

## Research Philosophy and Research Activities

I am working in the field of Digital Image Processing (DIP) methods and their applications. I started working on Face Recognition using IFS system towards my Masters Dissertation work in 2003. I was excited when I started reading papers on DIP and my enthusiasm took me in this field despite I did not have any knowledge of image processing those days. So, I continued research studies and participating in conferences and workshops. I also started publishing research papers for the conferences and few national level journals. The focus of the work was broad and then I realized that the research should be done in some specific areas of Image Processing.

I started research towards my PhD in the area of Image Enhancement which is one of the important components of Image Processing. The title of my work is Implementation of Frequency Domain *Image Enhancement* Methods. I studied numerous research contributions on Image Enhancement addressing different issues in Image Processing. I implemented a set of filters in frequency domain and evaluated their performance in terms of PSNR, CNR as metrics. I published this research in conferences and journals.

I thought to be more specific in the image processing field and then I started working with my research scholars of Masters and Doctoral level. I want to highlight about two PhD dissertations under my supervision which were on *Segmentation of Mammograms for Breast Cancer Detection* and *Sign Language Biometrics* respectively. In the breast cancer detection, the methods were tested over real data of a cancer research center. The good thing about this work lies in authentication of the diagnosis results and cancer stage determination by practicing radiologist. We authored two textbooks on *Medical Image Processing* and *Biometrics* as an outcome of the research work with reputed publishers *Prentice Hall of India* and *Wiley India (subsidiary of John Wiley)* respectively. We worked on Contrast Enhancement Methods and Histogram Equalization Methods for License Plate Recognition (LPR) and Medical Image Segmentation. In all Master theses and PhD theses supervision, we published good number of quality research papers. I got good amount of research funding around 55,000 USD but the area of research funding is not very much related to Image Processing but the research approach and philosophy helped me to get the grant.

Currently, I am working in the area of Cognitive Science that deals with analysis of Brain Signals and using the analysis in Cognitive Assessment. We are still working on Image Processing and Computer Vision but the work is more specific on Cognitive Science. I am supervising a PhD scholar who is doing her PhD research in National Institute of Technology Raipur India. I am also Editing books with reputed publishers Elsevier, Springer and IOP on the areas of my research.

I believe that research is an essential component of academia for socio-economic development of the world and therefore I aim at contributing something measurable that is useful for the society.

My focus of future research will be in following areas:

- *Cognitive Science Research*- This includes Investigation of Cognitive ability of human brain; Study of Cognitive Sensors; and Applications of Cognitive Science Research. I want to carry out significant research with real time impact with an enthusiastic research team.
- *Medical Image Analysis*: This includes research on medical image segmentation and post processing of selected medical image modalities such as MRI, CT and Mammograms.

### Ph.D. Supervision

Ph.D. Scholars (**AWARDED**): 08

1. Noise removal of Medical images using Wavelet transforms and its Performance evaluation, Devanand Bhonsle (Electronics and Telecommunication Engineering), Chhattisgarh Swami Vivekanand Technical University Bhilai, April 2019.
2. Performance Analysis of Space Time Coded Multiple Antenna System over Fading Channel, Hemalata Sinha (Electronics and Telecommunication Engineering), Chhattisgarh Swami Vivekanand Technical University Bhilai, December 2018.
3. Reliable CAD system for Lung Cancer Detection using Neuro-Fuzzy Method, Rakesh Khare (Computer Science and Engineering), CV Raman University Bilaspur, December 2018.
4. Mass Segmentation and Feature extraction of Mammographic breast images in Computer-aided Diagnosis, Bhagwati Charan Patel (Information Technology), Chhattisgarh Swami Vivekanand Technical University Bhilai, November 2018.
5. System level behavioral modeling and post simulation of Built-in-self Test of Sigma-delta modulator Analog to Digital converter, Anil Sahu (Electronics and Telecommunication Engineering), Chhattisgarh Swami Vivekanand Technical University Bhilai, December 2018.
6. Development and Analysis of Multi Modal Biometric System, Snehlata Barde (Computer Science and Engineering), CV Raman University Bilaspur, June 2015.
7. An Efficient hybrid denoising technique of Medical images using neural network and Fuzzy logic, Abha Choubey (Computer Science and Engineering), MATS University Raipur, April 2015.
8. An efficient hybrid model for License Plate Recognition using muti layer feed forward neural network and Fuzzy logic, Siddartha Choubey (Computer Science and Engineering), MATS University Raipur, March 2015.

Ph.D. Candidates **REGISTERED**: 01

1. Efficient Assessment of Cognitive Ability using Machine Learning and AI, Samrudhi Mohdiwale, National Institute of Technology Raipur.

### **Projects and Consultancy**

1. Received **36.6 Lakhs** (INR) for “Assessment of R&D Impact on Socio-Economic Status of Rural India”, under **NSTMIS Division of DST India** (Ongoing).
2. Received Travel Grant of around 2000 USD by ACM New York for travelling to Paris for delivering “ACM Distinguished Speaker” Lectures in Yangon, Allahabad, Nagpur and Bangalore, 2019.
3. Approved Travel Grant of 1600 USD by ACM New York for travelling to Paris for delivering “ACM Distinguished Speaker” Lecture in Internal Conference on Plant Sciences.
4. Approved Travel Grant of 800 USD by ACM New York for travelling to Sanya, China for delivering “ACM Distinguished Speaker” Lecture in Internal Conference on Signal and Image Processing, 28-30 November 2018 (could not utilize).
5. Received Travel Grant of 600 USD by ACM New York for travelling to Mysore for delivering “ACM Distinguished Speaker” Lectures in International Colloquium and inaugurating ACM chapter as chief guest.
6. Received Travel Grant of 900 USD by ACM New York for travelling to Bhilai for delivering “ACM Distinguished Speaker” Lecture.
7. Received Travel Support of 900 USD by ACM New York for travelling to Tiruchengode and delivering “ACM Distinguished Speaker” Lecture.
8. Received Travel Support of 1000 USD by ACM New York for travelling to Nagarcoil and delivering “ACM Distinguished Speaker” Lecture.
9. Appointed as an Expert Member in “Center of Excellence” by Tata Institute of Social Sciences (TISS\_SVE) Mumbai for Two Years (2017-2019).
10. Evaluator of Extra-Mural Research Funding of Science and Engineering Research Board of Department of Science and Technology, Government of India.
11. Consultant of National Skill Development Corporation, Govt. of India, for biometric operator with Wiley India.
12. Team Leader, “My Mission City without Crime: E-cops”, 2011 Projects, All India Young Engineers’ Humanitarian Challenge 2011, an IEEE Bangalore section initiative.
13. Coordinator for EAC camp (Entrepreneurship Awareness Camp) by Department of Science and Technology, India.
14. Coordinator and Convener of “Sensitization Programme on Copyright Protection Rights” by MSME, Government of India.

### Patents (Filed):

1. Computer Vision and its Application in Assessment of Cognitive Ability of Human Brain (201821034835 TEMP/E-1/38016/2018-MUM)
2. Methods and Systems for Rendering Road Information from a first vehicle to a second vehicle (201841044218/TEMP-E/1/48170/2018-CHE)

### Research Experience

1. Reviewer of **IEEE Transactions** on Image Processing, USA; **Elsevier** Computer Methods and Programs in Biomedicine; **Elsevier** Computers in Biology and Medicine; Neural Computing and Applications and Arabian Journal of Science and Engineering (**Springer**); Reviewer of Journal of Medical Imaging and Health Informatics (**SCI Journal**).
2. **International Advisory Committee** Member in International Conference on Information Systems and Management Science (ISMS 2018), **University of Malta**, Valletta.
3. **Editor-in-Chief** of Journal of Pattern Recognition, i-manager Publications.
4. Editorial Board Member of IETI Transactions on Computers, **Hong Kong**.
5. Reviewer of **Journal of Electronic Imaging**, **SPIE** (International society for optics and photonics); **ICTACT Journal on Image and Video Processing**; **Applied Physics Research, Canada**; Network Protocols and Algorithms, United States; Journal of Institute of Engineers-Series B, **Springer**; Journal of **Computing of Computer Society of India**.
6. **Program Committee Member**, **National Advisory Board Member** and Reviewer of **more than 50** International/National Conferences.

### M. Tech. Theses Guided

1. "Biometric Template Protection", M.M.Ashish, Chhattisgarh Swami Vivekanand Technical University, Bilai, India (2016).
2. "SNR and BER analysis for Multiple Antenna system using OFDM", Gulshan Jaiswal, Chhattisgarh Swami Vivekanand Technical University, Bilai, India (2016).
3. "Reversible Steganography using Reference pixel Choosing and CDD model based Image Impainting", Narendra Sharma, Chhattisgarh Swami Vivekanand Technical University, Bilai, India (2016).
4. "Image De-Noising Method using VHDL", Amit Ranjan Sinha, Chhattisgarh Swami Vivekanand Technical University, Bilai, India (2016).
5. "Image Segmentation using Mamdani Fuzzy based System", Shalini Agrawal, Chhattisgarh Swami Vivekanand Technical University, Bilai, India (2015).
6. "Modified Fuzzy based Decision algorithm for Image Denoising", Neha Agrawal, Chhattisgarh Swami Vivekanand Technical University, Bilai, India (2015).
7. "Automated Multispectral Satellite Image Denoising using Decomposable Pixel Filtration Algorithm (DPFA) and Bi-directional Recurrent Neural Network (BRNN)", Pragati Jha, Chhattisgarh Swami Vivekanand Technical University, Bilai, India (2015).

8. "A New approach for Image Denoising with Fuzzy Filtering Technique", Mansi Pathak, Chhattisgarh Swami Vivekanand Technical University, Bhilai, India (2015).
9. "Efficient Fractal Image Encoding using Distributed Architecture and SIMD Approach", Akhilesh Kumar, Chhattisgarh Swami Vivekanand Technical University, Bhilai, India (2015).
10. "Performance analysis of DWT based image watermarking techniques", Asma Ahamad, (Communication), Chhattisgarh Swami Vivekanand Technical University, Bhilai, India (2014).
11. "Implementation of Efficient Segmentation methods for tumor detection in MRI images", Kailash Sinha, (Communication), Chhattisgarh Swami Vivekanand Technical University, Bhilai, India (2013).
12. "Implementation of Modified DWT and LSB Techniques for Image Watermarking", Nikita Kashyap, M.E. (Communication), Chhattisgarh Swami Vivekanand Technical University, Bhilai, India (2012).
13. "Intrusion Detection system for wireless networks using Feature Vectorisation technique", Jaya Mishra, M.E. (Communication), Chhattisgarh Swami Vivekanand Technical University, Bhilai, India (2009).
14. "Fingerprint Verification System", Bhawna Shukla, (Communication), Chhattisgarh Swami Vivekanand Technical University, Bhilai, India (2008).
15. "Face recognition using Eigen Face Method", Laxmi Patel, Chhattisgarh Swami Vivekanand Technical University, Bhilai, India (2006).