Balamurali
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Research Interests

Application of deep learning to computer vision and medical images.

Education

- **College Of Engineering, Guindy** — Chennai,India
  Bachelor of Engineering in Biomedical Engineering; CGPA:(8.01/10.0) — *Aug. 2010 – July. 2014*
- **Indian Institute of Technology Madras (IIT Madras)** — Chennai,India
  Master of Science in Electrical Engineering; CGPA:(8/10.0) — *Aug. 2018 – Present*

Experience

- **Healthcare Technology Innovation Centre, IIT Madras** — Chennai,India
  Project associate — *June 2016 - Present*
  - **Annotation tools**: Annotation tools were created for obtaining segmentation and localization ground truth from high-resolution nissl stain and histopathology images.
  - **Processing high resolution images**: Application was developed to process high resolution images in efficient manner using univa grid engine.
  - **Challenge hosting**: Nissl section segmentation challenge is hosted in Medical Image Computing and Computer Assisted Intervention(MICCAI).
  - **Automatic Polyp detection in Colonoscopy videos**: Automatic Polyp detection increases the attentiveness of colonoscopists. Deep learning based algorithms were developed to localize polyp in the colon image.
  - **Clamp detection and status identification in life sciences**: Analysis of work-flows in life sciences could assist researchers. Object detection and classification networks are used to detect clamp and report open or close status.
  - **Deep learning for fast MRI reconstruction**: Accelerating the MRI acquisition time can reduce the scan cost. Deep learning networks are developed to provide better reconstruction with minimal k-space data.(Current work)
- **International Institute Of Information Technology Hydrebad (IIIT-H)** — Hydrebad,India
  Summer student — *July 2017*
  - **Summer school on computer vision**: Sessions introduced advancements of computer vision using deep learning. Selective topics: Semantic segmentation, Network visualization and Image synthesis.
- **Computational Neuroscience Lab, IIT Madras** — Chennai,India
  Project associate — *Jun 2015 - Apr 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 — *Nov 2014 - Apr 2015*
  - **iGest**: Device to assist physiotherapist track their patient activities. Built a complete product with contributions in hardware, software and algorithms development.

Publications

1. DC-WCNN: A deep cascade of wavelet based convolutional neural networks for MR Image Reconstruction. *International Symposium on Biomedical Imaging (ISBI 2020)(To appear)*
2. A context based deep learning approach for unbalanced medical image segmentation.*International Symposium on Biomedical Imaging (ISBI 2020)(To appear)*
3. Orlando, Jos Ignacio et al. 2020. REFUGE Challenge: A Unified Framework for Evaluating Automated Methods for Glaucoma Assessment from Fundus Photographs. *Medical Image Analysis* 59:101570.

4. Murugesan, Balamurali, S. Vijaya Raghavan, Kaushik Sarveswaran, Keerthi Ram, and Mohanasankar Sivaprakasam. 2019. Recon-GLGAN: A Global-Local Context Based Generative Adversarial Network for MRI Reconstruction. Pp. 3-15 in *Machine Learning for Medical Image Reconstruction*

5. Murugesan, Balamurali et al. 2019. Conv-MCD: A Plug-and-Play Multi-Task Module for Medical Image Segmentation. Pp. 292-300 in *Machine Learning in Medical Imaging*

6. Murugesan, B. et al. 2019. Psi-Net: Shape and Boundary Aware Joint Multi-Task Deep Network for Medical Image Segmentation. Pp. 7223-26 in *2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC).*

7. Ravichandran, V. et al. 2019. RespNet: A Deep Learning Model for Extraction of Respiration from Photoplethysmogram. Pp. 5556-59 in *2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC).*

8. Ravichandran, V. et al. 2019. Deep Network for Capacitive ECG Denoising. Pp. 1-6 in *2019 IEEE International Symposium on Medical Measurements and Applications (MeMeA).*

9. Murugesan, B. et al. 2018. ECGNet: Deep Network for Arrhythmia Classification. Pp. 1-6 in *2018 IEEE International Symposium on Medical Measurements and Applications (MeMeA).*

10. Murugesan, Balamurali et al. 2019. Deep Detection and Classification of Mitotic Figures. Pp. 177-82 in *Medical Imaging 2019: Digital Pathology.* Vol. 10956.SPIE.

Projects

- **Software for Optical Mark Reader (OMR)**: In collaboration with Hashbytes Technology Solutions, OMR recognition software was developed. It was used by the Government of Tamil Nadu and Karnataka to process 3.5 million sheets in total.
- **Platform for joint optic disc, and cup segmentation for analysis of Glaucoma**: Cup-to-disc ratio can be used to assess the progression of glaucoma. Deep learning based segmentation network was developed to segment fundus image into cup, disc and background.
- **Predictive modeling of Remaining Useful Life**: A tool is developed to predict Remaining Useful Life for Turbofan Engine Degradation dataset by NASA. This helps optimize the periodic maintenance operations.
- **Classify product images in supermarket**: Hackerearth hosted a challenge in collaboration with largest retailer in Germany with the theme, Product Classification. State-of-the-art deep networks like DenseNet and ResNet were used as ensemble to provide us place in top 5%.
- **Face recognition – A tool for person verification**: Lynk conducted hackathon with the theme, Face Verification. Deep learning networks were developed to localize and compare faces with improved accuracy.

Professional activities

- **Reviewer**: ML4H: Machine Learning for Health, Workshop at NeurIPS 2019
- **Workshops**: Conducted two day workshop on Deep Learning, Deep Learning for Self driving Cars in Kurukshetra (International techno-management fest, College Of Engineering, Guindy) 2017 and 2018.
- **Challenges in medical image analysis**: Placed 3rd in online classification of clinical glaucoma task in Retinal Fundus Glaucoma Challenge (REFUGE), Ophthalmic Medical Image Analysis (OMIA) Workshop, MICCAI 2018. Placed 2nd in Polyp Localization task in Endoscopic Vision Challenge, MICCAI 2018.

Coursework

Image Signal Processing, Deep Learning for Imaging, Geometry & Photometry-based Computer Vision, Fundamentals of Linear Optimization, Digital Video Processing.

Programming Skills

- **Languages**: Python,Matlab,Javascript, C++, SQL.
- **Modules**: Pytorch,Scikit-learn,OpenCV,Django,OpenLayers.