Curriculum Vitae

PERSONAL DETAILS

Name Manoj K. Arora

Date of Birth July 25, 1963

Address Director,
PEC University of Technology, Chandigarh
Sector 12, CHANDIGARH, 160012, INDIA
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Professor
Department of Civil Engineering
Indian Institute of Technology (IIT) Roorkee
ROORKEE, 247 667, INDIA
(On lien)

ACADEMICS

Education

- Ph. D. (Remote Sensing), University of Wales Swansea (now Swansea University), UK, 1996
- M.E. (Survey & Photogrammetry), University of Roorkee (now I I T Roorkee), India, 1986
- B.E. (Civil), Punjab Engineering College (now PEC University), Chandigarh, India, 1984

Training

- One week training course on Bernese' GPS Software in University of Bern, Switzerland, (15.2.99 to 21.2.99)

EMPLOYMENT

- Director, PEC University of Technology, Chandigarh (July 1, 2013 – to date)
- Professor, Department of Civil Engineering, I I T Roorkee, India, (19.12.07 to date) (on lien)
- Associate Professor, Department of Civil Engg., I I T Roorkee, India, (03.02.04 to 18.12.07)
- Visiting fellow, Department of Electrical Engineering and Computer Sciences, Syracuse University, NY, USA (15.05.04 to 15.07.04)
- Visiting Research Scholar, Department of Electrical Engineering and Computer Sciences, Syracuse University, NY, USA (15.01.02 to 15.07.03)
- Assistant Professor, Department of Civil Engineering, I I T Roorkee, India, (25.03.97 to 02.02.04)
- Lecturer, Department of Civil Engineering, I I T Roorkee, India, (13.10.88 to 24.03.97)
- Lecturer, Regional Engineering College, Kurukshetra, India, (18.08.88 to 12.10.88)
- Senior Research Fellow, Department of Civil Engineering, I I T Roorkee, India (26.08.86 to 12.08.88)

AWARDS & FELLOWSHIPS

- Outstanding Teacher Award, IIT Roorkee (2010)
- Outstanding Teacher Award, IIT Roorkee (2006)
- Star Performer in Teaching and Research, IIT Roorkee, (2005-06)
- Star Performer in Teaching and Research, IIT Roorkee, (2004-05)
- Star Performer in Teaching and Research, IIT Roorkee, (2003-04)
- Visiting fellowship, Syracuse University, USA (2004)
- Post Doctoral Research Fellowship in a NASA project at Syracuse University, USA (2002-2003)
- Young Teacher Career Award from All India Council of Technical Education (AICTE), India (1998)
- Commonwealth Scholarship Award for PhD in U.K. (1993)
- Research fellowship in Engineering and Technology from University Grants Commission (UGC), India (1986)

AREAS OF INTERESTS

Core areas: Remote Sensing and GIS, Surveying, GPS applications
Allied areas: Advances in Digital Image Classification, Soft Computing, Land Cover Mapping, SAR Interferometry, Hazard and Risk Studies.

SKILLS

Familiarity with C, C++ and FORTRAN, Competency in Erdas Imagine, Arc-GIS and other image processing and GIS software.

TEACHING EXPEREINCE

Total teaching experience till date: ~ 29 Years

Subjects taught at undergraduate level

- Geomatics Engineering (covering Photogrammetry, Remote Sensing, GIS & GPS)
- Engineering Surveys
- Principles of Surveying and Photogrammetry
- Surveying and Photogrammetric Mapping Techniques
- Project Surveys and Photogrammetry
- Computer Programming and its applications (FORTRAN and C)
- Computer Systems and Programming (C++)

Subjects taught at postgraduate level

- Survey Measurements and Adjustment Procedures
- Basic Remote Sensing
- Remote Sensing for Land Use Mapping and Urban Planning
- Digital Image Processing
- Remote Sensing for Civil Engineering
- Remote Sensing and GIS
- Programming Languages and Computer Graphics (C language)

- Advanced Programming and Computer Graphics (C and C++)

Short Term Courses Organised

- Training for Engineers on Modern Surveying Equipment, IRCON, Delhi (May 1999).
- A Teaching Capsule for Remote Sensing and GIS, QIP, I I T Roorkee, India (July, 2000).
- GIS Training for Army Personnel, BEG and Center, Roorkee Roorkee, India (Feb. 2007).
- Remote sensing and GIS training for scientists and engineers, Uttarakhand Space Application Centre, Dehradun (May 2008)

CONSULTANCY EXPERIENCE

Consultancy Projects in India and abroad: (Number: 23; Outlay: INR 4.00 Crore)

i. Field Survey Work for Bridge Alignment at river Ganges in DeoPrayag
ii. Reconnaissance Surveys for a Rail Route Alignment from Jammu to Poonch.
iii. Design of Drainage and Sewage in Moradabad City (Topographical surveys of a part of Moradabad City).
iv. Bridge Survey Work at Yamuna river.
v. Soil Erosion Estimation using GIS.
vi. Levelling of Feeder Channel connecting Upper Ganga Canal and Eastern Yamuna Canal.
vii. Topographical Survey of Pendaras Village, Koteshwar.
viii. Contour Survey of a Landslide area near Haridwar.
ix. Profile Leveling along proposed Sewer Line, BHEL, Haridwar
x. Development of Index to Monitor Debris Cover on Himalayan Glaciers using LISS II and LISS IV Data
xi. Software for Advanced Classifiers for Multispectral Remote Sensing Images, Defence Electronics Application Laboratory, DRDO, Dehradun
xii. Provision of GCP using GPS Survey in Delhi area.
xiii. GIS Training for Army Personnel
xiv. Remote Sensing and GIS Training for Scientists and Academicians
xv. Safeland: Living with Landslide Risk in Europe: Assessment, Effects of Global Change and Risk Management Strategies, International Center of GeoHazards, Norwegian Geotechnical Institute, Oslo, Norway
xvi. Development of an Operational Algorithm for Snow Water Equivalent, Snow and Avalanche Study Establishment (SASE)
xvii. Development of Algorithms for Anomaly Detection and Sub-pixel Classification from Hyperspectral Remote Sensing Data, Defence Electronics Application Laboratory, DRDO, Dehradun
xviii. Development of Algorithms for Feature Reduction and Per-pixel Classification from Hyperspectral Remote Sensing Data, Defence Electronics Application Laboratory, DRDO, Dehradun
xix. Groundwater Table Checking along Madhya Ganges Canal, World Bank Project, UP Irrigation Department.
xx. Alignment checking of Rishikesh to Karnprayag railway line
xxi. Third Party Quality (TPQ) assessment of CPWD projects, Delhi
xxii. Alignment checking of Anandpur Sahib to Bilaspur railway line (**ongoing**)
xxiii. Total Station Survey of Khudda Jassu Village, Chandigarh **(ongoing)**

RESEARCH EXPERIENCE

Total research experience till date: **> 30 Years**

M.E. Thesis Topic ***Error analysis in survey and photogrammetric projects***

Ph.D. Thesis Topic ***An Evaluation of Factors Affecting the Accuracy of Digital Multi-spectral Land Cover Classifications***

Publications

i) Articles ***232 (217 Papers + 15 Chapters)***

Research Papers
- Published/Accepted **217**
- Under Review **05**

Chapters in Books
- Published **12 (+1 Accepted)**

ii) Books
- Distance Education Learning Books **2**
- Edited Book **1**
- Text Book **1**

iii) Invited Lectures **45**

Google Scholar Record: Citations: 3825, *h*-index: 31 and *i*-10 index: 50

Ph. D Theses Supervision **20 (Completed)**
5 (In progress)

M. Tech./ M. S. Theses Supervised **54 (Completed)**
1 (In progress)

Sponsored Research Projects: **(Number: 17; Outlay: INR 3.00 Crore)**

i. Environmental Impact Assessment of River Valley Project using Remote Sensing Technique, UGC) **(1997-2000)**
ii. Fuzzy Approaches for Classification of Land Use/Land Cover Mixtures in a GIS Environment, AICTE), **Young Teacher Career Award (1998-2001)**
iii. Neural Network Techniques for Land Cover Classification, DST, **Young Scientist Award (1999-2001)**
iv. Integrated National Program on Terrain Dependent Accuracy Assessment of DEM of SRTM, DST **(2001)**
v. Soil Moisture Estimation using Microwave Remote Sensing Data, AICTE **(2000 - 2004)**
vi. Study of Shallow Earthquakes in Indian Region using Differential SAR Interferometry, AICTE **(2002 - 2004)**

vii. SAR Interferometry for Mapping Land Subsidence due to Mining in Jharia Coalfields, DST **(2002 - 2004)**
viii. Application of DIF-SAR to Investigate Critical Deformation in Garhwal Kumaon Himalaya Related to Earthquakes and Landslides, DST, **(2005 – 2007)**
ix. Sub-pixel Snow Cover Mapping from Remote Sensing Data, SASE, DRDO **(2006 – 2008)**
x. Landslide Risk Assessment using Advanced Pattern Recognition Techniques, DST **(2007-2011)**
xi. Remote sensing based debris-cover analysis of Chhota-Shigri Glacier, Himalaya, DST **(2007-2011)**
xii. Department of Science and Technology (DST), Delhi -International Center of Geohazards (ICG), Oslo (Indo-Norwegian Institutional Co-operation Project on Geohazards in the Himalayas **(2011-2014)**
xiii Application of Differential SAR Interferometry in Landslide Investigation, DST **(2012- 2016)**
xiv Study of Glacier Dynamics Using Advanced Remote Sensing Techniques, DST, **(2013-) (Ongoing)**
xv Facies Mapping of Gangotri Glacier using AWiFs data; A Super Resolution Approach, DST **(2015-) (Ongoing)**
xvi Drone mapping of Chandigarh Sectors, UT Chandigarh, **(2017 -) (Ongoing)**.
xvii Comprehensive solution of slope stability of road between zero bridge and Koteshwar (geomatics component), Tehri Hydro Development Corporation, Tehri, **(2017 -) (Ongoing)**

Establishment of Centers and Chairs

i) Establishment of Kalpana Chair of Geospatial Technology for Indian Railways at PEC University of Technology, Indian Railways (Endowment of INR 10.00 Crores)
ii) Establishment of Digital land record center at PEC University of Technology, Chandigarh Administration (INR 2.50 Crore).

Fellowship/Membership of Professional Societies

i. Fellow, Institution of Engineers, India
ii. Member, American Society of Photogrammetry and Remote Sensing (ASPRS) (2002-2010)
iii. Member, IEEE Geoscience and Remote Sensing Society (2002)
iv. Student Member, UK Remote Sensing Society (1993-1996)
v. Life Member, Indian Society of Remote Sensing
vi. Life Member, Indian Society of Construction Materials and Structures

Key Conferences attended

- American Society of Photogrammetry and Remote Sensing (ASPRS) Annual Convention and Exposition, Charlotte, NC, USA, Feb.27 - March 2, 1995
- 21st Annual Conference of the Remote Sensing Society, Southampton, UK, Sept. 11-14, 1995
- International Workshop on Soft Computing in Remote Sensing Data Analysis, Dec. 4-5, 1995, Milan, Italy.
- Remote Sensing Society One Day Student Meeting, April 4, 1996, Salford, UK.
- National Conference on Global Positioning System, Feb. 21-23, 1997, IIT Kanpur, India.
- Seminar on Recent Advances in Differential SAR Interferrometry and Applications, Jan. 18 – 22, 1999, IIT Bombay, Mumbai, India.
- Workshop on Problems and Methods in RS-based Land Use / Land Cover Mapping in Mountainous Terrain, Aug. 7-10, 2000, Wildlife Institute of India, Dehradun, India.

- International Conference on Mathematical Modelling, Jan. 29-31, 2001, University of Roorkee, Roorkee, India.
- International Conference on Remote Sensing and GIS/GPS, 2-5 Feb., 2001, Hyderabad, India.
- International Geoscience and Remote Sensing Symposium (IGARSS 02), June 24 – June 28, 2002, Toronto, Canada.
- 2nd Annual New York State Remote Sensing Symposium, April 17, 2003, Rochester, NY, USA.
- 1st India International Conference on Artificial Intelligence, Dec. 18-20, 2003, Hyderabad, India.
- American Society of Photogrammetry and Remote Sensing (ASPRS) Annual Convention and Exposition, Denver, CO, USA, May 23 – May 28, 2004.
- South Asian Countries Himalayan Science Workshop, Dehradun, India, June 27-28, 2006
- International Workshop on Snow, Ice, Glacier and Avalanches, IIT Bombay, Mumbai, India, Jan, 7-9, 2008
- National Snow Science Workshop, SASE, DRDO, Chandigarh, India, Jan. 11-12, 2008
- Cryosphere & Hazards Workshop for the Hindu Kush, Himalaya & Tibetan Plateau, 3-6 April, 2008, Kathmandu, Nepal
- Indo-Norwegian workshop on Geohazards, Anna University, Chennai, Feb. 9-10, 2010
- India-Norway Institutional Cooperation Project Workshop on Tsunami Modeling and Landslides, Aug. 13 – 16, 2010, Oslo, Norway.
- Indo-Norwegian workshop on Geohazards, Anna University, New Delhi, Feb. 7, 2011
- International Conference on Rock Mechanics, INDOROCK, Oct. 13-15, 2011, IIT Roorkee, Roorkee.
- National Seminar on “Geospatial Solutions for Resource Conservation and Management”, 18-20 January, 2012, Bangalore
- International Conference of Geospatial Techniques and Application (Geomatrix’ 12), Indian Institute of Technology Bombay, 26 - 29 February, 2012
- All India Seminar on Applications of Imaging, Visualisation and Optimisation Technologies, March 2-3, 2012, Dehradun.
- Mini Symposium on Soft Computing in Civil Engineering, 10th World Congress on Computational Mechanics, July 8 – 13, 2012, Sao Paulo, Brazil.
- 3rd International Conference on Biomedical Engineering and Assistive Technologies, Feb. 14-15, 2014, Chandigarh, India
- National Conference on Use of Technology in Higher Education, Feb. 25-26, 2014, IIT Bombay, India.
- EDU's Fourth Annual VCs' Retreat 2014, 19th & 20th September, 2014, Gurgaon.
- TEQIP Workshop on Good Governance, Leadership and Management, Oct. 12-13, 2014, New Delhi.
- FICCI Higher Education Summit 2014; Higher Education Vision 2030, Making it Happen, Nov. 12-14, 2014, New Delhi.
- Leadership Development Programme, Sept 28-Oct 2, NUS, Singapore.
- National Workshop on Urban Flood Mitigation-Lessons learnt and Roadmap for Future, Feb. 12-13, 2016, New Delhi.
- TEQIP Workshop on Good Governance, Leadership and Management, August 31, 2016, New Delhi.
- 91st Annual Meeting (General Session) of Association of Indian Universities, February 5, 2017 at Sri Venkateswara University, Tirupati

Administrative Experience

- Director, PEC University of Technology, Chandigarh, (July 1, 2013 – continuing)

At IIT Roorkee

- Dean Academic Studies (Jan. 1, 2013 – June 30, 2013)
- Professor in-Charge, Training and Placement (Jan. 2012 – Jan. 2013)
- Associate Dean (Academics) (Jan 2010 – Jan. 2012)
- Chairman GATE 2010, JAM 2010 (June 2009 – May 2010)
- Coordinating Chairman GATE 2009, JAM 2009 (June 2008 – May 2009)
- Vice Chairman GATE 2007, 2008, JAM 2007, 2008, (June 2006 – May 2008)
- Coordinator, Geomatics Engineering Group, Civil Engineering Department (May 2004 – April 2006, July 2010 – June 2012)
- Honorary Secretary, IIT Roorkee Alumni Association (April 2007- March 2009)
- Officer-in-charge, Guest House, IIT Roorkee (Aug. 2005 – May 2006)
- Warden, Student's Hostels (twice)
- Member, Center of Excellence Disaster Mitigation and Management, IIT Roorkee.
- Member, Various departmental and institute administration committees (from time to time).
- Staff Advisor, Squash sports activity (1996-2007).

Other Recognitions

i) Vice Chairman, State Higher Education Council (SHEC) Chandigarh, RUSA.
ii) Vice President, Chandigarh Region Innovation and Knowledge Cluster (CRIKC) society
iii) Chairman, Chandigarh Chapter of Indian Society of Remote Sensing.
iv) Vice Chairman, Governing Council, PEC Center of Consultancy Engineering
v) Member, GIS Academia Council of India.
vi) Member, CII, Northern Chandigarh Region
vii) Member, CII Northern Region Special Task Force on Entrepreneurship and Start-ups
viii) Member, Board of Governors, HP Technical University, Shimla
ix) Member, Board of Management, Indira Gandhi Delhi Technical University for Women, Delhi
x) Member, Governing Body, Punjab Remote Sensing Center
xi) Member, Academic Council DIT University
xii) Member, Academic Council, Ryat Bahra University
xiii) Member, Academic Council, JP University, Wagnaghat, Solan, HP
xiv) Member, Advisory Board of Journal of Conservation and Society, India
xv) Member, Advisory Board, Punjab Science Congress 2014, Punjab Academy of Sciences
xvi) Associate Editor, Proceedings of 1st Indian International Conference on Artificial Intelligence

xvii) Session Chair, Advanced Image Processing Algorithms for Remote Sensing Data, 1st Indian International Conference on Artificial Intelligence, Dec. 18-20, 2003, Hyderabad, India.
xviii) Session Chair, National Seminar on "Geospatial Solutions for Resource Conservation and Management", 18-20 January, 2012, Bangalore
xix) Session Chair, Hyperspectral Imaging, International Conference of Geospatial Techniques and Application (Geomatrix' 12), Indian Institute of Technology Bombay, 26 - 29 February, 2012, Mumbai
xx) Session Chair, All India Seminar on Applications of Imaging, Visualisation and Optimisation Technologies, March 2-3, 2012, Dehradun.
xxi) Session Chair, Mini Symposium on Soft Computing in Civil Engineering, 10th World Congress on Computational Mechanics, July 8 – 13, 2012, Sao Paulo, Brazil.
xxii) Guest of Honor, CSIR Foundation Day, September 26, 2013, CSIO, Chandigarh
xxiii) Guest of Honor, SASE, Chandigarh
xxiv) Guest of Honor, College of Engineering Roorkee, March 29-30, 2014
xxv) Guest of Honor, CCA, Chandigarh, April 4, 2014
xxvi) Panelist, Panel Discussion on Come, Make in India, Center for Economy Policy Research, Sept. 24, 2014, Chandigarh
xxvii) Panelist, Panel Discussion on Governance and Regulatory Framework, FICCI Higher Education Summit 2014; Higher Education Vision 2013 Making it Happen, Nov. 12-14, 2014, New Delhi,
xxviii) Chief Guest, National Level Technical Festival, April 3, 2015, Chandigarh Universiry, Mohali, Punjab
xxix) Chief Guest, First National Seminar on Engineering and Research Applications, June 5, 2015, Ryat-Bahara University, Mohali, Punjab
xxx) Chief Guest, Valedictory Function, DST Sponsored Training Programme on Geospatial Technology and its Applications, August 10, 2015, Chitkara University, Baddi, HP.
xxxi) Session Chair, MRS Trilateral Symposium, Nov 23-25, 2015, IISER, Mohali.
xxxii) Chief Guest, International Conference on Recent Advances in Civil Engineering (ICRACE-2017), May 4-5, Maharishi Markandeshwar University (MMU), Mullana - Ambala

Reviewer of Journals:

a. IEEE Transactions on Geoscience and Remote Sensing
b. IEEE Geoscience and Remote Sensing Letters
c. International Journal of Image Fusion
d. Remote Sensing of Environment
e. International Journal of Remote Sensing
f. Photogrammetric Engineering and Remote Sensing
g. Landslides
h. Landscape Ecology (UK)
i. Optical Engineering
j. Computers and Geosciences
k. Environmental Engineering Science
l. Journal of Applied Remote Sensing
m. Journal of Indian Society of Remote Sensing
n. Current Science
o. Hydrology Journal of Indian Association of Hydrologists

Countries Visited on Academic Assignments

1. UK
2. USA
3. Canada
4. Italy
5. Switzerland
6. Norway
7. Brazil
8. Singapore
9. Nepal
10. Taiwan

LIST OF PUBLICATIONS

Books

1. Varshney, P. K. and Arora, M. K. (Eds.), 2004, Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data, Springer Verlag Heidelberg, Germany.
2. Arora, M. K. and Badjatia, R. C, 2011. Introduction to Geomatics Engineering, Nem Chand & Bros., Roorkee, India.
3. Badjatia, R. C., and Arora, M. K., Remote Sensing and its Applications, Block II, Distance Learning Teaching course material, Indira Gandhi National Open University (IGNOU), New Delhi, India. (In Print)
4. Badjatia, R. C., and Arora, M. K. Surveying and its Applications, Block I, Distance Learning Teaching course material, Indira Gandhi National Open University (IGNOU), New Delhi, India (In Print)

Chapters in Books

1. Foody, G. M., and Arora, M. K., 1995, Fuzzy thematic mapping: incorporating mixed pixels in the training, allocation and testing stages of a supervised image classification, *In Soft Computing in Remote Sensing Data Analysis*, Edited by E. Binaghi, P. A. Alessandro and A. Rampini, World Scientific, Singapore, pp. 43-52.
2. Arora, M. K., 1997, Application of log linear modelling in digital image classification, In *Mathematics and its Applications in Engineering and Industry*, Edited by B. Singh, K. Murari, U.S. Gupta, G. Prasad and Sukavanam, Narosa Publishing House, UK, 237-246.
3. Arora, M. K., 2003, Role of Remote Sensing in Disaster Risk Management. In *Disaster Risk Reduction in South Asia*, (Eds) M. Ariyabandu and P. Sahni, Prentice-Hall (India), New Delhi, 84-100.
4. Rao, R. and Arora, M. K., 2004, Overview of Image Processing, In *Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data*, (Eds.) P. K. Varshney and M. K. Arora, Springer Verlag Heidelberg, Germany pp. 51-85.
5. Watanachaturaporn, P. and M. K. Arora, 2004, Support Vector Machines for Classification of Multi and Hyperspectral Data, , In *Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data*, (Eds.) P. K. Varshney and M. K. Arora, Springer Verlag Heidelberg, Germany pp. 238-255.
6. Kasetkasem, K. Arora, M. K. and Varshney, P. K., 2004, An MRF model based Approach for Sub-pixel Mapping from Hyperspectral Data, In *Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data*, (Eds.) P. K. Varshney and M. K. Arora, Springer Verlag Heidelberg, Germany pp. 257-277.
7. Shalan, M. A., Arora, M. K. and J. Algy, 2004, Crisp and Fuzzy Image Classification Accuracy Measures, In *Geodynamics*, (Eds) P. A. Atkinson, G. M. Foody, CRC Press, Boca Raton, FL, USA, pp. 11-23.
8. Arora, M. K., 2006, Modern Surveying Equipment, In *Advanced Survey*, Indira Gandhi National Open University, New Delhi, pp. 93-112.
9. Chen, H. M., Arora, M. K. and Varshney, P. K., 2006, A comparative assessment of similarity measures for registration of multi-temporal images, *In Analysis of Multi-temporal Remote Sensing Images*, Edited by P. Smits and L. Bruzzone, World Scientific, Singapore, pp. 43-52.
10. Arora, M. K., Shukla, A. and Gupta, R. P., 2010, Digital information extraction techniques for snow cover mapping from remote sensing data, *Encyclopedia of Snow, Ice and Glacier*, Springer, pp. 213-231.

11. M K Arora, A. K. Saha, Gupta, P. and R P Gupta, 2012, J-LaSIRF: Java-based Landslide Safe Intelligent Route Finder for mountainous terrain in GIS environment, Editors: B. Pradhan and M. Buchroithner, *GI Technology for Terrigenous Mass Movements*, Springer Verlag, Berlin, pp. 349-368.
12. Saini, V., Gupta, R. P. and Arora, M. K., 2015, Assessing the environmental impacts of coal mining using analytical hierarchy process: A case study of Jharia coal-field, India. In: Bulucea, A. (Ed.), *Advances in Environmental and Geological Science and Engineering*, Proceedings of the 8th International Conference on Environmental and Geological Science and Engineering, June 27-29, WSEAS Press, Salerno, Italy, pp. 281-289.
13. Arora, M. K., 2017, Application of differential SAR Interferometry in landslide investigation. In SM Ramasamy and Bhoop Singh (Eds), *Landslide Research: The DST's Initiatives*.
14. Kanungo, D. P. and Arora, M. K., 2017, Application of fuzzy logic and neural computing concepts for landslide susceptibility zonation and risk assessment in hilly terrain, In T. N. Singh, Prof. V. Vishal and Prof. S. P. Pradhan (Eds), *Landslides: Theory, Practice and Modelling*, NTHR series, Springer (In Press)
15. Saini, V., Gupta, R. P. and Arora, M. K., 2017, Environmental monitoring in Jharia coalfield using vegetation indices and land surface temperature patterns, *Coal and Peat Fires: New Perspectives*, Elsevier. (Accepted)

International Peer Reviewed Journals

1. Arora, M. and Garg, P. K., 1993, Expert systems in remote sensing- the way forward, *Asian-Pacific Remote Sensing Journal*, 5, 67-70.

2. Foody, G. M., and Arora, M. K., 1996, Incorporating Mixed Pixels in the Training, Allocation and Testing Stages of Supervised Classifications, *Pattern Recognition letters*, 17, 1389-1398.

3. Arora, M. K., and Foody, G. M., 1997, Log-linear Modelling for the Evaluation of Variables Affecting the Accuracy of Probabilistic, Fuzzy and Neural Network Classifications, *International Journal of Remote Sensing*, 18(4), 785-798.

4. Foody, G. M., and Arora, M. K., 1997, An Evaluation of Some Factors Affecting the Accuracy of Classification by an Artificial Neural Network, *International Journal of Remote Sensing*, 18(4), 799-810.

5. Arora, M. K., and Ghosh, S. K., 1998, A comparative evaluation of accuracy measures for the classification of remotely sensed data, *Asian Pacific Remote Sensing and GIS Journal*, 10(2), 1-9.

6. Arora, M. K., Narsimham, G., and Mohanty, B., 1998, Neural network approach for the classification of remotely sensed data, *Asian Pacific Remote Sensing and GIS Journal, 10 (2*), 11–18.

7. Arora, M. K., Tiwari, K. C., and Mohanty, B., 2000, Effect of Neural Network Variables on Image Classification, *Asian Pacific Remote Sensing and GIS Journal*, Vol. 13, 1 – 11.

8. Arora, M. K., and Mathur, S., 2001, Multi-source image classification using neural network in a rugged terrain, *Geo Carto International*, 16 (3), 37 – 44.

9. Saha, A. K., Gupta, R. P., and Arora, M. K., 2002, GIS- Based Landslide Hazard Zonation in a part of the Himalayas, *International Journal of Remote Sensing*, 23(2), 357-369.

10. Arora, M. K. and Agarwal, K., 2002, A program for sampling design for image classification accuracy assessment, *Photogrammetry Journal of Finland*, 18(1), 33-43.

11. Shalan, M. A., Arora, M. K., and Ghosh, S. K., 2003, An evaluation of fuzzy classifications from IRS 1C LISS III data, *International Journal of Remote Sensing*, 23(15), 3179 - 3186.

12. Chen, H., Varshney, P. K. and Arora, M. K., 2003, Mutual information based image registration of remote sensing data, *International Journal of Remote Sensing*, 24(18), 3701-3706.

13. Chen, H., Varshney, P. K. and Arora, M. K., 2003, Automated registration of multi-temporal remote sensing images using mutual information, *IEEE Transactions on Geoscience and Remote Sensing*, 41 (11), 2445-2454.

14. Chen, Hua-mei, Arora, Manoj K. and Varshney, Pramod K., 2003, Mutual information based image registration for remote sensing data, *Electrical Engineering and Computer Science.* Paper 127, Syracuse University, USA, (http://surface.syr.edu/eecs/127).

15. Shah, C. A, Arora, M. K., and Varshney, P. K., 2004, Unsupervised Classification of Hyperspectral Data: An ICA Mixture Model based Approach, *International Journal of Remote Sensing*, 25(2), 481-487

16. Arora, M. K, Gupta, A.S.D., Gupta, R. P., 2004, An artificial neural network approach for landslide hazard zonation in Bhaghirathi (Ganga) valley, Himalayas, *International Journal of Remote Sensing*, 25(3), 559-572.

17. Hyder, S. S., Said, S., Kothyari, U. C., and Arora, M. K., 2004, Soil moisture estimation using ERS-2 SAR data in Solani river catchment *Journal of International Association of Hydrological Sciences (IAHS)*, 49(2), 323–334.

18. Saha, A.K., R P Gupta , I Sarkar, M K Arora and E Csaplovics, 2005, A Statistical approach for GIS-based Landslide Hazard Zonation: A case study in the Himalayas, *Landslides*, 2, 61-69.

19. Sharma, M. L. and Arora, M. K., 2005, Prediction of seismicity cycles in the Himalayas using artificial neural network, *Acta Geophysica Polonica* 53(3), 299-309

20. Kasetkasem, T., Arora, M. K., and Varshney, P. K., 2005, MRF based approach for super resolution mapping, *Remote Sensing of Environment*, 96, 302-314.

21. Min Xu, P. Watanachaturaporn, P. K. Varshney and M. K. Arora, 2005, Decision Tree Regression for Soft Classification of Remote Sensing Data, *Remote Sensing of Environment*, 97, 322-336.

22. Ibrahim, M. A., Arora, M. K., and Ghosh, S. K., 2005, Estimating and Accommodating uncertainties through soft classification of remote sensing data, *International Journal of Remote Sensing*, 26, 2995-3007.

23. Saha, A.K., M. K. Arora, R P Gupta , M. L. Virdi, and E Csaplovics, 2005, GIS-Based Route Planning in Landslide Prone Areas, *International Journal of Geographic Information Science*, 19(10), 1149-1175.

24. Saha, A. K., Arora, M. K., Csaplovics E., and Gupta, R. P., 2005, Land cover classification using IRS 1C LISS and topographic data in a rugged terrain in Himalayas, *Geo Carto International*, 20(2), 33-40

25. Kanungo, D. P., Gupta, R. P., Arora, M. K., Sarkar, S., 2006, A comparative study of conventional, ANN Black Box, Fuzzy and combined neural and fuzzy Weighting Procedures for landslide susceptibility zonation in Darjeeling Himalayas, *Engineering Geology*, 85, 347-366.

26. Cheng, Qi, Varshney, P. K. and Arora, M. K., 2006, Logistic Regression for Feature Selection and Soft Classification of Remote Sensing Data, *IEEE Transactions on Geosciences and Remote Sensing Letters*, 3, 491-494

27. Singh, S., Parkash, B., Rao, M. S., Arora, M. K. and Bhosle, B, 2006, Geomorphology, Pedology and Sedimentology of the Deoha/Ganga- Ghaghara Interfluve, Upper Gangetic Plains (Himalayan Foreland Basin)- Extensional Tectonic Implications, *CATENA*, 67, 183-203.

28. Stehman, S. V., Arora, M. K., Kasetkasem, T. and Varshney, P. K., 2007, Estimation of Fuzzy Error Matrix Based Accuracy Measures for Soft Classification and their Variances under Stratified Random Sampling, *Photogrammetric Engineering and Remote Sensing*, 73, 165-174.

29. Sunderasan, A., Varshney, P. K. and Arora, M. K., 2007, Robustness of Change Detection Algorithms in the Presence of Registration Errors, *Photogrammetric Engineering and Remote Sensing*, 73, 375-384.

30. Shah, C. A, Arora, M. K., and Varshney, P. K, 2007. ICA Mixture Model Algorithm for Unsupervised Classification of Remote Sensing Imagery, *International Journal of Remote Sensing*, 28, 1711 – 1731.

31. Watanachaturaporn, P., P. K. Varshney and M. K. Arora, 2007, Multisource classification using support vector machines: an empirical comparison with decision tree and neural network classifiers, *Photogrammetric Engineering and Remote Sensing*, 74, 239-246.

32. Chauhan, H. J., M. K. Arora, A. Agarwal, 2007, A Comparison of Area Estimation Techniques for Remotely Sensed Derived Crisp Classification, *Journal of Applied Remote Sensing*, (Published online).

33. Tiwari, K. C., Singh, D. and Arora, M. K., 2008, Development of a Model for Detection and Estimation of Depth of Shallow Buried Non-Metallic Landmine at Microwave X-Band Frequency, *Progress In Electromagnetics Research, PIER*, 79, 225–250.

34. Said S., Kothyari, U. C., Arora, M. K., 2008, Soil Moisture Estimation from ERS-2 SAR Data over Bare and Vegetated Areas Using Neural Network: A Case Study, *ASCE Journal of Hydrologic Engineering*, 13, 461-475.

35. Kanungo, D. P., Arora, M. K., Gupta, R. P. and Sarkar, S., 2008, Comparative evaluation of GIS-based landslide susceptibility maps, *International Journal of Applied Earth Observation and Geoinformation*, 10, 330-341.

36. Kanungo, D. P., Arora, M. K., Gupta, R. P. and Sarkar, S., 2008, Landslide Risk Assessment Using Concepts of Danger Pixels and Fuzzy Set Theory in Darjeeling Himalayas, *Landslides*, 5, 407-416.

37. Kanungo, D. P., Arora, M. K., Gupta, R. P., Sarkar, S., 2009, A Fuzzy Set Based Approach for Integration of Thematic Maps for Landslide Susceptibility Zonation, *GeoRisk*, 3, 30-41

38. Shukla, A., Gupta, R. P., and Arora, M. K., 2009, Estimation of debris cover and its temporal variation using optical satellite sensor data: a case study in Chenab basin, Himalaya, *Journal of Glaciology*, 55, 444-452.

39. Kanungo, D. P., M. K. Arora, S. Sarkar and R. P. Gupta, 2009, Landslide susceptibility zonation mapping – A review, *Journal of South Asia Disaster Studies*, 2, 81-105

40. Shukla, A., Gupta, R. P., and Arora, M. K., 2010, Delineation of debris-covered glacier boundaries using optical and thermal remote sensing data, *Remote Sensing Letters*, 1, 11-17.

41. Shukla, A., M. K. Arora and R. P. Gupta, 2010, Synergistic approach for mapping debris-covered glaciers using optical-thermal remote sensing data with inputs from geomorphometric parameters, *Remote Sensing of Environment*, 114, 1378-1387.

42. Chauhan, S., Arora, M. K., and Gupta, N. K., 2010, Landslide Susceptibility Zonation through ratings derived from Artificial Neural Network, *International Journal of Applied Earth Observation and Geo Information*, 12, 340-350.

43. Pareek, N., Sharma, M. L., and Arora, M. K., 2010, Impact of seismic factors on Landslide Hazard Zonation: A case study in part of Indian Himalayas, *Landslides*, 7, 191-201.

44. Chauhan, S., Sharma, M and Arora, M. K., 2010, Landslide Susceptibility Zonation of Chamoli region, Garhwal Himalayas, using Logistic Regression Model, *Landslides*, 7(4), 411-423.

45. Maithani, S., Arora, M. K. and Jain, R. K., 2010, Urban Growth Zonation in Dehradun City using Artificial Neural Network, *Geo Carto International*, 25, 663-681.

46. Kasetkasem T., M.K. Arora, P.K. Varshney and V. Areekul, 2011, Improving Sub-pixel Classification by Incorporating Prior Information in Linear Mixture Models, *IEEE Transactions on Geoscience and Remote Sensing*, 49, 1001-1013.

47. Tiwari, K. C., Arora, M. K., and Singh, D., 2011, An Assessment of Independent Component Analysis for Detection of Military Targets from Hyperspectral Images, *International Journal of Applied Earth Observation and Geo Information*, 13, 730-740.

48. Varshney, A., Arora, M. K. and Ghosh, J. K., 2012, Median Change Vector Analysis Algorithm For Land Use Land Cover Change Detection From Remote Sensing Data, 2011 *Remote Sensing Letters*, 605-614.

49. Bhattacharya, A., Sharma, M. L., and Arora, M. K., 2012, Usefulness of SAR Interferometry for DEM Generation and subsidence estimation in Jharia Coalfield area, *Geo Carto International*, 27, 57-77.

50. Said, S., Kothiyari, U. C. and Arora, M. K., 2012, Vegetation Effects on Soil Moisture Estimation from ERS-2 SAR Images, *Hydrological Sciences Journal*, 57(3), 517-544

51. Kumar, K., Hari Prasad, K. H., and Arora, M. K., 2012, Estimation of Water Cloud Model Vegetation Parameters by Genetic Algorithms, *Hydrological Sciences Journal*, 57(4), 776- 789.

52. Bhattacharya, A., Sharma, M. L., and Arora, M. K., 2012, Surface Displacement Estimation along Himalayan Frontal Fault using Differential SAR Interferometry, *Natural Hazards*, 64(2), 1105-1126.

53. Mishra V. D., Gusain, H. and Arora, M. K., 2012, Algorithm to Derive Narrow Band to Broad Band Albedo for Snow Using AWiFS and MODIS Imagery of Western Himalaya – Validation, *International Journal of Remote Sensing Applications*, 2(3), 52-62.

54. Pareek, N., Sharma, M. L., and Arora, M. K., 2012, Inclusion of Peak Ground Acceleration in a GIS based Landslide Susceptiblity Zonation (LSZ) in Garhwal Himalayas, *Natural Hazards,* 65, 739-765.

55. Pareek, N., Pal, S., Sharma, M.L., Arora, M.K. 2013, Study of effect of seismic displacements on landslide susceptibility zonation (LSZ) in Garhwal Himalayan region of India using GIS and remote sensing techniques, *Computers & Geosciences*, 61, 50 – 63.

56. Bhattacharya A, Sharma ML, Arora MK, Voege M., 2013, Surface Displacement Estimation using Multi-temporal SAR Interferometry in a Seismically Active Region of Himalaya, *GeoRisk*, 7 (3), 184-197.

57. Atanu Bhattacharya, Manoj K. Arora, Mukat L. Sharma, Malte Vöge, Rajinder Bhasin, 2013, Surface displacement estimation using space-borne SAR interferometry in a small portion along Himalayan Frontal Fault, *Optics and Laser Scanning*, 53, 164-178.

58. K Mukherjee, A Bhattacharya, JK Ghosh, MK Arora, 2013, Comparative performance of fractal based and conventional methods for dimensionality reduction of hyperspectral data, *Optics and Lasers in Engineering*, 55, 267-274

59. Gusain, H., Mishra V. D., and Arora, M. K., 2013, A four-year record of the meteorological parameters, radiative and turbulent energy fluxes at the edge of the East Antarctic ice sheet, close to Schirmacher Oasis, *Antarctic Science Journal*, 26(1), 93–103.

60. MSG Prasad, MK Arora, 2014, A simple measure of confidence for fuzzy land-cover classification from remote-sensing data, *International Journal of Remote Sensing*, 35 (24), 8122-8137.

61. Ganesh Prasad M.S, Manoj K. Arora , 2014, Assessing uncertainty in fuzzy land cover classification by confusion index, *International Journal of Geomatics and Geosciences*, 5, 332-344.

62. Gusain, H., Mishra V. D. and Arora, M. K., 2014, Estimation of net shortwave radiation flux of western Himalayan snow cover during clear sky days using remote sensing and meteorological data, *Remote Sensing Letters*, 5:1, 83-92.

63. Kamal Kumar, Hari Prasad Suryanarayana Rao and M. K. Arora, 2015, Study of water cloud model vegetation descriptors in estimating soil moisture in Solani catchment, *Hydrological Processes*, 29 (9), 2015, 2137–2148.

64. Atanu Bhattacharya, Kriti Mukherjee, Manoj Kuri, Malte Vöge, M. L. Sharma, M. K. Arora & Rejinder K. Bhasin, 2015, Potential of SAR intensity tracking technique to estimate displacement rate in a landslide-prone area in Haridwar region, India, Natural Hazards, *Journal of the International Society for the Prevention and Mitigation of Natural Hazards* (DOI 10.1007/s11069-015-1949-6)

65. Kumar, K., Arora, M. K. and Hariprasad, K. S., 2014, Geostatistical Analysis of Soil Moisture Distribution in a Part of Solani River Catchment, *Applied Water Science*, Springer, DOI: 10.1007/s13201-014-0202-x

66. M.S. Ganesh Prasad and Manoj K. Arora, 2015, Representing Uncertainty in Fuzzy Land Cover Classification: A Comparative Assessment, *Journal of Remote Sensing Technology*, 3 (3), 34-45.

67. Saini, V., Gupta, R. P. and Arora, M. K., 2015, Environmental issues of coal mining - A case study of Jharia coal-field India. *Special publication of Journal of Engineering Geology*, October 2015, 989-989.

68. Varinder Saini, Ravi P. Gupta and Manoj K.Arora, 2016, Environmental Impact Studies in coalfields in India: A case study from Jharia coal-field, *Renewable and Sustainable Energy Reviews*, 53, 1222–1239.

69. H.S. Gusain, V.D. Mishra, M.K. Arora, Shailesh Mamgain, Dhiraj Kumar Singh, 2016, Operational algorithm for generation of snow depth maps from discrete data in Indian Western Himalaya, *Cold Regions Science and Technology*, 126, 22–29.

70. Kavita V. Mitkari, Manoj K. Arora, and Reet K. Tiwari, 2017, Extraction of Glacial Lakes in Gangotri Glacier using Object Based Image Analysis. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* (Under Review).

71. Deepti Yadav, M. K. Arora, K. C. Tiwari, J. K. Ghosh, 2017, An Approach to Detection and Identification of Camouflaged Targets using Hyperspectral and LiDAR Data, *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing (JSTARS)* (under review)

72. Deepti Yadav, M. K. Arora, K. C. Tiwari, J. K. Ghosh, 2017Parameters affecting Target Detection in VBIR and SWIR range, *Egyptian Journal of remote sensing and space sciences (EJRS)* (under review)

73. Kavita V. Mitkari, Manoj K. Arora, Reet Kamal Tiwari, Mohit Srivastava, and Hemendra S. Gusain, 2017, Object Based Classification for Glacier Cover Mapping using High Resolution Satellite Remote Sensing Data, *Remote Sensing of Environment* (Under Review).

Indian Peer Reviewed Journals

74. Tiwari, R. S., and Arora, M., 1989, An analysis of errors and their adjustments in precise traversing in surveying, *Journal of Institution of Engineers (India), Civil Engineering Division*, 70, 108-112.

75. Tiwari, R. S., and Arora, M., 1992, Adjustments of trilateration networks by finite element method, *Indian Surveyor*, 40, 8-16.

76. Arora, M., and Sharma, M. L., 1998, Seismic hazard analysis: an artificial neural network approach, *Current Science*, 75 (1), 55-59.

77. Tiwari, R. S. and Arora, M. K., 1999, Comparative study of least squares and finite element approach for the adjustment of trilateration networks, *Indian Surveyor*, 52(1), 30 – 38.

78. Gupta, R. P., Saha, A. K., Arora, M. K. and Kumar, A., 1999, Landslide Hazard Zonation in a part of the Bhagirathi Valley, Garhwal Himalayas, Using Integrated Remote Sensing – GIS, *Himalayan Geology*, 20(2), 71-85.

79. Tiwari, R. S., Arora, M. K. and Kailash T., 1999, Soft classification for sub-pixel land cover extraction, *Journal of Indian Society of Remote Sensing*, 27 (4), 225-234.

80. Arora, M. K., 1999, Thematic information extraction using neural network and fuzzy techniques, *Indian Cartographer*, 19, 344-351.

81. Tiwari, R. S., Arora, M. K., and Kumar, A, 2000, An appraisal of GPS related errors, *GIS@development*, 4, 37 – 40.

82. Gupta, R. D., Garg, P. K., and Arora, M.K., 2000, A GIS based statistical modelling for inter-block disparities analysis in Dehradun district, *GIS India* , 9(6), 23-27.

83. Gupta, R.D., Garg, P.K. and Arora, M., 2001, *A GIS Based Decision Support System for Developmental Planning in Dehradun District*, Journal Indian Cartographer, Vol. 21.

84. Chandra, S, Arora, M.K. and Sahu, V.K, 2001, Headway modeling on urban roads using artificial neural network, *Highway research Bulletin, Indian Roads Congress*, 65, 127-138.

85. Arora, M. K., and Shalan, M. A., 2002, A view on quality of remotely sensed derived thematic maps for GIS database, *GIS India*, 11(5), 6-9.

86. Arora, M. K., 2002, Land cover classification from remote sensing data, *GIS@development* , 6(3), 24-25, 30-31.

87. Arora, M. K., Sharma, M. L., and Patel, V. K. M., 2002, SAR Interferometry for DEM generation, *GIS@development* , 6(6), 26-30.

88. Baijal, R., Arora M. K., and Ghosh, S. K., 2002, A GIS assisted knowledge based approach for military operations, *GIS@Development*, 6(10), 21-24.

89. Kumar, P., Arora, M. K. and Sudhakar, M., 2003, Facility based Network Planning of Rural Roads Using GIS, *Indian Highways*, July 2004, 5-22.

90. Maithani S., Jain, R. K. and Arora, M. K., 2007, An Artificial Neural Network Approach for Modeling Urban Spatial Growth, ITPI Journal, 4(2), 43-51.

91. Shukla, A., Arora, M. K. and Gupta, R. P., 2008, Remote sensing based study of retreat of and accompanying increase in supra-glacial moraine cover over a Himalayan glacier. *Himalayan Journal of Sciences,* 5(7) (Special Issue), p.142. (Extended abstract)

92. Bhattacharya A, Arora MK, Sharma ML (2011) Improved Digital Elevation Model Creation using SAR Interferometry in Plane and Undulating Terrains. *Himalayan geology*, 33, 29-44.

93. Arora, M. K., Bansal, S., Khare, S. and Chauhan, K., A comparative assessment of some target detection algorithms for hyperspectral images, 2013, *Defence Science Journal*, DRDO, 63, 53-62.

94. Arora, M. K. and Tiwari, K. C., 2013, Subpixel Target Enhancement in Hyperspectral Images, *Defence Science Journal*, 63, 63-68.

95. Bhattacharya A, Arora MK, Sharma ML (2013) Usefulness of Adaptive Filtering for Improved Digital Elevation Model Generation. *Journal of Geological Society of India.* 82(2), 153-161.

96. Tiwari R. K., Gupta R. P. and Arora, M. K., 2014, Estimation of surface ice velocity of Chhota-Shigri glacier using sub-pixel ASTER image correlation, *Current Science*, 106, 853-859.

97. M. S. Ganesh Prasad and Arora, MK, 2015, Assessing the quality of fuzzy land cover classification by similarity and certainty measures, *Journal of Geomatics*, 9, 249-256.

98. Prabhu N, Manoj K Arora and Balasubramanian R., 2015, Wavelet Based Feature Extraction Techniques of Hyperspectral Data, *Journal of the Indian Society of Remote Sensing*, (DOI 10.1007/s12524-015-0506-9)

99. Saini, V., Gupta, R. P. and Arora, M. K. (2015). Environmental issues of coal mining - A case study of Jharia coal-field India. *Journal of Engineering Geology* (Special Publication), Proceedings of International conference on Engineering Geology in New Millenium, 27-29 October 2015, New Delhi, pp. 989-998.

100. Deepti Yadav, M. K. Arora, K. C. Tiwari, J. K. Ghosh, 2017, Identification of most useful spectral ranges in improvement of target detection using hyperspectral data. *Defence Science Journal* (under review)

Research Papers in Conferences/Symposia (International and National)

1. Arora, M. K., and Foody, G. M., 1995, Assessing the factors affecting classification accuracy: the log linear modelling approach, *Proceedings of the 55th ACSM/ 61st ASPRS Annual Convention and Exposition*, Charlotte, NC, USA, Feb.27 - March 2, 1995, 3, 806-815.

2. Foody, G. M., and Arora, M. K., 1995, An evaluation of factors affecting neural network classification accuracy, *Proceedings of 21st Annual Conference of the Remote Sensing Society*, Southampton, UK, Sept. 11-14, 1995, 42-49.

3. Arora, M. K., 1996, Increasing classification accuracy by accounting for mixed pixels in training statistics, *Proceedings of the Remote Sensing Society One Day Student Meeting*, April 4, 1996, 39-45.

4. Arora, M. K., 1999, Techniques for Sub-Pixel Land Cover Information from Remotely Sensed Data, *South-Asian Countries Conference on Challenges to Architects and Civil Engineers During Twenty First Century*, April 7 – 9, 1999, Kathmandu, Nepal.

5. Arora, M. K., 1999, Introduction to Ground Truth Data Collection, Training Course on Remote Sensing and GIS Applications in Water Resources, NIH, Roorkee and CWC, New Delhi, India, 32-38.

6. Arora, M. K., 1999, Advanced Techniques for Land use/land cover studies, Training Course on Remote Sensing and GIS Applications in Water Resources, NIH, Roorkee and CWC, New Delhi, India, 172-179.

7. Gupta, R. D., Garg, P. K., and Arora, M.K., 2000, Analysis of Intra-District Disparities for Dehradun District using GIS Techniques, *Proceedings of 3rd Annual International Conference and Exhibition on GIS/GPS/RS*, 10-11 April, 2000, New Delhi, 4UD-6UD.

8. Arora, M. K., 2000, Neural network and fuzzy techniques for land use land cover mapping, Invited paper presented at *Workshop on Problems and Methods in RS-based Land Use / Land cover Mapping in Mountainous Terrain,* Aug. 7 - 10, 2000, Dehradun.

9. Gupta, R. D., Garg, P. K., and Arora, M.K., 2001, A GIS based spatial modelling for developmental planning, *In Spatial Information Technology: Remote Sensing and GIS, Proceedings of ICORG* - 2000, Dec. 1 – 4, Edited by I. V. Muralikrishna, Vol I, B S Publications, Hyderabad, 265-270.

10. Arora, M. K., 2001, Issues related to neural network classification of remote sensing data, *In Spatial Information Technology: Remote Sensing and GIS, Proceedings of ICORG*, 2000, Dec. 1 – 4, Edited by I. V. Muralikrishna, Vol I, B S Publications, Hyderabad, 435-439.

11. Amin, S., Gupta, R., Saha, A. K., Arora, M. K., and Gupta, R. P., 2001, Genetic Algorithm based Neural Network for Landslide Hazard Zonation: Some preliminary results, *National Workshop on Application of Rock Engineering in Nation's Development*, April 27-28, Roorkee, 203-215.

12. Arora, M. K., 2001, A discussion on accuracy assessment procedures for crisp and fuzzy image classifications, *In International Conference on Mathematical Modelling*, Singh, B, Gupta U. S., Srivastava G. S., Gulati, T. R., and Katiyar, V. K., (Eds). , Tata McGraw Hill, New Delhi, 228 – 233.

13. Baijal R., and Arora, M. K., 2001, Modern Mapping Tools for Defence Forces, *All India Seminar on Infrastructure Development in Uttaranchal – Problems and Prospects*, Oct. 11-13, 2001, Roorkee.

14. Baijal, R., and Arora, M. K., 2001, GPS: A Military Perspective, *Asian GPS Conference*, 29-30 Oct., New Delhi

15. Arora, M. K., 2001, Remote sensing for land use assessment at micro level, Short course on Watershed Planning, Central Soil & Water Conservation Research & Training Institute, Dehradun, India, 255-267.

16. Sharma. M. L., M. Arora and Y. V. Raju, 2001, Seismic hazard analysis of the Himalayan region using Artificial Neural Network, *International Conference on Seismic Hazard with particular reference to Bhuj earthquake of January 26, 2001*, New Delhi, Abstract Volume, 280-282.

17. Robella, S. A., Varshney, P. K., and Arora, M. K, 2002, Poster paper presented at *International Geosciences and Remote Sensing Symposium*, Toronto, 24 June – 28 June, 2002.

18. Shah, C. A, Arora, M. K., Robella, S. A., and Varshney, P. K., 2002, An ICA mixture model based unsupervised classification of hyperspectral imagery, 31st Applied Imagery Pattern Recognition Workshop, Oct 16-18, IEEE Computer Society, Washington DC, USA, 29-35.

19. Ibrahim, M. A., Arora, M. K., Ghosh, S. K., Chandra, A. M., 2002, An overview of fuzzy methods for land cover classification from remote sensing images, *ISPRS TC VII and ISRS Symposium on "Resource and Environmental Monitoring*, Dec. 3 –6, 2002, Hyderabad, India, CD ROM.

20. Tripathi, K.P., Arora, M. K. and Tripathi, S.K. 2002. Sediment yield modelling from microwatershed – A review In : Resource conservation and watershed management technology options and future strategies. Eds. Dhyani, S.K. *et.al*., Indian Association of Soil & Water Conservationists, Dehradun, India, 394-401.

21. Hyder, S. S., Said, S., Kothyari, U. C., and Arora, M. K., 2003, Relationship between ERS-2 SAR backscatter coefficient and volumetric soil moisture in Solani river catchment, Symposium on Microwave Remote Sensing Applications, January 21-23, 2003, I I T Bombay, India, CD ROM.

22. Watanachaturaporn, P., Arora, M. K. and Varshney, P. K., 2003, Land Cover Classification using Support Vector Machines: Effect of Kernal Functions, presented in 2nd Annual New York State Remote Sensing Symposium, 17 April, 2003, Rochester, NY, USA.

23. Shah, C. A, Varshney, P. K., and Arora, M. K., 2003, ICA Mixture Model for Unsupervised Classification of non-Gaussian Classes in Multi/Hyperspectral Imagery, Aerosense 2003, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery IX, Proceedings of SPIE, vol. 5093, USA, 21–25 April 2003, 569-580.

24. Ibrahim, M. A., Arora, M. K. and Ghosh, S. K., 2003, Improving the Quality of Remotely Sensed Derived Land Cover Maps by Incorporating Mixed Pixels in Various Stages of a Supervised Classification Approach, IEEE *International Geosciences and Remote Sensing Symposium*, Toulouse, France, July 21 – 25, 2003, 3447-3449.

25. Chen, H, Varshney, P. K. and Arora, M. K., 2003, A Study of Joint Histogram Estimation Methods to Register Multi-Sensor Remote Sensing Images using Mutual Information, IEEE *International Geosciences and Remote Sensing Symposium*, Toulouse, France, July 21 – 25, 2003, 4035-4037.

26. Kasetkasem, T, Arora, M. K. and Varshney, P. K., 2003, A Markov Random Field Based Approach for Sub-pixel Land Cover Mapping, IEEE *International Geosciences and Remote Sensing Symposium*, Toulouse, France, July 21 – 25, 2003, 3456-3458.

27. Shalan, M. A., Arora, M. K. and Elgy, J., 2003, CAFCAM: Crisp And *Fuzzy Classification Accuracy Measurement Software, 7th* International Conference on Geocomputation, Sept. 8-10, Southampton, UK, CD.

28. Shah, C. A Arora, M. K , and Varshney, P. K., 2003, ICA mixture model algorithm - A higher order statistical approach for unsupervised classification of remote sensing imagery, *Western New York Image Processing Workshop*, Oct 17, Rochester, NY, USA, CD.

29. C. A. Shah, P. Watanachaturaporn, M. K. Arora , P. K. Varshney, 2003, Recent Results on hyperspectral Image Classification, *IEEE Workshop on Advances in Techniques for Analysis of Remotely Sensed Data*, Oct., 27-28, Washington DC, USA, CD.

30. Ibrahim, M. A., Arora, M. K. and Ghosh, S. K., 2003, A comparison of FCM and PCM for sub-pixel classification, Proceedings of *1st Indian International Conference on Artificial Intelligence*, Dec. 18-20, Hyderabad, CD.

31. Saha, A.K., R P Gupta , I Sarkar, M K Arora and E Csaplovics, 2004, A GIS-based Statistical approach for Landslide Hazard Zonation in the Himalayas, Proceedings of *Map India* 2004, Jan. 28-31, 2004, New Delhi. CD.

32. Shuang, Z, Arora, M. K. and Varshney, P. K, 2004, Improvement in image classification accuracy in the presence of uncertainty in data, *ASPRS 2004 Annual Conference*, Denver, USA, May 23-28, 2004, CD

33. Watanachaturaporn, P. Arora, M. K. and Varshney, P. K, 2004, Evaluation of factors affecting support vector machines for hyperspectral classification, *ASPRS 2004 Annual Conference*, Denver, USA , May 23-28, 2004, CD

34. Sunderasan, A, Arora, M. K. and Varshney, P. K., 2004, Robustness of change detection algorithms in the presence of registration errors, *ASPRS 2004 Annual Conference*, Denver, USA , May 23-28, 2004, CD

35. Ibrahim, M. A, Arora, M. K., Ghosh, S. K. and Chen H. M., 2004, Approaches to Improve Accuracy of Neural Network Classification of Images Dominated by Mixed Pixels, *IEEE International Geosciences and Remote Sensing Symposium*, Alaska, July, 2004, CD

36. Tripathi, K.P., Tripathi, S.K. Sharda, V. N., Arora, M. K. 2004, Sediment delivery ratio for small hilly watershed of outer Himalayas, National Conference on Resource Conserving Technologies for Social Upliftment, Dec. 7-9, 2004, New Delhi.

37. Said, S., Kothyari, U.C. and Arora, M. K., 2004, Comparison of empirical model approaches for soil moisture retrieval over bare surfaces, HYDRO-2004, National Conference on Hydrauilcs and Water Resources, Dec. 27-28, Nagpur, India, (Eds.) P. D. Porey and R. N. Ingle, Elite Publishing House Pvt. Ltd., New Delhi, 33-41.

38. Watanachaturaporn, P. Arora, M. K. and Varshney, P. K, 2005, Hyperspectral Image Classification Using Support Vector Machines: A Comparison with Decision Tree and Neural Network Classifiers, March 2005 *ASPRS Annual Conference*, USA. CD.

39. Chandra, S, Vergeese, G and Arora, M. K., 2005, Coastal Mangrove Management – A study using Remote Sensing and GIS in Tsunami affected Areas, Presented at National Seminar on

GIS for Rural Development with Special Focus on Disaster Management, March 9-11, Hyderabad.

40. Watanachaturaporn, P. Arora, M. K. and Varshney, P. K, 2005, Multisource Land Cover Classification using Support Vector Machines: A case study in Himalayas, Fusion 2005, July 25-28, Philadelphia, USA. CD.

41. Said, S, Kothyari, U. C., Arora, M. K., 2005, Soil moisture retrieval from ERS 2 SAR image over bare and vegetated areas using ANN, 2nd *Indian International Conference on Artificial Intelligence*, December, Pune, 1110-1125, CD.

42. Kanungo, D. P., Arora, M. K, Gupta, R. P.,, Sarkar, S., Landslide Hazard Zonation in GIS environment using neuro-fuzzy weighting, 2nd *Indian International Conference on Artificial Intelligence*, December, Pune, 1922-1937, CD.

43. Sajith, V. K. and Arora, M. K.,2006, Information extraction from remote sensing data using evidential reasoning classifier, Paper presented at Indo-Australian Workshop on Information Technology in Civil Engineering, Feb. 20-22, Roorkee.

44. Kanungo, D. P., Arora, M. K, Gupta, R. P., Sarkar, S., 2006, Fuzzy Gamma Operator for Integration of Thematic Maps, Paper presented at Indo-Australian Workshop on Information Technology in Civil Engineering, Feb. 20-22, Roorkee

45. Watanachaturaporn, P, M. K. Arora and P. K. Varshney, 2006, Sub-pixel land cover classification using Support Vector Machines, ASPRS, 2006 Annual Conference, May 1-5, 2006, Reno, Nevada, USA, CD

46. Varshney, P. K., Arora, M. K. and Rao R. M., 2006, Overview of hyperspectral signal processing, IEEE International Conference on Acoustics Speech and Signal Processing, May 14-19, 2005, Toulusse, France, V1181-V1184.

47. Kasetkasem, T, Varshney P. K., Arora, M. K., and , 2006, An MRF based approach for simultaneous land cover mapping and cast shadow removal, IGARSS 06, July 31-Aug.04, 2006, Denver, Colorado, USA. CD

48. Kanungo, D. P., Arora, M. K, Gupta, R. P., Sarkar, S., 2006, Evaluation of combined neural and fuzzy approach for landslide susceptibility zonation in Himalayas, Paper presented at Indian Himalayan Science Workshop, June 27-28, 2006, Dehradun, India.

49. Gupta, R. P., Arora, M. K., Saha, A. K., Virdi, M. L., Computing landslide safe route in GIS environment, Paper presented at Indian Himalayan Science Workshop, June 27-28, 2006, Dehradun, India.

50. Tiwari, K. C., Singh, D. and Arora, M. K., 2006, Detection and estimation of shape of shallow buried non-metalic landmines using signal and image analysis techniques from microwave remote sensing data, National conference on Recent Advancements in Microwave Techniques And Applications (Microwave 2006), University of Rajasthan, Jaipur 06 -08 Oct 2006, 298-301

51. Said, S, Kothyari, U. C., Arora, M. K., 2006, Soil moisture estimation from ERS 2 SAR in Solani river catchment, Asia Pacific Remote Sensing, SPIE, Nov. 13-17, 2006, Goa.

52. Sajith, V. K. and Arora, M. K., 2006, Deriving classification uncertainty map in evidential reasoning classifier", Proc. of SPIE Vol. 6405, Nov. 13-17, 2006, Goa.

53. Prasad, G. M. S., Sajith V. K. and Arora, M. K., 2006, An Overview of Modelling and Visualizing uncertainty in Image Classification, Asia Pacific Remote Sensing, SPIE, Nov. 13-17, 2006, Goa.

54. Gupta, S. and Arora, M. K., 2006, Surface displacement studies using Differential SAR interferometry, Asia Pacific Remote Sensing, SPIE, Nov. 13-17, 2006.

55. Suri S., Arora, Manoj K., Seiler R., Csaplovics E. (2006), Applicability and performance of some similarity metrics for automated image registration. In: Smith Sr. WL, Larar AM, Aoki T, Rattan R (eds) Multispectral, Hyperspectral, and Ultraspectral Remote Sensing Technology, Techniques, and Applications, Proc SPIE Vol. 6405 (64052J)

56. Chandra, S. and Arora, M. K., 2006, Forest fire risk zonation mapping using remote sensing technology, Asia Pacific Remote Sensing, SPIE, Nov. 13-17, 2006, Goa.

57. Kanungo, D. P., Arora, M. K, Gupta, R. P., Sarkar, S., 2006,Remote sensing and GIS-based landslide risk assessment using a linguistic rule-based fuzzy approach, Asia Pacific Remote Sensing, SPIE, Vol 6412, Nov. 13-17, 2006, Goa.

58. Tiwari, K. C., Singh, D. and Arora, M. K., 2006, Detection and estimation of depth of shallow buried non-metallic landmines using signal and image analysis techniques in microwave region in X band, presented in SPIE Asia Pacific Remote Sensing Conference, Panaji, Goa 13 to 17 Nov 06.

59. Kanungo, D. P., Arora, M. K, Gupta, R. P., Sarkar, S., 2006, A fuzzy concept based landslide risk assessment in Darjeeling Himalayas, 13th Symposium on Earthquake Engineering, Roorkee, December 18-20, 2006

60. Ganesh Prasad, M. S., and Arora, M. K., 2006, Modelling uncertainty in spatial Data: key inputs to seismic hazard zonation,13th Symposium on Earthquake Engineering, Roorkee, December 18-20, 2006.

61. Tiwari, K. C., Singh, D. and Arora, M. K., 2006, Development of polarimetric transforms for detection of shallow buried non-metallic landmines in microwave X – band region, Paper presented at 3rd International Conference on Microwaves, Antenna Propagation and Remote Sensing held at Jodhpur, from 20 – 22nd December 2006, 149.

62. Shukla, A., Arora, M. K., and Gupta, R. P., 2008, A Multi-source approach for Moraine Cover Mapping using Artificial Neural Networks. International Workshop on Ice, Snow and Avalanches, 7-9th January 2008, IIT Bombay, Bombay, India, 144-154

63. Gupta, R. P., Shukla, A., Arora, M. K., and Kulkarni, A. V., 2008, Mapping Moraine Cover in Himalayas Using IRS 1C- LISS-III data. International Workshop on Ice, Snow and Avalanches, 7-9th January 2008, IIT Bombay, Bombay, India, 155-163.

64. Arora, M. K., Shukla, A., Gupta, R. P., and Agarwal, P., 2008, Mapping of Snow-cover from Coarse Resolution images using Sub-pixel algorithms. National Snow Science Workshop, 11-12th January 2008, Snow and Avalanche Study Establishment, Chandigarh, India, 10-11.

65. Shukla, A., Arora, M. K., and Gupta, R. P., 2008, Artificial Neural Network based Multi-source Classification for Snow-cover Mapping in Himalayas. National Snow Science Workshop, 11-12th January 2008, Snow and Avalanche Study Establishment, Chandigarh, India, 12-13

66. Arora, M. K., Shukla A., Gupta R. P. and Agarwal, P., 2008, A Comparative study of Linear Mixture Modelling and Fuzzy c-Means Clustering for Sub-pixel Snow-cover mapping from MODIS sensor, Cryosphere & Hazards Workshop for the Hindu Kush, Himalaya & Tibetan Plateau, 3-6 April 2008, Kathmandu, Nepal.

67. Gupta, R. P., Shukla, A. and Arora, M. K., 2008, Mapping of Moraine Cover over Himalayan Glaciers Using Satellite Sensor Optical Data, Cryosphere & Hazards Workshop for the Hindu Kush, Himalaya & Tibetan Plateau, 3-6 April 2008, Kathmandu, Nepal

68. Shukla, A., Arora, M. K. and Gupta R. P., 2008, Delineation of moraine-covered glacier boundaries using combined optical and thermal remote sensing images, Cryosphere & Hazards Workshop for the Hindu Kush, Himalaya & Tibetan Plateau, 3-6 April 2008, Kathmandu, Nepal

69. Ganesh Prasad, MS and Arora, M. K., 2008, A measure to assess the quality of thematic maps derived from remotely sensed images, Geomatics 2008, National Conference on Geomatics for planet earth, Feb. 18-20, 2008.

70. Arora, M. K., 2009, Emerging Trends in Digital Image Interpretation of Remote Sensing Data, National Conference on Geomatics and Impact of Climate Change, 4-6 Feb., 2009, Dehradun, India, Abstract Volume

71. Shukla, A., Gupta, R. P., and Arora, M. K., 2009, Estimating retreat of a Himalayan glacier by remote sensing based studies, National Conference on Geomatics and Impact of Climate Change, 4-6 Feb., 2009, Dehradun, India, Abstract Volume

72. Chauhan, S., Sharma, M. and Arora, M. K., 2009, Application of Logistic Regression for Landslide Hazard Zonation of Chamoli region, Garhwal Himalayas, India, National Conference on Geomatics and Impact of Climate Change, 4-6 Feb., 2009, Dehradun, India, Abstract Volume. **Best Paper Award.**

73. Chandra, S., Kimothi, M. M., Sinha, A. R., 2009, Monitoring Forest Fires in Uttarakhand using MODIS and AWiFS data, National Conference on Geomatics and Impact of Climate Change, 4-6 Feb., 2009, Dehradun, India, Abstract Volume

74. Shukla, A., R. P. Gupta, M. K. Arora, A.V. Kulkarni, 2009, Discrimination of supraglacial and periglacial debris using combined optical and thermal remote sensing data, International Symposium on Snow and Avalanches, April 6-10, 2009, Manali, India.

75. Arora, M. K., 2009, Information Extraction from Radar Remote Sensing Data, Radar Remote Sensing Seminar, IIT Roorkee, Sept, 25-26, 2009.

76. Choudhary, K., Arora, M. K. and Mishra, M., 2010, Population estimation from remote sensing data, National Seminar on Population, Development and Environment, Feb. 18-20, 2010, BHU, Varanasi, India.

77. Varshney A., Arora, M. K. and Ghosh, J. K., 2010, Land Use Land Cover Change Detection using Improved Change Vector Analysis, National Seminar on Population, Development and Environment, Feb. 18-20, 2010, BHU, Varanasi, India, Abstract Volume.

78. Bhattacharya, A., Manoj K. Arora and M. L. Sharma, 2010, Application of SAR Interferometry for DEM Generation: Case Studies in Two Regions with Varied Terrain Conditions, Proceedings of Conference on Remote Sensing and GIS for Environmental Management, August 10, 2010, Jamia Millia Islamia, New Delhi, 1-16.

79. Kumar, K., Manoj K. Arora, K. S. Hariprasad and Agarwal, Astha, 2010, Bare Field Soil Moisture Estimation from ENVISAT ASAR Data, Proceedings of Conference on Remote Sensing and GIS for Environmental Management, August 10, 2010, Jamia Millia Islamia, New Delhi, 100-111

80. Chandra, S., Manoj K. Arora and J. K. Ghosh, 2010, Forest Resource Mapping from Remote Sensing Data using Advanced Image Classification Techniques, Proceedings of Conference on Remote Sensing and GIS for Environmental Management, August 10, 2010, Jamia Millia Islamia, New Delhi, 120-129

81. Chaudhary A., Manoj K. Arora and R. K. Jain, 2010, Identification of Most Probable Areas for Urban Growth in Dehradun city using Remote Sensing and GIS, Proceedings of Conference on Remote Sensing and GIS for Environmental Management, August 10, 2010, Jamia Millia Islamia, New Delhi, 130-148.

82. Varshney A., Manoj K. Arora, J. K. Ghosh, 2010, A Modified Change Vector Analysis Algorithm for Land Use Land Cover Change Detection from Remote Sensing Data, Proceedings of Conference on Remote Sensing and GIS for Environmental Management, August 10, 2010, Jamia Millia Islamia, New Delhi, 215-226.

83. Arora, M. K., Chauhan, S., Sharma, M. and Kanungo, D. P., 2011, LaSaRiZ: A Software for Landslide Susceptibility Zonation and Risk Assessment using Neural Network and Fuzzy Set Approaches, INDROCK, Third Indian Rock Conference, Oct 13-15, Roorkee.

84. Bhattacharya A, Arora MK, Sharma ML (2011) Detection of Active Landslide Area in Himalayas using Small Baseline Subset Interferometry. *National Conference on Recent Advancement of Civil Engineering (RACE 2011), Organized by* Department of Civil Engineering, Benaras Hindu University (BHU). ISBN 978-81-921121-0-7, pp. 336-342.

85. Bhattacharya A, Arora MK, Sharma ML (2011) Landslide Monitoring using Small Baseline SAR Interferometry Technique. International Conference on Advancement of Civil Engineering (ACE-2011), Vol 4(6): 309-314.

86. Bhattacharya A, Arora MK, Sharma ML, 2012 A study of surface displacement estimation using Differential SAR Interferometry in the Himalayan Region. *National Seminar on Geospatial Solutions for Resource Conservation and Management on 18-20 January, 2012*, KSRSAC, Bangalore, 387-395.

87. Arora, M. K., 2012, Advances in land cover extraction from remote sensing data, *National Seminar on Geospatial Solutions for Resource Conservation and Management on 18-20 January, 2012*, Lead Paper, KSRSAC, Bangalore, 349-359.

88. Prasad Ganesh and Arora, M. K., 2012, Measurement of Thematic Uncertainty: a comparison of two measures, *National Seminar on Geospatial Solutions for Resource Conservation and Management on 18-20 January, 2012*, Lead Paper, KSRSAC, Bangalore, 367-372.

89. Sharma ML, Bhattacharya A, Arora MK., 2012, Convergence rate estimation of Indian plate using advanced remote sensing technique. *International conference of Geospatial Technique and Application (Geomatrix' 12)* Indian Institute of Technology Bombay on 26th-29th February, 2012, (Presented)

90. Srivastava, M., Arora, M. K., and Balasubramanyan, R., 2012, An Evaluation Technique to Assess Quality Of Segmentation from Remote Sensing Data, *International conference of Geospatial Technique and Application (Geomatrix' 12)* Indian Institute of Technology Bombay on 26th-29th February, 2012, (Presented)

91. Gusain H. S., Mishra V. D. and Arora, M. K, 2012, Estimation of Net Shortwave Radiation Flux of Western Himalayan Snowcover during Clear Sky Days using Remote Sensing and Meteorological Data, *International conference of Geospatial Technique and Application (Geomatrix' 12)* Indian Institute of Technology Bombay on 26th-29th February, 2012, (Presented)

92. Bansal Shweta, Manoj K. Arora, Bharti Soni, Susmita Harrow and R. Balasubramanyan, 2012, RX Algorithm for Anomaly Detection from Hyperspectral Remote Sensing Images, All India Seminar on Applications of Imaging, Visualisation and Optimisation Technologies, March 2-3, 2012, Dehradun. (Presented). **Best Paper Award.**

93. Chatterjee, A., Jain, H., Biswas, D., Arora, M. K., and Balasubramanian, R., 2012, Spectral Correlation Mapper for Classification and Target Detection in Hyperspectral Remote Sensing Images, All India Seminar on Applications of Imaging, Visualisation and Optimisation Technologies, March 2-3, 2012, Dehradun. (Presented)

94. Srivastava M., Arora M. K. and Balasubramanian Raman, 2012, Fixation of Segmentation Parameters for Object Based Classification of Resourcesat LISS-IV Image - An Experimental Study, All India Seminar on Applications of Imaging, Visualisation and Optimisation Technologies, Feb. 10-11, 2012, Dehradun. (Presented)

95. Arora, M. K., 2012, Advances in Information Extraction from Digital Remote Sensing Images, Lead Paper, All India Seminar on Applications of Imaging, Visualisation and Optimisation Technologies, March 2-3, Dehradun. (Presented)

96. Arora, M. K., 2012, Comparative assessment of neural network, fuzzy set and neuro-fuzzy approaches for landslide susceptibility zonation in Garhwal Himalayas, Session on Soft Computing in Civil Engineering, 10th World Congress on Computational Mechanics, July 8-13, 2012, Sao Paulo, Brazil. (Presented)

97. Vijay S., Arora, M. K., Buchroithner, M. and Kropacek, J., 2012, Analysis of glacier mass Balance and Rheology of Kekesayi Glacier using Hexagon KH-9, ALOS-PRISM and SAR Data, ESA-CliC-EGU Joint Conference on Earth Observation and Cryosphere Science,13-16 November 2012, Frascati, Rome, Italy. (Presented).

98. Tiwari, R. K.**,** Gupta, R. P. and Arora, M.K., "Changes in the Chhota-Shigri Glacier: A Benchmark Glacier in Himalayas," In: HOPE-2013, International conference organized by Humboldt House of Uttarakhand, 12-14 September 2013, Nainital, India. (Presented)

99. Tiwari, R. K., Gupta, R. P. and Arora, M.K., "Integrated use of remote sensing and field investigations to study changes in the Chhota-Shigri glacier, Himalayas," In: National Conference on Earth Sciences in India: Challenges and Emerging Trends, November 7-9, 2013, IIT Roorkee, Roorkee, India (Presented).

100. N. Prabhu, M. K. Arora, R. Balasubramanian, and K. Gupta, Binary Weights to Neighbouring Pixels Based Resolution Enhancement Mapping of Hyperspectral Image. IEEE 2nd International Conference on Image Information Processing (ICIIP–2013), Dec 09 – 11, 2013. Waknaghat, Shimla, India (Presented).

101. N. Prabhu, M. K. Arora, R. Balasubramanian, and K. Gupta, 2013, An ICA Mixture Model Based Approach for Sub-Pixel Classification of Hyperspectral Data. 3rd International Conference on Soft Computing for Problem Solving (SocProS–2013), Dec 26 – 28, 2013, IIT Roorkee, India (Presented).

102. Arora, M. K., 2014, Information extraction from digital remote sensing images, Key note address, 3rd International Conference on Biomedical Engineering and Assistive Technologies, Feb. 14-15, Chandigarh, India (Presented)

103. Tiwari, R. K. and Arora, M.K (2014) Knowledge based classification for debris cover glacier mapping - A case study of Chhota-Shigri Glacier. In: *Proceedings of National Conference on Himalayan Glaciology* (NCHG-2014), October 30-31, Shimla, India, pp 10-11

104. Mitkari, K. V., Tiwari, R. K.**,** Kumar, K., Arora, M. K. and Gusain, H. S., 2014, Glacier ice velocity calculation using advanced remote sensing techniques In: *Proceedings of National Conference on Himalayan Glaciology (NCHG-2014)*, October 30-31, Shimla, India, pp 7-8.

105. Mitkari, K. V., Sharma, S., Tiwari, R. K., Arora, M. K., Kumar, K. and Gusain, H. S., 2015, Glacier facies mapping using high resolution satellite remote sensing data. In: *Proceedings of30th Himalaya-Karakoram-Tibet Workshop (HKT-2015)*, October 6-8, Dehradun, India, pp 203-204.

106. Yadav, D., M. K. Arora, K. C. Tiwari and J. K. Ghosh (2015), Spectral discrimination using neural network for target detection, 2015, National Conference on Recent Advances in Electronics & Computer Engineering (RAECE), Roorkee, India, 2015, pp. 154-159.

107. Saini, V., Gupta, R. P. and Arora, M. K., 2015, Spatio-temporal pattern of eco-environmental parameters in Jharia coalfield, India, Proceedings of SPIE Vol. 9644, Earth Resources and Environmental Remote Sensing Applications/GIS Applications VI, Sept 22-24, 2015 (doi:10.1117/12.2196645)

108. Saini, V., Arora, M. K. and Gupta, R. P. (2015). Assessment of impacts on vegetation using NDVI images in Jharia coal-field, India. In: *Proceedings of Seminar on Geospatial Technology in Natural Resource Management*, 17-18th March, Punjab Remote Sensing Center, Ludhiana, India, pp. 3. (**Outstanding Oral Presentation Award**).

109. Varinder Saini, Manoj K. Arora and Ravi P. Gupta, 2016, Relationship between surface temperature and SAVI using Landsat data in a coal mining area in India. In: Reza Khanbilvardi; Ashwagosh Ganju; A. S. Rajawat; Jing M. Chen (Editors) Proceedings of SPIE Asia Pacific

Remote Sensing 9877, Land Surface and Cryosphere Remote Sensing III, 987711; April 4-7, New Delhi. doi:10.1117/12.2228094

110. Yadav, Deepti, M. K. Arora, K. C. Tiwari, J. K. Ghosh (2016), Performing target specific band reduction using artificial neural networks and assessment of its efficacy using various target detection algorithms, Proc. SPIE 9845, Optical Pattern Recognition XXVII, 984507; doi:10.1117/12.2224429.

111. Yadav, Deepti, M. K. Arora, K. C. Tiwari, J. K. Ghosh (2016), An assessment of effects of various parameters on performance of target detection using hyperspectral data. Proc. SPIE 9880, Multispectral, Hyperspectral, and Ultraspectral Remote Sensing Technology, Techniques and Applications VI, 988023; doi:10.1117/12.2223921.

112. Ankita Khatri, Umesh Sharma, Manoj K. Arora, 2016, Application of various image processing techniques for evaluation of pavement deterioration, International Workshop on Remote Sensing Image Analysis , April 16-18, 2016, Indian Institute of Technology Bombay (IITB) (poster presentation)

113. Deepti Yadav, M. K. Arora, K. C. Tiwari, J. K. Ghosh, 2016, Fusion of HSI and LiDAR data for improving detection of man-made targets, International Workshop on Remote Sensing Image Analysis, April 16-18, 2016, Indian Institute of Technology Bombay (IITB) (poster presentation)

114. Kavita Mitkari, Mohit Srivastava, R. K. Tiwari, M. K. Arora, H. S. Gusain, 2016. Glacier Facies Mapping using Object Based Image Classification. International Workshop on Remote Sensing Image Analysis hosted under the India-Trento Program for Advanced Research (ITPAR) Phase-III, April 16-18, 2016, Indian Institute of Technology Bombay (IITB), India

115. Kavita Mitkari, R. K. Tiwari, M. K. Arora, H. S. Gusain, 2016. Extraction of Glacial Lakes in Gangotri Glacier using Object Based Image Analysis. National Symposium on Recent Advances in Remote Sensing and GIS with Special Emphasis on Mountain Ecosystems, December 7-9, 2016, Dehradun, India

116. Kavita Mitkari, R. K. Tiwari, Mohit Srivastava, M. K. Arora, H. S. Gusain, 2016. Extraction of Glacial Lakes from High Resolution Satellite Remote Sensing Data. National Geo-Research Scholars Meet-2016, June 1-4, 2016, Wadia Institute of Himalayan Geology, Dehradun, India.

117. V. Saini, M. K. Arora, R. P. Gupta, 2016, Role of image transformations in assessing the impact of coal mining on vegetation, April 16-18, 2016, Indian Institute of Technology Bombay (IITB) (poster presentation).

118. Yousuf, B., Shukla, A. and Arora, M. K. (2016). Retrieval of glacier facies area of Gangotri glacier at sub-pixel level using AWiFS data. In: *Proceedings of National Geo-scholars Meet-2016*, June 1-4, 2016, Wadia Institute of Himalayan Geology, Dehradun.

119. Yousuf, B., Shukla, A. and Arora, M. K. (2016). Optimal Selection of SVM parameters for glacier facies mapping at sub-pixel level. In: *National Symposium on "Recent Advances in Remote Sensing and GIS with Special Emphasis on Mountain Ecosystems"*, Dec 7-9, 2016, IIRS Dehradun.

120. Yousuf, B., Shukla, A. and Arora, M. K. (2017). Selection of suitable ancillary layers for effective characterization of glacier facies at sub-pixel level using AWiFS data. In: *Proceedings of National Geo-scholars Meet-2017*, May 17-20, 2017, Wadia Institute of Himalayan Geology, Dehradun (Accepted).

121. Sandhu, HAS, HS Gusain and Manoj K Arora, 2017, Glacier Monitoring in Bhagirathi River using remote Sensing National Conference on Polar Sciences, 16-17 May 2017 at NCAOR, Vasco-da-Gama, Goa. (Poster presentation. Accepted)

122. Sandhu, HAS, HS Gusain and Manoj K Arora, 2017, Mass balance estimation of Dokriani glacier in central Indian Himalaya using remote sensing data, 74th Eastern Snow Conference (ESC), University of Ottawa, Ottawa, Canada, 6-8 June, 2017 (Accepted)

Invited Lectures and Talks

1. Conventional Surveying equipment and their utility, Training on Modern Surveying Equipment, 1998, I I T Roorkee, India

2. Digital Image Classification Techniques,Training for Railway Engineers on Digital Mapping Techniques, 1999, I I T Roorkee, India.

3. Global Positioning System (GPS), Training for Railway Engineers on Digital Mapping Techniques, 1999, I I T Roorkee, India.

4. Principles of GIS, Short term course on A teaching capsule for Remote Sensing and GIS, 2000, I I T Roorkee, India.

5. Sources of errors, propagation and quality control in GIS, Short term course on Understanding GIS, 2001, Department of Continuing Education, I I T Roorkee, India

6. GIS data structures, Short term course on GIS, 2001, I I T Roorkee, India.

7. Leveling principles, Short term course for IRCON engineers, 2001, I I T Roorkee, India.

8. Introduction to Remote Sensing, 2002, Department of Electrical Engineering and Computer Science, Syracuse University, USA

9. Introduction to GIS and GPS, 2002, Department of Electrical Engineering and Computer Science, Syracuse University, USA

10. Uncertainty Visualisation, 2002, Department of Electrical Engineering and Computer Science, Syracuse University, USA

11. Accuracy assessment of land cover classification, State University of New York, 2003, USA

12. Land cover classification from remote sensing data, 2004, University of South Florida, Tampa, USA

13. Errors in GPS, Sponsored training course on GPS application for landslide and resource mapping, 2003, I I T Roorkee, India.

14. Errors and Accuracy in GPS observations, Short term course on GPS and its application, 2003, I I T Roorkee, India.

15. Digital elevation models and applications, GIS Training Course for DST Sub-programme on Bio-Geo Database for Ecological Modeling for Himachal Pradesh, 2004, I I T Roorkee, India.

16. Urban feature extraction using non-parametric techniques, PG Diloma Course on Remote Sensing and GIS Applications, 2004, Indian Institute of Remote Sensing, Dehradun, India.

17. Digital Image Processing, Landscape GIS/Remote Sensing Course, Aug. 2-16, 2004, Ashoka Trust for Research in Ecology and Environment (ATREE), Bangalore, India.

18. Advances in Remote Sensing, Landscape GIS/Remote Sensing Course, Aug. 2-16, 2004, Ashoka Trust for Research in Ecology and Environment (ATREE), Bangalore, India.

19. Role of Geoinformatics in Hazards, Expert Lecture, Dec., 7, 2004, Indian Institute of Remote Sensing, Dehradun, India.

20. Role of Remote Sensing and GIS in water resources studies, QIP short term course on ground water modeling, Feb. 21-25, 2005. IIT Roorkee, India.

21. Arora, M. K., Soft Classification and accuracy assessment, Defence Electronics Appliances Laboratory, July 2, 2005, Dehradun, India.

22. Ground truth and GPS survey, July, 2005, National Institute of Hydrology, Roorkee

23. Soft Classification and Accuracy Assessment, Institute of Remote Sensing, Sept. 30, 2005, Anna University, Chennai,

24. Soft Classification and Accuracy Assessment, October, 2005, Space Application Center, Ahmedabad, India.

25. Digital Image Processing, Short Term Course on Geomatics Engineering Applications, 2006, IIT Roorkee, India.

26. Sub-pixel snow cover mapping from remote sensing data, Short Term Course, Snow and Avalanches Study Establishment, May, 2007, Chandigarh, India.

27. Data analysis techniques for hyperspectral data, Defence Electronic Appliances Laboratory (DEAL), DRDO, May 2008, Dehradun, India.

28. Digital image processing, Short Term Training Course on Remote Sensing and GIS Applications in Hydropower Projects for NHPC Engineers, Feb. 22 – 27, 2010, IIT Roorkee,.

29. Advances in Image Classification, March 16, 2010, Indian Institute of Remote Sensing, Dehradun, India.

30. Advances in Image Classification and Accuracy Assessment of Remote Sensing Data, Sept., 13, 2010, IIT Bombay, Mumbai, India.

31. Advanced Hyper spectral Data Processing, CEP Course on Emerging Techniques for Image Processing, DEAL, DRDO, Oct 7, 2010, Dehradun, India.

32. Remote Sensing for Land Use Land Cover Mapping, Training Course on Applications of Remote Sensing and GIS in Water Resources Management, 2011, NIH, Roorkee, India.

33. Remote Sensing and GIS for Natural Disaster Studies, Training Course of SAARC Countries, Earthquake Risk Mitigation, 6-17 June, 2011, IITR Campus Noida

34. Overview of Geomatics for Hydro-power Projects, Training Course on Remote Sensing and GIS Applications in Hydro-power Projects, June 20-22, 2011, School of Hydrology, IIT Roorkee.

35. Information Extraction from Hyperspectral Remote Sensing Images, DRDO - Academia Workshop Futuristic Communication Technologies and Trends for Military Applications, 15 - 16 February 2012, DEAL, DRDO, Dehradun.

36. ANN and Fuzzy set based techniques for Earth Sciences Applications, CEP Course for SASE Scientists, July 2-6, 2012, SASE, DRDO, Chandigarh.

37. Information extraction from remote sensing data for hydro-power projects, CEP course on Remote Sensing and GIS Applications in Hydro-power, Department of Hydrology, IIT Roorkee.

38. How to earn a PhD in three years, Keynote address, One week TEQIP – Short Term Training Programme on Aspects and Applications of Research Methodology in Science and Engineering, July 8 – 13, 2013, UIET, Chandigarh.

39. Remote Sensing and GIS for landslide mapping and monitoring, Foundation Day Lecture, Sept. 27, 2013, CSIO, Chandigarh.

40. Modern Teaching Learning Tools, National Science Day-2014, February 28, 2014, SASE, Chandigarh

41. PhD Research: 3 Years agenda, Workshop on Research Methodology, Oct 19-21, 2015, SBUICET, Panjab University, Chandigarh.

42. An Account of Remote Sensing Data Analysis Applications, Keynote Address, International Workshop on Remote Sensing Image Analysis, April 16-18, 2016, Indian Institute of Technology Bombay (IITB).

43. Remote Sensing Image Interpretation, Training programme on ‘Geospatial Technology, Nov 14 – Dec 3, 2016, CEPT University.

44. Overview of Digital Image Processing for Remote Sensing Data, DST Winter School on Geospatial Technologies, Dec. 1 – 21, 2016, Chitkara University, Baddi.

45. PhD Agenda, Workshop on Research Methodology for Research Scholars from March 20, 2017 to March 22, 2017, UICET, PU.

Masters Theses Supervision **54 (01 continuing)**

1. Evaluation of Stereoscopic Capabilities of SPOT Imageries (1992)

2. Development of PC Based Software for some Selected Map Projection Systems including Inter Conversion (1993)
3. A Study of the Feasibility of Selection of Training Data for Image Analysis (1993)
4. Performance Evaluation of Back Propagation Neural Network, Fuzzy *c*-Means and Statistical Classifiers for Remotely Sensed Data (1998)
5. A Comparative Study of Linear Mixture Modelling and Maximum Likelihood Classifier for Sub-pixel Classification (1998)
6. A Knowledge Based System for Classification of Obstacles in War Planning (1999)
7. A Study of Neural Network Parameters affecting Image Classification (1999)
8. A Sampling Design Software for Image Classification Accuracy (1999)
9. Landslide Hazard Zonation Studies in the Bhagirathi Valley Using Remote Sensing and GIS (1999)
10. A Fuzzy Image Classification Package for Remotely Sensed Data (2000)
11. Evaluation of Control Establishment using GPS Surveys (2000)
12. Neural Network Classification using Remote Sensing and Ancillary data (2000)
13. Headway Modelling using Artificial Neural Network (2000)
14. Investigations into the topographic effect on classification of remote sensing data (2001)
15. Investigations into the geometric rectification of remote sensing data (2001)
16. Seismic hazard analysis using neural network (2001)
17. Run-off estimation using ANN (2001)
18. Facility based rural road network planning using GIS (2001)
19. Neural Network for landslide hazard zonation (2001)
20. Development of program for image classification accuracy measures (2001)
21. A software for image classification accuracy assessment (2002)
22. Development of a Knowledge-based System for Military Use (2002)
23. Seismic Hazrad Estimation Using GIS (2002)
24. Development of Software for Trip Assignment in Urban Areas (2002)
25. Soil moisture estimation from microwave remote sensing data: some preliminary results (2002)
26. A comparative study of some neural network algorithms for classification of remote sensing data (2004)
27. Quality of DEM generation from topographical maps and GPS observations (2004)
28. Accuracy of soft classification in the presence of uncertainty (2004)
29. Techniques for area Estimation for remote sensing classifications (2005)
30. Wavelet based image fusion for image classification problems (2006)
31. Investigations into some automatic intensity based registration techniques (2006)
32. Study of Evidential Reasoning for Image Classification (2006)
33. Investigations into surface displacement estimation using Differential SAR Interferometry (2006)
34. A comparative study of some decision tree algorithms for image classification (2007)
35. Conflation of vector data with remote sensing image (2007)
36. Development of some feature extraction algorithms for hyperspectral images (2008)
37. Landslide hazard zonation and risk assessment using Neuro-fuzzy techniques (2009)
38. Oil spill detection using microwave remote sensing data (2009)
39. Visualisation of travel behaviour of people in GIS environment (2009)
40. Population estimation from remote sensing data (2010)
41. Development of region growing segmentation software for object based image classification (2010)
42. Assessing land use land cover change using modified change vector analysis (2010)
43. Remote sensing and GIS based landslide risk assessment in Darjeeling hills (2010)
44. GIS based urban growth assessment in Dehradun city (2010)
45. GIS based land use planning in Vizag city (2010)

46. Study and implementation of some feature reduction techniques for hyperspectral imaging, Roshni Sanyal (2011)
47. Study and implementation of some per-pixel classifiers for hyperspectral imaging, Debojit Biswas (2011).
48. Development of an algorithm for snow cover reflectance and snow fraction, M Kavita V (2011)
49. An assessment of some anomaly and target detection algorithms for hyperspectral images, Shweta Bansal (2012)
50. Glacier rheology studies in Kuksai glacier using Terra SAR-X data, Saurabh Vijay (2012)
51. Application of differential SAR interferometry in landslide studies, Shreyansh Singh (2013)
52. Object based image classification for extraction of buildings, Arti Tiwari (2013)
53. Information Extraction From Remote Sensing Images Using Object Based Image Analysis, Anshul Gupta (2013)
54. Glacial Cover Mapping Using High Resolution Remote Sensing Data, Sahil Sharma (2015)
55. Classification of Objects from High Resolution Remote Sensing Images Using ANN, Nikita Aggarwal (2016)
56. Information Extraction from Remote Sensing Techniques using Super Resolution Techniques (2017) (ongoing)

Ph. D. Theses Supervision **25 (Completed: 19, Submitted: 01, Continuing: 05)**

Completed

1. Remote sensing and GIS based decision support system for district level planning, R. D. Gupta (2002)
2. GIS-based Study for Route Planning in Landslide Susceptible Terrain, Ashis K Saha (2004)
3. Evaluation of Soft Classifiers for Remote Sensing Data, M. A. Ibrahim (2004)
4. Support vector machines for remote sensing image classification, USA, Pakorn Watanachaturaporn (2005)
5. Geomorphological and Pedological Evaluation of Interfluves between the Ganga and Ghaghara Rivers, Satwinder Singh (2005)
6. Soil moisture retrieval from microwave remote sensing data, Saif Said (2006)
7. GIS Based Landslide Susceptibility Studies Using Neural and Fuzzy Approaches, D. P. Kanungo (2006)
8. Target detection using optical and microwave remote sensing data, K. C. Tiwari (2008)
9. A neural network based cellular model for urban growth simulation, Sandeep Maithani (2008)
10. Modeling of uncertainty in remote sensing data, M. S. Ganesh Prasad (2009)
11. Remote sensing based glaciological studies in parts of Chenab basin, Himalayas, Aparna Shukla (2009)
12. Remote Sensing based forest cover mapping using recent techniques, Sunil Chandra (2012)
13. Estimation of displacements due to earthquakes using SAR Interferometry, Atanu Bhatacharya (2013)
14. Derivation of hydrological parameters from remote sensing data, Kamal Kumar (2013)
15. Object based image analysis of remote sensing data, Mohit Srivasatva (2014)
16. Geospatial Modeling of Snow-Met Parameters and Esetimation of Energy Fluxes, Heemendra Gussain (2014)
17. Remote Sensing Studies in Chhotashigri Glacier, Reet Kamal Tiwari (2015)
18. Per pixel and sub-pixel classification of hyperspectral data, N. Prabhu (2015)
19. Geo-Ecological Studies in Jharia Coalfields, India, Varinder Saini (2016)

Submitted

20. Camouflage target detection using remote sensing data, Deepti Yadav (2017)

In Progress

21. Differential SAR Interferometry for Landslide studies, Manoj Kuri
22. Glacier Retreat Monitoring and Mass Balance Estimation in Bhagirathi Basin using Remote Sensing and GIS, Har Amrit Singh Sandhu
23. Potential Assessment for Renewable Energy Based Rural Electrification using GIS and AI, Sanjay Sharma
24. Assessment of Highway Pavement Deterioration using Image Processing Techniques, Ankita Khatri
25. Advanced image processing techniques for glaciological studies, Kavita Mitkari

Ph. D. Theses Examined

1. Mutual information based image registration with applications, Syracuse University, USA
2. Robust transmission of DCT coded images and image quality evaluation, Syracuse University, USA
3. Application of Independent Component Analysis for hyperspectral image processing, Syracuse University, USA
4. An integrated approach to large scale mapping using remote sensing and digital photogrammetric techniques, Anna University, Chennai, India.
5. Landslide studies using remote sensing and GIS techniques, Anna University, Chennai, India
6. SAR polarimetry techniques for snowpack parameters estimation, IIT Bombay, Mumbai, India.
7. Integration of GIS and Artificial Neural Networks to Map the Landslide Susceptibility in Nilgiris District, Anna University, Chennai, India
8. Studies on sub-pixel classification of satellite images and spectra of landcover components for improved estimation of the capacity of reservoirs, Anna University, Chennai, India
9. Object based image classification of high resolution remote sensing data, IIT Bombay, Mumbai, India.
10. Studies on Stereo Image Correspondence using Probablistic Neural Network based Feature Matching as Constraint Initializer for Defense Matching, IIT Bombay, Mumbai
11. Effectiveness of Spectral Similarity Measures to develop Spectra for Visually Inseparable Classes and their Classification using Hyperspectral Data, Hasmukh Chauhan, IIT Bombay.
12. 3D Semantic Labelling of Urban Lidar Point Cloud and Multispectral Data, IIST, Trivendrum.

REFERENCES

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