

# Arindam Biswas

**Professor,  
Information Technology,**

**Dean, International Relations and Alumni Affairs,  
Indian Institute of Engineering Science and Technology, Shibpur**

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## Profile

Arindam Biswas graduated from Jadavpur University, Kolkata, India, and received his master's and doctorate degree both from the Indian Statistical Institute, Kolkata, India. He is currently Associate Professor in the Department of Information Technology, Indian Institute of Engineering Science and Technology, Shibpur, India. His research interests include digital geometry, image processing, approximate shape matching and analysis, medical image analysis, natural language processing, and biometrics. He has published over 100 research papers in international journals, edited volumes, and refereed conference proceedings, and holds one US patent. He is currently a Board Member of the Technical Committee 18 (tc18) for Discrete Geometry and Mathematical Morphology of International Association of Pattern Recognition (IAPR).

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## Education

1990 Bachelor of Engineering, Jadavpur University, Kolkata, India.

2001 M. Tech in Computer Science, Indian Statistical Institute, Kolkata, India.

2010 PhD in Computer Science, Indian Statistical Institute, Kolkata, India.

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## PhD Thesis

Biswas, A. (2010). “Geometric Characterisation of Digital Objects: Algorithms and Applications to Image Analysis”. PhD thesis. Indian Statistical Institute, Kolkata.

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## Area of Research

Digital Geometry, Shape Analysis, and Medical Image Analysis.

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## Member

1. Board Member: IAPR Technical Committee 18 (tc18)
  2. IEEE Member
  3. ACM Member
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## Subjects Taught

Operating Systems, Computer Networks, Computational Geometry, Computational Topology, Information and System Security, Discrete Mathematics, Software Engineering, Web Technology, Graph Theory, and Formal Languages and Automata Theory.

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## PhD Supervised

### COMPLETED

1. Subarna Chatterjee (2013) "Computer Aided Breast Cancer Diagnosis Systems for Sono-mammogram"
2. Anirban Chatterjee (2013) "Automatic Diagram Drawing based on Natural Language Text Understanding"
3. Mousumi Dutt (2014) "On Some Shape-Analytic Algorithms and Applications for Isothetic Polygons"
4. Oishila Bandyopadhyaya (2016) "Automated Analysis of Orthopaedic X-ray Images based on Digital-Geometric Techniques"
5. Nilanjana Karmakar (2016) "Shape Analysis of 3D Objects using Digital Geometric Techniques"
6. Apurba Sarkar (2016) "On Some Combinatorial Algorithms for Analysis of Digital Objects on Isothetic and Triangular Grids"
7. Sandip Banerjee (2018) "Studies in four geometric optimization problems based on neighborhood-attributes of point-sets"
8. Shanta Phani (2018 submitted) "Culturomics and Style Analyses of Low-resourced Indian Languages"

### ONGOING

1. Nilanjana Dutta Ray (2015)
2. Sharmistha Mandal (2015)
3. Sabyasachi Banerjee (2017)

4. Somrita Saha (2018)
  5. Ujjwal Kumar Kamilla (2018)
  6. Anukul Maity (2018)
  7. Bijoly Saha (2018)
  8. Aman Aziz (2018)
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## **Reviewer of**

1. IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI).
  2. IEEE Transactions on Systems, Man and Cybernetics (SMC-A)
  3. Theoretical Computer Science - Elsevier.
  4. Information Sciences - Elsevier.
  5. Pattern Recognition Letters - Elsevier.
  6. Journal of Computer and System Sciences - Elsevier.
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## **Projects**

### **COMPLETED**

1. Generation, Decomposition, and Analysis of Isothetic Polygon, UGC, 3 years (July 2012 - June 2015), Rs. 2,59,400/-, PI
2. 3DTV-3D View from All Directions without Glasses, CSIR, 3 years (May 2012 - March 2015), Rs. 7,38,993/-, PI

### **ONGOING**

1. A Foldscope Based Malaria Detection and Realtime Monitoring of Malaria outbreak, DBT, 1 year (May 2018 - ), Rs. 8,00,000/- PI.
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## **Work Experience**

### **TEACHING**

1. Lecturer, Computer Science and Technology, IEST Shibpur, 01.09.2003 - 22.09.2008, 5 years
2. Assistant Professor, Information Technology, IEST Shibpur, 23.09.2008 - 22.09.2011, 3 years
3. Associate Professor, Information Technology, IEST Shibpur, 23.09.2011 - 21.02.2019, 7 years
4. Professor, Information Technology, IEST, Shibpur, 22.02.2019 - till date

### **INDUSTRY**

1. Deputy Manager, Steel Authority of India Ltd, Durgapur Steel Plant, 20.10.1990 - 09.10.2000, 10 years
  2. Senior Software Engineer, Novell Software Development India Ltd, 06.08.2001 - 29.08.2003, 2 years
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## **Institute Administrative Responsibilities**

1. HOD (Actg.), Department of Information Technology, IEST, Shibpur, 26.01.2009 - 14.08.2009
2. Director, Purabi Das School of Information Technology, IEST, Shibpur, 09.09.2010 - 09.07.2018.
3. Convener, INSTRUO 2009, Techno-Management festival of IEST, Shibpur.
4. HOD, Department of Information Technology, IEST, Shibpur, 03.02.2014 - 09.07.2018
5. External Member, Purchase Committee of CST, IEST Shibpur, 2012 - 2015
6. Member, Website and Infrastructure Committee, IEST, Shibpur, 2010 - 02.07.2018

7. Convener, INSTRUO 2015, Techno-Management festival of IEST, Shibpur.
  8. Member, Academic Committee, IIT Kalyani, 2014 - 2017
  9. Member, CPPC, IEST, Shibpur, 2017 - 2018
  10. Chairman, Network and IT Infrastructure Committee, 03.07.2018 -
  11. Convener, Committee for Strengthening Placement, 29.09.2018 -
  12. Institutional Coordinator, Scheme for Promotion of Academic and Research Collaboration, 24.10.2018 -
  13. Member, Committee for Digital Display Board, 01/01/2019 -
  14. Dean, International Relations and Alumni Affairs, 01/03/2019 -
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## **Conferences/Workshops Attended**

### **Annexure I**

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## **Conferences/Workshops Organized**

### **Annexure II**

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## **Publications**

### **INTERNATIONAL JOURNALS**

30. Oishila Bandyopadhyay, Arindam Biswas, and Bhargab B Bhattacharya (2018). Bone Cancer Assessment and Destruction Pattern Analysis in Long-Bone X-ray Image. Journal of Digital Imaging, Springer. (Accepted)
29. Sarkar, A., A. Biswas and, M. Dutt, and S. Mondal (2018). Finding Shortest Triangular Path and its Family inside a Digital Object. Fundamenta Informaticae 159(3), pp. 297-325, 2018.

28. S. Phani, S. Lahiri, and A. Biswas (2018). Readability Analysis of Bengali Literary Texts. *Journal of Quantitative Linguistics*. Taylor and Francis. DOI: 10.1080/09296174.2018.1499456
27. Nilanjana Karmakar, Sharmistha Mondal, and Arindam Biswas (2018). Determination of 3D curve skeleton of a digital object. *Information Sciences*, (in press) <https://doi.org/10.1016/j.ins.2018.06.021>
26. Sarkar, A., A. Biswas, M. Dutt, and A. Bhattacharya (2018). Finding a Largest Rectangle inside a Digital Object and Rectangularization. *Journal of Computer and System Sciences, JCSS* (95), pp. 204-217.
25. Bandyopadhyay, O., T. Dutta, N. Dutta, A. Biswas, and B. B. Bhattacharya (2017). Structural feature analysis of the vascular network in retinal images. *Computer Methods in Biomechanics and Biomedical Engineering: Imaging and Visualization*, 1-12.
24. Banerjee, S., B. B. Bhattacharya, B. Bhattacharya, A. Biswas, S. Das, R. Mandal, and S. Roy (2017). On Representing a Simple Polygon Perceivable to a Blind Person. *Information Processing Letters* 120. <http://dx.doi.org/10.1016/j.ipl.2017.04.001> 1-5.
23. Biswas, A., P. Bhowmick, B. B. Bhattacharya, B. Das, M. Dutt, and A. Sarkar (2017). Triangular Covers of a Digital Object. *Journal of Applied Mathematics and Computing, JAMC*, <https://doi.org/10.1007/s12190-017-1162-8>.
22. Phani, S., S. Lahiri, and A. Biswas (2017). A Supervised Learning Approach for Authorship Attribution of Bengali Literary Texts. *ACM Transaction Asian Low-Resource Language Information Processing* 16(4), 20-27.
21. Sarkar, A., A. Biswas, M. Dutt, P. Bhowmick, and B. B. Bhattacharya (2017). A Linear-Time Algorithm to Compute the Triangular Hull of a Digital Object. *Discrete Applied Mathematics* 216. doi:10.1016/j.dam.2016.01.014, pp 408-423.
20. Bandyopadhyay, O., A. Biswas, and B. B. Bhattacharya (2016). Automated Analysis of Orthopaedic X-ray Images based on Digital-Geometric Techniques. *Electronic Letters in Computer Vision and Image Analysis* 15(2), 7-9.

19. Bandyopadhyay, O., A. Biswas, and B. B. Bhattacharya (2016). Classification of Long-Bone Fractures based on Digital-Geometric Analysis of X-ray images. *Pattern Recognition and Image Analysis: Advances in Mathematical Theory and Applications* 26(4), 10-25.
18. Bandyopadhyay, O., A. Biswas, and B. B. Bhattacharya (2016). Long-bone Fracture Detection in Digital X-ray Images Based on Digital-Geometric Techniques. *Computer Methods and Programs in Biomedicine* 123, pp 2-14.
17. Karmakar, N., A. Biswas, and P. Bhowmick (2016). Reeb Graph based Segmentation of Articulated Components of 3D Digital Objects. *Theoretical Computer Science* 624. DOI=10.1016/j.tcs.2015.11.013, 25-40.
16. Bera, S., A. Biswas, and B. B. Bhattacharya (2015). A Fast and Automated Granulometric Image Analysis Based on Digital Geometry. *Fundamenta Informaticae* 138, 321-338.
15. Dutt, M., A. Biswas, P. Bhowmick, and B. B. Bhattacharya (2014). On Finding a Shortest Isothetic Path and its Monotonicity inside a Digital Object. *Annals of Mathematics and Artificial Intelligence* 22(7), 590-605.
14. Dutt, M., A. Biswas, P. Bhowmick, and B. B. Bhattacharya (2014). On the Family of Shortest Isothetic Paths in a Digital Object: An Algorithm with Applications. *Computer Vision and Image Understanding* 129, 75-88.
13. Mukherjee, A., U. Garain, and A. Biswas (2014). Experimenting with Automatic Text-to-Diagram Conversion: A Novel Teaching Aid for the Blind People. *Journal of Educational Technology and Society* (ISSN 1436-4522), Vol. 17, No. 3 (July 2014), pp. 40-53.
12. Dutt, M., A. Biswas, and P. Bhowmick (2013). Approximate Partitioning of 2D Objects into Orthogonally Convex Components. *Computer Vision and Image Understanding* 117(4), 326-341.
11. Biswas, A., P. Bhowmick, M. Sarkar, and B. B. Bhattacharya (2012). A Linear-time Combinatorial Algorithm to Find the Orthogonal Hull of an Object on the Digital Plane. *Information Sciences, Elsevier* 216. DOI:10.1016/j.ins.2012.176-195.
10. Bhowmick, P., A. Biswas, and B. B. Bhattacharya (2011). On the Representation of a Digital Contour with an Unordered Point Set for Visual



- Perception. *Journal of Visual Communication and Image Representation* 22(7), 590-605.
9. Chatterjee, S., R. Karim, A. Biswas, and A. K. Ray (2011). Image Processing of Ultrasound Color Doppler to Characterize Malignant Breast Lesion. *Advanced Materials Research Journal (AMR)* 403. DOI:10.4028/www.scientific.net/AMR/408.830, ISSN:1022-6680, pp 830-834.
  8. Chatterjee, S., A. K. Ray, R. Karim, and A. Biswas (2011). Architectural Design to Characterize Malignant Breast Lesion. *International Journal of Computer Applications* 31(11). DOI: 10.5120/3939-5529, ISBN: 978-93-80865-13-7, 8-15.
  7. Dutt, M., A. Biswas, P. Bhowmick, and B. B. Bhattacharya (2011). On Finding an Orthogonal Convex Skull of a Digital Object. *International Journal of Imaging Systems and Technology* 21(1), 14-27.
  6. Dutt, M., A. Sarkar, A. Biswas, P. Bhowmick, and B. B. Bhattacharya (2011). Efficient Word Segmentation and Baseline Localization in Handwritten Documents Using Isothetic Covers. *International Journal of Digital Library Systems* 2(3), 1-13.
  5. Biswas, A., P. Bhowmick, and B. B. Bhattacharya (2010). Construction of Isothetic Covers of a Digital Object: A Combinatorial Approach. *Journal of Visual Communication and Image Representation, Elsevier* 21(4), 295-310.
  4. Pal, S., P. Bhowmick, A. Biswas, and B. B. Bhattacharya (2010). Understanding Digital Documents Using Gestalt Properties of Isothetic Components. *International Journal of Digital Library Systems* 1(3), 1-25. -
  3. Bhowmick, P., A. Biswas, and B. B. Bhattacharya (2008). Thinning-free Polygonal Approximation of Thick Digital Curves Using Cellular Envelope. *Electronic Letters on Computer Vision and Image Analysis (ELCVIA)* 7(2), 76-95.
  2. Biswas, A., P. Bhowmick, and B. B. Bhattacharya (2008). Archival Image Indexing with Connectivity Features using Randomized Masks. *Applied Soft Computing, Elsevier* 8(4), 1625-1636.

1. Biswas, A., P. Bhowmick, and B. B. Bhattacharya (2008). Multiresolution Shape Codes and Their Applications to Image Retrieval. *Electronic Letters on Computer Vision and Image Analysis (ELCVIA)* 7(2), 62-75.
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#### PAPERS IN INTERNATIONAL CONFERENCE PROCEEDINGS

68. Eric Andres, Mousumi Dutt, Arindam Biswas, Gaelle Largeteau-Skapiin and Rita Zrour. Digital Two-dimensional Bijective Reflection and Associated Rotation. DGC I 2019
67. Roy N.D., Biswas A. (2019) Early Detection of Proliferative Diabetic Retinopathy in Neovascularization at the Disc by Observing Retinal Vascular Structure. In: Proceedings of the International Conference on ISMAC in Computational Vision and Bio-Engineering 2018 (ISMAC-CVB). ISMAC 2018. Lecture Notes in Computational Vision and Biomechanics, vol 30. Springer, Cham
66. Sabyasachi Mukherjee, Oishila Bandyopadhyay, Arindam Biswas and Bhargab B Bhattacharya (2018). International Workshop on Combinatorial Image Analysis (IWCIA 2018)At: Porto, Portugal, November 22 - 24, 2018.
65. Nilanjana Dutta Roy and Arindam Biswas (2018). Graph Theoretical Characterization of Retinal Vascular Network Finding Minimum Cost Spanning Tree. Computational Intelligence, Communications, and Business Analytics CICBA 2018 (Accepted)
64. Nilanjana Dutta Roy, Arindam Biswas and Suchismita Goswami (2018). Biometric Template Generation Framework using Retinal Vascular Structure . Computational Intelligence, Communications, and Business Analytics CICBA 2018 (Accepted)
63. Raina Paul, Apurba Sarkar, and Arindam Biswas (2018). Construction of Simple Isothetic Polygon from a Set of Points. Fifth International Conference on Emerging Applications of Information Technology (EAIT-2018).
62. Ujjwal Kamila, Oishila Bandyopadhyay, and Arindam Biswas (2018). "Detection of Hemorrhagic region in Brain MRI", International Conference on Communication, Computing and Networking, LNNS 46, pp. 383-391, 2018.

61. Sabyasachi Mukherjee, Oishila Bandyopadhyay, Arindam Biswas, Bhargab B. Bhattacharya (2017), "Does Rotation Influence the Estimated Contour Length of A Digital Object?", Pattern Recognition and Machine Intelligence (PReMI), LNCS 10597, pp. 179-186, 2017.
60. Roy N.D., Suchismita Goswami, Sushmita Goswami, Sohini De, Arindam Biswas (2017) Extraction of Distinct Bifurcation Points from Retinal Fundus Images. In: Proceedings of the First International Conference on Intelligent Computing and Communication. Advances in Intelligent Systems and Computing, vol 458, pp. 443-450. Springer, Singapore.
59. M. Dutt, S. Saha, and A. Biswas (2017), A Study on the Properties of 3D Digital Straight Line Segments, In Proceedings of 7th International Conference on Pattern Recognition and Machine Intelligence: PReMI'17, Kolkata, India, LNCS 10597, pp. 212-218, Springer-Verlag, December 5-8, 2017.
58. Karmakar N., Mondal S., Biswas A. (2017) A 3D Curve Skeletonization Method. In: Brimkov V., Barneva R. (eds) Combinatorial Image Analysis. IWCIA 2017. Lecture Notes in Computer Science, vol 10256. Springer, pp. 184-197
57. Dutt, M. and A. Biswas (2016). Boundary and Shape Complexity of a Digital Object. In: 5th International Symposium Computational Modeling of Objects Presented in Images: Fundamentals, Methods, and Applications: CompIMAGE'16, Niagara Falls, New York, USA. Springer-Verlag. Lecture Notes in Computer Science (LNCS), vol 10149. Springer, pp. 105-117.
56. Karmakar, N. and A. Biswas (2016). Construction of an Approximate 3D Orthogonal Convex Skull. In: 6th International Workshop on Computational Topology in Image Context: CTIC 2016, Marseille, France. Vol. 9667. Springer-Verlag. Lecture Notes in Computer Science (LNCS), pp. 180-192.
55. Karmakar, N. and A. Biswas (2016). Shape Matching of 3D Topologically Segmented Objects. In: 6th International Workshop on Computational Topology in Image Context: CTIC 2016, Marseille, France. Vol. 9667. Springer-Verlag. Lecture Notes in Computer Science (LNCS), pp. 170-179.
54. Kundu, D. and A. Biswas (2016). Finding Shortest Isothetic Path inside a 3D Digital Object. In: 5th International Symposium Computational

Modeling of Objects Presented in Images: Fundamentals, Methods, and Applications: CompIMAGE'16, Niagara Falls, New York, USA. Springer-Verlag. Lecture Notes in Computer Science (LNCS).

53. Mukherjee, S., O. Bandyopadhyay, and A. Biswas (2016). Automated Brain Tumor Diagnosis and Severity Analysis from Brain MRI. In: 5th International Symposium Computational Modeling of Objects Presented in Images: Fundamentals, Methods, and Applications: CompIMAGE'16, Niagara Falls, New York, USA, Springer-Verlag. Lecture Notes in Computer Science, vol 10149. Springer, pp. 194-207.
52. Phani, S., S. Lahiri, and A. Biswas (2016). A machine learning approach for authorship attribution for Bengali blogs. In: Proceedings of the 2016 International Conference on Asian Language Processing (IALP). IEEE, pp. 271-274.
51. Phani, S., S. Lahiri, and A. Biswas (2016). Personality Recognition in Source Code Working Note: Team BESUMich. In: FIRE (Working Notes). IEEE, pp. 16-20.
50. Phani, S., S. Lahiri, and A. Biswas (2016). Sentiment Analysis of Tweets in Three Indian Languages. In: Proceedings of the 6th Workshop on South and Southeast Asian Natural Language Processing (WSSANLP2016), Osaka, Japan. Osaka, Japan: The COLING 2016 Organizing Committee, pp. 93-102.
49. Phani, S., S. Lahiri, S. Dutta, and A. Biswas (2016). An Indic Language N-gram Viewer. In: Proceedings of the 8th Annual Meeting of the Forum on Information Retrieval Evaluation, FIRE '16, Kolkata, India. New York, NY, USA: ACM, pp. 32-36.
48. Sarkar, A., A. Biswas, M. Dutt, and A. Bhattacharya (2016). Finding Largest Rectangle inside a Digital Object. In: 6th International Workshop on Computational Topology in Image Context: CTIC 2016, Marseille, France. Vol. 9667. Springer-Verlag. Lecture Notes in Computer Science (LNCS), pp. 170-179.
47. Sarkar, A., A. Biswas, S. Mondal, and M. Dutt (2016). Finding Shortest Triangular Path in a Digital Object. In: 19th IAPR International Conference on Discrete Geometry for Computer Imagery: DGCI'16, Nantes,

- France. Vol. 9647. Springer-Verlag. Lecture Notes in Computer Science (LNCS), pp. 206-218.
46. Sarkar, A., M. Dutt, and A. Biswas (2016). On Generation of 3D Random Digital Curves. In: 5th International Symposium Computational Modeling of Objects Presented in Images: Fundamentals, Methods, and Applications: CompIMAGE'16, Niagara Falls, New York, USA. Springer-Verlag. Lecture Notes in Computer Science (LNCS).
  45. Dutt, M., A. Biswas, and B. B. Bhattacharya (2015). Enumeration of Shortest Isothetic Paths inside a Digital Object. In: 6th International Conference on Pattern Recognition and Machine Intelligence (PReMI'15). Vol. 9124. Warsaw, Poland: Lecture Notes in Computer Science (LNCS), pp. 105 -115.
  44. Dutt, M., A. Biswas, and B. Nagy (2015). Number of Shortest Paths in Triangular Grid for 1- and 2-Neighborhoods. In: 17th International Workshop on Combinatorial Image Analysis: IWCIA'15. Vol. 9448. DOI: 10.1007/978-3-319-26145-4 10. Kolkata, India: Lecture Notes in Computer Science (LNCS), pp. 115-124.
  43. Karmakar, N. and A. Biswas (2015). Construction of 3D orthogonal Convex Hull of a Digital Object. In: 17th International Workshop on Combinatorial Image Analysis: IWCIA'15. Vol. 9448. DOI: 10.1007/978-3-319-26145-4 10. Kolkata, India: Lecture Notes in Computer Science (LNCS), pp. 125-142.
  42. Phani, S., S. Lahiri, and A. Biswas (2015). Authorship Attribution in Bengali Language. In: Twelfth International Conference on Natural Language Processing (ICON-2015). Trivandrum, India.
  41. Sarkar, A., A. Biswas, M. Dutt, and A. Bhattacharya (2015). Detection of Bifurcation Angle in a Retinal Fundus Image. In: Eighth International Conference on Advances in Pattern Recognition (ICAPR), 2015. Vol. 8959. Kolkata, ISI, India: IEEE Explore, pp. 1-6.
  40. Sarkar, A., A. Biswas, M. Dutt, and A. Bhattacharya (2015). Generation of Random Digital Curves Using Combinatorial Techniques. In: Conference on Algorithms and Discrete Applied Mathematics: CALDAM'15. Vol. 8959. Kanpur, India: Lecture Notes in Computer Science (LNCS), pp. 286 -297.

39. Sarkar, A., A. Biswas, M. Dutt, and A. Bhattacharya (2015). Generation of Random Triangular Digital Curves using Combinatorial Techniques. In: 6th International Conference on Pattern Recognition and Machine Intelligence (PReMI'15). Vol. 9124. Warsaw, Poland: Lecture Notes in Computer Science (LNCS), pp. 136 -145.
38. Bandyopadhyay, O., A. Biswas, and B. B. Bhattacharya (2014). Long Bone Fracture Detection in Digital X-ray Images based on Concavity Index. In: 16th International Workshop on Combinatorial Image Analysis: IWCIA'14. Vol. 8466. Brno, Czech Republic: LNCS, pp. 212-223.
37. Bera, S., A. Biswas, and B. B. Bhattacharya (2014). A Fast Digital-Geometric Approach for Granulometric Image Analysis. In: 2nd International Conference on Recent Advances in Information Technology: RAIT'14. accepted. Dhanbad, India: LNCS.
36. Das, B., M. Dutt, A. Biswas, P. Bhowmick, and B. B. Bhattacharya (2014). A Combinatorial Technique for Construction of Triangular Covers of Digital Objects. In: 16th International Workshop on Combinatorial Image Analysis: IWCIA'14. Vol. 8466. Brno, Czech Republic: LNCS, pp. 76-90.
35. Karmakar, N., P. Bhowmick, and A. Biswas (2014). Segmentation of 3D Articulated Components by Slice-based Vertex-weighted Reeb Graph. In: 18th IAPR International Conference on Discrete Geometry for Computer Imagery: DGCI'14. Vol. 8668. Sienna, Italy: Lecture Notes in Computer Science (LNCS), pp. 370-383.
34. Phani, S., S. Lahiri, and A. Biswas (2014). Inter-rater Agreement Study on Readability Assessment in Bengali. In: International Conference On Natural Language Processing And Cognitive Computing. Imphal, India.
33. Roy, N. D., M. Someswar, H. Dalmia, and A. Biswas (2014). Identification of Distinct Blood Vessels in Retinal Fundus Images. In: Computational Modeling of Objects Presented in Images: Fundamentals, Methods, and Applications: CompIMAGE'14. Vol. 8641. Pittsburgh, PA, USA: Lecture Notes in Computer Science (LNCS), pp. 106 -114.
32. Bandyopadhyay, O., A. Biswas, B. Chanda, and B. B. Bhattacharya (2013). Bone Contour Tracing in Digital X-ray Images based on Adaptive Thresholding. In: 5th International Conference on Pattern Recognition and Ma-

- chine Intelligence, PReMI'13. Vol. 8251. ISI, Kolkata, India: LNCS, pp. 465-473.
31. Mukherjee, A., U. Garain, and A. Biswas (2013). Evaluation of the Graphical Representation for Text-to-Graphic Conversion Systems. In: 10th IAPR International Workshop on Graphics Recognition, GREC 2013. Vol. 8746. Lehigh University, Bethlehem, USA: LNCS, pp. 252-256.
  30. Das, J. K., S. K. Saha, and A. Biswas (2012). Depth from Images Of External Outdoor Scenes. In: 8th Indian Conference on Computer Vision, Graphics and Image Processing: ICVGIP'12. Mumbai, India: ACM, New York, USA, pp. 1-7.
  29. Dutt, M., A. Biswas, P. Bhowmick, and B. B. Bhattacharya (2012). On Finding Shortest Isothetic Path inside a Digital Object. In: 15th International Workshop on Combinatorial Image Analysis: IWCIA'12. Vol. 7655. Austin, Texas, USA: Lecture Notes in Computer Science (LNCS), Springer, pp. 16-30.
  28. Karmakar, N., A. Biswas, and P. Bhowmick (2012). Fast Slicing of Orthogonal Covers Using DCEL. In: 15th International Workshop on Combinatorial Image Analysis: IWCIA'12. Vol. 7655. Austin, Texas, USA: Lecture Notes in Computer Science (LNCS), Springer, pp. 16-30.
  27. Phani, S., S. Lahiri, and A. Biswas (2012). Culturomics On A Bengali Newspaper Corpus. In: International Conference on Asian Language Processing 2012 (IALP 2012). Hanoi, Vietnam, pp. 237-240.
  26. Chatterjee, S., R. Karim, A. Biswas, and A. K. Ray (2011). Image Processing of Ultrasound Color Doppler to Characterize Malignant Breast Lesion. In: In Proc. of International Conference on Control, Robotics and Cybernetics: ICCRC'11. New Delhi, India: IEEE Catalog Number: CFP1176M-PRT, pp. 159-162.
  25. Chatterjee, S., A. K. Ray, R. Karim, and A. Biswas (2011). Classification of Malignant Tumors Using Multiple Sonographic Features. In: IEEE Proceedings of the International Conference on Recent Trends in Information

Systems(ReTIS-2011). Jadavpur University, Kolkata, India, pp. 252-256.

24. Chatterjee, S., A. K. Ray, R. Karim, and A. Biswas (2011). Micro-calcification Detection to Characterize Malignant Breast Lesion. In: Annual IEEE India Conference (INDICON 2011). Hyderabad, India, pp. 1-4.
23. Dutt, M., A. Biswas, and P. Bhowmick (2011). ACCORD: With Approximate Covering of Convex Orthogonal Decomposition. In: In Proc. of 16th IAPR International Conference on Discrete Geometry for Computer Imagery: DGCI'11. Vol. 6607. Nancy, France: Lecture Notes in Computer Science (LNCS), Springer, pp. 489-500.
22. Dutta, S. C., A. Biswas, S. Mitra, and C. Saha (2011). Extraction of Lip Region from Video Sequences of Basic Facial Expressions. In: In Proc. of International Conference on Computational vision and Robotics: IC-CVR'11.
21. Karmakar, N., A. Biswas, P. Bhowmick, and B. B. Bhattacharya (2011). Construction of 3D Orthogonal Cover of a Digital Object. In: In Proc. of 14th International Workshop on Combinatorial Image Analysis: IWCIA'11. Vol. 6636. Madrid, Spain: Lecture Notes in Computer Science (LNCS), Springer, pp. 70-83.
20. Pal, S., P. Bhowmick, and A. Biswas (2011). FACET: A Fast Approximate Circularity Estimation Technique. In: In Proc. of 2nd International Conference of Emerging Applications of Information Technology: EAIT'11. Kolkata, India: IEEE CS Press, pp. 106-109.
19. Sarkar, A., A. Biswas, P. Bhowmick, and B. B. Bhattacharya (2011). Combinatorial Construction of the Orthogonal Concavity Tree of a Digital Object. In: In Proc. of 2nd International Conference of Emerging Applications of Information Technology: EAIT'11. Kolkata, India: IEEE CS Press, pp. 210-213.



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4. Biswas, A., P. Bhowmick, and B. B. Bhattacharya (2005). MuSC: Multigrid Shape Codes and Their Applications to Image Retrieval. In: In Proc. of International Conference on Computational Intelligence and Security: CIS'05. Vol. 3801. Xian, China: Lecture Notes in Computer Science (LNCS), Springer, pp. 1057-1063.
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2. Biswas, A., P. Bhowmick, and B. B. Bhattacharya (2005). TIPS: On Finding a Tight Isothetic Polygonal Shape Covering a 2D Object. In: In Proc. of 14th Scandinavian Conference on Image Analysis: SCIA'05. Vol. 3540. Joensuu, Finland: Lecture Notes in Computer Science (LNCS), Springer, pp. 930-939.
1. Biswas, A., P. Bhowmick, and B. B. Bhattacharya (2004). CONFERM: Connectivity Features with Randomized Masks and Their Applications to Image Indexing. In: In Proc. of 4th Indian Conference on Computer Vision, Graphics and Image Processing: ICVGIP'04. Ed. by S. C. B. Chanda and L. Davis. Kolkata, India: Allied Publishers Private Limited, pp. 556-

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**BOOK CHAPTERS**

1. Biswas, A., S. Pal, P. Bhowmick, and B. B. Bhattacharya (2010). Geometric Analysis and Efficient Indexing of Digital Documents, Machine Learning Techniques for Adaptive Multimedia Retrieval: Technologies, Applications and Perspectives, C. H. Wei.
2. Mukherjee, A., U. Garain, and A. Biswas (2013). Automatic Text-to-Diagram Conversion:a Novel Teaching Aid for the Blind People, Global Trends in Knowledge Representation and Computational Intelligence, IGI Global, B. K. Tripathy and D. P. Acharjya (Eds.)
3. Mukherjee, A., U. Garain, and A. Biswas (2014). Diagram Drawing Using Braille Text: A Low Cost Learning Aid for Blind People, Global Trends in Intelligent Computing Research and Development, IGI Global, B. K. Tripathy and D. P. Acharjya (Eds.)

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**PAPERS IN NATIONAL CONFERENCES**

1. S. Chatterjee, A. K. Ray, R. Karim, A. Biswas, Architectural Design for Median Filter, IEEE Proceedings of the 3rd National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG-2011), pp. 247-250, Dec, 15-17, 2011, Hubli, Karnataka, India.
  2. S. Bag, P. Bhowmick, G. Harit, and A. Biswas, Character Segmentation of Handwritten Bengali Text by Vertex Characterization of Isothetic Covers, 3rd National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG 2011), Dec, 15-17, 2011, Hubli, Karnataka, India.
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## Patents

1. Acharya, T., B. B. Bhattacharya, P. Bhowmick, A. Bishnu, A. Biswas, M. K. Kundu, C. A. Murthy, S. Das, and S. C. Nandy (2008). "Minutia Matching using Scoring Techniques". Patent US 7359532 (US).
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## Invited Talks

1. Workshop on Digital Geometric Algorithms, Shape analysis using digital geometric techniques, IIIT Kalyani, 29th Oct 2018.
  2. Insitute Talk: Cyber Security and Ethical Hacking, St. Thomas College of Engineering & Technology, 31st Oct, 2018.
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# Annexure I

## Conferences/Workshops Attended

1. IWCIA-2017: (PC Member) 17th International Workshop on Combinatorial Image Analysis, June 19-21, 2017, Plovdiv, Bulgaria, Europe. (attended - session chair to a keynote session, a paper presented)
2. CompIMAGE-2016: (As a session chair) International Symposium CompIMAGE'16 - Computational Modeling of Objects Presented in Images: Fundamentals, Methods, and Applications, Sep 21-23, 2016, Niagara Falls, USA. (attended, session chair and presented a paper)
3. (Member Scientific Committee) WRRPR 2016 : 1st workshop on Reproducible Research in Pattern Recognition, 4 Dec 2016, Cancun (Mexico).
4. (Member of the Review Committee) Tenth Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP) 2016 18 - 22 December, Indian Institute of Technology Guwahati.
5. (Member Review Committee) 5th International Conference on Informatics, Electronics & Vision (5th ICIEV), 13 14 May, 2016, Dhaka, Bangladesh.
6. DGCI-2016:(Member of the review committee) 19th IAPR International Conference on Discrete Geometry for Computer Imagery, Nantes, France, April 18-20, 2016.
7. CTIC-2016:(Member Program Committee) 6th International Workshop on Computational Topology in Image Context, Marseille, France June 15-17, 2016.
8. CALDAM-2015: (As a member of organizing committee) Conference on Algorithms and Discrete Applied Mathematics, February 8-10, 2015, Indian Institute of Technology, Kanpur, India. (attended and presented a paper)
9. ICAPR-2015: (As a member of program committee) 8th International Conference on Advances in Pattern Recognition, January 4-7, 2015, Indian Statistical Institute, Kolkata, India.
10. ICACNI-2014: (As session chair) 2nd International Conference on Advanced Computing, Networking, and Informatics, June 24-26, 2014, St. Thomas' College of Engineering and Technology, Kolkata, India.

11. IWZIA-2014: (As session chair) 16th International Workshop on Combinatorial Image Analysis, May 28-30, 2014, Brno University of Technology, Czech Republic, Europe.
12. WALCOM-2013: (As a member of organizing committee) 7th International Workshop on Algorithms and Computation, February 14-16, 2013, Indian Institute of Technology, Kharagpur, India.
13. ICVGIP-2012: (Attended) The Eight Indian Conference on Computer Vision, Graphics, and Image Processing, December 16-19, 2012, Indian Institute of Technology, Bombay, India.
14. DGCI 2011: 16th IAPR International Conference on Discrete Geometry for Computer Imagery
15. EAIT 2011: Second International Conference on Emerging Applications of Information Technology
16. ICFHR 2010: International Conference on Frontiers in Handwriting Recognition ICFHR 2010
17. ICCTA-2007: International Conference on Computing: Theory and Applications (ICCTA-2007), Platinum Jubilee of the Indian Statistical Institute, March 5-7, 2007, Kolkata.
18. ICAPR-2007: The Sixth International Conference on Advances in Pattern Recognition (ICAPR- 2007), January 2 - 4, 2007, Indian Statistical Institute, Kolkata.
19. PReMI-2005: 1st International Conference on Pattern Recognition and Machine Intelligence (PReMI 2005). Organized by: Indian Statistical Institute, Kolkata. Dec. 20-22, 2005.
20. SCIA 2005: 14th Scandinavian Conference on Image Analysis, Joensuu, Finland, June 19-22, 2005.
21. Biometrics Workshop 2005: International Workshop on Recent Advances in Biometric Systems. Organized by: IIT, Kanpur. April 15-16, 2005. Major Speakers: Prof. J. L. Wayman (Director, U.S. National Biometric Test Center, San Jose State University, U.S.A.), Dr. Vinod Chandran (Queensland University of Technology, Australia), Dr. V.K. Chhada (Bhaba Atomic Research Center, Mumbai).

22. VLSI-2005: (As a member of the organizing committee.) 18th International Conference on VLSI Design and 4th International Conference on Embedded Systems. Organized by: Indian Statistical Institute, Kolkata. Taj Bengal, January 3-7, 2005.
23. IWDC-2004: (As a member of the organizing committee.) 6th International Workshop on Distributed Computing. Organized by: IEEE, Calcutta Chapter. Indian Statistical Institute, Kolkata, 27-30 December, 2004.
24. ICVGIP-2004: 4th Indian Conference on Computer Vision, Graphics and Image Processing. Organized by: Indian Unit for Pattern Recognition and Artificial Intelligence (IUPRAI-IAPR) and Indian Statistical Institute. In cooperation with: ACM Siggraph and IIT Bombay. December 16-18, 2004, Kolkata.



## Annexure II

### Conferences/Workshops Organized

1. PC Member: CTIC 2019: 7th Workshop on Computational Topology in Image Context, Universidad de Malaga, France
2. PC Member: MIKE 2017: 5th International Conference on Mining Intelligence and Knowledge Exploration IDRBT Hyderabad, India, December 13-15, 2017
3. PC Member: ISED2017 (7th International Symposium on Embedded Computing and System Design). Durgapur, India, December 18-20, 2017
4. PC Member: Ninth International Conference on Advances in Pattern Recognition (ICAPR-2017) December 28-30, 2017
5. WoAAA-2016: (Co-Coordinator) Workshop on Advanced Application of Algorithms, 21-23 December, IEST, Shibpur. (organized)
6. IWCIA-2015:(Program Chair) Seventeenth International Workshop on Combinatorial Image Analysis, November 24-27, 2015, ISI, Kolkata, India. (organized)
7. Research Promotion Workshop on Digital Geometry-2014: (As Coordinator and Speaker) Research Promotion Workshop on Digital Geometry, June 23-25, 2014, Indian Institute of Engineering Science and Technology, Shibpur, Howrah, India.
8. Research Promotion Workshop-2013: (As Co-convener) Research Promotion Workshop on Introduction to Graph and Geometric Algorithms, March 14-16, 2013, Bengal Engineering and Science University, Shibpur, Howrah, India.
9. Research Promotion Workshop-2013: (As Co-convener) Research Promotion Workshop on Introduction to Graph and Geometric Algorithms, March 14-16, 2013, Bengal Engineering and Science University, Shibpur, Howrah, India.
10. ISED-2012: (As organizing Chair) International Symposium on Electronic System Design, December 19-22, 2012, Bengal Engineering and Science University, Shibpur, Howrah, India.

11. VDAT-2012: (As organizing Chair) 16th International Symposium on VLSI Design and Test, July 1-4, 2012, Bengal Engineering and Science University, Shibpur, Howrah, India.
12. ISAAC 2006: (As a member of the organizing committee) 17th International Symposium on Algorithms and Computation (ISAAC 2006) at Hotel Taj Bengal, Kolkata, India, December 18-20,2006. Hosted by Indian Statistical Institute, Kolkata in association with Indian Association for Research in Computing Science (IARCS) and Computer Science and Engineering Department, Indian Institute of Technology, Kharagpur.

## Post Graduate Students

### Annexure III

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## Graduate Students

### Annexure IV

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## Annexure III

## Post Graduate Students

### COMPLETED

To be populated.

### ONGOING

1. 2018: Arnab Chakrabarty
  2. 2019: Debanjan Basak
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## Annexure IV

## Graduate Students

### PROJECTS

1. 2018: Face recognition using Deep Learning Methods: Rohitashwa Chakraborty, Vivek Sharma
2. 2018: Object recognition from a video stream: Kanav Mehra, Soumik Pal, Agnibha Chandra
3. 2018: Analyzing patterns in Brain MRIs: Mimat Khalil Kasu, Suprotik Dey

## MINI PROJECTS

1. 2018 Fall: GENERATION OF FRACTALS, Sobhan Mondal (Reg.No-510816054), Kainat Kauser Ali (Reg.No-510816059), Adil Mahmood (Reg.No-B08-511116011)
  2. 2018 Fall: Study of Digital Spiral, Arjun Basu, Anagh Goswami, Md Jasimuddin
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