

Dr. R. Balasubramanian, BOYSCAST Fellow

Associate Professor, Dept. of Computer Science and Engineering, IIT Roorkee, Roorkee 247 667, India,
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Education

Ph.D (Mathematics and Computer Science)	Indian Institute of Technology Madras, Chennai, India , July 2001	-
M. Sc (Mathematics)	Madras Christian College, University of Madras, July' 96	89.81% (Gold Medalist)
B. Sc (Mathematics)	A.M.Jain College, University of Madras, July' 94	91.8%

Work Experience

- **Associate Professor**, Department of Computer Science and Engineering, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, 247 667, INDIA (Sep'13 – Ongoing)
- **Visiting Researcher** with Dr. Pradeep Atrey, Department of Computer Science, University at Albany - State University of New York (SUNY), NY, USA (Dec'14)
- **Visiting Researcher** with Prof. Mohan S. Kankanhalli, Department of Computer Science, School of Computing as well as SeSaMe Research Centre, National University of Singapore, SINGAPORE (Jul'13 and Jul'14)
- **Visiting Researcher** with Prof. C. Eswaran, Faculty of Computing and Informatics, Multimedia University, Cyberjaya Campus, MALAYSIA (Jun'12 and Jul'14)
- **Associate Professor**, Department of Mathematics, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, 247 667, INDIA (Oct'12 – Sep'13)
- **Visiting Researcher** with Dr. Ibrahim Venkat, School of Computer Sciences, Universiti Sains Malaysia, Pulau Pinang, MALAYSIA (Jun'12 and Jul'13)
- **Assistant Professor**, Department of Mathematics, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, 247 667, INDIA (Feb' 06 – Oct'12)
- **Visiting Scientist** with Dr. K. Swaminathan, Department of Mathematics, Indian Institute of Technology Madras, Chennai 600 036, INDIA (Oct' 11 and Dec'11)
- **Visiting Professor** (under BOYSCAST fellowship) with Dr. Jonathan Wu, Department of Electrical and Computer Engineering, University of Windsor, Windsor, Ontario, ON, N9B 3P4 CANADA (May' 09 – Aug' 09)
- **Assistant Professor** (On Contract), Department of Mathematics, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, 247 667, INDIA (Jan' 06 – Feb' 06)

- **Lecturer** (On Contract), Department of Mathematics, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, 247 667, INDIA (Sep' 04 – Dec'05)
- **Lecturer**, Department of Computer Science and Information Systems, IPCU Group, Birla Institute of Technology and Science, Pilani, Rajasthan 333 031, INDIA (Sep' 03 – Sep' 04)
- **Post Doctoral Associate** with Prof. Deborah Silver, Department of Electrical and Computer Engineering, Rutgers, The State University of New Jersey, USA (July'02 – Apr'03)
- **Post Doctoral Fellow** with Prof. Pascal Matsakis, Computer Engineering and Computer Science Department, University of Missouri, Columbia, USA (Oct' 01 – June' 02)
- **Guest Scientist**, International Center for Theoretical Physics (ICTP) Trieste, ITALY (Sep' 01, Sep' 00)

Thesis supervised

Ph.D	- 15 completed and 11 Ongoing
M.Sc/M.C.A/M.Tech	- 112 completed
B. Tech/Int. M.Sc	- 25 completed

Completed Ph.D Students

1. **Dr. Sanjeev Kumar** (Jul 2004- Mar 2008): *Reconstruction of 3D Objects from 2D views: Simulation, Applications and Error Analysis*, (Awarded Ph.D in Nov. 2008 and presently in the Department of Mathematics, IIT Roorkee as an Associate Professor from Apr. 2016. He was a Post Doctoral Fellow in the Department of Mathematics and Computer Science, The Artificial Vision and Real-Time Systems (AVIRES) Laboratory, University of Udine, **ITALY** from Mar. 2008 to Nov. 2010).
2. **Dr. Gaurav Bhatnagar** (Jul 2006 - Sep 2009): *Emphasized Digital Watermarking on Singular Value Decomposition in Frequency Domain*, (Awarded Ph.D in Nov. 2010 and he was in the Dept. of Electrical and Computer Engineering, University of Windsor, **CANADA** as a Post Doctoral Fellow from October 2009 to August 2013 and Presently working as an Assistant Professor in the Dept. of Mathematics and Statistics at IIT Jodhpur).

3. **Dr. Nidhi Taneja** (Jan 2007 – May 2010): *Security Solutions for Still Visual Data*, (Awarded Ph.D in Nov. 2010 and presently working as an Assistant Professor in the Dept. of Electronics and Communication Engineering at Delhi Technological University from July 2010).
4. **Dr. Manoj Kumar** (Jul 2006-Dec 2010): *Reconstruction of 3-D Objects using Shape From Shading Algorithms* (Awarded Ph.D in Nov. 2011 and Presently working as an Assistant Professor in the Department of Computer Science, Babasaheb Bhimrao Ambedkar Central University, Lucknow).
5. **Dr. Sanjay Rawat** (Jan 2008 - June 2011): *Digital Watermarking for Copyright Protection and Authentication* (Awarded Ph.D in Nov. 2012 and presently working as an Assistant Professor in the Department of Mathematics, THDC Institute of Hydropower Engineering and Technology, Bhagirathipuram, Tehri Garhwal).
6. **Dr. Anil Balaji Gonde** (Jul 2007-Aug 2011): *Local and Global Descriptors using Wavelet based features for Image Retrieval* (Awarded Ph.D in Nov. 2012 and presently working as an Associate Professor in the Department of Electronics and Tele communication Engineering, Shri Guru Gobind Singhji Institute of Engineering and Technology, Nanded).
7. **Dr. Subrahmanyam Murala** (Aug 2009-Apr 2012): *Design and Integration of Feature Descriptors for Content Based Image Retrieval* (Defended his thesis on 05/11/2012 and presently in Department of Electrical and Computer Engineering, University of Windsor, **CANADA** as a Post Doctoral Fellow from 1st July 2012).
8. **Dr. Sanoj Kumar** (Jul 2008- Dec 2012): *Robust Estimation of Optical Flow and Disparity map from Image Sequences* (Defended his thesis on 23/05/2013 and presently in the Department of Computer Science, The Artificial Vision and Real-Time Systems (AVIRES) Laboratory, University of Udine, ITALY as a Post Doctoral Fellow from 1st October 2013).
9. **Dr. Mohit Srivastava** (Jan 2009 - July 2013): *Quantitative Approaches for Object Based Image Analysis of Satellite Data* (Defended his thesis on 27/12/2013 and presently working as an Associate Professor in the Department of Electronics & Communication Engineering, Bharat Institute of Technology Meerut from August 2013)

10. **Dr. Himanshu Agarwal** (July 2009 - July 2014): *Multipurpose Invisible and Visible Digital Image Watermarking Schemes* (Defended his thesis on 23/02/2015 and presently working as an Assistant Professor in the Department of Mathematics, Department of Mathematics Jaypee Institute of Information Technology, UP, India. He was an Exchange Ph.D student under Dr. Pradeep Atrey in the Applied Computer Science Department, The University of Winnipeg, MB, **CANADA** under the Canadian Commonwealth Scholarship Program, for Six months from September 1, 2012 to February 28, 2013)
11. **Dr. Prabhu Natarajan (Jul 2010- Oct 2014)**: Study of Some Information Extraction Techniques for Hyperspectral Imaging (Defended his thesis on 06/04/2015)
12. **Dr. Manisha Verma (Jul 2012- Dec 2015)**: New Feature Descriptors for Image Retrieval, Object Tracking and Shot Detection (Defended her thesis on 06/04/2016, and presently working as a Post Doctoral Fellow in the Department of Computer Science and Engineering at IIT Gandhinagar from August 1, 2016)
13. **Dr. Tasneem Ahmed (Jan 2012- Jan 2016)**: Development of Land Surface Monitoring Algorithms for Satellite Images (Defended his thesis on 11/05/2016)
14. **Pushpendra Kumar (Jul 2011- Jul 2016)**: Some Efficient Algorithms for Optical Flow Estimation ((Defended his thesis on 27/01/2017)
15. **Bhavik R Patel (Jul 2013-Dec 2016)**: Face Image Analysis for Soft Biometric Classification (Submitted his thesis on 19/12/2016)

Post Doctoral Research Associate

Dr. Asha Rani (30th June 2011 – 31st March 2014): Under **CSIR Project** entitled "Digital Watermarking for Rightful Ownership and Copyright Protection".

Dr. Asha Rani (2014-2017) under **DST WOS-A** Project entitled " Multimodal Biometric based person Authentication and Identification System".

Dr. Priyanka Singh (Jan 2016- Jan 2017) under **DeitY Project** in the area of "Multimedia Security".

Project Fellows

1. **Dr. Asha Rani** (ISRO Project, June 2007 to December 2007)
2. **Dr. Gaurav Gupta** (ISRO Project, October 2007 to August 2010)
3. **Mr. Deepak Murugan** (ISRO Project, April 2013 to February 2015)

Major Awards

- **BOYSCAST Fellowship (2008-09)** (Fellowship of US \$3000 per month + perks) in Mathematical Sciences awarded by Department of Science and Technology (DST), Government of India to visit **University of Windsor, CANADA** for the duration of THREE months for conducting advanced training/research in the area of Computational aspects of Geometry and Algebra under the mentorship of **Prof. Jonathan Wu**, Canada Research Chair, Department of Electrical and Computer Engineering, University of Windsor, CANADA.
- **Outstanding Teacher Award** awarded by Indian Institute of Technology Roorkee, 2010 (On Teacher's Day).

Sponsored Research Projects

S. N	Title of the Project	Sponsoring Agency	Grant Sanctioned (in Rs.)	Investigator	Status
1.	Nearest neighbor vector based Palmprint verification	IIT Roorkee, Scheme A	1.0 Lac	Principal Investigator	Completed (2006-07)
2	Reconstruction of 3D curves and surfaces from arbitrary Perspective views	MHRD, IIT Roorkee, Scheme B	3.14 lacs	Principal Investigator	Completed (2007-10)
3.	Face Recognition: A Neural Network Approach	DST, New Delhi	2.88 lacs	Principal Investigator	Completed (2007-10)

4.	Reconstruction of 3D objects from Stereo space Imagery for Development of city models	ISRO, SAC Ahmedabad	11.5 lacs	Co-PI, PI: Prof. Rama Bhargava	Completed (Apr 2007 to August 2010)
5.	Digital Watermarking for Rightful Ownership and Copyright Protection	CSIR, New Delhi	10.92 lacs	Principal Investigator	Completed 2011-14
6.	3D Reconstruction and Software Development for City Model Generation from Satellite Images	ISRO, SAC Ahmedabad	7.73 lacs	Principal Investigator	Completed 2012-15
7.	Multimodal Biometric based person Authentication and Identification System	DST, New Delhi	23.52667 lacs	Mentor, PI: Dr. Asha Rani (under WOS-A)	Ongoing 2014-17
8.	Information Security Education and Awareness (ISEA) Project phase II	DeitY, New Delhi	137.7 lacs	Co-PI, PI: Prof. Manoj Misra (Head, CSE)	Ongoing 2014-19
9.	Development and Real-time Implementation of Filters to Remove Noise and Blur Effect	Instruments Research & Development Establishment (IRDE), Dehradun	18.50 lacs	Co-PI, PI: Dr. B. K. Kaushik	Ongoing 2016-18
10.	Multi-oriented Indic text recognition in natural scene and video images	Science & Engineering Research Board, New Delhi	17.8871 lacs	Co-PI, PI: Dr. Partha Pratim Roy	Ongoing 2016-19
11	NVIDIA Hardware Grant, Titan X {non-Pascal} GPU	NVIDIA Corporation	1.5 Lacs	PI	2016-17

Consultancy Projects

S. N	Title of the Project	Sponsoring Agency	Grant Sanctioned (in Rs.)	Investigator	Status
1.	Development of feature reduction and classification algorithms for Hyperspectral data processing	Defence Electronics Applications Laboratory (DEAL), Dehradun	9.3755 Lacs	Principal Investigator	Completed Nov 2010 to Mar 2012
2	Anomaly Detection and Sub-pixel Classification Algorithms for Hyperspectral Imaging	Defence Electronics Applications Laboratory (DEAL), Dehradun	19.854 lacs	Investigator, PI: Prof. Manoj Arora	Completed Nov 2010 to Mar 2012
3	Study of Heat Shimmer Removal Techniques for Long Range Imaging Systems	Instruments Research & Development Establishment (IRDE), Dehradun	8.98 lacs	Co-PI, PI: Dr. B. K. Kaushik	Completed 2013-15
4	Investigating and Analyzing the Program and Course Structure with respect to its Conformance with the International Standards and Research & Industry needs	Govt. of Yemen	US \$8423.00	Investigator, PI: Dr. Sandeep Kumar Garg	Completed 2014-15
5	Development of Restoration Techniques for Weather Degraded Images	Instruments Research & Development Establishment (IRDE), Dehradun	9.70 lacs	Co-PI, PI: Dr. B. K. Kaushik	Ongoing 2015-17

Industry Interaction

- Microsoft R & D, Bangalore
- Sarnoff Innovative Tech. Ltd., Bangalore
- JFWTC, GE India, Bangalore
- IBM India
- iLink Systems, Seattle, USA

Teaching

- So far I have taught **Computer Applications (MA 550), Computer Programming and Numerical Analysis (MA 739), Fundamentals of Object Oriented Programming (CSN-103), Data Structures (CS 102/ MA 106/ MA 568/CA 506/MA 302), Mathematical Aspects of Computer Graphics (IMA 17/ MA 634), Unix Network Programming (CA 602), Image Processing (CA/MA 625), Data Base Management System (MA 635/ MA 303), Artificial Intelligence (CA 701), Computer Aided Design (CA 633/CA 717/ MA 632), Computer Systems and Programming (EC 101 A), Object Oriented Programming Languages (CA 503), Graph Theory (MA 631), Object Oriented Analysis and Design (CS-291), Discrete Structures (CSN-106), Machine Learning (CSN-382) and Basic Engineering Mathematics (MA 101, MA 102 and MA 201)** courses for UG and PG students (B.Tech, MCA, M.Tech and M.Sc) in the Dept. of Computer Science and Engineering and Dept. of Mathematics, IIT Roorkee, India.

Course Development

- Computer Vision, Image Processing, Computer Graphics, Data Structures, Design Analysis of Algorithms, and DBMS (all for FIVE year M.Sc Integrated Programme)
- Data Structures, Image Processing, Computer Graphics, Computer Aided Design, Theory of Computation, Object Oriented Programming Languages and DBMS (for M.C.A.).
- Elective Courses for B. Tech Computer Science and Engineering: Computer Vision, Image Processing, Probability and Statistics for Engineers, Computational Geometry, Advanced Graph Theory and Multimedia Technologies

Expertise

- **Computer Vision** – Vision Geometry, Shape from Shading and Optical Flow Problems
- **Graphics** – Visualization and Volume Graphics
- **Image Processing** – Fractional Transform Theory, Wavelet Analysis, Mathematical Image and Video Processing, Multimedia Security: Digital Watermarking and Encryption Techniques, Biometrics, Content Based Image and Video Retrieval, Object Tracking, Hyperspectral, Microwave Imaging and Video Skimming and Summarization.

Publications Summary

Category	Published/Accepted	Under Submission/Revision
Refereed Journal Papers	80	07
Refereed Conference Papers	80	01
International Book Chapters	06	00
Total	166	08

List of Representative Publications

A. Refereed International Journal Papers:

1. **R. Balasubramanian**, Sukhendu Das and K. Swaminathan, Error Analysis in reconstruction of a line in 3-D space from two arbitrary perspective views, *International Journal of Computer Mathematics (Taylor and Francis)*, **Vol. 78**, No.2, pp. 191-212, 2001.
2. **R. Balasubramanian**, Sukhendu Das, S. Udayabaskaran and K. Swaminathan, Quantization error in stereo imaging systems, *International Journal of Computer Mathematics (Taylor and Francis)*, **Vol. 79**, No.6, pp. 671-691, 2002.
3. **R. Balasubramanian**, Sukhendu Das and K. Swaminathan, Reconstruction of quadratic curves in 3-D from two or more perspective views, *Mathematical problems in Engineering (Taylor and Francis, Now Hindawi)*, **Vol. 8**, No.3, pp. 207-219, 2002.

4. **R. Balasubramanian**, Sukhendu Das and K. Swaminathan, Simulation studies for the performance analysis of the reconstruction of a line in 3-D from two arbitrary perspective views using two plane intersection method, *International Journal of Computer Mathematics (Taylor and Francis)*, **Vol. 80**, No.5, pp. 559-571, 2003.
5. Yatharth Saraf, **R. Balasubramanian** and K. Swaminathan, A classical approach for thinning of binary images using divergence of the potential field, *International Journal of Computer Mathematics (Taylor and Francis)*, **Vol. 82**, No.6, pp. 673-684, 2005.
6. N. Cornea, D. Silver, X. Yuan and **R. Balasubramanian**, Computing Hierarchical Curve-Skeletons of 3D Objects, *The Visual Computer (Springer)*, **Vol. 21**, No. 11, pp. 945-955, 2005.
7. N. Sukavanam, **R. Balasubramanian** and Sanjeev Kumar, Error estimation in reconstruction of quadratic curves in 3-D space, *International Journal of Computer Mathematics (Taylor and Francis)*, **Vol. 84**, No. 1, pp. 121-132, 2007.
8. Yatharth Saraf, **Balasubramanian Raman** and Krishnan Swaminathan, Computing the Curve- Skeletons of Images, *International Journal of Computer Mathematics (Taylor and Francis)*, **Vol. 85**, No. 2, pp.253-270, 2008.
9. Gaurav Bhatnagar, R. Jayaganthan and **Balasubramanian Raman**, Wavelet Analysis of Surface Morphologies of Magnetron Sputtered Al-Cu thin films, *International Journal of Wavelets, Multiresolution and Information Processing (World Scientific)*, **Vol. 7**, No. 1, pp. 59-74, 2009.
10. Gaurav Bhatnagar and **Balasubramanian Raman**, A new Robust Reference Watermarking Scheme based on DWT-SVD, *Computer Standards and Interfaces (Elsevier)*, **Vol. 31**, No. 5, pp. 1002-1013, 2009.
11. Gaurav Bhatnagar, Sanjeev Kumar, **Balasubramanian Raman** and N. Sukavanam Stereo Image Coding via Digital Watermarking, *Journal of Electronic Imaging (IS&T and SPIE)*, **Vol. 18**, No. 3, 033012, 2009.
12. Gaurav Bhatnagar and **Balasubramanian Raman**, Distributed Multiresolution Discrete Fourier Transform and its Application to Watermarking, *International Journal of Wavelets, Multiresolution and Information Processing (World Scientific)*, **Vol. 8**, No. 2, pp. 225-241, 2010.
13. Gaurav Bhatnagar, Jonathan Wu and **Balasubramanian Raman**, A robust security framework for 3D images, *Journal of Visualization (Springer-Verlag)*, **vol. 14**, no. 1, pp. 85–93, <http://dx.doi.org/10.1007/s12650-010-0067-5>, 2011.

14. Nidhi Taneja, **Balasubramanian Raman**, and Indra Gupta, Selective Image Encryption in Fractional Wavelet Domain, *AEÜ - International Journal of Electronics and Communications (Elsevier)*, **Vol. 65**, No. 4, pp. 338-344, <http://dx.doi.org/10.1016/j.aeue.2010.04.011>, 2011.
15. Gaurav Bhatnagar and **Balasubramanian Raman**, A new Robust Reference Logo Watermarking Scheme, *Multimedia Tools and Applications* (Special Issue on *Data Hiding for Multimedia Security*, *Springer-Verlag*), **Vol. 52**, No. 2, pp. 621-640, DOI: 10.1007/s11042-009-0433-2, 2011.
16. Nidhi Taneja, **Balasubramanian Raman** and Indra Gupta, Chaos based partial encryption of SPIHT Compressed Images, *International Journal of Wavelets, Multiresolution and Information Processing (World Scientific)*, **Vol. 9**, No. 2, pp. 317-331, 2011.
17. Sanjay Rawat and **Balasubramanian Raman**, A chaotic system based fragile watermarking scheme for image tamper detection, *AEÜ - International Journal of Electronics and Communications (Elsevier)*, **Vol. 65**, No. 10, pp. 840-847, 2011.
18. Nidhi Taneja, **Balasubramanian Raman** and Indra Gupta, Combinational Domain Encryption for Still Visual Data, *Multimedia Tools and Applications (Springer-Verlag)*, **Vol. 59**, No. 3, pp. 775-793, 2012.
19. Nidhi Taneja, **Balasubramanian Raman** and Indra Gupta, Chaos based cryptosystem for still visual data, *Multimedia Tools and Applications (Springer-Verlag)*, **Vol. 61**, No. 2, pp. 281-298, 2012.
20. Gaurav Bhatnagar, Q.M. Jonathan Wu and **Balasubramanian Raman**, A new Fractional Random Wavelet Transform for Fingerprint Security, *IEEE Transactions on Systems, Man and Cybernetics Part-A: Systems and Humans*, **Vol. 42**, No. 1, pp. 262-275, 2012.
21. Gaurav Bhatnagar, Jonathan Wu and **Balasubramanian Raman**, Fractional Dual Tree Complex Wavelet Transform and its Application to Biometric Security during Communication and Transmission, *Future Generation Computer Systems (Elsevier)*, **Vol. 28**, No. 1, pp. 254-267, 2012.
22. Subrahmanyam Murala, R. P. Maheshwari and **R. Balasubramanian**, Expert System Design Using Wavelet and Color Vocabulary Trees for Image Retrieval, *Expert Systems With Applications (Elsevier)*, **Vol. 39**, No. 5, pp. 5104-5114, 2012.
23. Gaurav Bhatnagar, Jonathan Wu and **Balasubramanian Raman**, A new Robust Adjustable Logo Watermarking Scheme, *Computers & Security (Elsevier)*, **Vol. 31**, No. 1, pp. 40-58, 2012.

24. Subrahmanyam Murala, R. P. Maheshwari and **R. Balasubramanian**, Local Maximum Edge Binary Patterns: A New Descriptor for Image Retrieval and Object Tracking, *Signal Processing (Elsevier)*, **Vol. 92**, No. 6, pp. 1467-1479, 2012.
25. Sanjay Rawat and **Balasubramanian Raman**, A blind watermarking algorithm based on fractional Fourier transform and visual cryptography, *Signal Processing (Elsevier)*, **Vol. 92**, No. 6, pp. 1480-1491, 2012.
26. Sanjay Rawat and **Balasubramanian Raman**, Best tree wavelet packet transform based copyright protection scheme for digital images, *Optics Communications (Elsevier)*, **Vol. 285**, No. 10-11, pp. 2563-2574, 2012.
27. Subrahmanyam Murala, R. P. Maheshwari and **R. Balasubramanian**, Local Tetra Patterns: A New Feature Descriptor for Content Based Image Retrieval, *IEEE Transactions on Image Processing*, **Vol. 21**, No. 5, pp. 2874-2886, 2012.
28. Gaurav Bhatnagar, **Balasubramanian Raman** and Q.M. Jonathan Wu, Robust watermarking using fractional wavelet packet transform, *IET Image Processing*, **Vol. 6**, No. 4, pp. 386-397, 2012.
29. Gaurav Bhatnagar and **Balasubramanian Raman**, Wavelet Packet Transform based Robust Video Watermarking Technique, *Sadhana: Academy Proceedings in Engineering Sciences (Springer)*, **Vol. 37**, No. 3, pp. 371-388, 2012.
30. Gaurav Bhatnagar, Jonathan Wu and **Balasubramanian Raman**, Image and Video Encryption based on Dual Space Filling Curve, *The Computer Journal (Oxford Press)*, **Vol. 55**, No. 6, pp. 667-685, 2012.
31. Subrahmanyam Murala, R. P. Maheshwari and **R. Balasubramanian**, Directional Binary Wavelet Patterns for Biomedical Image Indexing and Retrieval, *Journal of Medical Systems (Springer)*, **Vol. 36**, No. 5, pp. 2865-2879, 2012.
32. Gaurav Bhatnagar, Jonathan Wu and **Balasubramanian Raman**, Robust Gray-scale Logo Watermarking in Wavelet Domain, *Computers & Electrical Engineering (Elsevier)*, **Vol. 38**, No. 5, pp. 1164-1176, 2012.
33. Sanjay Rawat and **Balasubramanian Raman**, A publicly verifiable lossless watermarking scheme for copyright protection and ownership assertion, *AEÜ - International Journal of Electronics and Communications (Elsevier)*, **Vol. 66**, No. 11, pp. 955-962, 2012.
34. Anil Balaji Gonde, R. P. Maheshwari and **R. Balasubramanian**, Modified Curvelet Transform with Vocabulary Tree for Content Based Image Retrieval, *Digital Signal Processing (Elsevier)*, **Vol. 23**, No. 1, pp. 142-150, 2013.

35. Gaurav Bhatnagar, Jonathan Wu and **Balasubramanian Raman**, Discrete Fractional Wavelet Transform and its Application to Multiple Encryption, *Information Sciences (Elsevier)*, **Vol. 223**, No. 2013, pp. 297–316, 2013.
36. Subrahmanyam Murala, Q M Jonathan Wu, R P Maheshwari and **R Balasubramanian**, Modified Color Motif Co-Occurrence Matrix for Image Indexing and Retrieval, *Computers & Electrical Engineering (Elsevier)*, **Vol. 39**, No. 3, pp. 762–774, 2013.
37. Sanoj Kumar, Sanjeev Kumar, N. Sukavanam and **Balasubramanian Raman**, Human Visual System and Segment-Based Disparity Estimation, *AEÜ - International Journal of Electronics and Communications (Elsevier)*, **Vol. 67**, No. 5, pp. 372–381, 2013.
38. Sanoj Kumar, Sanjeev Kumar, **Balasubramanian Raman** and N. Sukavanam, An Efficient Disparity Estimation Using Fractional Dual-Tree Complex Wavelet Transform: A Multiscale Approach, *International Journal of Wavelets, Multiresolution and Information Processing (World Scientific)*, **Vol. 11**, No. 1, 1350004 (21 pages), 2013.
39. Gaurav Bhatnagar, Q.M. Jonathan Wu and **Balasubramanian Raman**, A new Aspect in Robust Digital Watermarking, *Multimedia Tools and Applications (Springer-Verlag)*, **Vol. 66**, No. 2, pp. 179-200, 2013.
40. Madhuri Arya, Kusum Deep, Manoj Thakur and **Balasubramanian Raman**, Stereo camera calibration using particle swarm optimization, *Applied Artificial Intelligence (Taylor and Francis)*, **Vol. 27**, No. 7, pp. 618–634, 2013.
41. Nidhi Taneja, Gaurav Bhatnagar, **Balasubramanian Raman** and Indra Gupta, Joint Watermarking and Encryption for Still Visual Data, *Multimedia Tools and Applications (Springer)*, **Vol. 27**, No. 7, pp. 618–634, 2013.
42. Asha Rani, **Balasubramanian Raman** and Sanjeev Kumar, A Robust Watermarking Scheme Exploiting Balanced Neural Tree for Rightful Ownership Protection, *Multimedia Tools and Applications (Springer)*, Available online 07 June 2013, pp. 1-24, DOI: [10.1007/s11042-013-1528-3](https://doi.org/10.1007/s11042-013-1528-3), 2013.
43. Sanoj Kumar, Sanjeev Kumar, N. Sukavanam and **Balasubramanian Raman**, Dual Tree Fractional Quaternion Wavelet Transform for Disparity Estimation, *ISA Transactions (Elsevier)*, **Vol. 53**, No. 2, pp 547-559, 2014.
44. Himanshu Agarwal, **Balasubramanian Raman** and Ibrahim Venkat, Blind reliable invisible watermarking method in wavelet domain for face image watermark, *Multimedia Tools and Applications (Springer)*, Available online 23 March 2014, pp 1-39, DOI: [10.1007/s11042-014-1934-1](https://doi.org/10.1007/s11042-014-1934-1), 2014.

45. Himanshu Agarwal, Pradeep Atrey and **Balasubramanian Raman**, Image Watermarking in Real Oriented Wavelet Transform Domain, *Multimedia Tools and Applications (Springer)*, Available online 15 August 2014, pp 1-39, DOI: 10.1007/s11042-014-2212-y, 2014.
46. Asha Rani and **Balasubrmanian Raman**, An image copyright protection scheme by encrypting secret data with the host image, *Multimedia Tools and Applications (Springer)*, Available online 30 November 2014, pp 1-16, DOI: [10.1007/s11042-014-2344-0](https://doi.org/10.1007/s11042-014-2344-0), 2014.
47. Manisha Verma, **Balasubramanian Raman** and Subrahmanyam Murala, Extrema Co-occurrence Pattern for Color and Texture Image Retrieval, *Neurocomputing (Elsevier)*, **Vol. 165**, pp 255-269, 2015.
48. Himanshu Agarwal, Debashis Sen, **Balasubramanian Raman** and Mohan Kankanhalli, Visible Watermarking based on Importance and Just Noticeable Distortion of Image Regions, *Multimedia Tools and Applications (Springer)*, Available online 26 May 2015, pp. 1-25, DOI: 10.1007/s11042-015-2685-3, 2015.
49. Tasneem Ahmed, Dharmendra Singh, Shweta Gupta and **Balasubramanian Raman**, Efficient Application of Fusion approach for Hotspot Detection with MODIS and PALSAR-1 Data, Accepted for publication in *Geocarto International (Taylor and Francis)*, 2015.
50. Manisha Verma and **Balasubramanian Raman**, Center Symmetric Local Binary Co-occurrence Pattern for Texture, Face and Bio-medical Image Retrieval, *Journal of Visual Communication and Image Representation (Elsevier)*, **vol. 32**, pp. 224-236, 2015.
51. Prabhu Natarajan, Manoj Arora and **Balasubramanian Raman**, Wavelet Based Feature Extraction Techniques of Hyperspectral Data, Accepted for publication in *Journal of the Indian Society of Remote Sensing (Springer)*, 2015.
52. Madhumanti Dey, **Balasubramanian Raman** and Manisha Verma, A novel colour and texture based image retrieval technique using multi-resolution local extrema peak valley pattern and RGB colour histogram, Available online 30 Oct 2015, DOI 10.1007/s10044-015-0522-y, *Pattern Analysis and Applications (Springer)*, 2015.
53. Bhavik Patel, R P Maheshwari and **Balasubramanian Raman**, Multi-quantized local binary patterns for facial gender classification, *Computers and Electrical Engineering (Elsevier)*, Available online 28 Nov 2015, pp. 1-14, DOI:10.1016/j.compeleceng.2015.11.004, 2015.
54. Asha Rani and **Balasubramanian Raman**, An image copyright protection system using chaotic maps, *Multimedia Tools and Applications (Springer)*, Available online 29 Jan 2016, DOI: 10.1007/s11042-016-3287-4, 2016.

55. ManishaVerma and **Balasubramanian Raman**, Local Tri-Directional Patterns: A New Texture Feature Descriptor for Image Retrieval, *Digital Signal Processing (Elsevier)*, **Vol. 51**, pp. 62-72, 2016.
56. Tasneem Ahmed, Dharmendra Singh and **Balasubramanian Raman**, A Potential Application of KLT Tracker on Satellite Images for Automatic Change Detection, *Journal of Applied Remote Sensing (SPIE)*, **Vol. 10**, No.2, 026018, 2016.
57. Pushpendra Kumar, Sanjeev Kumar and **Balasubramanian Raman**, A fractional order variational model for the robust estimation of optical flow from image sequences, *Optik - International Journal for Light and Electron Optics (Elsevier)*, **Vol. 127**, No. 20, pp. 8710–8727, 2016.
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Pushpendra Kumar, Sanjeev Kumar and **Balasubramanian Raman**, A Fractional Order Total Variation Model for the Estimation of Optical Flow, Accepted for publication in *The Fifth National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG'15)*, December 16-19, 2015, Patna, INDIA.
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Honors, Awards and Recognition

- I Rank holder in B. Sc. Examinations, A.M. Jain College, 1994.
- Gold Medalist in M. Sc. Examinations, Madras Christian College, 1996.
- DST travel award (Rs. 30,000) to attend *Vision Geometry XIII, IS&T/SPIE International Symposium on Electronic Imaging – 2005*, San Jose, California, USA, January 2005.

- SPIE travel and registration award (\$525) to attend *Vision Geometry XIII, IS&T/SPIE International Symposium on Electronic Imaging – 2005*, San Jose, California, USA, January 2005.
- Best paper award for a research paper in "*International Conference of Cognition and Recognition (ICCR-08)*", April 10-12, 2008, Mysore, INDIA, 2008.
- **DST Young Scientist** travel and Registration award (Rs. 1,05,559) to attend *Wavelet Applications in Industrial Processing VI, 21st IS&T/SPIE International Symposium on Electronic Imaging – 2009*, 18 – 22, Jan 2009, San Jose, California, USA.
- CSIR travel award (50% of Airfare) to attend *IEEE Symposium on Industrial Electronics & Applications (ISIEA 2011)*, September 25-28, 2011, Langkawi Island, MALAYSIA.
- Science and Engineering Research Board (A Statutory body under Department of Science & Technology) travel award (Rs. 84,240) to attend and present a paper in **IS&T/SPIE symposium on Electronics Imaging, Conference On Video Surveillance and Transportation Imaging Applications – 2014**, held in **San Francisco, California, USA** from 2nd February 2014 to 6th February 2014.
- Best Paper Award for a research paper in "*IEEE International Conference on Signal and Image Processing Applications (ICSIPA'2015)*", Kuala Lumpur, MALAYSIA.
- CSIR travel award (50% of Airfare) to attend *IEEE TENCON 2016*, November 22-25, 2016, Singapore, SINGAPORE.
- **One of the jury members** of 6th IDRBT Doctoral Colloquium held in Institute for Development and Research in Banking Technology (IDRBT), Hyderabad during 8-9, December 2016. High quality papers from ISI Kolkata, IISc Bangalore, IIT Kharagpur, IIT Madras, IIT Hyderabad, IIT Guwahati, IIIT Hyderabad, IIIT Bangalore and IIM Lucknow were presented and top 3 papers have got the cash prizes.

Abroad Visits

- Participated as one of the fifty scientific researchers in the world, who was invited by **International Center for Theoretical Physics, Trieste, ITALY**, under **UNESCO** fellowship for three weeks course on "*School on Mathematical Problems in Image Processing*" during 4th September 2000 to 22nd September 2000.
- Participated as one of the fifty scientific researchers in the world, who was invited by **International Center for Theoretical Physics, Trieste, ITALY**, under **UNESCO** fellowship for four weeks course on "*Summer School on Mathematical Control Theory*" during 3rd September 2001 to 28th September 2001.
- Worked as a Post Doctoral Fellow in the **Computer Engineering and Computer Science Department, University of Missouri Columbia, Missouri -65211, USA** from 1st October 2001 to 30th June 2002.

- Worked as a Post Doctoral Associate in the **Department of Electrical and Computer Engineering, Rutgers, The State University of New Jersey, NJ -08855, USA** from 1st July 2002 to 28th April 2003.
- Presented a paper "Error analysis in the reconstruction of a 3D parabola from two arbitrary perspective views" in **Vision Geometry XIII, IS&T/SPIE International Symposium on Electronic Imaging - 2005**, held in **San Jose, California, USA** from 16th January 2005 to 21st January 2005.
- Delivered an invited talk entitled "Applications of Image Processing in health care" in **the Indo-German Workshop on Clean Room Technology, part of 5th World Congress on Bio-Mechanics**, held in **Munich, GERMANY** from 29th July 2006 to 4th August 2006.
- Presented a paper "Automated Stroke Classification in Tennis" in **International Conference on Image Analysis and Recognition (ICIAR 2007)**, held in **Montreal, CANADA** from 22nd August 2007 to 24th August 2007.
- Presented a paper "Multipurpose Watermarking Scheme using Essentially Non-Oscillatory Point-Value Decomposition" in **Wavelet Applications in Industrial Processing VI, 21st IS&T/SPIE International Symposium on Electronic Imaging - 2009** held in **San Jose, California, USA** from 18th January 2009 to 24th January 2009.
- Worked as a **Visiting Professor** under **BOYSCAST Fellowship (2008-09)** (Fellowship of US \$3000 per month + perks, awarded by DST) at **University of Windsor, CANADA** from 18th May 2009 to 17th August 2009 (duration of THREE months) for conducting advanced training/research in area of Computational aspects of Geometry and Algebra under the mentorship of **Prof. Jonathan Wu,** Canada Research Chair, Department of Electrical and Computer Engineering, University of Windsor, **CANADA**.
- Presented a paper "Human Action Recognition in a Wide and Complex Environment" in **Real-Time Image and Video Processing 2011, part of IS&T/SPIE Electronic Imaging 2011**, held in **San Francisco, California, USA** from 23rd January 2011 to 27th January 2011.
- Presented a paper "Navigation and Surveillance using Night Vision and Image Fusion", in **IEEE Symposium on Industrial Electronics & Applications (ISIEA 2011)**, held in Langkawi Island, **MALAYSIA** from 25th September to 28th September 2011.
- Presented a paper "Recognizing Human Gestures Using a Novel SVM Tree" in **IS&T/SPIE symposium on Electronics Imaging, Conference On Image Processing: Machine Vision Application V, 2012**, held in **San Francisco, California, USA** from 22nd January 2012 to 26th January 2012.
- Visited **Stanford University, California, USA** to have a technical discussion with **Dr. Daniel L. Rubin, MD, MS**, Assistant Professor of Radiology and Medicine (Biomedical Informatics) in the problem of "Content Based Image Retrieval (CBIR) for Decision Support" on 26th January 2012.

- Delivered an invited talk entitled "Human Action Recognition in a Wide and Complex Environment" in the **School of Computer Sciences, Universiti Sains Malaysia**, Pulau Pinang, **MALAYSIA** on 7th June 2012.
- Conducted a workshop on "Advanced Algorithms in Computer Vision and Imaging using MATLAB" in the **School of Computer Sciences, Universiti Sains Malaysia**, Pulau Pinang, **MALAYSIA** during June 08-09, 2012.
- Delivered two invited talks on "Digital Image Watermarking using Mathematical Transformations and SVD" and "Recognizing Human Gesture Using a Novel SVM Tree" in the **Faculty of Computer Science and Information Technology, Universiti Putra Malaysia**, Serdang, Selangor, **MALAYSIA** on 12th June 2012.
- Conducted a workshop and Seminar on "Content Based Image Retrieval and Computer Vision" in **the Centre for Visual Computing, Multimedia University, Cyberjaya, MALAYSIA** on 13th June 2012.
- Delivered an invited talk on "Mathematics and its Applications in Real Life" in **Linton University College**, Mantin, Negeri Sembilan, **MALAYSIA** on 15th June 2012.
- Presented a paper "Joint Histogram Between Color and Local Extrema Patterns for Object Tracking" in **IS&T/SPIE symposium on Electronics Imaging, Conference On Video Surveillance and Transportation Imaging Applications – 2013**, held in **San Francisco, California, USA** from 3rd February 2013 to 7th February 2013.
- Visited **National University of Singapore, SINGAPORE** to have a technical discussion with **Prof. Mohan S. Kankanhalli, Department of Computer Science, School of Computing**, in the areas of Visual Saliency in watermarking, Affective Video Analysis and Retrieval and Multimedia Security during July 01-06, 2013.
- Conducted a workshop on "Advanced Algorithms in Computer Vision and Imaging using MATLAB" in the **School of Computer Sciences, Universiti Sains Malaysia**, Pulau Pinang, **MALAYSIA** during July 08-09, 2013.
- Presented a paper "Development of a multispectral active stereo vision system for video surveillance applications" in **IS&T/SPIE symposium on Electronics Imaging, Conference On Video Surveillance and Transportation Imaging Applications – 2014**, held in **San Francisco, California, USA** from 2nd February 2014 to 6th February 2014.
- Visited SeSaMe Research Centre at **National University of Singapore, SINGAPORE** to have a technical discussion with **Prof. Mohan S. Kankanhalli, Department of Computer Science, School of Computing**, in the areas of Visual Saliency in watermarking, Multi-camera/Multi-sensor surveillance, Multi-agent systems and PTZ camera networks during July 02-07, 2014.
- Conducted a workshop on "Digital Image Watermarking and Optical flow problems" and have a technical discussion with **Prof. C. Eswaran, Faculty of Computing and Informatics, Multimedia University, Cyberjaya Campus, MALAYSIA** in the area of Multimedia Security during July 08-10, 2014.

- Visited **iLink Systems** at **Seattle, Washington, USA** to have a technical discussion in the areas of Data Science and Machine learning during 27/11/2014 to 3/12/2014.
- Visited **University at Albany - State University of New York (SUNY), NY, USA** to have a technical discussion with **Dr. Pradeep Atrey's** research group and Delivered an invited talk on " Applications of Fractional and Multi-resolution Transforms in Information Security, Optical flow Problems and Content Based Image Retrieval" in the **Department of Computer Science** during 4/12/2014 to 6/12/2014.
- Visited **MIMOS Berhad, Technology Park Malaysia, Kuala Lumpur, MALAYSIA** to have a technical discussion with **Prof. Arichandran's** R&D group and delivered an invited talk on "Machine Learning in Vision, Information Security and Content Based Image Retrieval" during 31/5/2015 to 3/6/2015.
- Visited **Telekom Malaysia, Kuala Lumpur, MALAYSIA** to have a technical discussion with **Dr. Ettikan Kandasamy Karuppiyah's** R&D group and delivered an invited talk on "Applications of Soft Computing in Vision, Information Security and Content Based Video Retrieval" during 4/6/2015 to 7/6/2015.
- Presented a paper "Fusion of Submanifold and Local Texture Features for Palmprint Authentication" in **IEEE International Conference on Visual Communications and Image Processing (VCIP'2015)**, held in **NTU, Singapore, SINGAPORE** during 13-16, December 2015.
- Presented a paper "A Reversible Robust Watermarking Scheme Based on Two out of Two Visual Cryptography Approach" in IEEE TENCON 2016 held in **Singapore, SINGAPORE** during 22-25 November 2016.
- **USA**, B1/B2 (Visiting/Business) visa holder for 10 years (December 2004 to December 2014).
- Visited **MALAYSIA** (January 2005), **AUSTRIA** (August 2006), **USA** (June, July 2009) and **SINGAPORE** (February 2013, January 2014).

Professional activities

- Reviewer of Several International Journals and Conferences
- Technical, Advisory and International Program Committee member for various conferences.
- Coordinated Eight QIP Short term courses
 - Vision, Graphics and Image Processing (2007)
 - Robotic Vision and Image Processing (2008)
 - Vision, Graphics, Robotics and their Applications (2009)
 - Robotic Vision and Image Processing (2011)
 - Image Processing and Computer Graphics for Scientific Visualization (2012)
 - Image Processing with Multidisciplinary Applications (2014)
 - Mathematical Modelling and Numerical Computation Using Matlab (2015)

- Vision, Graphics and their Applications (2016)
- iv. Instructor, Finishing School Programme, Continuing Education, IIT R, 2007 and 2008.
- v. Established Computer Vision, Graphics and Image Processing Laboratory at Department of Mathematics, IIT Roorkee under MHRD, DST and ISRO Projects, 2007–08.
- vi. Served as an Examiner for many Ph.D theses of IIT Bombay, IIT (ISM) Dhanbad, IIIT Allahabad, MNIT Jaipur, MNIT Allahabad, NIT Trichy, Anna University, VIT University, Bharthidasan University, Madras University, Sathyabama University, Mother Teresa Women's University, Manonmanium Sundaranar University, Vel Tech Univeristy, JNTUH-Kukatpally and JNTU Kakinada.
- vii Served as a Foreign Examiner in Four Ph.D theses of Faculty of Computing and Informatics, Multimedia University, MALAYSIA.
- viii. Delivered Invited Talks, many places in India and **Nine in abroad**.
- ix. Convener, International Conference on Computer Vision and Image Processing (CVIP 2016), IIT Roorkee, February 26-28, 2016.

Administrative Responsibilities (Department and Institute)

- i. Deputy Superintend of Examinations, Nov. 2004.
- ii. Department Research Committee (DRC) Member, 2006-08, 2012-13 (Dept. of Mathematics), 2013- (Dept. of computer Science and Engineering)
- iii. Academic Programme Committee (DRC (APC), MCA Programme) Member, 2006 to 2016.
- iv. Secretary, Department Faculty Board (DFB), January 2007 – June 2009.
- v. Course Coordinator, MCA II year, 2007-08, 2009-10, 2010-11 and 2011-12.
- vi. Course Coordinator, MCA I year, 2008-09, 2011-12 and 2012-13.
- vii. Department Academic Committee Member (Formerly Under Graduate Committee), 2008-10 and 2010-12.
- viii. Deputy Coordinator, Mathematics I (MA 101), B. Tech, 2007-08, 2009-10.
- ix. Coordinator, Summer Term Course Mathematics I (MA 101), B. Tech, 2007-08.
- x. O.C. Garden, Dept. of Mathematics, IIT Roorkee, July 2009 to April 2012.

- xi. Faculty Advisor, Cognizance 2010 and 2011 (Technical Festival), Dept. of Mathematics, IIT Roorkee.
- xii. Joint Secretary, IEEE Utrakhand Subsection, July 2010 to March 2013.
- xiii. Member, Board of SRIC, IIT Roorkee, March 2011 to Dec 2015.
- xiv. Chairman, Department Website Committee, IIT Roorkee, March 2011 to September 2013.
- xv. Coordinator, Summer Term Course Computer Systems and Programming (EC-101 A), B.Tech 2010-11 and 2011-12.
- xvi. Coordinator, MCA III year, Industrial Project, IIT Roorkee, 2011-12.
- xvii. Department FIST, DST committee member, IIT Roorkee, 2011-12
- xviii. O.C. Training and Placement, Dept. of Mathematics, IIT Roorkee, April 2012 to Sep 2013.
- xix. Department Anti Ragging Committee member, IIT Roorkee, 2012-13.
- xx. Presiding Officer, SAC Elections, Azad Bhawan, IIT Roorkee, 2012-13.
- xxi. Institute Strategy Committee member, IIT Roorkee, January 2013 to Till Date.
- xxii. Course Coordinator, M.Sc Final year, IIT Roorkee, 2012-13.
- xxiii. Secretary, IEEE Utrakhand Subsection, March 2013 to Till Date.
- xxiv. Course Coordinator, MCA III year, 2012-13
- xxv. Institute Research Committee member, Department of Computer Science and Engineering, October 2013 onwards.
- xxvi. Faculty Coordinator, CodeChef, IIT Roorkee Chapter.
- xxvii. Faculty Coordinator, B. Tech II Year, 2014-15.
- xxviii. Institute Panel of Chairpersons for Screening and Selection committees for the recruitment of Project/Research staff under Sponsored Research and Consultancy Projects, January 2015 to December 2015.
- xxix. **Head, Institute Computer Centre, IIT Roorkee, February 2015 onwards.**
- xxx. Chairman, Department Purchase Committee, February 2015 onwards.

xxxi. O.C. Seminar, Dept. of Computer Science and Engineering, IIT Roorkee, February 2015 to December 2016.

xxxii. **Faculty In-charge, Communications, IIT Roorkee, May 2016 onwards**

xxxiii. **Chairman, Department Research Committee, November 2016 onwards.**

Names of Referees

- Dr. Jonathan Wu, Professor and Canada Research Chair, Department of Electrical and Computer Engineering, University of Windsor, 401 Sunset Ave., Windsor, ON, Canada N9B 3P4, Tel: +1 519 253 3000 ext. 2580, e-mail: jwu@uwindsor.ca
- Dr. Mohan S Kankanhalli, Professor, Associate Provost (Graduate Education), NUS, Department of Computer Science, School of Computing, National University of Singapore, Singapore 117417, Tel: [+65 6516-6738](tel:+6565166738), e-mail: mohan@comp.nus.edu.sg
- Dr. Pradeep K. Atrey, Associate Professor and Director of Undergraduate Program, Co-Director, Albany Lab for Privacy and Security (ALPS), Department of Computer Science, College of Engineering and Applied Sciences, University at Albany - State University of New York (SUNY) UAB 421, 1225 Western Avenue, Albany, NY 12222, USA, Tel: +1 518 437 4943, e-mail: patrey@albany.edu
- Dr. Ram N Mohapatra, Professor and Graduate Coordinator , Department of Mathematics, University of Central Florida, Orlando, FL 32816, USA, e-mail: ramm@mail.ucf.edu
- Dr. K. Swaminathan, Associate Professor (Retired), Department of Mathematics, Indian Institute of Technology Madras, Chennai -600 036, India, Tel: 91-44-2257 4636, email: kswamy@iitm.ac.in