Digbalay Bose

- **Address**: AA-32, Block-C, Flat-3D, Mahendra Enclave, Prafulla Kanan (W) Kolkata-700101
- **Contact no**: +91-9167923129
- **Date of Birth:** 15/11/1992
- **Email id**: digbose92@gmail.com , dbose@usc.edu
- **Nationality**: Indian
- **Languages known:** English, Hindi, Bengali

RESEARCH INTERESTS

- **Statistical Signal Processing**: Multi modal signal processing, image processing, wavelets, compressive sensing, speech processing
- **Machine Learning**: Metric learning, clustering algorithms, multi task learning
- **Time series analysis**: Time series forecasting algorithms
- **Computational Intelligence**: Evolutionary algorithms

EDUCATION

INDIAN INSTITUTE OF TECHNOLOGY (IIT), BOMBAY

- July 2014-June 2016
- **Master of Technology** in Electrical Engineering
- **Specialization:** Control and Computing
- **Academic Performance**:
    - CPI (Cumulative Performance Index): **9.51/10**
    - Rank**:** **2nd** out of **16 students** in specialization

JADAVPUR UNIVERSITY, KOLKATA

- July 2010-June 2014
- **Bachelor of Engineering** in Electronics and Telecommunication Engineering
- **Academic Performance:**
    - CGPA (Cumulative Grade Point Average): **9.34/10**
    - Percentage of Marks**: 87.75%**
    - Rank**: 2nd** out of **50 students** in class

KENDRIYA VIDYALAYA No 1. SALT LAKE

- May 2010
- **All India Senior Secondary School Examination (AISSCE) (CBSE Class 12)**
- **Academic Performance:**
    - Percentage of Marks**: 94.4%**

- School topper
- Rank: **15th** in the Kolkata region

KENDRIYA VIDYALAYA No 1. SALT LAKE

- May 2008
- **All India Secondary School Examination(AISSE) (CBSE Class 10)**
- **Academic Performance:**
  - Percentage of Marks: **95.6%**
  - School topper
  - Rank: **11th** in the Kolkata region

PUBLICATIONS

INTERNATIONAL JOURNAL PAPERS

- **Digbalay Bose**, Subhodip Biswas, Athanasios V. Vasilakos, Sougata Laha, "***Optimal filter design using an improved artificial bee colony algorithm***", Information Sciences, vol 281, pp 443-461, 2014, DOI: https://doi.org/10.1016/j.ins.2014.05.033

INTERNATIONAL CONFERENCE PAPERS

- **Digbalay Bose**, Subhasis Chaudhuri, "***Hierarchical spectral clustering based large margin classification of visually correlated categories***", Indian Conference on Vision, Graphics and Image Processing, Article:48, pp 1-8, 2016, DOI: https://doi.org/10.1145/3009977.3010064

- Srinjoy Ganguly, **Digbalay Bose**, Amit Konar, "***Clustering using vector membership: An extension of the fuzzy C means algorithm***", International Conference on Advanced Computing(ICoAC) 2013, pp 27-32, 2013, DOI: https://doi.org/10.1109/ICoAC.2013.6921922

- Subhodip Biswas, Souvik Kundu, **Digbalay Bose**, Swagatam Das, P.N. Suganthan, "***Synchronizing differential evolution with a modified affinity-based mutation framework***", IEEE Symposium on Differential Evolution (SDE), 2013, pp 61-68, DOI: https://doi.org/10.1109/SDE.2013.6601443

- Subhodip Biswas, Souvik Kundu, **Digbalay Bose**, Swagatam Das, P.N. Suganthan, B.K. Panigrahi, "***Migrating forager population in a multi-population artificial bee colony algorithm with modified perturbation schemes***", IEEE Symposium on Swarm Intelligence (SIS), 2013, pp 248-255, DOI: https://doi.org/10.1109/SIS.2013.6615186

- **Digbalay Bose**, Souvik Kundu, Subhodip Biswas, Swagatam Das, "***Circular Antenna Array Design Using Novel Perturbation Based Artificial Bee Colony Algorithm",*** Swarm, Evolutionary, and Memetic Computing(SEMCCO),2012, pp 459-466, DOI: https://doi.org/10.1007/978-3-642-35380-2_54

- **Digbalay Bose**, Subhodip Biswas, Souvik Kundu, Swagatam Das, "***A Strategy Pool Adaptive Artificial Bee Colony Algorithm for Dynamic Environment through Multi-population Approach",***

Swarm, Evolutionary, and Memetic Computing(SEMCCO),2012, pp 611-619, DOI: https://doi.org/10.1007/978-3-642-35380-2_71

- Subhodip Biswas, **Digbalay Bose**, Souvik Kundu, "***A clustering particle based artificial bee colony algorithm for dynamic environment***", Swarm, Evolutionary, and Memetic Computing(SEMCCO),2012, pp 151-159, DOI: https://doi.org/10.1007/978-3-642-35380-2_19

- Souvik Kundu, Subhodip Biswas, Swagatam Das, **Digbalay Bose, "*A selective teaching-learning based niching technique with local diversification strategy*",** Swarm, Evolutionary, and Memetic Computing(SEMCCO),2012, pp 160-168, DOI: https://doi.org/10.1007/978-3-642-35380-2_20

- Souvik Kundu, **Digbalay Bose**, Subhodip Biswas, "***Differential Evolution with a Relational Neighborhood-Based Strategy for Numerical Optimization",*** Swarm, Evolutionary, and Memetic Computing(SEMCCO),2012, pp 189-197, DOI: https://doi.org/10.1007/978-3-642-35380-2_23

- Subhodip Biswas, Souvik Kundu, **Digbalay Bose**, Swagatam Das, "***Cooperative Co-evolutionary Teaching-Learning Based Algorithm with a Modified Exploration Strategy for Large Scale Global Optimization",*** Swarm, Evolutionary, and Memetic Computing(SEMCCO),2012, pp 467-475, DOI: https://doi.org/10.1007/978-3-642-35380-2_55

WORK EXPERIENCE

SOFTWARE ENGINEER | IBM RESEARCH LAB, BANGALORE | 21ST JULY 2016- 1ST JUNE 2018

- Worked on developing statistical models for time series signals like soil moisture readings from fields. Used interpolation-based techniques for estimating soil moisture signals at locations of interest for customers.

- Developed methods for explaining results of machine learning models used in image classification and visual search, to customers, in the areas of fashion products like dresses, eyeglasses.

RESEARCH EXPERIENCE

APPLICATIONS OF SPARSITY AND METRIC LEARNING BASED METHODS IN CLASSIFICATION PROBLEMS

- Master's thesis project, **June 2015-June 2016**
- Advisor: **Prof. Subhasis Chaudhuri, KN Bajaj Chair Professor, Department of Electrical Engineering, Indian Institute of Technology Bombay**
- **Contributions:**
    - Analyzed the performance of existing sparsity-based algorithms in various classification problems.

    - Proposed a novel scheme of image classification, which involved hierarchical organization of image categories using a clustering-based approach followed by

metric learning on the hierarchical structure. The scheme when tested on a subset of ImageNet dataset outperformed existing algorithms and was published in **Indian Conference on Vision Graphics and Image Processing, 2016.**

ANALYSIS OF GOOGLE PAGE RANK ALGORITHM

- Master's seminar, **August 2014-November 2014**
- Advisor: **Prof. Debasattam Pal, Assistant Professor, Department of Electrical Engineering, Indian Institute of Technology Bombay**
- **Contributions:**
    - Analyzed the PageRank algorithm as a graph problem by using tools from matrix analysis like Perron Frobenius Theorem and Banach fixed point Theorem for contraction mapping.

MODIFICATION OF THE FUZZY C MEANS CLUSTERING ALGORITHM TO INCLUDE A VECTORIZED MEMBERSHIP FUNCTION

- Undergraduate research project, **January 2013 – October 2013**
- Advisor: **Prof. Amit Konar, Department of Electronics and Telecommunication Engineering, Jadavpur University**
- **Contributions:**
    - Proposed a novel approach for Fuzzy C Means clustering algorithm where the original scalar membership of the examples w.r.t. different clusters were replaced by a vectorized membership function. It was published in **International Conference on Advanced Computing(ICoAC) 2013**

DESIGN OF CUSTOM PROCESSOR FOR BLOCK MATCHING ALGORITHM

- Bachelors thesis, **August 2013 – June 2014**
- Advisor: **Prof. Mrinal Kanti Naskar, Department of Electronics and Telecommunication Engineering, Jadavpur University**
- **Contributions:**
    - Analysed existing block matching algorithms for motion estimation in videos and proposed a hardware accelerator design for implementing the corresponding algorithms.

EVOLUTIONARY ALGORITHMS FOR NUMERICAL OPTIMIZATION

- Undergraduate research project, **May 2012 – June 2013**
- Advisor: **Prof. Swagatam Das, Associate Professor, Electronics and Communication Sciences Unit, Indian Statistical Institute, Kolkata**
- **Contributions:**
    - Proposed optimization-based solutions to design problems of analog filter and circular antenna array. Designed novel evolutionary algorithms for numerical optimization. Works were published in **SEMCCO**, **SDE, SIS, Information Sciences.**

SKILLS

- **LANGUAGES:** C, C++, Python, R, MATLAB, JavaScript, HTML, VHDL
- **TOOLS:** TensorFlow, PyTorch, Caffe, Torch, OpenCV, LATEX, Linux Shell
- **HARDWARE:** Arduino, Raspberry Pi

TEST SCORES

GRE:

- Total Score**: 326 out of 340**
- Verbal**: 159 out of 170,** Quantitative**: 167 out of 170,** Analytical Writing: **5.0 out of 6.0**

TOEFL:

- Total Score**: 107 out of 120**
- Reading: **28 out of 30**, Listening: **24 out of 30**, Speaking: **26 out of 30**, Writing: **29 out of 30**

RELEVANT COURSEWORK

- **MASTERS**:

  Relevant courses done during Masters at IIT Bombay are listed as below:

  - **Wavelets**
  - **Image Processing**
  - **Applied Linear Algebra**
  - **Matrix Computations**
  - **Foundations of Machine Learning**
  - **Computer Vision**
  - **High Performance Scientific Computing**

- **BACHELORS**:

  Relevant courses done during Bachelors at Jadavpur University are listed as below:

  - **Digital signal processing**
  - **Digital control systems**
  - **VLSI design**
  - **C language and data structures**
  - **Operating systems**
  - **Compiler Design**
  - **Computer organization and architecture**

ACHIEVEMENTS

- Received a certificate of academic excellence from the **Department of Electrical Engineering, IIT Bombay**
- All India Rank **251**(out of 216367 candidates) in GATE-2014, Electronics & Communication
- Recipient of **Jnan Saran Chatterjee gold medal**, 2014 for securing the highest aggregate marks in *Electromagnetic Theory* and *Antennas and Propagation* at Jadavpur University
- **32nd** rank out of 1,08,961 students in Engineering in West Bengal JEE 2010
- Secured an **All India Rank of 3128** and **state rank of 53** in AIEEE, 2010 out of 10 lakh examinees
- Secured an **All India Rank of 7241** in IIT JEE 2010 out of 4.5 lakh examinees
- Awarded the **Kishore Vaigyanik Protsahan Yojana scholarship 2009** by the Department of Science and Technology
- Received the certificate of merit from the **Central Board of Secondary Education(CBSE)** for being among the **top 0.1 percent** of successful candidates of **AISSCE (CBSE Class 12)** for outstanding performance in Mathematics.
- Received a **certificate of merit** from Kendriya Vidyalaya Sangathan, New Delhi for securing a rank of 15 in the Kolkata Region in **AISSCE (CBSE Class 12)**
- Received the **Mamraj Agarwal Rashtriya Puraskar**, **2008** presented by Shri Gopalkrishna Gandhi, then Governor of West Bengal, India for outstanding performance in **AISSE 2008(CBSE Class 10)**

EXTRACURRICULAR ACTIVITIES

- Was a part of **Students Reading group** in Department of Electrical Engineering, IIT Bombay. Presented a talk on "**Application of sparsity-based methods in image processing**" .
- Actively participated as the member of **Student Organizing Committee** in the **10th Departmental Reunion of Electronics and Telecommunication engineering (Sanjog 2013), Jadavpur University.**
- Received the First position in the **Essay writing Competition, 2006**, in connection with the **Earth Day Celebration** (organized by the Government of West Bengal, Directorate of Forests).
- Received a certificate of merit in the **Green Olympiad ,2005** (conducted by the **Ministry of Environment and Forests**), Government of India and The Energy and Resources Institute
- Participated in the **VIIth All Bengal SPELL Linc competition 2005**

- Participated in several **Inter School Quiz Contests** and **drawing competitions**

REFERENCES

- **Prof. Subhasis Chaudhuri,** K. N. Bajaj Chair Professor, Department of Electrical Engineering, Indian Institute of Technology Bombay

- **Dr. Debasattam Pal,** Assistant Professor, Department of Electrical Engineering, Indian Institute of Technology Bombay

- **Prof. Amit Konar,** Professor, Department of Electronics and Telecommunication Engineering, Jadavpur University, Kolkata