Balamurali Murugesan

Email : balamuralim1993@gmail.com
Website: https://bala93.github.io/

Research Interests

My primary research focus is on developing reliable and efficient deep learning networks for computer vision. My earlier research works were in image restoration and segmentation.

Education

- **Indian Institute of Technology Madras (IIT Madras)** — Chennai, India
  Master of Science in Electrical Engineering; CGPA: (8.18/10.0) — *August 2018 – Present*
- **College Of Engineering, Guindy (CEG)** — Chennai, India
  Bachelor of Engineering in Biomedical Engineering; CGPA: (8.01/10.0) — *August 2010 – May 2014*

Experience

- **Healthcare Technology Innovation Centre, IIT Madras** — Chennai, India
  Project associate — *June 2016 - Present*
  - **Annotation tools**: Developed annotation tools to obtain segmentation and localization ground truth from high-resolution nissl stain images in collaboration with Cold Spring Harbor Laboratory (CSHL), New York, USA.
  - **Processing high resolution images**: Developed an application to efficiently track and process high resolution images on the Univa Grid Engine in collaboration with CSHL, New York, USA.
  - **Clamp detection and status identification in life sciences**: Automated analysis of work-flows in life sciences can assist researchers. Used object detection and classification networks to locate clamp and report open or close status in collaboration with GE Healthcare, Bengaluru, India.
  - **Temporal bone segmentation**: Detecting structures in temporal bone can help in surgical planning. Developed rigid and demons registration to map the atlas segmentation to new CT data in collaboration with Eindhoven Medical Robotics, Netherlands
  - **Deep learning for fast MRI reconstruction**: Accelerating the MRI acquisition time can reduce the scan cost. Developing deep learning networks to provide better reconstruction with minimal k-space data in collaboration with GE Healthcare, Bengaluru, India.
  - **Non-contact physiological monitoring**: Non-contact sensing could reduce the risk of infection for vulnerable patients and the discomfort caused by obtrusive leads and electrodes. Developing deep networks to extract heart rate from video recordings of adults and neonates.
- **Computational Neuroscience Lab, IIT Madras** — Chennai, India
  Project associate — *June 2015 - May 2016*
  - **Telugu handwritten recognition**: Developed a telugu handwritten recognition system in collaboration with Centre for Development of Advanced Computing.
  - **Bharati - Common script for India**: Bharati is proposed as a common script for all the regional languages to avoid communication barrier. Worked on font design and character recognition.
- **Assistive Technology lab, IIT Madras** — Chennai, India
  Project associate — *August 2014 - April 2015*
  - **iGest**: Device to assist physiotherapist track their patient activities. Built a complete product with contributions in hardware, software and algorithms development.

Selected Publications (🎓)

- **Medical Image analysis**:

1. **B. Murugesan** *et al.* A deep cascade of ensemble of dual domain networks with gradient-based T1 assistance and perceptual refinement for fast MRI reconstruction, in *Computerized Medical Imaging and Graphics* (CMIG 2021).
2. **B. Murugesan** *et al.* KD-MRI: A knowledge distillation framework for image reconstruction and image restoration in MRI workflow, in *Medical Imaging with Deep Learning* (MIDL 2020).
3. S. Ramanarayanan, **B. Murugesan** *et al.* MAC-ReconNet: A Multiple Acquisition Context based Convolutional Neural Network for MR Image Reconstruction using Dynamic Weight Prediction, in *Medical Imaging with Deep Learning* (MIDL 2020) (Runner-up for best paper award).

4. J. I. Orlando *et al.* REFUGE Challenge: A unified framework for evaluating automated methods for glaucoma assessment from fundus photographs, *Medical Image Analysis* (MedIA 2020).
5. **B. Murugesan** *et al.* A context based deep learning approach for unbalanced medical image segmentation, in *International Symposium on Biomedical Imaging* (ISBI 2020).
6. S. Ramanarayanan, **B. Murugesan** *et al.* DC-WCNN: A Deep Cascade of Wavelet Based Convolutional Neural Networks for MR Image Reconstruction, in *International Symposium on Biomedical Imaging* (ISBI 2020).
7. **B. Murugesan** *et al.* Recon-GLGAN: A Global-Local Context Based Generative Adversarial Network for MRI Reconstruction, in *Machine Learning for Medical Image Reconstruction* (MLMIR 2019).
8. **B. Murugesan** *et al.* Conv-MCD: A Plug-and-Play Multi-task Module for Medical Image Segmentation, in *Machine Learning in Medical Imaging* (MLMI 2019).
9. **B. Murugesan** *et al.* Psi-Net: Shape and boundary aware joint multi-task deep network for medical image segmentation, in International Conference of *Engineering in Medicine and Biology Society* (EMBC 2019).
10. **B. Murugesan** *et al.* Deep detection and classification of mitotic figures, in *Medical Imaging: Digital Pathology* (SPIE 2018).

- **Biosignal analysis**:

1. S. Vijayarangan, V. Ravichandran, **B. Murugesan**. *et al.* RPnet: A Deep Learning approach for robust R Peak detection in noisy ECG, in International Conference of *Engineering in Medicine and Biology Society* (EMBC 2020).
2. S. Vijayarangan, **B. Murugesan**. *et al.* Interpreting Deep Neural Networks for Single-Lead ECG Arrhythmia Classification, in International Conference of *Engineering in Medicine and Biology Society* (EMBC 2020).
3. V. Ravichandran, **B. Murugesan**. *et al.* Deep Network for Capacitive ECG Denoising, in International Symposium on *Medical Measurements and Applications* (MeMeA 2019).
4. **B. Murugesan** *et al.* ECGNet: Deep Network for Arrhythmia Classification, in International Symposium on *Medical Measurements and Applications* (MeMeA 2018).

Selected Projects ()

- **Software for Optical Mark Reader (OMR)**: Developed a OMR recognition software in collaboration with Hashbytes Technology Solutions. The Govt. of Tamil Nadu and Karnataka used this tool and have processed 3.5 million sheets.
- **Platform for Glaucoma analysis** : Cup-to-disc ratio can be used to assess the progression of glaucoma. Developed an application to segment the fundus image to cup, disc and background.
- **Automatic Polyp detection in Colonoscopy videos**: Automatic Polyp detection increases the attentiveness of colonoscopists. Developed deep learning based algorithms to localize polyp in the colon image.
- **Course projects**: Image mosaicing, Camera trajectory to motion blur, Shape from Focus, Photometric Stereo, Stereo matching, Structure from Motion, Video background subtraction, Hand detection

Accomplishments

- **Reviewer**: ML4H, CHIL, MIDL, MICCAI, ICML, NeurIPS
- **Medical imaging challenges**: Hosted HRNTS 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**: Attended summer school on computer vision organized by International Institute Of Information Technology Hyderabad (IIIT-H), July 2017
- **Workshops**: Conducted two day workshop on Deep Learning, Deep Learning for Self driving Cars in Kurukshetra (International techno-management fest), CEG 2017 and 2018.
- **Articles**: Contributed to Do It Yourself column in Electronics For You (EFY) magazine. Design and Development of an Assistive Device for Speech Impaired. October 2015 Issue Vol. 47 No. 10.
- **Scholarships**: Recipient of Central sector scheme of scholarships and Tamil Nadu Educational Trust scholarships

Coursework

Fundamentals of Linear Optimization, Image Signal Processing, Geometry & Photometry-based Computer vision, Digital Video Processing and Deep Learning for Computer vision

Programming Skills

- **Languages**: Python, Matlab, C++, Javascript
- **Modules**: PyTorch, Scikit-learn, OpenCV, Skimage, Django