Anirban Biswas

Personal Data

Place and Date of Birth:	West Bengal, India	05 Mar 1991
Address:	Bhimpur, Nadia, WB, India
Phone:	+91 9563152271
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LinkedIn:	linkedin.com/in/anirban-biswas-b8799055
Github:	github.com/anirban-code-to-live

Work Experience

Jan 2020-Present | Research Associate
Indian Institute of Science

Working at Machine & Language Learning (MALL) Lab under the guidance of Prof. Partha Talukdar. I currently work at the intersection of NLP, Vision and Robotics. I am involved in a project for building conversational interface for Robots and human-robot interaction.

Jul 2019-Dec 2019 | Applied Scientist
Amazon

Working on developing solutions of some real life Machine Learning Problems for Amazon. Part of India Machine Learning Group(IML), led by Rajeev Rastogi. In order to provide an elegent solutions to these problems, I focus on building state of the art ML techniques like Deep Models, Gradient Boosting methods to name a few.

Nov 2013-Jun 2017 | Software Developer
Lexmark International, Inc.

Developed mobile application on Android and iOS, both native application as well as hybrid mobile app. Worked on functionality like document *edge detection* using OpenCV, *push notification* for iOS and Android. Familiar with Javascript, CSS, HTML, Hybrid application development framework like Backbone.js

Jul 2013-Sep 2013 | Trainee Decision Scientist
Mu Sigma

Worked on : Data analysis using R, Microsoft Excel.

Education

Current-2017 | Master of Technology in Computer Science
Indian Institute of Science, Bangalore
Advisor: Prof. M. N. Murthy
GPA: 9.2/10 | Detailed List of Courses

2009-2013 | Bachelor of Engineering in Electronics and Telecom. Engg.
Jadavpur University, Kolkata
GPA: 9.31/10 | Detailed List of Courses

2007-2009 | Higher Secondary at **Krishnagar Collegiate School**, Krishnagar
Percentage: 91/100

2007 | Secondary at **Bhimpur Swamiji Vidyapith**, Bhimpur
Percentage: 95.2/100

Research Experience

Research Assistant
Dec 2019 - Present | *Machine & Language Learning (MALL) Lab, IISc Bangalore*
Advisor: Partha Talukdar

- Conversational Interface Building for Robots
- Human-Robot Interaction

Postgraduate Research Assistant
Apr 2018 - Jul 2019 | *Topic Analysis & Synthesis Lab, Indian Institute of Science*
Advisor: M.N.Murty

- Attributed Network Embedding using multilayered informative random walk
- Direct Unsupervised Edge Representation Learning framework for Information Networks

Summer Intern
May 2012 - Jun 2012 | *Variable Energy Cyclotron Centre, Kolkata*
Advisor: Mou Chatterjee, P.Y.Nabhiraj

- Design Micro-controller Based Infrared Transmitter & Receiver.

Teaching Experience

Teaching Assistant
Computer Science & Automation, IISc
Courses: Linear Algebra, Topics in Pattern Recognition, Deep Learning

Aug 2018 - Dec 2018 | **Course**: Linear Algebra | **Instructor**: M.N. Murty

Designed assignments for a batch of 80 students in Linear Algebra course for summer term at Computer Science and Automation taught by Prof. MNM. Assignments span the areas of Systems of Linear Equations, Matrix Algebra, Singular Value Decomposition and Clustering. Provided guidance on various topics in Linear Algebra and Machine Learning.

Jan 2019 - Apr 2019 | **Course**: Topics in Pattern Recognition | **Instructor**: M.N. Murty

Designed assignments for a batch of 20 students in Topics in Pattern Recognition(TIPR) course for fall term at Computer Science and Automation taught by Prof. MNM. Assignments span the areas of Neural Network, CNN, LSH.

Jan 2020 - May 2020 | **Course**: Deep Learning | **Instructor**: Sargur Srihari

Conducted tutorials on basics of *Python* and several deep learning frameworks like *Tensorflow* and *PyTorch* for a batch of 100 students in Deep Learning course for fall term at Computer Science and Automation taught by Prof. Sargur Srihari. Tutorials focused on hands-on learning about building Linear and Logistic Regression models, multi-layer feed-forward neural networks and Convolutional networks.

PUBLICATION

Centrality and Diversity in Search

AUG 24, 2019 | *Springer International Publishing*

Authors: M.N.Murty, Anirban Biswas

The concepts of centrality and diversity are highly important in search algorithms, and play central roles in applications of artificial intelligence (AI), machine learning (ML), social networks, and pattern recognition. This work examines the significance of centrality and diversity in representation, regression, ranking, clustering, optimization, and classification. Requiring only a basic background in undergraduate-level mathematics, the work is suitable for senior undergraduate and graduate students, as well as researchers working in machine learning, data mining, social networks, and pattern recognition.

URL: www.springer.com/gp/book/9783030247126

A Multilayered Informative Random Walk for Attributed Social Network Embedding

Accepted in ECAI, 2020

Authors: Sambaran Bandyopadhyay, Anirban Biswas, Harsh Kara, M.N.Murty

In this work, we propose *MIRand*, a network representation technique using structure and content. It is a multi-layered graph approach which uses a random walk to generate the node embedding. Our approach is simple and computationally fast, yet able to use the content as a complement to structure and the vice-versa. Experimental evaluations on three real world publicly available datasets show the merit of our approach compared to state-of-the-art algorithms in the domain.

Beyond Node Embedding: A Direct Unsupervised Edge Representation Framework via Collective Homophily for Information Networks

Under review in ECML-PKDD 2020

Authors: Sambaran Bandyopadhyay, Anirban Biswas, M.N.Murty, Ramasuri Narayanam

In spite of the existence of important edge driven mining tasks, edge representation learning is mostly unexplored in network embedding space. Towards this end, we propose a novel concept of converting a network to its weighted line graph which is ideally suited to find the embedding of edges of the original network. We further derive a novel algorithm to embed the line graph, by introducing the concept of *collective homophily*. To the best of our knowledge, this is the *first direct unsupervised approach for edge embedding in information networks*, without relying on the node embeddings. We validate the edge embeddings on three downstream edge mining tasks. Our proposed optimization framework for edge embedding also generates a set of node embeddings, which are not just the aggregation of edges. Further experimental analysis shows the connection of our framework to the concept of node centrality.

URL: arxiv.org/abs/1912.05140

Natural Language Instructions for Robot Manipulation

Under review in CoRL 2020

Authors: Anirban Biswas*, Sagar Gubbi*, Raviteja Upadrashta, Vikram Srinivasan, Partha Talukdar, Bharadwaj Amrutur

Robots that can operate in unstructured environments and collaborate with humans should be capable of understanding natural language. We propose a pipelined architecture of two stages to perform spatial reasoning on the text input. All the objects in the scene are first localized, and then the instruction for the robot in natural language and the localized co-ordinates are mapped to the *start* and *end* co-ordinates corresponding to the locations where the robot must pick up and place the object respectively. We show that constraining the output of the neural network to the location of one of the objects in the scene along with an offset chosen from a small pre-defined set of offsets results in better performance than directly regressing the co-ordinates. We also show that attention improves generalization and can overcome biases in the dataset. The proposed method is used to pick-and-place playing cards using a robot arm. (* Authors contributed equally)

PROJECTS

Diverse Clustering : Partitioning a set of objects into groups of diverse objects

OCT 2018 - PRESENT | *Computer Science & Automation, IISc*

Course: Data Analytics | Advisor: Prof. Rajesh Sunderasan & Ramesh Hariharan

The project is about partitioning a set of objects into groups(clusters) of diverse objects. The aim is to maximise intra-cluster diversity while at the same time maintaining the inter-cluster similarity. The focus is to come up with a suitable strategy to partition a set of objects into groups such that (I) *each group is diverse* and (II) *different groups are similar or uniform*.

Solution Approach - As of now, I have experimented with three different approaches to solve the problem -Random partitioning, Uniform KMeans and Modularity optimization.

URL: github.com/anirban-code-to-live/diverse-clustering

Sentiment Analysis : Message Polarity Classification

MAR 2018 - APR 2018 | *Computer Science & Automation, IISc*

Course: Natural Language Understanding | Advisor: Prof. Partha Talukdar

In this project, we have done a comparative study of different methods for sentiment analysis on twitter data for both english and hindi language. Our task is - given a message also known as "Tweet", classify whether the tweet is of positive, negative or neutral sentiment. For tweets conveying both a positive and negative sentiment, the sentiment that is stronger should be chosen. Various preprocessing techniques are employed like Hashtag handling, emoticons, acronyms etc. Also, we tried many machine learning models like Naive Bayes, Support Vector Machine(SVM), Maximum Entropy, LSTM model for the classification task.

Associates: Nihar Sahoo, Monish Keswani | **URL**: github.com/anirban-code-to-live/Senti-checker

Automated Program Repair using Seq2Seq Model

FEB 2018 - MAR 2018 | *Computer Science & Automation, IISc*

Course: Automated Software Engg. with Machine Learning | Advisor: Prof. Aditya Kanade

Developed a machine-learning based program repair solution that can fix simple errors for a toy programming language. Given a grammar for a programming language and pair of correct and incorrect programs generated based on the grammar, a encoder-decoder neural network is trained. This trained model is employed to fix an incorrect program of this kind. Tensorflow's Seq2Seq model is used to design this model. This is a small project done as a part of assignment.

URL: bitbucket.org/anirban_code-to-live/programcorrecter/

Community Detection in an Information Network

SEP 2018 | *Computer Science & Automation, IISc*

Course: Data Analytics | Advisor: Prof. Rajesh Sunderasan

Made use of the two different methids - Fiedler-vector and Louvain, to identify the two communities in a bottlenose-dolphins network. The dolphin network has a total of 62 nodes(i.e. dolphins) and 159 edges between them. While the Fiedler-vector method focuses on finding the second smallest eigen value of the graph Laplacian matrix and then cluster using K-Means technique, the Louvain uses Modularity Maximization approach to obtain the communities present in the network.

URL: github.com/anirban-code-to-live/CommunityDetector

Unsupervised Learning Task of Clustering

OCT 2017 - NOV 2017 | *Computer Science & Automation, IISc*

Course: Linear Algebra | Advisor: Prof. M.N.Murthy

Designed and implemented unsupervised learning task of clustering similar data points using k-means and spectral clustering algorithms. This project deals with eigenvalues, eigenvectors and one of their numerous applications, namely clustering. K-means and Spectral Clustering have been applied on two different datasets and observed the differences. This was done as a part of assignment.

Accomplishments

GATE 2017	Secured All India Rank 19 in Computer Science (Score : 938/1000)
IIT-JEE 2009	Secured All India Rank 5131
WBJEE 2009	Achieved Rank 15 in West Bengal Joint Entrance Examination
KVPY 2009	Selected for Kishore Vaigyanik Protsahan Yojana(KVPY) scholarship
RMO 2008	Qualified Regional Math Olympiad (RMO) organized by ISI, Kolkata

Certifications

Aug 2019 — **Convolutional Neural Networks**
Coursera | See Certificate

Jun 2019 — **Entrepreneurship 1: Developing the Opportunity**
Coursera | See Certificate

Jun 2019 — **Sequence Models**
Coursera | See Certificate

May 2019 — **Introduction to TensorFlow for Artificial Intelligence, Machine Learning, and Deep Learning**
Coursera | See Certificate

Feb 2019 — **Mathematics for Machine Learning: Multivariate Calculus**
Coursera | See Certificate

Jan 2018 — **Structuring Machine Learning Projects**
Coursera | See Certificate

Dec 2017 — **Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization**
Coursera | See Certificate

Nov 2017 — **Neural Networks and Deep Learning**
Coursera | See Certificate

Computer Skills

Basic Knowledge:	tensorflow, keras, PySpark, html, css, OpenGL, LaTeX
Intermediate Knowledge:	python, Java, Javascript, Android

Languages

Bengali:	Mothertongue
English:	Fluent
Hindi:	Basic Knowledge

Interests and Activities

Technology, Machine Learning, Programming
Calligraphy, Fiction, Photography, Travelling
Tennis, Badminton, Football

Talks

Jul 2019 Student Speaker at 7th CSA Summer School
Indian Institute of Science, Bangalore
Student talk at 7th CSA Summer School, organised by the Department of Computer Science & Automation, IISc Bangalore. I talked about the Sequence Models and the areas of application for the same. This talk encompasses briefly about LSTM and GRU as well.
Talk Link: www.youtube.com/watch?v=0Ux3kWZfYGc

Jul 2018 Student Speaker at 6th CSA Summer School
Indian Institute of Science, Bangalore
Student talk at 6th CSA Summer School, organised by the Department of Computer Science & Automation, IISc Bangalore. I spoke on the basics of Reinforcement Learning (RL), with a focus on Markov Decision Process(MDP) and Reward Design.
Talk Link: www.youtube.com/watch?v=avROqj5E_vI&t=2480s

Volunteer Experience

Aug 2017-
Jun 2019 Student Representative
Computer Science & Automation, IISc, Bangalore
In this role, I was responsible for organising various events held at CSA as well as being the bridge of communication between the students and the departmental curriculum committee.

Mar 2018 Event Coordinator at Open Day
Indian Institute of Science, Bangalore
Worked as a coordinator for the Open Day event 'Opportunities at CSA', held on 10th March, 2018. Part of Website design team. Also designed the Logo for Open Day, 2018.

Jul 2018 Volunteer at CSA Summer School
Indian Institute of Science, Bangalore
Part of the organising team for one-week long 6th CSA Undergraduate Summer School. I was responsible for designing the poster and website for this event. Also I gave a talk on Reinforcement Learning in this particular event.

Nov 2018-
Jan 2019 Website Designer and Volunteer
Theory Workshop, Indian Institute of Science, Bangalore
Designed and managed the website for the theory workshop organised by Department of Computer Science and Automation, IISc, spanning 2-3 January, 2019. It took place in Faculty Hall, IISc. The details of the website can be found here.

Feb 2019-
Mar 2019 Design Team Lead
Open Day, Indian Institute of Science, Bangalore
Led the Design Team for the Open Day event held on 23rd March, 2019. Responsible for designing the website, event logo and posters, flyers and banners.
Website link : https://events.csa.iisc.ac.in/open-day-2019/

Master of Technology in COMPUTER SCIENCE

Grades

EXAM	GRADE	CREDIT HRS
MTech Thesis	**A+**	**24**
Topics in Pattern Recognition	A+	3:1
Automated Software Engg. with Machine Learning	A	3:1
Natural Language Understanding	B+	3:1
Pattern Recognition & Neural Networks	B+	3:1
Linear Algebra	A+	3:1
Probability & Statistics	A	3:1
Computer Graphics	B+	3:1
Design and Analysis of Algorithms	B	3:1
Data Analytics	A	3:1
Graph Theory	A	3:1
	Total	64
	GPA	**9.2**

Undergraduate Degree in ELECTRONICS & TELECOMM. ENGG.

Grades

EXAM	GRADE	GRADE PTS
Comp. Lang. & Data Struc.	A	9
Operating System	A	9
Compiler Design	A	9
Systems Software	A	9
Comp. Org. & Architecture	S	10
Digital Signal Processing	A	9
Comp. Comm. Networks	A	9
Digital Circuits & Systems	S	10
Digital Control Systems	S	10
VLSI Design	A	9
IC Technology & Design	A	9
Analog Circuits-I	A	9
Analog Circuits-II	S	10
Optical Fiber Comm.	A	9
Analog Comm. Systems	A	9
Digital Logic Circuits	B	8
Microprocessor	S	10
Trans. Lines & Waveguides	A	9
Microwave Engg.	A	9
Antennas & Propagation	S	10
Control Engineering	S	10
Digital Comm. Systems	A	9
Electrical Machines	C	7
Electrical Measurements	S	10
Material Science	S	10
Comm. Switching Systems	B	8
Satellite Communication	A	9

Exam	Grade	Grade Pts
Signal Theory & Noise	S	10
Network Synthesis	B	8
Electromagnetic Theory	S	10
Physics-II	S	10
Engineering Mechanics	S	10
Industrial Management	A	9
Industrial Electronics	A	9
Instru. & Measurements	S	10
Mathematics-IV	A	9
Mathematics-III	A	9
Electron Device-II	B	8
Circuit Theory	S	10
Physics-I*	A	9
Mathematics-II	A	9
Mathematics-I	S	10
Electron Device-I	A	9
Humaities-A	B	8
Seminar	S	10
Project	A	9
	Gpa	**9.31**