Soumen Bag

E-mail : **soumen@iitism.ac.in, bagsoumen@gmail.com**

Contact No. : **+91-9430358489 (M) / +91-326-223-5168 (O)**

Permanent Address : **C/O- Sasankasekhar Bag, Konnagar, P.O. - Ghatal, Dist- Paschim Medinipur, Pin-721212, West Bengal, India.**

CURRENT EMPLOYMENT

Organization : Indian Institute of Technology (Indian School of Mines), Dhanbad

Designation : Associate Professor

Department : Computer Science and Engineering

Duration : 13.04.2022 to till date

ACADEMIC QUALIFICATION

1. **PhD** in **Computer Science and Engineering** from **IIT Kharagpur** in 2013.
2. **MTech (Gold Medalist)** in **Computer Science and Engineering (**Specialization in **Information Technology)** with **9.10 (CGPA)** from **NIT Durgapur** in 2008.
3. **BE (Hons.)** in **Computer Science and Engineering** with **79.6% (TCPA)** from **REC (presently NIT) Durgapur** in 2003.
4. **Higher Secondary Examination (10+2)** from **WBCHSE** with **80.5%** in 1998.
5. **Madhyamik Pariksha (Class 10th)** from **WBBSE** with **81.4%** in 1996.

AWARDS

- **Gold medal** for standing first class first in M.Tech. at NIT Durgapur, 2008.
- National Scholarship for Higher Secondary Examination, 1998.
- Silver medal in Higher Secondary Examination at Midnapore Collegiate School, 1998.
- National Scholarship for Madhyamik Pariksha (Secondary Exam.), 1996.
- Certificate of 'A' examination under the authority of Ministry of Defence, Govt. of India, 1994.
- Certificate of Science Aptitude & Talent Search Test.

SKILL SET

Language	:	C, C++, Java, COBOL, SQL.
Special Interest	:	Digital Image Processing, OCR for Indian Scripts, Discrete Mathematics, Data Structure, Design and Analysis of Algorithms.
Image Processing Tool	:	Matlab, OpenCV.

PRACTICAL TRAINING

Place of Training	Duration	Nature of Training
Central Mechanical Engineering Research Institute (C.M.E.R.I), Durgapur, West Bengal, India	June, 2002 (One month)	Project on Serial Data Transfer between two Computers

THESIS & PROJECT

I. Ph.D Thesis on:

Processing and Analysis of Bangla Optical Characters using Geometric and Topological Features

- ***Area of Research*:**

  OCR for Indian Scripts, Document Image Processing

- ***Thesis Description*:**

Optical character recognition (OCR) has been an active area of research over last few decades. Several OCR systems are available today in the market; however, their performance degrades significantly with different fonts, orientation, quality, and presence of compound characters in the script. Our research goal is to achieve higher recognition accuracy for existing OCR systems for Bangla, which is the second-most popular language/script in India and among the top ten popular languages/scripts all over the world. Researchers of this domain aim in finding out new methods that can enhance the performance of existing systems. At the same time, use of existing schemes up to its fullest potential for solving application-specific problems is also important. Several significant contributions have been made in this dissertation toward solving some of the well-known problems in the domain of document image processing in general, and Bangla OCR in particular. To start with, we propose an *adaptive-cum-interpolative binarization* method in a *multi-scale framework* to handle degraded documents, a character segmentation method based on *vertex characterization* of *isothetic covers*, and a *medial-axis-based thinning* strategy tailored for thinning printed and handwritten characters in Bangla and few other Indian scripts. We also present certain novel features based on the *topology* of a character, captured by structural features of the strokes and their spatial relation. We use these topological features for recognition of printed and handwritten Bangla characters. Finally, we focus on the challenges to recognize compound characters in Bangla script in order to further improve the OCR performance. We examine the multiple *segmentation hypotheses* to segment the compound characters into prominent shape components. *Grouping principles* specific to language and structural characteristics are used to identify these shape components in a compound character. Identification of the compound character is done by taking note of the identity of the shape components using topological *features* and *template matching* technique. Exhaustive experimentation has been done in each stage to evaluate the performance of our proposed techniques.

- ***Platform*:**

  C, OpenCV 2.0, Matlab 7.0, Linux, Windows XP

II. ***M.Tech Thesis on*:**

Face Recognition: Combination of Eigenface & k-Means Clustering

- ***Thesis Description*:**

The proposed work has considered one of the limitations of the Eigenface method by M. A. Turk & A. P. Pentland. This work proposes k-Means Clustering for avoiding the difficulty of selecting the correct threshold value and also proposes the idea of considering different images of a single human face taken together as a cluster. Eigenface method has been used for mapping the training images from image space to face space. Then mean is taken of each cluster individually. The mean is recalculated by placing the test image (mapped in the face space) in each cluster. By checking the difference between the new and previous mean of each cluster, the recognition is performed. The test conducted using the AT&T Database of images and the performance was found satisfactory. The work has been carried out for obtaining better result in human face recognition.

- ***Platform*:**

  C, Matlab 7.0, Windows XP

***III. B.E. Project on*:**

Wireless Communication in Local Area Network (LAN)

- ***Project Description*:**

Two computers are placed within 200 metre. They are not connected by cable. Two H/W circuits are externally connected with these two computers (one act as a Transmitter & another act as a Receiver). Now using Laser ray as a wireless medium we transfer data@ 9600 Bps between these two computers.

- ***Platform*:**

  C, Windows 98

PUBLICATIONS

Journals:

1. Kousik Sarkar, **Soumen Bag**, and Prasun Chandra Tripathi, "*Noise Aware Content-noise Complementary GAN with Local and Global Discrimination for Low-dose CT Denoising* ", Neurocomputing, Elsevier, vol. 582, article no. 127473, 2024 **[Impact Factor: 5.5]**.

2. Prasun Chandra Tripathi and **Soumen Bag**, "*An Attention-guided CNN Framework for Segmentation and Grading of Glioma using 3D MRI Scans*", IEEE/ACM Transactions on Computational Biology and Bioinformatics, **IEEE**, 2022 (in Press) **[Impact Factor: 3.702]**.

3. Priyanka Roy and **Soumen Bag**, "*Ink Analysis based Forensic Investigation of handwritten Legal Documents*", Multimedia Tools and Applications, **Springer**, vol. 81, pp. 23001–23047, 2022 **[Impact Factor: 2.577]**.

4. Prabhat Dansena, **Soumen Bag,** and Rajarshi Pal, "*Pen Ink Discrimination in Handwritten Documents using Statidtical and Motif Texture Analysis: A classification based Approach*", Multimedia Tools and Applications, **Springer**, vol. 81, pp. 30881–30909, 2022 **[Impact Factor: 2.577]**.

5. Prasun Chandra Tripathi and **Soumen Bag**, "*A Computer-aided Grading of glioma tumor using Deep Residual Networks Fusion*", Computer Methods and Programs in Biomedicine, **Elsevier**, vol. 215, article no. 106597, 2022 **[Impact Factor: 7.027]**.

6. Deepika Gupta and **Soumen Bag**, "*Holistic versus Segmentation-based Recognition of Handwritten Devanagari Conjunct Characters: A CNN-based Experimental Study*", Neural Computing and Applications, **Springer**, vol. 34, pp. 5665–5681, 2022 **[Impact Factor: 5.102]**.

7. Anuja Dixit and **Soumen Bag**, "*Adaptive Clustering-based Approach for Forgery Detection in Images Containing Similar Appearing but Authentic Objects*", Applied Soft Computing, vol. 113, part A, article no. 107893, **Elsevier**, 2021 **[Impact Factor: 8.263]**.

8. Anuja Dixit and **Soumen Bag**, "*A Fast Technique to Detect Copy-move Image Forgery with Reflection and Non-affine Transformation Attacks*", Expert Systems with Applications, vol. 182, pp. 115282, **Elsevier**, 2021 **[Impact Factor: 8.665]**.

9. Rahul Pramanik and Soumen Bag, "*HA Novel Skew correction Methodology for Handwritten Words in Multilingual Multi-oriented Documents*", Multimedia Tools and Applications, **Springer**, vol. 80, pp. 27323–27342, 2021 **[Impact Factor: 2.577]**.

10. Rahul Pramanik and Soumen Bag, "*Handwritten Bangla City Name Word Recognition using CNN-based Transfer Learning and FCN*", Neural Computing and Applications, **Springer**, vol. 33, pp. 9329–9341, 2021 **[Impact Factor: 5.102]**.

11. Prabhat Dansena, **Soumen Bag,** and Rajarshi Pal, "*Generation of Synthetic Data for Handwritten Word Alteration Detection*", IEEE Access, **IEEE CS Press**, vol. 9, pp. 38979–38990, 2021 **[Impact Factor: 3.476]**.

12. Deepika Gupta and **Soumen Bag**, "*CNN-based Multilingual Handwritten Numeral Recognition: A Fusion-free Approach*", Expert Systems with Applications, vol. 165, article no. 113784, **Elsevier**, 2021 **[Impact Factor: 8.665]**.

13. Anuja Dixit and **Soumen Bag**, "*Composite Attacks-based Copy-move Image Forgery Detection using AKAZE and FAST with Automatic Contrast Thresholding*", IET Image Processing, **IET Digital Library**, vol. 14, no. 17, pp. 4528–4542, 2020 **[Impact Factor: 1.773]**.

14. Prasun Chandra Tripathi and **Soumen Bag**, "*Segmentation of Brain Magnetic Resonance Images using a Novel Fuzzy Clustering based Method*", IET Image Processing, **IET Digital Library**, vol. 14, no. 15, pp. 3705–3717, 2020 **[Impact Factor: 1.773]**.

15. Anuja Dixit and **Soumen Bag**, "*Utilization of Edge Operators for Localization of Copy-move Image Forgery using WLD-HOG Features with Connected Component Labeling*", Multimedia Tools and Applications, vol. 79, pp. 26061–26097, **Springer**, 2020 **[Impact Factor: 2.577]**.

16. Prasun Chandra Tripathi and **Soumen Bag**, "*CNN-DMRI: A Convolutional Neural Network for Denoising of magnetic Resonance Images*", Pattern Recognition Letters, vol. 135, pp. 57–63, **Elsevier**, 2020 **[Impact Factor: 4.757]**.

17. Prabhat Dansena, Rajarshi Pal, and **Soumen Bag**, "*Quantitative Assessment of Capabilities of Color Models for Pen Ink Discrimination in Handwritten Documents*", IET Image Processing, vol. 14, no. 4, pp. 1594–1604, **IET Digital Library**, 2020 **[Impact Factor: 1.773]**.

18. Rahul Pramanik and **Soumen Bag**, "*A Segmentation-based Recognition System for Handwritten Bangla and Devanagari Words using Conventional Classification and Transfer Learning*", IET Image Processing, vol. 14, no. 5, pp. 959–972, **IET Digital Library**, 2020 **[Impact Factor: 1.773]**.

19. Deepika Gupta and **Soumen Bag**, "*Handwritten Multilingual Word Segmentation using Polygonal Approximation of Digital Curves for Indian Languages*", Multimedia Tools and Applications, **Springer**, vol. 78, no. 14, pp. 19361–19386,2019 **[Impact Factor: 2.577]**.

20. Rahul Pramanik and **Soumen Bag**, "*Shape Decomposition-based Handwritten Compound Character Recognition for Bangla OCR*", Journal of Visual Communication and Image Representation, **Elsevier**, vol. 50, pp. 123–134, 2018 **[Impact Factor: 2.887]**.

21. **Soumen Bag** and Partha Bhowmick, "*Adaptive-interpolative Binarization with Stroke Preservation for Restoration of Faint Characters in Degraded Documents* ", Journal of Visual Communication and Image Representation, **Elsevier**, vol. 31, pp. 266–281, 2015 **[Impact Factor: 2.887]**.

22. **Soumen Bag**, Gaurav Harit, and Partha Bhowmick, "*Recognition of Bangla Compound Characters using Structural Decomposition*", Pattern Recognition, **Elsevier**, vol. 47, no. 3, pp. 1187–1201, 2014 **[Impact Factor: 8.518]**.

23. **Soumen Bag** and Gaurav Harit, "*A Survey on Optical Character Recognition for Bengali and Hindi Documents*", Sadhana-Academy Proceedings in Engineering Science, **IAS & Springer**, vol. 38, no. 1, pp. 133–168, 2013 **[Impact Factor: 1.214]**.

24. **Soumen Bag** and Gaurav Harit, "*An Improved Contour-based Thinning Method for Character Images",* Pattern Recognition Letters, **Elsevier,** vol. 32, no. 14, pp. 1836–1842, 2011 **[Impact Factor: 4.757]**.

25. **Soumen Bag** and Gaurav Harit, "*Skeletonizing Character Images using a Modified Medial Axis-based Strategy",* International Journal of Pattern Recognition and Artificial Intelligence (IJPRAI), **WSPC,** vol. 25, no. 7, pp. 1035–1054, 2011 **[Impact Factor: 1.261]**.

Conferences:

1. Patho Barui, **Soumen Bag**, and Ayan Das, "*Potato Leaf Disease Classification using PSOK Image Segmentation and CNN Model*", 2nd International Conference on Agriculture-Centric Computation (ICA), **Springer-CCIS**, May 21–24, 2024.

2. Raj Kumar Saw, Ayan Das, and **Soumen Bag**, "*A Deep Learning-based Tomato Plant Disease Classification System*", 2nd International Conference on Agriculture-Centric Computation (ICA), **Springer-CCIS**, May 21–24, 2024.

3. Prasun Chandra Tripathi and **Soumen Bag**, "*A Dilated Convolution-based Denoising Network for Magnetic Resonance Images*", 31st International Joint Conference on Neural Networks (IJCNN), **IEEE CS Press**, pp. 1–8, Jul 18–22, 2021.

4. Deepika Gupta and **Soumen Bag**, "*Degraded Document Image Binarization using Active Contour Model*", 5th International Conference on Computer Vision and Image Processing (CVIP), **Springer-CCIS**, vol. 1377, pp. 124–136, Allahabad, India, Dec 4–6, 2020.

5. Priyanka Roy and **Soumen Bag**, "*Detection of Handwritten Document by Analyzing Writers' handwriting*", 8th International Conference on Pattern Recognition and Machine Intelligence (PReMI), **Springer-LNCS**, pp. 596–605, Tezpur, India, Dec 17–20, 2019.

6. Prabhat Dansena, Rahul Pramanik, **Soumen Bag**, and Rajarshi Pal, "*Ink Analysis Using CNN-based Transfer Learning to Detect Alteration in Handwritten Words*", 4th International Conference on Computer Vision and Image Processing (CVIP), **Springer-CCIS**, vol. 1147, pp. 223–232, Jaipur, India, Sep 27–29, 2019.

7. Shraddha Wankhade, Anuja Dixit, and **Soumen Bag**, "*A Fast and Rigid Copy Move Forgery Detection Technique using HDBSCAN*", 4th International Conference on Computer Vision and Image Processing (CVIP), **Springer-CCIS**, vol. 1147, pp. 15–24, Jaipur, India, Sep 27–29, 2019.

8. Priyanka Roy and **Soumen Bag**, "*Forensic Performance on Handwriting to Identify Forgery Owing to Word Alteration*", 5th IEEE International Conference on Identity, Security and Behavior Analysis (ISBA 2019), **IEEE CS Press,** Hyderabad, India, Jan 22–24, 2019.

9. Anuja Dixit and **Soumen Bag**, "*Utilization of HOG-SVD based Features with Connected Component Labeling for Multiple Copy-move Image Forgery Detection*", 5th IEEE International Conference on Identity, Security and Behavior Analysis (ISBA 2019), **IEEE CS Press,** Hyderabad, India, Jan 22–24, 2019.

10. Prasun Tripathi and **Soumen Bag**, "*Non-Invasively Grading of Brain Tumor Through Noise Robust Textural and Intensity based Features*", 1st International Conference on Computational Intelligence in Pattern Recognition (CIPR), **Springer-AISC**, vol. 999, pp. 531–539, Shibpur, India, Jan 19–20, 2019.

11. Deepika Gupta and **Soumen Bag**, "*A Local to Global Approach for Document Image Binarization*", 1st International Conference on Computational Intelligence in Pattern Recognition (CIPR), **Springer-AISC**, vol. 999, pp. 693–702, Shibpur, India, Jan 19–20, 2019.

12. Saumyadipta Sarkar, Prasun Chandra Tripathi, and **Soumen Bag**, "*An Improved Non-Local Means Denoising Technique for Brain MRI*", 1st International Conference on Computational Intelligence in Pattern Recognition (CIPR), **Springer-AISC**, vol. 999, pp. 765–773, Shibpur, India, Jan 19–20, 2019.

13. Rahul Pramanik, Prabhat Dansena, and **Soumen Bag**, "*A Study on the Effect of CNN-based Transfer Learning on Handwritten Indic and Mixed Numeral Recognition*", 4th Workshop on Document Analysis and Recognition (DAR), **Springer-CCIS**, vol. 1020, pp. 41–51, Hyderabad, India, Dec 18, 2018.

14. Arkajyoti Mitra, Prasun Chandra Tripathi, and **Soumen Bag**, "*Identification of Astrocytoma Grade using Intensity, Texture, and Shape based Features*", 8th International Conference on Soft Computing for Problem Solving (SocProS 2018), vol. 1048, pp. 455–465, Vellore, India, Dec 17–19, 2018.

15. Anupam Wadhwa, Mohak Meheshwari, Prabhat Dansena, and **Soumen Bag**, "*Geometrical and Structural Features for Forensics in Handwritten Bank Cheques*", 15th IEEE INDICION, **IEEE CS Press**, Coimbatore, India, Dec 16–18, 2018.

16. Anuja Dixit and **Soumen Bag**, "*Copy-move Image Forgery Detection using Gray-tones with Texture Description*", 3rd International Conference on Computer Vision and Image Processing (CVIP), **Springer-CCIS**, vol. 1024, pp. 75–86, Jabalpur, India, Sep 29–Oct 1, 2018.

17. Priyanka Roy and **Soumen Bag**, "*Identification of Fraudulent Alteration by Similar Pen Ink in Handwritten Bank Cheque*", 3rd International Conference on Computer Vision and Image

Processing (CVIP), **Springer-CCIS**, vol. 1024, pp. 183–195, Jabalpur, India, Sep 29–Oct 1, 2018.

18. Rahul Pramanik, Vivek Raj, and **Soumen Bag**, "*Finding the Optimum Classifier: Classification of Segmentable Components in Offline Handwritten Devanagari Words*", 4th International Conference on Recent Advances in Information Technology (RAIT), **IEEE CS Press**, Dhanbad, India, Mar 15–17, 2018.

19. Rahul Pramanik, **Soumen Bag**, and Ranjit Kumar, "*A Fuzzy and Contour-based Segmentation Methodology for Handwritten Hindi Words in Legal Documents*", 4th International Conference on Recent Advances in Information Technology (RAIT), **IEEE CS Press**, Dhanbad, India, Mar 15–17, 2018.

20. Mouli Laha, Prasun Chandra Tripathi, and **Soumen Bag**, "*A Skull Stripping from Brain MRI using Adaptive Iterative Thresholding and Mathematical Morphology*", 4th International Conference on Recent Advances in Information Technology (RAIT), **IEEE CS Press**, Dhanbad, India, Mar 15–17, 2018.

21. Deepika Gupta and **Soumen Bag**, "*An Efficient Character Segmentation Approach for Handwritten Hindi Text*", 5th International Conference on Signal Processing and Integrated Networks (SPIN), **IEEE CS Press**, pp. 730–734,Noida, India, Feb 22–23, 2018.

22. Deepayan Chakraborty, Rahul Pramanik and **Soumen Bag**, "*A Novel Approach Towards Segmentation of Connected Handwritten Numerals*", 4th International Conference on Image Information Processing (ICIIP), **IEEE CS Press**, pp. 340–344, Shimla, India, Dec 21–23, 2017 (**Received Beat Paper Award in the *Information Processing* track**).

23. Rahul Pramanik and **Soumen Bag**, "*Linear Curve Fitting-based Headline Estimation in Handwritten Words for Indian Scripts*", 7th International Conference on Pattern Recognition and Machine Intelligence (PReMI), **Springer-LNCS**, vol. 10597, pp. 116–123, Kolkata, India, Dec 05–08, 2017 (**Received Springer Beat Student Paper Award**).

24. Prabhat Dansena, **Soumen Bag**, and Rajarshi Pal, "*Differentiating Pen Inks in Handwritten Bank Cheques using Multi-layer Perceptron*", 7th International Conference on Pattern Recognition and Machine Intelligence (PReMI), **Springer-LNCS**, vol. 10597, pp. 655–663, Kolkata, India, Dec 05–08, 2017 (**Received Springer Beat Student Paper Award**).

25. Rahul Pramanik and **Soumen Bag**, "*Linear Regression-based Skew Correction of Handwritten Words in Indian Languages*", 2nd International Conference on Computer Vision and Image Processing & Workshop on Multimedia (CVIP-WM), **Springer-AISC**, vol. 704, pp. 129–139, Greater Noida, India, Sep 09–12, 2017.

26. Rahul Pramanik and **Soumen Bag**, "*Segmentation of Bengali Handwritten Conjunct Characters Through Structural Disintegration*", 1st International Conference on Computational Intelligence, Communications, and Business Analytics (CICBA), **Springer-CCIS**, vol. 776, pp. 297–306, Kolkata, India, Mar 24–25, 2017.

27. Kapil K Upreti and **Soumen Bag**, "*Segmentation of Handwritten Hindi Words using Polygonal Approximation*", 15th International Conference on Frontiers in Handwriting Recognition (ICFHR), **IEEE CS Press**, pp. 150–155, Shenzhen, China, Oct 23–26, 2016.

28. Shalmoly Mondal and **Soumen Bag**, "*Face Recognition using PCA and Minimum Distance Classifier*", 5th International Conference on Frontiers in Intelligent Computing: Theory and Applications (FICTA), **Springer-AISC**, vol. 515, pp. 397–405, Bhubaneswar, India, Sep 16–17, 2016.

29. **Soumen Bag** and Ankit Krishna, "*Character Segmentation of Hindi Unconstrained Handwritten Words*", 7th International Workshop on Combinatorial Image Analysis (IWCIA), **Springer-LNCS**, vol. 9448, pp. 247–260, Kolkata, India, Nov 24–27, 2015.

30. **Soumen Bag** and Glory Chawpatnaik, "A *Modified Parallel Thinning Method for Handwritten Oriya Character Images*", 4th International Conference on Frontiers in Intelligent Computing: Theory and Applications (FICTA), **Springer-AISC**, vol. 404, pp. 181–189, Durgapur, India, Nov 16–18, 2015.

31. Soumyadeep Ghosh and **Soumen Bag**, "*A Modified Thinning Strategy to Handle Junction Point Distortion for Bangla Characters*", 3rd IEEE TechSym, **IEEE CS Press**, pp. 52–56, Kharagpur, India, 28 Feb–2 Mar, 2014.

32. Soumyadeep Ghosh and **Soumen Bag**, "*An Improvement on Thinning to Handle Characters with Noisy Contour*", 3rd National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG), **IEEE CS Press**, pp. 1–4, Jodhpur, India, Dec 19–21, 2013.

33. **Soumen Bag**, Partha Bhowmick, and Gaurav Harit, "*Detection of Structural Concavities in Character Images–A Writer-independent Approach*", 1st Indo-Japan Conference on Perception and Machine Intelligence (PerMIn), **Springer-LNCS**, vol. 7143, pp. 260–268, Kolkata, India, Jan 12–13, 2012.

34. **Soumen Bag**, Partha Bhowmick, Gaurav Harit, and Arindam Biswas, "*Character Segmentation of Handwritten Bengali Text by Vertex Characterization of Isothetic Covers*", 2nd National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG), **IEEE CS Press**, pp. 21–24, Hubli, India, Dec 15–17, 2011.

35. **Soumen Bag**, Partha Bhowmick, Priyaranjan Behera, and Gaurav Harit, "*Robust Binarization of Degraded Documents using Adaptive-cum-interpolative Thresholding in a Multi-scale Framework*", 1st International Conference on Image Information Processing (ICIIP), **IEEE CS Press**, Shimla, India, Nov 3–5, 2011.

36. **Soumen Bag** and Goutam Sanyal, "*An Efficient Face Recognition Approach using PCA and Minimum Distance Classifier*", 1st International Conference on Image Information Processing (ICIIP), **IEEE CS Press**, Shimla, India, Nov 3–5, 2011.

37. **Soumen Bag**, Gaurav Harit, and Partha Bhowmick, "*Topological Features for Recognizing Printed and Handwritten Bangla Characters*", Joint Workshop on Multilingual OCR and Analytics for Noisy Unstructured Text Data (J-MOCR-AND) at 11th International Conference on Document Analysis and Recognition (ICDAR), **ACM Digital Library**, Article no. 10, Beijing, China, Sep 17, 2011.

38. **Soumen Bag**, Partha Bhowmick, and Gaurav Harit, "*Recognition of Bengali Handwritten Characters using Skeletal Convexity and Dynamic Programming*", 2nd International Conference on Emerging Applications of Information Technology (EAIT), **IEEE CS Press**, pp 265–268, Kolkata, India, Feb 18–20, 2011.

39. **Soumen Bag** and Gaurav Harit, "*A Novel Topographic Feature Extraction Method for Indian Character Images*", 1st International Conference on Computer Science and Information Technology (CCSIT), **Springer–CCIS**, vol. 131, part–I, pp. 358–367, Bangalore, India, Jan 2–4, 2011.

40. **Soumen Bag** and Gaurav Harit, "*A Medial Axis Based Thinning Strategy and Structural Feature Extraction of Character Images*", 17th IEEE *International* Conference on Image Processing (ICIP), **IEEE CS Press,** pp. 2173–2176, Hong Kong, Sep 26–29, 2010.

41. **Soumen Bag** and Gaurav Harit, "*A Medial Axis Based Thinning Strategy for Character Images*", 1st National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG), pp. 67–72, Jaipur, India, Jan 15–17, 2010.

42. **Soumen Bag**, Soumen Barik, Prithwiraj Sen, and Gautam Sanyal, "*A Statistical Nonparametric Approach of Face Recognition: Combination of Eigenface & Modified K-means Clustering*", 4th International Conference on Information Processing, **I. K. International Publishing House**, pp. 198–204, Bangalore, India, Aug 8–10, 2008.

Book Chapter:

1. **Soumen Bag**, "*A nearest opposite contour pixel based thinning strategy for character images*", Feature Detectors and Motion Detection in Video Processing, Chapter 6, pp. 123–140, N. Dey, A. Ashour, and P.K. Patra (Ed.), **IGI Global, USA**, 2016.

Monograph:

1. **Soumen Bag**, "*An efficient human face recognition approach*: Combination of eigenface *and k-means clustering methods*", **Lap Lambert Academic Publishing GmbH & Co. KG**, Germany, ISBN 978-3-8433-7830-7, 2010.

Posters Presentation:

1. **Soumen Bag**, Partha Bhowmick, and Gaurav Harit, *"Bangla handwritten character segmentation using vertex characterization of outer isothetic covers",* Research Scholars' Day, Department of Computer Science and Engineering, IIT Kharagpur, India, Mar 17, 2012.

2. **Soumen Bag**, Partha Bhowmick, and Gaurav Harit, *"Recognition of handwritten Bengali characters using skeletal convexity and dynamic programming",* Research Scholars' Day, Department of Computer Science and Engineering, IIT Kharagpur, India, Feb 12, 2011.

3. **Soumen Bag** and Gaurav Harit, *"Structural analysis of character images",* Research Scholars' Day, Department of Computer Science and Engineering, IIT Kharagpur, India, Feb 6, 2010.

Externally Funded Projects

Sl No.	Project Title	Funding Agency	Role	Budget	Status
1	Design and Implementation of Multiple Strategies to Identify Handwritten Forgery Activities in Legal Documents	SERB, Govt. of India	PI	Rs. 13.09 lakhs	Completed
2	To Strengthen the Research Facilities in the Department of Computer Science and Engineering	FIST, Govt. of India	Co-PI	Rs. 52 lakhs	On-going

Thesis / Project Supervised

Sl.No.	Degree	Institute	Status: # of Thesis/Project
1	Ph.D	IIT (ISM) Dhanbad	Degree Awarded : 5 On-going : 3
2	PG	IIT (ISM) Dhanbad	Completed : 33 On-going : 3
		IIIT Bhubaneswar	Completed : 3
3	Dual Degree	IIT(ISM) Dhanbad	Completed : 4 On-going : 1
4	UG	IIT(ISM) Dhanbad	Completed : 31 On-going : 0
		IIIT Bhubaneswar	Completed : 12
		BCET Durgapur	Completed : 6

Professional Recognition

1. Selected as an IEEE Senior member, 2021.
2. Nominated as an Associate Editor for the journal named "IET Image Processing", 2021-2024.
3. Early Career Research Award (ECR), SERB, Govt. of India, 2017.
4. Best Springer Student Paper Award (Two in number) in PReMI, 2017.
5. Best Student Paper Award at the Information Processing track in ICIIP, 2017.
6. Mentor of the team participated in Amdocs Could-based Innovation Lab Contest held in Pune on 20.03.2017. The team holds the Runner-up position.
7. Listed in the Marquis Who's Who in the World, USA, 32nd Ed., 2015.
8. Certificate of Achievement as a coach for ACM International Collegiate Programming Contest, 2015.

Scholarship/Fellowship

- IEEE Signal Processing Society International Travel Grant to attend ICIP 2010 in Hong Kong.
- CSIR India International Travel Grant to attend ICIP 2010 in Hong Kong.
- Microsoft India International Travel Grant to attend J-MOCR-AND 2011 in Beijing, China.
- IIT Kharagpur Institute International Travel Grant to attend J-MOCR-AND 2011 in Beijing, China.
- MHRD, Govt. of India scholarship from July, 2006 to May, 2008.
- MHRD, Govt. of India scholarship from July, 2008 to July, 2012.

Review Work

1. Pattern Recognition.
2. IEEE Transactions on Human-Machine Systems.
3. Neural Networks.
4. Pattern Recognition Letters.
5. ACM Transactions on Asian and Low-Resource Language Information Processing.
6. Artificial Intelligence Review.
7. International Journal on Document Analysis and Recognition.
8. Transactions on Multimedia Computing Communications and Applications.
9. Sustainable Cities and Society.

10. Interdisciplinary Neurosurgery.
11. Sadhana-Academy Proceedings in Engineering Science.
12. National Academy Science Letters.
13. International Conference on Computer Vision and Image Processing (CVIP), 2022.
14. International Conference on Computer Vision and Image Processing (CVIP), 2020.
15. International Conference on Machine Learning, Image Processing, Network Security and Data Science (MIND), 2020.
16. National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG), 2019.
17. Australian Joint Conference on Artificial Intelligence (AI), 2018.
18. Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP), 2018.
19. International Conference on Computer Vision and Image Processing (CVIP), 2018.
20. International Conference on Recent Advances in Information Technology (RAIT), 2018.
21. IEEE Indian Council International Conference (INDICON), 2017.
22. International Conference on Next Generation Computing Technologies (NGCT), 2017.
23. International Conference on Recent Advances in Information Technology (RAIT), 2016.
24. International Conference on Advances in Computing and Management (ICACM), 2016.
25. National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG), 2015.
26. International Workshop on Combinatorial Image Analysis (IWCIA), 2015.
27. International Conference on Image Information Processing (ICIIP), 2015.
28. International Conference on Advances in Computing, Communications and Informatics (ICACCI), 2015.
29. International Conference on Soft Computing in Data Science (SCDS), 2015.
30. International Conference on Computing, Communication and Automation (ICCCA), 2015.
31. International Symposium on Computer Vision and the Internet (VisionNet), 2014.
32. International Conference on Advanced Computing, Networking, and Informatics (ICACNI), 2014.
33. National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG), 2013.
34. International Conference on pattern Recognition and Machine Intelligence (PReMI), 2013.
35. International Conference on Mining Intelligence and Knowledge Exploration (MIKE), 2013.
36. International Conference on Image Information Processing (ICIIP), 2013.
37. International Conference on Pattern Recognition (ICPR), 2012.
38. National Conference on Computing and Communication Systems (NCCCS), 2012.
39. International Workshop on VLSI, 2011.

Professional Activities

Sl No.	Event	Role
1.	AICTE Sponsored Short Term Training Programme on "Machine Learning, Pattern Recognition and their Applications", Kolkata, 2020	Invited Speaker
2.	International Conference on Machine Intelligence and Data Science Applications (MIDAS), Dehradun, 2020.	National Advisory Committee Member
3.	International Conference on Recent Advances in Information Technology (RAIT), IIT(ISM) Dhanbad, 2018.	Financial Chair, Session Co-Chair & Member of the Organizing Committee

4.	International Conference on Advances in Computer Applications (ICACA), NIT Uttakhand, 2018.	Organizing Committee Member
5.	Short-Term Course on Image Processing: Algorithms and Applications, IIT(ISM) Dhanbad, 2016.	Co-Coordinator & Speaker
6.	International Conference on Recent Advances in Information Technology (RAIT), IIT(ISM) Dhanbad, 2016.	Tutorial Co-Chair, Session Co-Chair & Member of the Organizing Committee
7.	HackFest 2016, 2017 & 2018, IIT(ISM) Dhanbad.	Faculty-Coordinator
8.	International Conference Frontiers in Intelligent Computing: Theory and Applications (FICTA), Durgapur, 2015.	Session Chair
9.	Board of Course and Studies (BOCS) for B.Tech in the department of Computer Science and Engineering, IIT(ISM) Dhanbad for 2015–2018.	Member
10.	Short-Term Course on Image Processing and its Applications, IIT(ISM) Dhanbad, 2015.	Invited Speaker
11.	Workshop on Image and Video Processing: WIVP 2014, IIIT Bhubaneswar.	Organizing Committee Member
12.	Faculty Seminar Committee, IIIT Bhubaneswar, 2014–2015 & 2013–2014.	Coordinator
13.	Maintenance and House Keeping Committee, IIIT Bhubaneswar, 2014–2015.	Faculty-in-change
14.	Techno-Financial Committee, IIIT Bhubaneswar, 2013–2014 & 2014–2015.	Member
15.	Counseling for 1st year students at IIIT Bhubaneswar, 2013–2014.	Faculty Mentor
16.	Anti-Ragging Committee, BCET Durgapur, 2005–2006.	Member
17.	Counseling for 1st year students at BCET Durgapur, 2005–2006.	Faculty Mentor

Technical Program Committee Member in Conferences

1. International Conference on Computer Vision and Image Processing (CVIP), Nagpur, India, Nov 4–6, 2022.
2. IEEE Indian Council International Conference (INDICON), Guwahati, India, Dec 19–21, 2021.
3. International Conference on Frontiers in Computing and Systems (COMSYS), Shillong, India, Sep 30–Oct 2, 2021.
4. International Conference on Information Systems & Computer Networks (ISCON), Mathura, India, October, 2021.
5. International Conference on Range Technology (ICORT), Chandipur, DRDO, India, Aug 5–6, 2021.
6. International Conference on Computer Vision and Image Processing (CVIP), Allahabad, India, Dec 4–6, 2020.

7. International Conference on Frontiers in Computing and Systems (COMSYS), Jalpaiguri, West Bengal, India, Jan 13–15, 2020.
8. Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP), Hyderabad, India, Dec 18–22, 2018.
9. International Conference on Information, Communication and Computing Technology (ICICCT), New Delhi, India, May 12, 2018.
10. International Conference on Recent Advances in Information Technology (RAIT), Dhanbad, India, Mar 15–17, 2018.
11. International Conference on Advances in Computer Applications (ICACA), Uttakhand, India, Feb 26–27, 2018.
12. IEEE Indian Council International Conference (INDICON), Roorkee, India, Dec 15–17, 2017.
13. International Conference on Next Generation Computing Technologies (NGCT), Dehradun, India, Oct 30–31, 2017.
14. International Conference on Advances in Computing, Communications and Informatics (ICACCI), Karnataka, India, Sep 13–16, 2017.
15. International Conference on Advances in Computing, Communications and Informatics (ICACCI), Jaipur, India, Sep 21–24, 2016.
16. International Conference on Recent Advances in Information Technology (RAIT), Dhanbad, India, Mar 3–5, 2016.
17. International Conference on Advances in Computing and Management (ICACM), Pune, India, Jan 15–17, 2016.
18. National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG), Patna, India, Dec 16–19, 2015.
19. International Conference on Image Information Processing (ICIIP), Waknaghat, Shimla, India, Dec 10–13, 2015.
20. International Workshop on Combinatorial Image Analysis (IWCIA), Kolkata, India, Nov 24–27, 2015.
21. International Conference on Advances in Computing, Communications and Informatics (ICACCI), Kochi, India, Aug 10–13, 2015.
22. International Conference on Advanced Computing, Networking, and Informatics (ICACNI), Bhubaneswar, India, Jun 23–25, 2015.
23. International Conference on Computing, Communication and Automation (ICCCA), Uttar Pradesh, India, May 15–16, 2015.
24. International Symposium on Computer Vision and the Internet (VisionNet), Delhi, India, Sep 24–27, 2014.
25. International Symposium on Biomedical Imaging and Sensing (BIS), Delhi, India, Sep 24–27, 2014.
26. International Conference on Advanced Computing, Networking, and Informatics (ICACNI), Kolkata, India, Jun 24–26, 2014.
27. National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG), Jodhpur, India, Dec 19–21, 2013.
28. International Conference on Image Information Processing (ICIIP), Waknaghat, Shimla, India, Dec 9–11, 2013.
29. International Conference on Computer Science and Information Technology (CCSIT), Bangalore, India, Feb 18–20, 2013.
30. International Conference on Pervasive Computing and Communication (PCC), New Delhi, Jun 2–3, 2012.
31. International Conference on Advances in Computer, Electronics and Electrical Engineering (ICACEEE), Mumbai, India, Mar 24–25, 2012.
32. International Conference on Advances in Computer Science and Electronics Engineering (ICACSEE), New Delhi, India, Feb 2–3, 2012.

Conferences, Workshops, Seminars, etc. (already attended / to be attended)

1. DST-FIST Project Review Meeting, CSIR-IMMT, Bhubaneswar, May 04, 2023.
2. SERB, Govt, of India Project Review Meeting, IIT madras, Chennai, Mar 06, 2020.
3. International Workshop on Combinatorial Image Analysis (IWCIA), Kolkata, India, Nov 24–27, 2015.
4. International Conference on Frontiers in Intelligent Computing: Theory and Applications (FICTA), Durgapur, India, Nov 16–18, 2015.
5. DST-Lockheed Martin India Innovation Growth Programme, Bhubaneswar, India, Jan 28, 2014.
6. Joint Workshop on Multilingual OCR and Analytics for Noisy Unstructured Text Data (J–MOCR–AND) at International Conference on Document Analysis and Recognition (ICDAR), Beijing, China, Sep 17–21, 2011.
7. International Conference on Emerging Applications of Information Technology (EAIT), Kolkata, India, Feb 18–20, 2011.
8. International Conference on Computer Science and Information Technology (CCSIT), Bangalore, India, Jan 2–4, 2011.
9. IEEE International Conference on Image Processing (ICIP), Hong Kong, Sep 26–29, 2010.
10. National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG), Jaipur, India, Jan 15–17, 2010.

Membership in Professional Societies

1. IEEE Computer Society; Senior Member #90875816.
2. IEEE Young Professionals.
3. Indian Unit for Pattern Recognition and Artificial Intelligence (IUPRAI); Life time Member #L0100.
4. International Association of Computer Science and Information Technology (IACSIT); Member #80342360.
5. International Association of Online Engineering (IAOE); Member #289.
6. International Association of Engineers (IAENG); Member #114680.
7. International Association of Computer and Electronics Engineers (UACEE); Member #A7800633

WORK EXPERIENCE

Organization	Designation	Department	Duration	Course Taught
IIT (ISM) Dhanbad, India	Assistant Professor	CSE	18/12/2014 to 12/04/2022 (**7 years & 3 months**)	Image and Video Processing (L & p) Digital Image Processing (L) Image Processing-II (L) Discrete Mathematics (L) Advanced Data Structures and Algorithms (L & P) Algorithm Design and Analysis (L & P) Data Structure (L & P)

				Computer Programming (L & P)
IIIT Bhubaneswar, India	Assistant Professor	CSE	22/08/2012 to 06/12/2014 (**2 years & 3 months**)	Document Imaging and Pattern Analysis (L) Design and Analysis of Algorithms (L) Data Structure using C (L & P) Programming in C (L & P)
BCET, Durgapur, India	Lecturer	CSE and IT	01/01/2004 to 15/06/2006 (**2 years & 6 months**)	Data Structure and Algorithm (L & P) Design and Analysis of Algorithms (L) Introduction to Computing (L & P) Operating System (L) Computer Organization and Architecture (L) System Analysis and Design (L) Computer Graphics (P) Object Oriented Programming (P)

L: Lecture P: Practical

PERSONAL INFORMATION

Father's Name	:	Mr. Sasankasekhar Bag
Mother's Name	:	Mrs. Prity Bag
Spouse's Name	:	Dr. Swati Maiti (Bag)
Son's Name	:	Sounak Bag
daughter's Name	:	Shrinika Bag
Date of Birth	:	04-06-1979
Sex	:	Male
Nationality	:	Indian
Languages Known	:	English, Bengali, and Hindi
Hobbies	:	Playing cricket, Watching movies, Listening music, Reading thriller books

REFERENCES

1. **Partha Bhowmick**
   Professor
   Department of Computer Science and Engineering
   IIT Kharagpur, India
   Email id: bhowmick@gmail.com

2. **Gaurav Harit**
   Professor
   Center for Information and Communication Technology
   IIT Jodhpur, India
   Email id: gharit@iitj.ac.in

3. **Jayanta Mukhopadhyay**
   Professor
   Department of Computer Science and Engineering
   IIT Kharagpur, India
   Email id: jay@cse.iitkgp.ernet.in

4. **Goutam Sanyal**
   Professor (Retired)
   Department of Computer Science and Engineering
   NIT Durgapur, India
   Email id: nitgsanyal@gmail.com

Date: 04.02.2025
Place: Dhanbad

Signature