

Vaanathi Sundaresan

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RESEARCH EXPERIENCE

- April 2020 – present **Postdoctoral Researcher**
Wellcome Centre for Integrative Neuroimaging (WIN), Nuffield department of clinical neurosciences (NDCN), University of Oxford, United Kingdom
- Funded by Wellcome Trust, UK.
Working on developing deep learning-based domain adaptation techniques for harmonisation of medical imaging data from different scanners, enabling analysis of wider range of clinical data.
- October 2016 – April 2020 **DPhil (PhD) research scholar** (with Prof. Mark Jenkinson)
Oxford Centre for Functional MRI of the Brain (FMRIB), University of Oxford, United Kingdom
- Developed a clinically useful end-to-end automated cerebral microbleed (CMB) analysis pipeline.
Designed and implemented an ensemble deep learning model for white matter hyperintensities (WMH) segmentation and improved the performance of the existing WMH segmentation tool (<https://git.fmrrib.ox.ac.uk/vaanathi/truenet>).
Modelled WMH distribution within a population with respect to various clinical factors using Bayesian Inference.
- July 2016 – October 2016 **Research scholar** (with Prof. Alison Noble)
Institute of Biomedical Engineering, University of Oxford, United Kingdom
- Worked on automatic characterization of fetal echocardiography using deep learning.
Paper based on the work done in the project got shortlisted for 'Best Paper Award 2017' in 14th International Symposium on Biomedical Imaging, ISBI 2017.
- July 2012 – August 2015 **M.S. Research Scholar** (with Prof. Mohanasankar Sivaprakasam)
Biomedical Instrumentation group, Indian Institute of Technology Madras (IITM), India
- Worked on identification of bright lesions for diabetic retinopathy screening.
Developed a software tool to detect various signs related to different stages of age-related macular degeneration on retinal fundus images.
Paper selected for presentation at MICCAI OMIA Workshop 2015.

EDUCATION

- 2015 - 2020 **DPhil in Biomedical Imaging**
Nuffield department of clinical neurosciences (NDCN), University of Oxford, United Kingdom
Enrolled in the Oxford-Nottingham Centre for doctoral training in Biomedical Imaging.
Thesis: Detection of cerebral small vessel disease signs on brain MR images.
Supervisors: Prof. Mark Jenkinson, Dr. Ludovica Griffanti, Dr. Giovanna Zamboni.

- 2012 - 2015 **M.S. (By Research) in Electrical Engineering**
Department of Electrical Engineering, Indian Institute of Technology Madras, India
CGPA: 8.0/10
Thesis: Detection of Age-related Macular Degeneration on Retinal Fundus Images.
Supervisors: Prof. Mohanasankar Sivaprakasam, Dr. Niranjana Joshi.
- 2007 - 2011 **B.Tech in Electronics and Communication Engineering**
Pondicherry Engineering College, India
CGPA: 8.8/10

TEACHING EXPERIENCE

- January 2021 **Organiser and Tutor, Deep Learning workshop using Pytorch 2021**
FMRIB, NDCN, University of Oxford
Course contents: Basics of DL coding: Data preparation and preprocessing, training regime, effect of training hyperparameters, static and dynamic data augmentation, feature visualisation and debugging using hook functions, fine-tuning pre-trained models and visualising saliency maps. Practical material available at https://git.fmrrib.ox.ac.uk/vaanathi/deep_learning_workshop_2020.
- October 2016 – **Tutor for Graduate Students**
November 2018
Doctoral Training Centre, University of Oxford, United Kingdom
Courses taught: Medical Image Analysis, Implementation of Machine Learning algorithms in Matlab and Python.
- March 2017
Tutor at Somerville College for Electrical Engineering Undergraduates
University of Oxford
Course taught: Electrical Machines - Motors
- July 2017
Secured **Supporting Learning Award (aligned with Descriptor 1 of the UK Professional Standards Framework)** – Staff and Educational Development Association (SEDA).
Successfully completed 'Developing Learning and Teaching (DLT)' portfolio. DLT is a short accredited programme for DPhil, postdoctoral researchers and college staff who are teaching at the University. The programme aims to develop skills in teaching. Completing the portfolio marks the criteria to earn the SEDA accreditation mapped at UKPSF Descriptor 1 for Teaching and Supporting Learning in Higher Education.
- July 2014 – **Co-supervisor of summer research interns**
September 2014
Healthcare Technology Innovation Centre (HTIC), IITM Research Park, India
Project: Optic cup detection on retinal colour fundus images
Responsibilities: Data preparation, reviewing the intern's reports, assisting in problem refinement and method development and monitoring their progress.

INDUSTRY EXPERIENCE

- July 2018 – **Medical Image Computing and Machine Learning Intern**
September 2018
Canon Medical Research Europe Ltd, Edinburgh, United Kingdom
Supervised by Dr. Keith Goatman
Worked on Domain adversarial neural networks for data harmonisation, applicable of classification of chest X-ray images.
- July 2014 – **Project Associate**
December 2014
Healthcare Technology Innovation Centre, IITM Research Park, IITM, India

Supervised by Dr. Niranjn Joshi
Worked on Machine learning based decision-making tool for diabetic macular edema grading. Paper selected for presentation at IEEE EMBC 2015.

October 2013 –
May 2014

Research Intern

Healthcare Technology Innovation Centre, IITM Research Park, IITM, India
Supervised by Dr. Niranjn Joshi and Mr. Keerthi Ram

A robust, integrated method for detection and localization of optic disc and macula on retinal fundus images.

Paper selected for oral presentation at Ophthalmic Medical Image Analysis workshop, MICCAI 2014.

RESEARCH INTERESTS

Machine Learning Domain adaptation	Deep Learning Computer Vision	Medical Image Analysis Tool development for image analysis and computer-aided diagnosis
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TECHNICAL SKILLS AND COMPETENCIES

Programming languages	Matlab – 9 yrs, Python – 7 yrs, [Keras, Tensorflow, Pytorch] – 5 yrs, R – 4 yrs, C - 3 yrs, OpenCV – 2 yrs, Git – 5 yrs, [Singularity, Docker] – 2 yrs
Software tools	Excel, WordPress, Adobe Creative Suite, LaTeX, HTML/CSS, FSL (neuroimaging)
Medical Image Analysis	Worked with retinal fundus images, fetal echocardiography images, chest X-Ray, brain (structural and functional) and cardiac magnetic resonance images.
Project management skills	Technical documentation and presentations. Experience in working in multi-disciplinary teams.

PATENTS

Method and system for performing ophthalmic image analysis, Patent no: 350467, Patent date: 07 August 2013 (Application no. 3534/CHE/2013), **Status:** Granted, in force since 2015.

Patentee: Healthcare Technology Innovation Centre.

Inventors: Niranjn Joshi, Keerthi Ram, Mohanasankar Sivaprakasam, Preeti Gopal, **Vaanathi Sundaesan**, Garima Gupta

AWARDS, PRIZES & SCHOLARSHIPS

2018 - 2019	Oxford Indira Gandhi Graduate Scholarship Awarded by Somerville College, University of Oxford, UK. Awarded to up to 3 Indian students annually to pursue graduate studies at the University of Oxford.
2015 - 2018	Prem-Suki Foundation Scholarship Awarded by Somerville College, University of Oxford, UK. Awarded to an Indian student annually to pursue graduate studies in Biomedical/Healthcare sciences at University of Oxford.
2019, 2017	Guarantors of Brain travel grant Awarded by Organization for Human Brain Mapping (OHBM) board for attending Annual meetings of OHBM at Vancouver in 2017 & Italy in 2019.

2018

Best poster award

Won for poster titled "Improvements in the White Matter Hyperintensities Detection Algorithm using local adaptive thresholding" at Wellcome centre integrative neuroimaging Neurodegeneration Day, University of Oxford, UK.

2012 - 2015

Half-time Research/Teaching Assistantship

Awarded at Indian Institute of Technology Madras, India

CONFERENCE CHALLENGES PARTICIPATED

- **MICCAI Brain Tumor Segmentation Challenge 2020** – Secured 5th highest score (10th place) out of 78 participated teams.
- **MICCAI Multi-Centre, Multi-Vendor & Multi-Disease Cardiac Image Segmentation Challenge 2020** – Secured 6th place out of 14 participated teams.

LIST OF PUBLICATIONS

Google Scholar Profile: <https://scholar.google.com/citations?user=Pr3C3V0AAAAJ&hl=en>

JOURNAL ARTICLES

- V Bordin, I Bertani, I Mattioli, **V Sundaresan**, P McCarthy, S Suri, E Zsoldos, N Filippini, A Mahmood, L Melazzini, and M M Laganà, et al, "Integrating large-scale neuroimaging research datasets: harmonisation of white matter hyperintensity measurements across Whitehall and UK Biobank datasets." *NeuroImage*
- L Melazzini, C E Mackay, V Bordin, S Suri, E Zsoldos, N Filippini, A Mahmood, **V Sundaresan**, M Codari, E Duff and A Singh-Manoux et al. "White matter hyperintensities classified according to intensity and spatial location reveal specific associations with cognitive performance." *NeuroImage: Clinical* 30, p.102616. **2021**
<https://doi.org/10.1016/j.nicl.2021.102616>
- **V Sundaresan**, G Zamboni, C Le Heron, P M Rothwell, M Husain, M Battaglini, N De Stefano, M Jenkinson, and L Griffanti. "Automated lesion segmentation with BIANCA: impact of population-level features, classification algorithm and locally adaptive thresholding." *NeuroImage* 202: 116056. **2019**
<https://doi.org/10.1016/j.neuroimage.2019.116056>
- **V Sundaresan**, L Griffanti, P Kindalova, F Alfaro-Almagro, G Zamboni, P M Rothwell, T E. Nichols, and M Jenkinson. "Modelling the distribution of white matter hyperintensities due to ageing on MRI images using Bayesian inference." *Neuroimage* 185: 434-445. **2019**
<https://doi.org/10.1016/j.neuroimage.2018.10.042>
- L Griffanti, G Zamboni, A Khan, L Li, G Bonifacio, **V Sundaresan**, U G Schulz et al. "BIANCA (Brain Intensity AbNormality Classification Algorithm): a new tool for automated segmentation of white matter hyperintensities." *Neuroimage* 141: 191-205. **2016**
[10.1016/j.neuroimage.2016.07.018](https://doi.org/10.1016/j.neuroimage.2016.07.018)

JOURNALS UNDER REVIEW/PREPRINTS

- **V Sundaresan**, G Zamboni, N K Dinsdale, P M Rothwell, L Griffanti and M Jenkinson. "Comparison of domain adaptation techniques for white matter hyperintensity segmentation in brain MR images." *Medical Image Analysis* (**submitted in 2021, under review**)

(preprint available at <https://doi.org/10.1101/2021.03.12.435171>, citation count: 0)

- **V Sundaresan**, G Zamboni, P M Rothwell, M Jenkinson, and L Griffanti. "Triplanar ensemble U-Net model for white matter hyperintensities segmentation on MR images." *Medical Image Analysis* (submitted in 2020, under second round of review)

(preprint available at <https://doi.org/10.1101/2020.07.24.219485>, citation count: 1)

INTERNATIONAL CONFERENCES

- G Gentile, M Battaglini, L Luchetti, A Giorgio, L Griffanti, **V Sundaresan**, M Jenkinson, & N De Stefano. "BIANCA for an automatic detection of multiple sclerosis lesions using machine learning." 25, Article: P1256. SAGE publications. **2019**
<https://doi.org/10.1177/1352458519868081>
- **V Sundaresan**, L Griffanti, M Jenkinson. "Brain Tumour Segmentation Using a Triplanar Ensemble of U-Nets on MR Images." In: Crimi A., Bakas S. (eds) *Brainlesion: Glioma, Multiple Sclerosis, Stroke and Traumatic Brain Injuries*. BrainLes 2020, MICCAI 2020. Lecture Notes in Computer Science, vol 12658. Springer, Cham **2021**.
https://doi.org/10.1007/978-3-030-72084-1_31
- J A Acero*, **V Sundaresan***, N Dinsdale, V Grau, and M Jenkinson. "A 2-Step Deep Learning Method with Domain Adaptation for Multi-Centre, Multi-Vendor and Multi-Disease Cardiac Magnetic Resonance Segmentation." In *International Workshop on Statistical Atlases and Computational Models of the Heart*, MICCAI 2020, pp. 196-207. Springer, Cham, **2020**.
https://doi.org/10.1007/978-3-030-68107-4_20
- **V Sundaresan**, C P Bridge, C Ioannou, and J A Noble. "Automated characterization of the fetal heart in ultrasound images using fully convolutional neural networks." In *2017 IEEE 14th International Symposium on Biomedical Imaging (ISBI)*, pp. 671-674. IEEE, **2017**.
<https://doi.org/10.1109/ISBI.2017.7950609>
- **V Sundaresan**, K Ram, K Selvaraj, N Joshi, and M Sivaprakasam. "Adaptive super-candidate based approach for detection and classification of drusen on retinal fundus images." *Proceedings MICCAI-OMIA* **2015**.
<https://doi.org/10.17077/omia.1030>
- **V Sundaresan**, K Ram, N Joshi, M Sivaprakasam, and R Gandhi. "Computer-assisted grading of diabetic macular edema on retinal color fundus images." In *2015 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, pp. 4330-4333. IEEE, **2015**.
<https://doi.org/10.1109/EMBC.2015.7319353>
- **V Sundaresan**, K Ram, N Joshi, M Sivaprakasam, and R Gandhi. "Integrated approach for accurate localization of optic disc and macula." *Proceedings MICCAI-OMIA* **2014**
<https://doi.org/10.17077/omia.1014>

INTERNATIONAL CONFERENCE ABSTRACTS

- **V Sundaresan**, M Jenkinson, G Zamboni and L Griffanti. "Detection of white matter hyperintensities using Triplanar U-Net ensemble network" - Annual Meeting of International Society for Magnetic Resonance in Medicine (ISMRM) **2020**, France.
- **V Sundaresan**, C Arthofer, G Zamboni, S Sotiropoulos, P Rothwell, R Dineen, D Auer, M Jenkinson, and L Griffanti "Identifying Subjects with Cerebral Microbleeds in Big Datasets: a Pipeline for Candidate Selection" - Annual meeting of Organization for Human Brain Mapping (OHBM) **2019**, Italy.

- **V Sundaresan**, M Jenkinson, G Zamboni and L Griffanti. "*Local Intensity Guided Spatially Adaptive Thresholding of White Matter Lesion Probabilities*" - OHBM **2018**, Singapore.
- **V Sundaresan**, M Jenkinson, G Zamboni and L Griffanti. "*Machine Learning-based improvements in the white matter hyperintensities detection algorithm.*" Medical Sciences Day, Nuffield Department of Clinical Neurosciences, University of Oxford, UK, **2018**.
- **V Sundaresan**, M Jenkinson, G Zamboni and L Griffanti. "*White matter hyperintensities distribution modelling with respect to ageing*" – Biomedical Imaging festival 2017, University of Oxford, UK, **2018**.
- 'Modelling white matter hyperintensities distribution within a population using Bayesian Inference.' - OHBM **2017**, Vancouver.

TALKS IN SYMPOSIUMS

- 'Modelling structural and functional changes in Brain in disease' – CDT summer school, Imperial College, London 2017.
- 'Detection of small vessel disease signs on brain MRI images' – Translational Neuroimaging Group, Department of psychiatry, University of Oxford 2017.

OTHER VOLUNTARY/STUDENT ACTIVITIES

- Participated in the online student outreach event "I'm an engineer: get me out of here!" Nov 8 – Nov 18, 2016.
- Serving as an expert scientific mentor in Karta Initiative widening access program.

REVIEWING ACTIVITIES

- NeuroImage
- NeuroImage Clinical.