

Honors and Awards

- Mentor at Smart India Hackathon 2024 Grand Finale
- Received Wipro Certified Faculty award under Digital skills readiness program conducted by wipro for Java full stack development in Feb. 2023.
- Awarded Grade A in Task Based Training during Oct. 1, 2018 to Jan. 10, 2019 conducted as a part of Teacher Training through the eLSI organized by Dept. of CSE, IIT Bombay.
- Served as a Judge in Toycathon, 2021
- Served as an Technical Program committee member of various international conferences

List of Publication

JOURNALS

- Roop Singh, **Raju Pal**, Deepak joshi *"Optimal frame selection-based watermarking using a meta-heuristic algorithm for securing video content"*, Computers and Electrical Engineering, Elsevier , Vol 121, Jan. 2025 *(IF: 4.0, SCIE)*
- Roop Singh, **Raju Pal**, Himanshu Mittal, Deepak joshi *"Multi-objective optimization-based medical image watermarking scheme for securing patient records"*, Computers and Electrical Engineering, Elsevier , Vol 118, Part A, Aug. 2024 *(IF: 4.0, SCIE)*
- **Raju Pal**, Mukesh Saraswat, Sandeep Kumar, Anand Nayyar, and Pushpendra Kumar Rajput, *"Energy efficient multi-criterion binary grey wolf optimizer based clustering for heterogeneous wireless sensor networks"*, Soft Computing, Springer, Oct., 2023. *(IF: 4.1, SCIE)*
- **Raju Pal**, Mukesh Saraswat, and Himanshu Mittal, *"Improved Bag-of-Features using Grey Relational Analysis for Classification of Histology Images"*, Complex & Intelligent Systems, Springer, Vol. 7, pp. 1429–1443, 2021. *(IF: 4.92, SCIE)*
- **Raju Pal** Subash Yadav, Rishabh Karnwal, and Aarti, *"EEWC: Energy Efficient weighted clustering method based on genetic algorithm for HWSNs"*, Complex & Intelligent Systems, Volume 6, Issue, 2, pp. 391-400, Mar., 2020. *(IF: 4.92, SCIE)*
- **Raju Pal** and Mukesh Saraswat, *"Histopathological image classification using enhanced bag-of-feature with spiral biogeography-based optimization"*, Applied Intelligence, Volume 49, Issue 9, pp 3406–3424, 11 April, 2019. *(IF: 5.086, SCIE)*
- **Raju Pal** Ashish Kumar Tripathi, Avinash Chandra Pandey, Mohammad Ayoub Khan, Varun G Menon, Himanshu Mittal, *"A N2CNN-Based Anomaly Detection Method for Cardiovascular Data in Cyber-Physical System"*, IEEE Transactions on Network Science and Engineering, pp. 1-10, July, 2022. *(IF: 5.033, SCI)*
- Avinash Chandra Pandey, Ankur Kulhari, Himanshu Mittal, Ashish Kumar Tripathi, Raju Pal, **Raju Pal**, *"Improved exponential cuckoo search method for sentiment analysis"*, Multimedia Tools and Applications, Vol 82, Issue 16, pp. 23979-24029, Springer, July. 2023. *(IF: 2.75, SCIE)*
- Roop Singh, Himanshu Mittal, and **Raju Pal**, *"Optimal keyframe selection-based lossless video-watermarking technique using IGSA in LWT domain for copyright protection"*, Complex & Intelligent Systems, Springer, Vol. 8, pp. 1047–1070, 2021. *(IF: 4.92, SCIE)*
- Roop Singh, Mukesh Saraswat, Alaknanda Ashok, Himanshu Mittal, Ashish Tripathi, Avinash Chandra Pandey, **Raju Pal**, *"From classical to soft computing based watermarking techniques: A comprehensive review"*, Future Generation Computer Systems, Elsevier, Vol. 141, pp. 738–754, Apr. 2023 *(IF: 7.37, SCIE)*
- Avinash Chandra Pandey, Ankur Kulhari, Himanshu Mittal, Ashish Kumar Tripathi, **Raju Pal**, *"Improved exponential cuckoo search method for sentiment analysis"*, Multimedia Tools and Applications, Springer, Nov. 2022. *(IF: 2.75, SCIE)*
- Himanshu Mittal, Ashish Kumar Tripathi, Avinash Chandra Pandey, P. Venu, Varun G. Menon, **Raju Pal**, *"A novel fuzzy clustering-based method for human activity recognition in cloud-based industrial IoT environment"*, Wireless Networks, Springer, pp. 1-13, June 2022. *(IF: 2.62, SCIE)*
- Himanshu Mittal, Ashish Kumar Tripathi, Avinash Chandra Pandey, Mohammad Dahman Alshehri, Mukesh Saraswat, and **Raju Pal**, *"A new intrusion detection method for cyber-physical system in emerging industrial IoT"*, Computer Communications, Elsevier, Vol. 190, pp. 24-35, 2022. *(IF: 3.16, SCIE)*
- Himanshu Mittal, Avinash Chandra Pandey, Mukesh Saraswat, Sumit Kumar, **Raju Pal**, and Garv Modwel, *"A comprehensive survey of image segmentation: clustering methods, performance parameters, and benchmark datasets"*, Multimedia Tools and Applications, Springer, 2021. (10.1007/s11042-021-10594-9) *(IF: 2.75, SCIE)*

- Himanshu Mittal, Avinash Chandra Pandey, **Raju Pal**, and Ashish Kumar Tripathi, *"A new clustering method for the diagnosis of CoVID19 using medical images"*, Applied Intelligence, Springer, Vol. 51, pp. 2988–3011, 2021. *(IF: 5.08, SCIE)*
- Himanshu Mittal, Ashish Tripathi, Avinash Chandra Pandey, and **Raju Pal**, *"Gravitational search algorithm: a comprehensive analysis of recent variants"*, Multimedia Tools and Applications, Springer, Vol. 80, pp. 7581–7608, 2020. *(IF: 2.75, SCIE)*
- **Raju Pal** and Mukesh Saraswat, *"Improved Biogeography-based Optimization"*, International Journal of Advanced Intelligence Paradigms, Inderscience Publishers, Vol. 21, Issue 1-2, pp. 18-40, Feb., 2022. *(Scopus Indexed)*
- **Raju Pal** and Mukesh Saraswat, *"A new weighted two-dimensional vector quantisation encoding method in bag-of-features for histopathological image classification"*, Intelligent information systems and intelligent database systems, Volume 13, Issue 2-4, pp. 150-171 , August, 2020. *(Scopus Indexed)*
- **Raju Pal**, Mukesh Saraswat, *"Grey Relational Analysis based Keypoints Selection in Bag-of-Features for Histopathological Image Classification"*, Recent Patents on Computer Science, Vol 12, Issue 4, pp. 260 - 268, 2019. *(Scopus Indexed)*
- Avinash Chandra Pandey, **Raju Pal** and Ankur Kulhari, "Unsupervised data classification using improved biogeography based optimization", International Journal of System Assurance Engineering and Management, Volume 9, Issue 4, pp 821–829, 2018. *(Scopus Indexed)*

BOOK CHAPTERS

- **Raju Pal**, Himanshu Mittal, Avinash Pandey, and Mukesh Saraswat, "An Efficient Bag-of-Features for Diseased Plant Identification" In Uddin M.S., Bansal J.C. (eds) Computer Vision and Machine Learning in Agriculture. Algorithms for Intelligent Systems, Springer, pp. 159-172, Mar., 2021. *(Scopus Indexed)*
- Aarti, **Raju Pal**, "Empirical Sentiment Analysis of Social Pages" In K. K. Sharma, A. Gupta, B. Sharma, S. L. Tripathi (eds) Intelligent Communication and Automation Systems, pp. 331-342. CRC Press, Apr., 2021. *(Scopus Indexed)*
- **Raju Pal**, A. K. Malik, Subash Yadav, and Rishabh Karnwal, "Optimal Cluster Head Election in Industrial WSNs using Multi-Objective Genetic Algorithm", Goel, Chauhan, and Malik (eds) In Applications of Advanced Optimization Techniques, pp. 169-180, CRC Press, Jan., 2022. *(Scopus Indexed)*
- **Raju Pal**, Subash Yadav, Pushpendra Kumar Rajput, and Anand Nayyar, "Automated Methods for the Detection of Green Land in Satellite Images", Fadi Al-Turjman, Anand Nayyar, Ajantha Devi, Piyush Kumar Shukla (eds) In Intelligence of Things: AI-IoT Based Critical-Applications and Innovations, pp. 145-165. Springer, Cham, Oct., 2021. *(Scopus Indexed)*

BOOKS

- **Raju Pal**, Aarti, Himanshu Mittal, and Mukesh Saraswat, Applied Intelligence for Medical Image Analysis, AAP CRC Press, a Taylor & Francis Group, 2022. (In press) *(Scopus Indexed)*
- **Raju Pal** and Praveen Kumar Shukla, "SCRS Conference proceedings on intelligent systems", SCRS Book Series on Computing and Intelligent Systems, 2021

CONFERENCES

- P*ushpendra Kumar Rajput, Aarti, and Raju Pal, "*Genetic Algorithm-Based Clustering with Neural Network Classification for Software Fault Prediction*" In Proceedings of International Conference on Data Science and Applications: ICDSA 2022, Volume 1, pp. 399-414, Lecture Notes in Networks and Systems, vol 551, Singapore: Springer Nature Singapore, Feb. 2023.* *(Scopus Indexed)*

- M*ukesh Saraswat, Raju Pal, Roop Singh,* "DS-AT: An efficient watermarking technique based on Arnold transform in DCT and SVD domain*" In Proceedings of the Fourteenth International Conference on Contemporary Computing, ACM, pp. 11-14. Oct. 2022.* *(Scopus Indexed)*

- M*ukesh Saraswat, Raju Pal, Roop Singh, Himanshu Mittal, Avinash Pandey, and Jagdish Chand Bansal,* "An Optimal Feature Selection Approach Using IBBO for Histopathological Image Classification*" In Congress on Intelligent Systems, pp. 31-40. Springer, Singapore, 2020.* *(Scopus Indexed)*

- H*imanshu Mittal, Mukesh Saraswat, and Raju Pal,* "Histopathological Image Classification by Optimized Neural Network Using IGSA*", In proc. of International Conference on Distributed Computing and Internet Technology , pp. 429-436, Springer, 2020.* *(Scopus Indexed)*

- R*aju Pal, Himanshu Mittal, and Mukesh Saraswat,* "Optimal Fuzzy Clustering by Improved Biogeography-based Optimization for Leukocytes Segmentation*", In proc. of Fifth International Conference on Image Information Processing, pp. 74-79 , IEEE, 2019.* *(Scopus Indexed)*

- A*vinash Chandra Pandey, Ashish Kumar Tripathi, Raju Pal, Himanshu Mittal, and Mukesh Saraswat,* "Spiral Salp Swarm Optimization Algorithm*", In proc. of 4th International Conference on Information Systems and Computer Networks (ISCON), pp. 722-727. IEEE, 2019* *(Scopus Indexed)*

- R*aju Pal and Mukesh Saraswat,* "A New Bag-of-Features Method using Biogeography-based Optimization for Categorization of Histology Images.*" In proc. of 4th International Conference on Computers and Management, pp. 155-160, Elsevier, International Journal of Information Systems & Management Science, Vol 1, Issue 2, Apr. 03, 2018* *(Scopus Indexed)*

- S*hashi Bhushan, Raju Pal, and Svetlana G. Antoshchuk,* "Energy Efficient Clustering Protocol for Heterogeneous Wireless Sensor Network: A Hybrid Approach Using GA and K-means*" in proc. of IEEE Second International Conference on Data Stream Mining & Processing, pp. 381-385, 2018.* *(Scopus Indexed)*

- R*aju Pal and Mukesh Saraswat,* "Enhanced Bag of Features using AlexNet and improved biogeography-based optimization for Histopathological Image Analysis*", in proc. of Eleventh IEEE International Conference on Contemporary Computing, India, pp. 1-6, 2018.* *(Scopus Indexed)*

- R*ohan Gupta and Raju Pal, "Biogeography-based optimization with lévy-flight exploration for combinatorial optimization", in proc. of International Conference on Cloud Computing, Data Science & Engineering, Noida, India, pp. 664-669, 2018.* *(Scopus Indexed)*

- R*aju Pal and Mukesh Saraswat,* "Data Clustering using Enhanced Biogeography-based Optimization*", in proc. of Tenth IEEE International Conference on Contemporary Computing, India, pp. 1-6, 2017.* *(Scopus Indexed)*

- Komal Mehta and Raju Pal, "*Biogeography based optimization protocol for energy efficient evolutionary algorithm:(BBO: EEEA)*", International Conference on Computing and Communication Technologies for Smart Nation, India, pp. 281-286, 2017. *(Scopus Indexed)*

- Raju Pal, Himanshu Mittal, Avinash Pandey, and Mukesh Saraswat, "*BEECP: Biogeography optimization-based energy efficient clustering protocol for HWSNs*", in proc. of Ninth IEEE International Conference on Contemporary Computing, India, pp. 1-6, 2016. *(Scopus Indexed)*

- Himanshu Mittal, Raju Pal, Ankur Kulhari, and Mukesh Saraswat, "*Chaotic Kbest gravitational search algorithm (CKGSA)*", in proc. of Ninth IEEE International Conference on Contemporary Computing, India, pp. 1-6, 2016. *(Scopus Indexed)*

Education

- **Ph.D. in Computer Science & Engineering** Aug., 2014 - Dec., 2019
  Jaypee institute of Information Technology *Noida, India*
  - Supervisor: Dr. Mukesh Saraswat [mukesh.saraswat@jiit.ac.in]
- **M. Tech. in Computer Science & Engineering** Aug., 2010 - July, 2012
  Dr. B. R. Ambedkar National Institute of Technology *Jalandhar, Punjab*
  - Supervisor: Prof. Ajay K. Sharma [director@nitdelhi.ac.in]
- **B. Tech. in Information Technology** Aug., 2005 - July, 2009
  Uttar Pradesh Technical University *Lucknow, India*

Ph.D. Thesis

- **Enhancement of Bag-of-Features Method for Classification of Histopathological Images**
  - Introduced a new keypoints selection method in the Bag-of-features methods for the classification of Histopathological images
  - A meta-heuristic based codebook construction method is developed to find optimal visual words
  - A weighted two-dimensional vector quantization method in the Bag-of-features is developed for histopathological image classification.

Research Interests

- Computer Vision, Machine Learning, Evolutionary Algorithms, Multi-objective Optimization, Clustering, Image Analysis

Programming Skills

- Python, MATLAB, OpenCV, Java, C, C++

Thesis Guided

- **M. Tech.: Komal Mehta** 2015 - 2017
  Topic: Energy Efficient Routing Protocols for HWSNs based on Evolutionary Algorithms
- **M. Tech.: Aditya Dhar Dwivedi** 2022 - 2024
  Topic: A Comparative study of deep learning models and transformers on Image classification

Professional Activities

REVIEWER

- Future Generation Computer Systems, Elsevier
- International Journal of Electrical and Computer Engineering (IJECE)
- Cluster Computing, Springer
- Heliyon, Elsevier
- IET Communications
- Telecommunication Systems, Springer
- Journal of Communications and Networks, Hindawi
- Neural Computing and Applications, Springer

EXPERT TALKS

- ***Delivered a talk on Solving Traveling salesman problem using Ant colony optimization*** July 4, 2019
  Place: Department of Mathematics, Jaypee Institute of Information Technology, Sector-62, Noida, India

Expert Lecture on Report Writing using LaTeX

- *Place:Department of Computer Science & Engineering, Modern Institute of Technology & Research Centre, Alwar, India* — *Dec 11-13, 2018*

Expert Lecture on Handling references using LaTeX — Sep. 07, 2018

- *Place: Department of Mathematics, B K Birla Institute of Engineering &Technology, Pilani, Rajasthan, India*

Expert Lecture on "Report Writing using LaTeX"

- *Place: Department of Computer Science & Engineering, Srinathji Institute of Technology & Engineering , Nathdwara, India* — *Sep. 09, 2018*

Expert Lecture on "Biogeography-based Optimization"

- *Place: Department of Electronics and Communication Engineering, Govt. Engineering College, Ajmer, India* — *July 23-24, 2018*

References

- **Dr. Mukesh Saraswat** — mukesh.saraswat@jiit.ac.in
  Associate Professor, Department of Computer Science
  Jaypee Institute of Information Technology, Noida, India

- **Dr. Jagdish Chand Bansal** — jcbansal@sau.ac.in
  Associate Professor, Department of Mathematics
  South Asian University, New Delhi, India