

Suman Saha

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Contact Information:

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RESEARCH INTERESTS

Computer Vision, Deep Learning and Machine Learning

RESEARCH EXPERIENCE

Oxford Brookes University (December 2017 - Present)
Research Fellow

Project title: *Action tube formulation using deep convolutional neural networks*. A transition matrix based network has been proposed for spatio-temporal human action localisation in videos. The related work has been submitted to ECCV 2018.

Disney Research Zurich (April 2017 - July 2017)
Research Intern

Project title: *Unsupervised and semi-supervised learning of audience facial expressions using deep generative models*. Improved the classification accuracy by 9% over the existing method.

University of Bedfordshire (June 2013 - September 2013)
Research Intern

Project title: *New Foundational Structures for Engineering Verified multi-UAVs*
Collaborator: Department of Computer Science, University of Oxford

DEEP LEARNING SKILLS

- **Deep CNN architectures:** AlexNet and VGG-16 (image and video classification); Faster-RCNN and SSD object detectors (for images); AMTnet and ACT human action detectors (for videos).
- **Deep generative models:** VAEs (Variational Autoencoders), GANs (Generative adversarial networks), semi-supervised deep generative models.
- **Deep learning software tools:** PyTorch, Torch, Caffe, Theano.
- **GPU application:** multi-GPU training / testing in PyTorch.

EDUCATION

Ph.D. in Computer Science and Mathematics (September 2014 - May 2018)

Artificial Intelligence and Vision research group, Oxford Brookes University

Thesis title: *Spatio-temporal Human Action Detection and Instance Segmentation in Videos*.

Supervisors: Professor Fabio Cuzzolin, Professor Nigel Crook, Dr Tjeerd Olde Scheper.
Thesis assessment committee: Professor Mubarak Shah, Professor Andrea Vedaldi, Dr Faye R Mitchell.

MSc in Computer Science (September 2012 - March 2014)

University of Bedfordshire, United Kingdom

Grade: **double distinction** (Scored 94.27% marks)

Thesis: *A Monocular Vision Approach for Obstacle Detection and Collision Avoidance*

for Low-cost Quadcopters.

Supervisors: Ashutosh Natraj, Sonia Waharte

Related Publication link, Project page link, MSc thesis poster

Polytechnic Diploma Engineering in Computer Science (August 1999 - June 2002)

Siddaganga Polytechnic College, Tumkur, Karnataka, India

PUBLICATIONS

- **Suman Saha**, Rajitha Navarathna, Leonhard Helming, Romann M. Weber. 2018.
Unsupervised Deep Representations for Learning Audience Facial Behaviors, accepted in **CVPR** (Computer Vision and Pattern Recognition) workshop, Salt Lake City United States, June 2018.
- **Suman Saha**. 2018.
Spatio-temporal Human Action Detection and Instance Segmentation in Videos, PhD thesis, Oxford Brookes University, UK.
- Gurkirt Singh, **Suman Saha**, Fabio Cuzzolin. 2018.
Transition Matrix Network for High-Performance Spatio-temporal Action Localisation, submitted to **ECCV** (European Conference on Computer Vision), Munich Germany, September 2018.
- Harkirat S. Behl, Michael Sapienza, Gurkirt Singh, **Suman Saha**, Fabio Cuzzolin, Philip H. S. Torr. 2018.
Incremental Tube Construction for Human Action Detection, arXiv preprint arXiv:1704.01358, 2018.
- **Suman Saha**, Gurkirt Singh, Fabio Cuzzolin. 2017.
AMTnet: Action-Micro-Tube Regression by End-to-end Trainable Deep Architecture, arXiv preprint arXiv:1704.04952. **ICCV** (International Conference on Computer Vision), Venice Italy, October 2017.
- Gurkirt Singh, **Suman Saha**, Michael Sapienza, Philip H. S. Torr, Fabio Cuzzolin. 2017.
Online Real time Multiple Spatiotemporal Action Localisation and Prediction on a Single Platform, arXiv preprint arXiv:1611.08563. **ICCV** (International Conference on Computer Vision), Venice Italy, October 2017.
- **Suman Saha**, Gurkirt Singh, Michael Sapienza, Philip H. S. Torr, Fabio Cuzzolin. 2017.
Spatio-temporal Human action Localisation and Instance Segmentation in Temporally Untrimmed Videos, arXiv preprint arXiv:1707.07213 (2017).
- Fabio Cuzzolin, Michael Sapienza, Patrick Esser, **Suman Saha**, Miss Marloes Franssen, Johnny Collett, Helen Dawes. 2017.
Metric Learning for Parkinsonian Identification from IMU Gait Measurements, Journal Gait & Posture 54 (2017): 127-132.
- **Suman Saha**, Gurkirt Singh, Michael Sapienza, Philip H. S. Torr, Fabio Cuzzolin. 2016.
Deep Learning for Detecting Multiple Space-Time Action Tubes in Videos, In Proceedings of the 27-th British Machine Vision Conference (BMVC), York, United Kingdom. Our proposed method **achieved the state-of-the-art results to date** in spatiotemporal human action localisation in videos.
Project page link, YouTube video link.
- **Suman Saha**, Ashutosh Natraj and Sonia Waharte. 2014.
A Real-time Monocular Vision-based Frontal Obstacle Detection and Avoidance for Low Cost UAVs in GPS Denied Environment, 2014 IEEE International Conference on Aerospace Electronics and Remote Sensing Technology, Yogyakarta, pp. 189-195. Project page link, Paper link.
- **Suman Saha**. 2014.
A Monocular Vision Approach for Obstacle Detection and Collision Avoidance for Low-cost Quadcopters, MSc thesis, University of Bedfordshire, UK.
- **Suman Saha**. 2014.
Face Recognition using PCA and Multilayer Feedforward Neural Networks, European Journal of Applied Sciences and Technology.
- **Suman Saha**. 2014.
Parallelization of Genetic Algorithms using MapReduce, European Journal of Applied Social Sciences Research.

PROFESSIONAL EXPERIENCE	<p>Tata Steel Limited, Jamshedpur, India (November 2006 - August 2012)</p> <p>Software Analyst at the Research and Development Division (R&D)</p> <p>Link to reference letter-1</p> <p>Link to reference letter-2</p> <p>Major works include:</p> <ul style="list-style-type: none"> • Designed and developed a software to increase the thermal efficiency and reduce the fuel consumption of WRM (wire rod mill) reheating furnace. • Designed and developed software to predict mill force, mean flow stress, strain, percentage elongation, yield strength using <i>ANN</i> (artificial neural networks). • Maintained a software which predicts the mechanical properties of the hot rolled strip using a series of physical and microstructural based models, coupled with various techniques including <i>ANN</i> (artificial neural networks). • Applied different Machine learning algorithms such as SVM (Support Vector Machine), PCA (Principal Component Analysis) for production data analysis.
	<p>SICT Pvt. Ltd. India (July 2002 - October 2006)</p> <p>Software Developer</p>
TEACHING EXPERIENCE	<p>Oxford Brookes University, United Kingdom</p> <ul style="list-style-type: none"> • Delivered an introductory lecture on <i>Advance Computer Vision</i> to MSc students, 6th July 2015. • Helped two MSc Computer Vision students with their final projects (2015-2016 batch). • Teach undergraduate students <i>IT Skills</i> module (September 2016-2017 batch).
	<p>Tata Steel Limited, Jamshedpur, India</p> <ul style="list-style-type: none"> • Guided 3 Bachelor in Computer Science summer interns at R&D division (2010).
TECHNICAL REPORT, TALK	<ul style="list-style-type: none"> • Delivered a talk on spatio-temporal human action localisation at the Departmental Research Seminar, Oxford Brookes University, February 2016. • <i>A survey report on Deep Learning Approach for Human Action Detection from Video</i> submitted to CCT Dept. Oxford Brookes University, September, 2015. • <i>Performance analysis on temporal tubes: A benchmarking report</i> submitted to CCT Dept. Oxford Brookes University, 2014. • <i>Streaming hierarchical graph based video segmentation</i>, a talk presented at research group seminar, Oxford Brookes University, November, 2014. • <i>Streaming hierarchical graph based video segmentation: A step-by-step guide</i> submitted to CCT Dept. Oxford Brookes University, 2014.
AWARDS AND ACHIEVEMENTS	<ul style="list-style-type: none"> • Our group won the reading group competition at <i>ICVSS 2015 Summer School</i> - 2015 • Received the prestigious University Research Studentship award, Oxford Brookes University - 2014 • Successfully passed ICVSS 2015 examination, July 2015. • Nominated for the prestigious Overseas PhD Scholarship award Scheme, Aberystwyth University, United Kingdom (<i>declined</i>) - 2014 • <i>Best Overall Performance award</i> for MSc course, 3rd April, 2014 • <i>Best Masters Project award</i> on 3rd April, 2014

- *Merit Scholarship award* at Masters level, 2014
- Secured highest marks in Computers Science in standard X(96%) and XII(grade: A).
- Secured top rank in school in standard 'X' final board examinations.

COURSES UNDERTAKEN

- CS231n: Convolutional Neural Networks for Visual Recognition, Stanford Vision Lab (mode - online).
- Machine Learning course, department of Computer Science, University of Oxford (mode - online).
- Attended International Computer Vision Summer School 2015, Sicily, Italy.
- Attended doctorate training programme for statistical methods of data analysis, Oxford Brookes University, 2015.
- Attended training session on the use of Oxford Brookes high performance computing facilities, 2015.
- Attended talk on *Visualizing and Understanding Recurrent Neural Networks* by *Andrej Karpathy*, Stanford Computer Science group, at Engineering and Science Department, Oxford University.
- Attended two reading groups in the Department of Engineering Science at University of Oxford, topic discussed Generative Adversarial Nets (GANs), Variational Autoencoders (VAEs), June, 2016.
- *MSc taught courses*: Intelligent Agents, Programming Embedded Systems, Distributed and Parallel Computing, Systems Architecture, Data Modelling and Management, Network Systems, Cryptography and Cryptanalysis, Professional Project Management.
- *Self-motivated learnings (MSc)*: Multiple View Geometry in Computer Vision, Probability Theory and its Applications, Linear Algebra, Single and Multi-Variable Calculus.
- *Polytechnic Diploma Engineering*: Applied Mathematics, Applied Science, Digital Electronics and Introduction to Microprocessor, Electrical and Electronic Engineering, Computer Network and Architecture, System Programming, Software Engineering, Operating System, Advanced C programming and Data Structures.

SERVICES AND PARTICIPATION

- Presented a poster on *Deep Learning for Detecting Multiple Space-Time Action Tubes in Videos* in the *MURI Meeting* at St. Catherines College, Oxford, UK, 1st August, 2016.
- Presented a poster on *Online Human Action Localisation based on Appearance and Motion Cues* at (*ICVSS*) 2015, Sicily, Italy, July 2015.
- Actively participated in the TeenTech event at London, 1st December 2015.
- Attended the Ambassadors visit at Gipsy Lane campus, Oxford Brookes University, UK, 30th September, 2015.
- Actively participated in the BBC News live broadcast at BBC broadcasting hub, London, 14th September, 2015. Watch: video1 , video2.
- Taking humanoid robot Artie to Magna Carta event on 18th June 2015.
- Actively participated in the Outburst Festival with humanoid robot Artie and the Naos, 9th May, 2015.

- Actively participated in the Joint University Alliance and Deloitte research showcase, Royal Institution, 21 Albemarle Street, London, W1S 4BS, UK, 12 March, 2015.
- Attended the Real World Impact filming event organised by University Alliance on 31st January, 2015 at Gipsy lane campus, Oxford Brookes University, UK, 31st January, 2015.

COMPUTING SKILLS

- **Programming Languages:** C/C++, Matlab, Lua, Python, Java.
- **Scientific computing software tool:** Torch, Caffe, Theano, OpenCV.
- **GPU application:** multi-GPU training/testing in Torch.
- **Operating Systems:** Linux and Windows.
- **Development Environments:** PyCharm, Lua Development Tool, GCC, NetBeans.
- **Productivity Applications:** LaTeX, Bitbucekt, Github, Vim, Kate, MS Office, Libreoffice.
- **Multi-media development software:** Inkscape, Openshot, Audacity, GIMP.

REFERENCES

Academic references

1. Professor Fabio Cuzzolin
 - Relationship: Director of studies and PhD Supervisor.
 - Organization: Oxford Brookes University
 - Position: Professor of Artificial Intelligence
 - Website URL: <http://cms.brookes.ac.uk/staff/FabioCuzzolin/>
 - E-mail: fabio.cuzzolin@brookes.ac.uk
2. Professor Nigel Crook
 - Relationship: PhD co-supervisor
 - Organization: Oxford Brookes University
 - Position: Head of the Computing and Communication Technology Department
 - Website URL: <https://www.brookes.ac.uk/profiles/staff/nigel-crook/>
 - E-mail: ncrook@brookes.ac.uk
3. Dr Tjeerd Olde Scheper
 - Relationship: PhD co-supervisor and research tutor
 - Organization: Oxford Brookes University
 - Position: Senior Lecturer at Computing and Communication Technology Department
 - Website URL: <http://cct.brookes.ac.uk/staff/tjeerdoldescheper.html>
 - E-mail: tvolde-scheper@brookes.ac.uk
4. Dr Michael Sapienza
 - Relationship: PhD advisor
 - Organization: University of Oxford
 - Position: Postdoctoral research fellow
 - Website URL: <https://sites.google.com/site/mikesapi/>
 - E-mail: michael.sapienza@eng.ox.ac.uk

5. Dr Ashutosh Natraj
 - Relationship: MSc supervisor
 - Organization: University of Oxford
 - Position: Postdoctoral research fellow
 - Website URL: <https://www.cs.ox.ac.uk/people/ashutosh.natraj/>
 - E-mail: ashutosh.natraj@gmail.com
6. Dr Sonia Waharte
 - Relationship: MSc co-supervisor
 - Organization: University of Oxford
 - Position: Postdoctoral research fellow
 - Website URL: <https://www.cs.ox.ac.uk/people/sonia.waharte/>
 - E-mail: sonia.waharte@gmail.com

Professional references

1. Dr Romann Weber
 - Relationship: Project leader / supervisor
 - Organization: Disney Research Zurich
 - Position: Research Scientist
 - E-mail: romann.weber@disneyresearch.com
 - Link to the reference letter received
2. Dr Rajitha Navarantha
 - Relationship: co-supervisor
 - Organization: Disney Research Pittsburgh
 - Position: Associate Research Scientist
 - E-mail: rajitha.navarathna@disneyresearch.com
3. Dr Sumitesh Das
 - Relationship: Project leader
 - Organization: Tata Steel Limited, India
 - Position: Chief (Global Research Programmes) at Tata Steel Limited
 - Website URL: Google Scholar link
 - E-mail: sumitesh.das@tatasteel.com
 - Link to the reference letter received
4. Dr Abhishek Raj (M. Tech. and PhD, IIT Mumbai, India)
 - Relationship: Project advisor
 - Organization: Tata Steel Limited, India
 - Position: Researcher at R&D division
 - E-mail: abhishek.raj@tatasteel.com
 - Link to the reference letter received
5. Raju Venkat Dasu (M. Tech. IIT Delhi)
 - Relationship: Project leader
 - Organization: Tata Steel Limited, India
 - Position: Researcher at R&D division
 - E-mail: dvr019@gmail.com