Balamurali Murugesan
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Education

- **École de technologie supérieure (ETS)** — Montreal, Canada
  Doctorate in Engineering; CGPA: (4.3/4.3) – Prof. Jose Dolz and Ismail Ben Ayed — *Jan 2022 – Dec 2025 (Expected)*
- **Indian Institute of Technology Madras (IIT Madras)** — Chennai, India
  M.S Electrical Engineering; CGPA: (8.44/10.0) – Prof. Mohanasankar Sivaprakasam — *August 2018 – September 2021*
- **College of Engineering, Guindy (CEG)** — Chennai, India
  B.E Biomedical Engineering; CGPA: (8.01/10.0) – Prof. S Poonguzhali — *August 2010 – May 2014*

Experience

- **Amazon** — Vancouver, Canada
  Applied Scientist Intern — *June - Sept 2024*
  - **Context compression:** Built RAG systems capable of working with abstractive and extractive context.
- **Nuance Communications, Microsoft** — Montreal, Canada
  Research Scientist Intern — *May - July 2023*
  - **Domain specific prompting:** Refined the predictions of OpenAI's whisper model through in context learning.
- **Healthcare Technology Innovation Centre, IIT Madras** — Chennai, India
  Computer Vision Engineer, Full Stack Developer — *June 2016 - December 2021*
  - **High resolution image framework:** Developed an efficient pipeline to obtain segmentation labels from high-resolution nissl stain images in collaboration with *Cold Spring Harbor Laboratory, USA.*
  - **Temporal bone segmentation:** Developed rigid and demons registration to map the atlas of temporal bone structures to new CT data in collaboration with *Eindhoven Medical Robotics, Netherlands.*
  - **Deep learning for fast MRI reconstruction:** Developed deep learning networks to provide better reconstruction with minimal k-space data in collaboration with *GE Healthcare, India.*
  - **Non-contact physiological monitoring:** Developed deep networks to extract heart rate from video recordings of neonates in collaboration with *Saveetha Medical College Hospital, India.*
- **Assistive Technology Lab; Computational Neuroscience Lab, IIT Madras** — Chennai, India
  Project associate — *August 2014 - May 2016*
  - **iGest:** Device to assist physiotherapist track their patient activities. Built a complete product with contributions in hardware, software and algorithms development.
  - **Handwriting recognition:** Developed a handwritten recognition system for Telugu and Bharati script in collaboration with *Centre for Development of Advanced Computing, Pune, India.*

Consulting Services

- **Machine learning tools for carbon accounting:** Building Retrieval-augmented generation based Large language models to aid in carbon reporting. *Machine Learning Engineer, Zasti, USA.* (*Jan-Aug 2024*)
- **Fetal biometry and plane detection:** Developing a Fetal ultrasound assistance tool for sonographers, to detect the standard planes and report the fetal biometry, *Applied Machine Learning Scientist, HTIC, India.* (*Jan-Aug 2024*)
- **Retinal disease diagnosis:** Developing deep networks for diagnosing retinal conditions with optical coherence tomography and fundus images. *Machine Learning Engineer, Diagnos, Canada.* (*Jan 2022 - Apr 2024*)
- **Bone age prediction:** Developed a regression model to assess the skeletal age of children to detect hormonal problems and deployed it in 3D Slicer (MONAI) for hospitals. *Computer Vision Consultant, Ostequant, India.* (*Jan-Apr 2024*)
- **Vial label extraction:** Developed an algorithm to obtain the drug name, and dosage from syringe vial aiding the ICU nurse to avoid crucial human errors. *Machine Learning Consultant, SonoNurse, Canada.* (*Jan-Feb 2024*)
- **Medical AI LifeCycle; Non-contact sensing:** Developed clinical pipeline for brain tumor segmentation using MONAI. Analysed the rPPG related research works. *Computer Vision Consultant, TensorGo, India.* (*Jan-April 2023*)
- **Pose and face normalization:** Normalizing the face pose is mandatory for using the standard tools in 3D pipeline. Developed a deep network to achieve them for avatars. *Data Scientist, MyMeta3D, India.* (*Sept-Dec 2022*)
- **Software for Optical Mark Reader (OMR):** Developed a OMR recognition software in collaboration with *Hashbytes Technology Solutions* for The Govt. of Tamil Nadu and Karnataka and have processed 3.5 million sheets. (*2016)*

Publications (🎓)

- Neighbor-Aware Calibration of Segmentation Networks with Penalty-Based Constraints, **Under Review**
- Robust Calibration of Large Vision-Language Models Adapters, **ECCV** 2024.
- Class and Region-Adaptive Constraints for Network Calibration, **MICCAI** 2024.
- Do not trust what you trust: Miscalibration in Semisupervised Learning, **TMLR** 2024
- Prompting classes: Exploring the Power of Prompt Class Learning in Weakly Supervised Segmentation, **WACV** 2024.
- Trust your neighbours: Penalty-based constraints for model calibration, **MICCAI** 2023.
- Calibrating Segmentation Networks with Margin-based Label Smoothing, **MedIA** 2023.
- MCI-HyperNet: An Adaptive Weight Learning Network for Image Reconstruction, **Neurocomputing** 2023.
- Deep learning based non-contact physiological monitoring in Neonatal Intensive Care Unit, **EMBC** 2022.
- A deep cascade of dual domain networks with T1 assistance for fast MRI reconstruction, **CMIG** 2021.
- Style Transfer Based Coronary Artery Segmentation in X-Ray Angiogram, **ICCVW** 2021.
- MAC-ReconNet: A Network for MR Image Reconstruction using Dynamic Weight Prediction, **MIDL** 2020
- KD-MRI: A knowledge distillation framework for image reconstruction and restoration in MRI workflow, **MIDL** 2020.
- MRI Super-Resolution using Laplacian Pyramid Networks with Isotropic Undecimated Wavelet Loss, **EMBC** 2020.
- AutoSyncoder: an adversarial autoencoder framework for multimodal MRI synthesis, **MICCAIW** 2020.
- Dual-encoder-Unet for fast MRI reconstruction, ISBIW 2020.
- REFUGE Challenge: A framework for evaluating automated methods for glaucoma assessment, **MedIA** 2020.
- A context based deep learning approach for unbalanced medical image segmentation, **ISBI** 2020.
- DC-WCNN: A Deep Cascade of Wavelet Based Convolutional Neural Networks for MRI Reconstruction, **ISBI** 2020.
- Conv-MCD: A Plug-and-Play Multi-task Module for Medical Image Segmentation, **MICCAIW** 2019.
- RPnet: A Deep Learning approach for robust R Peak detection in noisy ECG, **EMBC** 2020.
- Interpreting Deep Neural Networks for Single-Lead ECG Arrhythmia Classification, **EMBC** 2020.
- Recon-GLGAN: A Global-Local Context Based GAN for MRI Reconstruction, **MICCAIW** 2019.
- Psi-Net: Shape and boundary aware joint multi-task deep network for medical image segmentation, **EMBC** 2019.
- RespNet: A deep learning model for extraction of respiration from photoplethysmogram, **EMBC** 2019.
- Deep Network for Capacitive ECG Denoising, **MeMeA** 2019.
- ECGNet: Deep Network for Arrhythmia Classification,**MeMeA** 2018.
- Deep detection and classification of mitotic figures, **SPIE** 2018.

Accomplishments

- **Awards and Scholarships:** Recipient of Institute research award for M.S. thesis on *"Deep learning for fast MRI reconstruction"* and Special prize for B.E. project on *"Assistive device for speech impaired"*. Recipient of Industrial sponsorship in M.S; Central sector scheme of scholarships, and Tamil Nadu Educational Trust scholarships in B.E.
- **Medical imaging challenges:** Hosted High resolution neuronal tissue segmentation challenge, MICCAI 2017. Placed 3rd in glaucoma classification task in REFUGE challenge, MICCAI 2018. Placed 2nd in Polyp Localization task in EndoVis challenge, MICCAI 2018. Placed top 5% in MRI reconstruction in fastMRI.
- **Summer school and workshops:** Attended summer school on computer vision organized by International Institute Of Information Technology Hyderabad (IIIT-H), July 2017. Conducted two day workshop on Deep Learning, Deep Learning for Self driving Cars in Kurukshetra (International techno-management fest), CEG 2017 and 2018.
- **Open-source:** Contributed to MONAI framework - TverskyLoss and NACLLoss, Do It Yourself in Electronics For You (EFY) magazine – Design and Development of an Assistive Device for Speech Impaired.
- **Reviewer:** TMI, NeurIPS, ICML, MICCAI, MIDL, ML4H, CHIL, AIME, CIBM.
- **Leadership:** Mentored 15+ students in various stages of their career, in product development and conducting research.

Relevant Coursework, Projects, and Programming Skills

- **Coursework:** Fundamentals of Linear Optimization, Introduction to Machine Learning, Geometry & Photometry-based Computer vision, Deep Learning for Computer vision, Natural Language Processing
- **Projects:** Image mosaicing, Camera trajectory to motion blur, Shape from Focus, Photometric Stereo, Stereo matching, Structure from Motion, Video background subtraction, Hand detection, Face recognition.
- **Languages:** Python, Matlab, C++, Javascript
- **Modules:** PyTorch, Scikit-learn, OpenCV, Skimage, SimpleITK, Pandas, Django