

# K. A. Muthukumar, Ph.D.

Assistant Professor · AI Healthcare · Computer Vision · Founder, Shinkai Labs

✉ muthukumar9890@gmail.com

☎ +91-9789285742

in muthukumarka

🐙 https://github.com/kamuthukumar



## Professional Summary

Artificial Intelligence researcher, Assistant Professor, and founder with a Ph.D. in Engineering from Keio University, Japan. Specialization in **machine learning, deep learning, computer vision, medical image analysis**, and **biomedical signal processing**, including fetal ECG extraction, infrared sensing, activity recognition, and edge AI on IoT devices. Record of IEEE conference publications, DST-SERB funded healthcare research, industry consultation in defect detection, and copyrighted software in drone tracking and digital health. Combines teaching, research supervision, grant execution, and product development across academia and startups.

## Employment History

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|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mar. 2025 – Present   | ■ <b>Founder &amp; CEO</b> , Shinkai Labs Pvt. Ltd.<br>Direct AI product research in computer vision, drone detection and tracking, and digital health. Deliver copyrighted software (Python, Dart) with ML model integration, UI, and documentation; lead industry partnerships in inspection and healthcare AI. |
| May 2025 – Present    | ■ <b>Assistant Professor</b> , SSN College of Engineering, Anna University<br>Teach and supervise research in machine learning, computer vision, and AI for healthcare. Publish in IEEE venues (ICC, EMBC, SPACE) and serve as Session Chair at IEEE EMBC 2026, Toronto.                                          |
| Nov. 2022 – Feb. 2025 | ■ <b>Assistant Professor</b> , University of Petroleum and Energy Studies (UPES)<br>Founded and led the Centre of Excellence in IoT-AI Healthcare. Mentored undergraduate to Ph.D. students; executed DST-SERB fetal arrhythmia research; consulted on railway and facade inspection using computer vision.       |
| Jan. 2022 – Mar. 2022 | ■ <b>Computer Vision / Machine Learning Engineer</b> , MOTiV Research Co., Japan<br>Developed deep learning pipelines for visual recognition and applied computer vision in an industrial research setting.                                                                                                       |
| Apr. 2018 – Sep. 2019 | ■ <b>MEXT Scholar / Researcher</b> , Ohtsuki Laboratory, Keio University, Japan<br>Conducted doctoral research on infrared-array sensing, hybrid deep learning (CNN-LSTM, CGAN), and AI healthcare for activity and fall detection.                                                                               |
| Apr. 2017 – Aug. 2017 | ■ <b>Operations Officer</b> , ANZ, Bengaluru<br>Supported banking operations and process execution in a regulated financial environment.                                                                                                                                                                          |
| Jun. 2010 – Aug. 2010 | ■ <b>Research Fellow</b> , Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT)<br>Contributed to research in information and communication technology.                                                                                                                               |

## Education

- |                         |                                                                                                                                                                                                                                       |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sept. 2019 – Sept. 2022 | ■ <b>Ph.D., Engineering</b> , Keio University, Japan.<br>Thesis: Activity and fall detection for AI healthcare using infrared array sensors and deep computer vision (CGAN, CNN-LSTM, RGB+IR, IoT on Raspberry Pi and NVIDIA Jetson). |
| Sept. 2023 – Sept. 2024 | ■ <b>Post-Graduate Diploma in Intellectual Property Rights Law (PGDIPRL)</b> , National Law School of India University, Bengaluru.                                                                                                    |

## Education (continued)

- Aug. 2014 – Aug. 2016  **M.Tech., Computer Science and Engineering**, Pondicherry University.  
Thesis: Secure sharing of medical data in a hybrid cloud (OpenStack, cryptography).
- Jun. 2008 – Jun. 2012  **B.Tech., Computer Science and Engineering**, National Institute of Technology, Tiruchirappalli.  
Project: Edge detection, face detection, and blink detection.

## Research Publications

### Journal Articles

- 1 **K. A. Muthukumar**, D. Nandi, P. Ranjan, K. Ramachandran, P. J. Shiny, A. Ghosh, M. Ashwini, A. Radhakrishnan, V. E. Dhandapani, and R. Janardhanan, "Integrating electrocardiogram and fundus images for early detection of cardiovascular diseases," *Scientific Reports*, vol. 15, 4390, 2025.  DOI: 10.1038/s41598-025-87634-z.
- 2 **K. A. Muthukumar**, S. Gupta, and D. Saikia, "Leveraging machine learning techniques to analyze nutritional content in processed foods," *Discover Food*, vol. 4, no. 1, 182, 2024.  DOI: 10.1007/s44187-024-00253-x.
- 3 **K. A. Muthukumar**, A. Gurung, and P. Ranjan, "Vision Mamba: Cutting-edge classification of Alzheimer's disease with 3D MRI scans," *arXiv preprint*, 2024.  DOI: 10.48550/arXiv.2406.05757. arXiv: 2406.05757.
- 4 **K. A. Muthukumar**, A. Ganeshan, D. Nandi, P. Ranjan, S. Mohandas, K. Ramachandran, K. N. Kaur, L. Mohanan, J. Swaminathan, H. Solomon, R. Dahiya, R. Kumar, A. Oomman, K. M. Ramkumar, H. Singh, V. E. Dhandapani, and R. Janardhanan, "Multi-modal detection of cardiovascular disease at the community level," *Indian Heart Journal*, vol. 75, S76–S77, 2023, abstract.  DOI: 10.1016/j.ihj.2023.11.162.
- 5 **K. A. Muthukumar**, D. Nandi, P. Ranjan, K. Ramachandran, P. J. Shiny, A. Ghosh, M. Ashwini, A. Radhakrishnan, V. E. Dhandapani, and R. Janardhanan, "A multi-modal computational approach to accurate and rapid prediction of cardiovascular health using fundus images," *Indian Heart Journal*, vol. 75, S9, 2023, abstract.  DOI: 10.1016/j.ihj.2023.11.027.
- 6 **K. A. Muthukumar**, M. Bouazizi, and T. Ohtsuki, "An infrared array sensor-based approach for activity detection, combining low-cost technology with advanced deep learning techniques," *Sensors*, vol. 22, no. 10, 3898, 2022.  DOI: 10.3390/s22103898.
- 7 **K. A. Muthukumar**, M. Bouazizi, and T. Ohtsuki, "A novel hybrid deep learning model for activity detection using wide-angle low-resolution infrared array sensor," *IEEE Access*, vol. 9, pp. 82 563–82 576, 2021.  DOI: 10.1109/ACCESS.2021.3084926.

### Conference Proceedings

- 1 **K. A. Muthukumar**, "GWO-TriLL: Accelerating linked list search via grey wolf optimization and tridirectional traversal," in *Proc. 6th Int. Conf. Emerg. Techn. Comput. Intell. (ICETCI)*, Hyderabad, India, 2026.
- 2 **K. A. Muthukumar**, "Hybrid diffusion–dynamical modeling for robust non-invasive fetal ECG extraction from abdominal ECG recordings," in *Proc. 48th Annu. Int. Conf. IEEE Eng. Med. Biol. Soc. (EMBC)*, 2026.
- 3 **K. A. Muthukumar**, "Intelligent screening of chronic kidney disease from clinical biomarkers: A dimensionality-aware ensemble approach," in *Proc. 18th IEEE Int. Conf. Comput. Intell. Commun. Netw. (CICN)*, 2026.

- 4 **K. A. Muthukumar**, “Multi-level adapter fusion with learnable text anchors for few-shot medical anomaly classification,” in *Proc. 48th Annu. Int. Conf. IEEE Eng. Med. Biol. Soc. (EMBC)*, 2026.
- 5 **K. A. Muthukumar**, “Neural combinatorial fusion for deterministic radar tracking with calibrated uncertainties,” in *Proc. IEEE SPACE Conf.*, Bengaluru, India, 2026.
- 6 **K. A. Muthukumar**, “TopOT-Net: Topology-preserving medical image segmentation via Sinkhorn divergence-regularized deformable attention,” in *Proc. 11th Int. Conf. Comput. Vis. Image Process. (CVIP)*, Calicut, India, 2026.
- 7 **K. A. Muthukumar**, R. Anurag, and A. Li, “Non-invasive fetal electrocardiogram extraction using deep learning and earth mover’s distance,” in *Proc. IEEE Int. Conf. Commun. (ICC)*, Glasgow, U.K., 2026.
- 8 A. Ganeshan, S. R. Abishek, P. Deekshith, P. Piyush, **K. A. Muthukumar**, and P. Ranjan, “HRIDAY: ECG tagging at your fingertips using Android app,” in *Proc. Annu. Conf. Cardiological Soc. India*, abstract, 2024.
- 9 **K. A. Muthukumar**, A. Gurung, and P. Ranjan, “Exploring vision transformers for enhanced MRI-based Alzheimer’s disease classification,” in *Proc. 3rd Int. Conf. Biol. Inspired Techn. Many-Criteria Decision-Making (BITMDM)*, 2024, pp. 60–70.  DOI: 10.1007/978-3-031-82706-8\_7.
- 10 **K. A. Muthukumar** and P. Ranjan, “Enhancing EEG-based brain–computer interfaces through biologically inspired neural networks incorporating Dale’s law and Hebbian learning,” in *Proc. 2nd Nature Conf. Neuromorphic Comput.*, abstract, Beijing, China, 2024.
- 11 **K. A. Muthukumar**, M. Bouazizi, and T. Ohtsuki, “Comparative study of activity detection system using wide angle low-resolution infrared array sensor at different positions,” in *Proc. IEICE Gen. Conf.*, 2021.
- 12 **K. A. Muthukumar**, M. Bouazizi, and T. Ohtsuki, “Activity detection using wide angle low-resolution infrared array sensors,” in *Proc. IEICE Soc. Conf.*, 2020.
- 13 **K. A. Muthukumar**, M. Bouazizi, and T. Ohtsuki, “Detection of human activity based on hybrid deep learning model using a low-resolution infrared array sensor,” in *Proc. IEICE Tech. Rep.*, 2020.
- 14 **K. A. Muthukumar** and M. Nandhini, “Modified secret sharing algorithm for secured medical data sharing in cloud environment,” in *Proc. 2nd Int. Conf. Sci. Technol. Eng. Manage. (ICONSTEM)*, 2016, pp. 67–71.  DOI: 10.1109/ICONSTEM.2016.7560925.

## Core Skills

|             |                                                                                                                                                                                                                                                                                  |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Research    |  Artificial Intelligence, Machine Learning, Deep Learning, Computer Vision, Medical Image Analysis, Biomedical Signal Processing, Fetal ECG, Anomaly Detection, Object Detection and Tracking |
| Systems     |  IoT, Edge AI, Raspberry Pi, NVIDIA Jetson, Cloud Computing, OpenStack, Robotics (ROS)                                                                                                        |
| Programming |  Python, Dart, C/C++, Julia, R, $\text{\LaTeX}$                                                                                                                                               |
| Frameworks  |  PyTorch, TensorFlow, Keras, OpenCV, NumPy, Pandas, Scikit-learn, Matplotlib, Qiskit                                                                                                          |
| Tools       |  Google Colab, IBM Watson, IBM Quantum Experience, Git                                                                                                                                        |
| Domain      |  AI Healthcare, Digital Health, Intellectual Property, Research Supervision, Grant Writing, Industry Consultation                                                                             |
| Languages   |  English, Tamil, Japanese                                                                                                                                                                     |

## Selected Experience

### Grants and Fellowships

- 2026  **IEEE Communications Society Travel Grant**, IEEE ICC 2026, Glasgow, U.K. (USD 1930).
- 2024–2027  **DST–SERB Grant**, Fetal Arrhythmia Detection (INR 2.2 million).
- 2019–2022  **KLL Research Grant**, Keio University, Japan (JPY 1.8 million).
- 2018–2022  **MEXT Scholarship**, Ministry of Education, Culture, Sports, Science and Technology, Japan.
- 2014–2016  **NHFDC Foundation Scholarship**, Ministry of Social Justice and Empowerment, Government of India.
- 2008–2012  **Post-Matric Scholarship**, Ministry of Minority Affairs, Government of India.

### Copyrights

- 2026  **Shinkai-Labs Drone Detection & Tracking Platform**  
Copyright (Computer Program) | Reg. No. SW-2026023145 | App. No. SW-945/2026-CO  
Granted by Copyright Office, Government of India. Owner: Shinkai-Labs Pvt. Ltd.  
Authors: Muthukumar K A, Ajithkumar A, Sruthi Padullaparti. Drone detection and tracking web application (Python, Dart).
- 2025  **Sulabh: Disability Indexing App**  
Copyright (Computer Program) | Reg. No. SW-20217/2025  
Granted by Copyright Office, Government of India. AI-based disability indexing and assessment.
- 2024  **Hriday: ECG Tagging App**  
Copyright (Computer Program) | Reg. No. SW-19736/2024  
Granted by Copyright Office, Government of India. ECG tagging and clinical support software.

### Invited Talks

-  **AI for Everyone and Recent Advances in AI**, PATH, New Delhi.
-  **AI in Micro-Grid**, Dayananda Sagar College of Engineering, Bengaluru.
- 2023  **Infrared Imaging in Healthcare**, IEEE CSNT 2023, Bhopal.
-  **Image Processing** tutorial, Nagaland University.

### Industry Consultation

- 2023–2024  **Railway Inspection AI**, Raspect (Hong Kong) and Alstom (France): crack, rust, board-damage, and fault detection.
-  **Facade Monitoring**, Raspect (Hong Kong): crack, water-leakage, and building-damage detection.

### Awards

- 2021  **ICM English Session Encouragement Award**, IEICE Conference, Japan.

### Conference Session Chair

- 2026  **IEEE EMBC 2026**, 48th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Toronto, Canada.
- 2024  **BITMDM 2024**, Nagaland University, India.
-  **ICAT 2024**, National University of Science and Technology, Muscat, Oman.

## Selected Experience (continued)

- 2023  **IEEE CSNT 2024**, Gyan Ganga Institute of Technology and Sciences, Jabalpur, India.
- 2023  **IEEE CSNT 2023**, Technocrats Institute of Technology, Bhopal, India.

## Leadership

- 2023–2024  **Centre of Excellence, IoT-AI Healthcare Lab:** Founded and led lab strategy, industry–academia collaboration, budgeting, and infrastructure.
-  **Research Supervision:** Mentored undergraduate, master’s, and Ph.D. students in AI healthcare and medical imaging.
-  **Faculty Development:** Delivered FDPs and professional training in machine learning, computer vision, and healthcare AI.
-  **Workshops and Grants:** Organized AI and medical-imaging workshops; supported grant acquisition for lab research.