DATA GLIMPSE

A Newsletter of Department of Computer Science and Engineering (Data Science)
SOE, DSU, Bangalore

VISION AND MISSION

DSU

Vision

To be a centre of excellence in education, research & training, innovation & entrepreneurship and to produce citizens with exceptional leadership qualities to serve national and global needs.

Mission

To achieve our objectives in an environment that enhances creativity, innovation and scholarly pursuits while adhering to our vision

VISION AND MISSION

Data Science

Vision

To endow the succeeding generation of engineers for a data-centric world by expanding their capacity to contribute in the field of data science by providing an absolute resolution in social aspects.

Mission

- To develop the Department of CSE (Data Science) as a Center of Excellence in Data Science domain by imparting Quality Education and Research to the students.
- To motivate the students to be ethical data science practitioners and innovators in data-driven global society.

Dayananda Sagar University, Innovation Campus, School of Engineering
Kudlu Gate, Hosur Road, Bengaluru - 560 068

DEAN'S MESSAGE

Dr. Udaya Kumar Reddy K R
Dean - School of Engineering
Professor, Dept. of Computer
Science and Engineering
DSU

I am delighted that the Department of Computer Science and Engineering (Data Science) is bringing out the newsletter that can provide wonderful insights for students and faculty fraternity.

A lot has been happening in the school of computing sciences over the years, and one of the significant changes involves this newsletter.

Our graduate students are doing amazing things in many different areas in different ways. In the current issue, you'll meet some remarkable students and faculty who are making a difference in the technical aspects and otherwise. We are hoping to build this endowment with your support, to afford even more opportunities for students to take part in this important component of their graduate education.

I hope this magazine provides the reader a wonderful insights and I thank the editorial team for their wonderful effort in bringing out this newsletter.
Wish you all the best.

CHAIRPERSON'S MESSAGE

Dr. Shaila S G
Professor & Chairperson
Department of CSE
(Data Science),
SOE,DSU

It gives me immense pleasure and pride to introduce the first volume Issue two of the Newsletter **DATA GLIMPSE** from the Department of Computer Science & Engineering (Data Science). The department is designed to bridge the industry gaps in terms of research and development using cutting-edge technologies. The department aims to meet the requirements of various job roles in Data Science.

The students and faculty members of the department have contributed technologically to solving real-world challenges through projects, hackathons, and quizzes. The program has offered various workshops and webinars for the students to develop their skills and knowledge in multiple domains. These events are effectively captured in the newsletter in the form of articles and achievements. I hope the Data Science newsletter motivates and encourages the students and faculty members with ample opportunities and exposure.

I thank the students, faculty members, and the editorial team for their wonderful efforts in bringing out this newsletter.

"Data science isn't about the quantity of data but rather the quality." — Joo Ann Lee

ABOUT THE PROGRAM

B.Tech CSE (Data Science) is a 4-year undergraduate degree programme. Data Science teaches the students how to combine Machine Learning techniques, algorithms, tools, business acumen and mathematics and apply on raw data to extract insight information from it. In short, technology algorithm development and data inference are blended together to solve complex problems analytically in Data Science.

Throughout the entire duration of the programme, the students are taught how to amalgamate business knowledge, tools and statistics to generate business value in creative ways.

The four-year undergraduate curriculum includes a detailed delivery of Basic Sciences, Mathematical Foundations, Statistical Foundations, Artificial Intelligence, Machine Learning, Data Science, Deep Learning, and Data Visualization.

The curriculum imparts 21st century skills having the components like: Liberal education aspects for all round development, courses that trigger new age skills, project based learning, special topics (hands-on sessions on multiple topics with mentoring from expert), option for MOOC, UG Research Project/Product Development/Internships.

The curriculum focuses on Liberal Art Courses, Foundation Courses, Professional Courses, and Electives that helps them build expertise in some specialised areas. Curriculum developed also emphasis on Design oriented thinking, Communication, Collaboration and Creativity right from 1st year.

A degree in Computer Science (Data Science) can lead to the following job roles in a variety of industries such as Retail, Finance, E-commerce, Healthcare, IT services:

- Data Scientist
- Data Analyst
- Business Analyst
- Data Engineer
- Senior Data Engineer
- Senior Data Analyst
- Data Director

What's inside...

- Articles
- Programme Events
- Staff Achievements
- Student Achievements
                    And more....

"Playing with Data - Towards Data Science." — Shaila S G

FACULTY LIST

Dr. Shaila S G has earned her Ph.D in Computer Science from NIT, Trichy, Tamil Nadu for her thesis on "Multimedia Information Retrieval in Distributed System". She has 17 years of experience in teaching & research in the concerned field. She has worked for CPRI, Bangalore as a Trainee Engineer. Later, she worked as a Research Fellow for a DST project, India for a period of 3 years. She has also worked in Indo-US collaborated project for "Obama-Singh Knowledge Initiative Program" in the University of Nevada (UNLV), Las Vegas, United States. She is a certified IBM trainer for the Business Intelligence. Her research areas are Data mining, Information Retrieval, Image Processing and Computational Neuroscience. She has published more than 50 research articles in reputed Journals and Conferences, books and book chapters. She has 11 Indian Patents and 2 Australian Patents.

Dr. Shaila S G
Professor & Chairperson

Shivamma D is working as an Assistant Professor in the Department of Computer Science and Engineering (Data Science). She is pursuing Ph.D in Dayananda Sagar University, Bengaluru. She completed her M.Tech from Birla Institute of Technology and Science (BITS), Pilani (Rajasthan). She has an extensive experience of 7 years in the field of Teaching and Research. She has worked as an IT Officer/IT Programmer/Data Analyst at National Institute of Mental Health And Neuro Science (NIMHANS), An Institute of National Importance, Government of India located at Bangalore. Her research interests are in the area of Technology Enabled Digital Learning, Machine Learning, Image Processing, Computational Neuroscience, Big Data Analytics and Data Science.

Prof. Shivamma D
Assistant Professor

Monish L is working as an Assistant Professor in the Department of Computer Science & Engineering (Data Science). He is pursuing Ph D on Image Analytics in Dayananda Sagar University. He has completed M. Tech from Dayananda Sagar University, and B.E. from The Oxford College of Engineering. He has one year of industrial experience in ADAS. He is a certified trainer of JAVA and FSD from Virtusa. He has published 3 Book chapters in an international journal. His paper is awarded with the best paper award in the ICAMIDA 2022 conference. His areas of interest are Data Mining, Knowledge Discovery, Data Analytics, Machine Learning and Artificial Intelligence.

Prof. Monish L
Assistant Professor

Sindhu A is working as an Assistant Professor in the Department of Computer Science & Engineering (Data Science). She has completed M.Tech from Dayananda Sagar University, and B.E. from BMS College of Engineering,Bangalore.Worked as an intern in Tech Citi Technologies. She has published 3 research papers. Areas of interest are Computer Vision, Machine Learning, Data Mining, Artificial Intelligence and Image Processing.

Prof. Sindhu A
Assistant Professor

"Data is the language of the powerholders." — Jodi Petersen

ARTICLES

Predictive Analytics for Speech Emotion Detection

Emotions play an essential role in human life in process of communication between people. It is one way to express ones feelings to others. Nowadays, emotion recognition and classification play a vital role in the field of Human-Computer Interaction (HCI). Emotions are being recognized through the different actions of body such as facial expression, voice tone, and body movement. In some cases where there is a face-to-face conversation, the emotions of the person can be easily analysed through his/her facial expression and body language. The conversation and interaction between two people residing in different places is made through the medium of the channel, and then it is hard to predict the emotion of the person. Here, speech emotion recognition (SER) is a method of expressing one's emotional state through his/her speech. The main feature by which humans differ from other living creatures is modulated vocal sounds. The voice of a human can be categorised into several attributes, such as loudness, pitch, vocal tone, and timbre. Through different vocal attributes, we can analyse human emotions easily. There are a few universal emotions like anger, sadness, happiness, surprise, fear, and neutrality that any system can be trained to identify easily. The feature extraction with the help of a human audio signal supports recognising emotions. Emotion recognition has gained importance as it also supports physically disabled people who cannot express their emotions. The Speech Emotion Recognition (SER) uses one of the foremost used modality to identify emotions. This mechanism is used due to its high temporal resolution with no risks and less cost. Over the last decades, many researchers involved SER signals in sequence to cope up with Brain-Computer Interface (BCI) to detect emotions. It includes removing noises from audio signals, extracting temporal or spectral features from the audio signals, analysis on time or frequency domain respectively, and eventually, designing a multi-class classification strategy. The recent approach used machine learning technique such as Random Forest (RF), Multilayer Perceptron (MLP), Support Vector Machine (SVM), Convolution Network (CNN), and Decision Tree (DT) Models for classification.

Dr. Shaila S G
Professor & Chairperson
Department of CSE
(Data Science)
SOE, DSU

"Torture the data, and it will confess to anything" - Ronald Coase

A Machine Learning approach for Facial Emotion Recognition

Nowadays, more and more intelligent systems are using emotion recognition models to improve their interaction with humans. This is important, as the systems can adapt their responses and behavioral patterns according to the emotions of the humans and make the interaction more natural. As an ancient Chinese celebrity, Zeng Guofanno wisdom involves the skill of facial emotion recognition. His book Bing Jian summarizes eight methods on how to identify people, especially how to choose the right one, which means "look at the eyes and nose for evil and righteousness, the lips for truth and falsehood; the temperament for success and fame, the spirit for wealth and fortune; the fingers and claws for ideas, the hamstrings for setback; if you want to know his consecution, you can focus on what he has said." It is said that a person's personality, mind, goodness and badness can be showed by his face. The emotion analytics software analyzes a person's facial expression. It records their mood, attitude and emotional personality by analyzing the data collected on their verbal as well as non-verbal communications. Emotional analytics tells what people are feeling and why. It provides deep and contextual understanding with valuable insights to identify and resolve issues. Facial Emotion Recognition (FER) is the technology that analyses facial expressions from both static images and videos in order to reveal information on one's emotional state. The complexity of facial expressions, the potential use of the technology in any context, and the involvement of new technologies such as artificial intelligence raise significant privacy risks. Emotion recognition has application in various fields such as medicine (rehabilitation, therapy, counseling, etc.), e-learning, entertainment, emotion monitoring, marketing, and law. Different algorithms for emotion recognition include feature extraction and classification based on physiological signals, facial expressions, and body movements. Emotion recognition uses different algorithms like neural network, machine learning models like KNN, SVM etc.

Prof. Sindhu A
Assistant Professor
Department of CSE
(Data Science)
SOE, DSU

"Data are just summaries of thousands of stories" - Chip & Dan Heath

PROGRAMME EVENTS

COMPUTER AWARENESS PROGRAM UNDER NSS ACTIVITY

Under DataScience@DSU club, Department of Computer Science and Engineering (Data Science) conducted "Computer Awareness Program under NSS activity" on 22nd July 2022 for the Government School students of DSU adopted village.

The objective of the program was to Identify the various benefits of using word processing software basics of Computer, Students will be able to claim proficiency in Word, Excel and PowerPoint and able to perform documentation and presenting skills, proficient in using Windows, Word Processing Applications, Spreadsheet Applications, to enable the students to study MS Office and to enrich the practical knowledge in MS Office. The organizers were **Dr. Shaila S G,** Chairperson and Professor, Dept. of CSE(DS), **Prof. Shivamma D, Prof. Monish L,** Assistant Professor, Dept. of CSE (DS), SoE, DSU.

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Cheelur, Karnataka, India
JCV9+QVG, Cheelur, Karnataka 562117, India
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"Data will talk to you if you are willing to listen". — Jim Bergeson

VALUE ADDED COURSE ON "MACHINE LEARNING WITH HANDS ON (TENSORFLOW/PYTHON)"
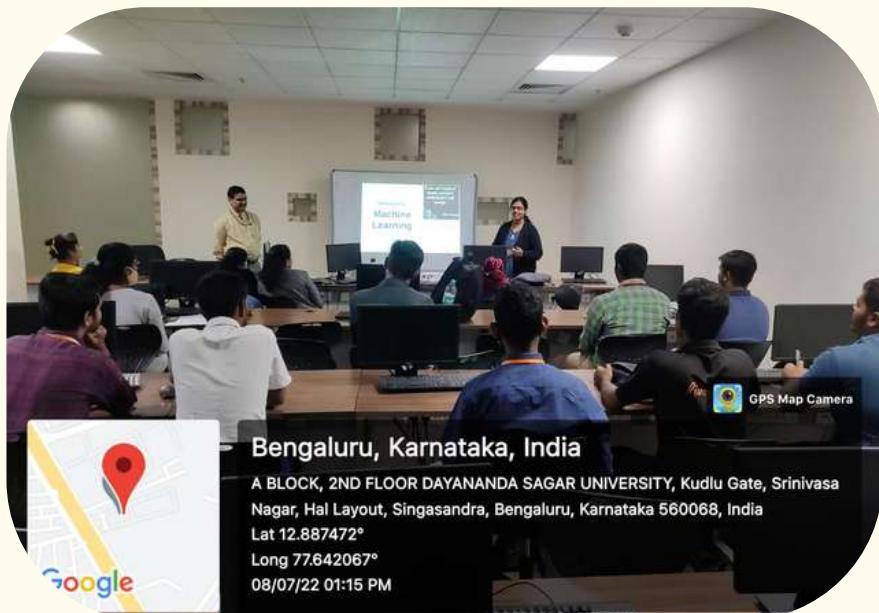
Under DataScience@Data Analytics and Visualisation (DAV) club, Dept. of CSE (Data Science) has successfully organised a 5 days Value Added Course on **"Machine Learning With Hands On (Tensorflow/Python)".** The organizers of the course were Dr. Shaila S G, Chairperson and Professor, Dept. of CSE (DS), Prof. Shivamma D, Prof. Monish L, Assistant Professor, Dept. of CSE (DS), and **Dr. Sanjeev Kumar, Professor, Dept. of CSE (DS), SoE, DSU** was th**e resource person** of the event. The targeted audience was B. Tech and M. Tech students of the Department of CSE. The course was organised in offline. Around 60+ students were registered for the course. All students were trained on both theoretical and practical knowledge of machine learning. At the end of the course an evaluation was carried out and the students have performed satisfactorily, feedback was taken from the students and it was found to be satisfactory.

"It's easy to lie with statistics It's hard to tell the truth without statistics."— Andrejs Dunkels

ONE - WEEK FDP ON "MACHINE LEARNING FOR REAL TIME APPLICATIONS"

Under DataScience@DSU club, Department of Computer Science and Engineering (Data Science) conducted Faculty Development Program on Machine Learning from 23rd August to 27th August 2022. The organizers of the FDP were Dr. Shaila S G, Chairperson and Professor, Dept. of CSE (DS), Prof. Shivamma D, Prof. Monish L, Assistant Professor, Dept. of CSE (DS), and Dr. Sanjeev Kumar, Professor, Dept. of CSE (DS), SoE, DSU was the resource person of the FDP. Workshop covered following topics introduction to machine learning that includes Intuitive solving number puzzles, familiarize with Machine Learning terminology, Statistical/Probabilistic ML framework, Flow of the ML framework analysis, Strategies for machine learning algorithms (Adaptive vs Batch etc.), Introduction to Tensor flow, Feature Vector Methods, Foundation of Statistical Machine Learning, Learning Problems that includes Classification (Pattern Recognition and Support Vector Machines), Regression (Function estimation), Tree Based/Ensemble Based Methods, Introduction to Deep Learning, Healthcare applications of Machine/Deep Learning, Hands on session on implementation of Tensor Flow, Python, R. At the end of the course an evaluation was carried out and the faculties performed satisfactorily, feedback was taken from the faculties and it was found to be satisfactory.

Bengaluru, Karnataka, India
1st Floor, Hosur Rd, Kudlu Gate, Srinivasa Nagar, Hal Layout, Singasandra, Bengaluru, Karnataka 560068, India
Lat 12.887606°

Bengaluru, Karnataka, India
Sagar IT Park, S T Rd, Kudlu Gate, Srinivasa Nagar, Hal Layout, Singasandra, Bengaluru, Karnataka 560068, India
Lat 12.887433°

"Data! Data! Data! I can't make bricks without clay."— Arthur Conan Doyle

WEBINAR ON "DATA PREPARATION FOR DATA SCIENCE WORKFLOWS"

Resource Person

Mr. Vinod
Senior Consultant, EY GDS,
Bangalore

Under the DataScience@DSU club, Department of Computer Science and Engineering (Data Science) organised a webinar on "Data Preparation for Data Science Workflows" on 10th September 2022. The event was organised by Dr. Shaila S G, Professor and Chairperson, Dept. of CSE (DS), DSU, Prof. Shivamma D, Assistant Professor, Prof. Monish L, Assistant Professor. The resource person was Mr. Vinod D, Senior Consultant, EY GDS, Bangalore. The targeted audience was 2nd and 3rd year students of Department of CSE (Data Science). The Webinar covered practical exposure of tools and techniques of Data Science along with Mining approaches. The main objective of the webinar was to explain how the data preparation is done using data science methodologies. Understanding available data resources which are used in industry, data cleaning methods, and data integration techniques. The speaker addressed the participants and highlighted focus points of acquiring data quality, data tools and techniques, data transformation methodologies. As the speaker has expertise in the domain of data science. He has discussed the different tools and techniques used in the industry for data sourcing, how the data is moved from source to destination and how mapping and transformation is done in industry. Next he gave depth knowledge about different data cleaning methods such as quality of data and tools used for cleaning the data which are used in industry. At the end of the webinar an evaluation was carried out and the students performed satisfactorily, feedback was taken from the students and it was found to be satisfactory.

"Where there is data smoke, there is business fire."—Thomas Redman

ENGINEER'S DAY CELEBRATION

On the occasion of the 152 years Birthday of the great legend Sir M. Visveswaraya, Department of Computer Science and Engineering (Data Science), the DataScience@DSU Club organised Engineers Day celebration at DSU for Data Science students. The event was organised by Dr. Shaila S G Professor and Chairperson, Dept. of CSE (DS), DSU, Prof. Shivamma D, Assistant Professor, Prof. Monish L, Assistant Professor, Dept. of CSE (DS). A magnificent message was sent to our students from **Dr. Lakshmi Jagannathan,** Chief Executive Officer, DERBI and **Mr. Abhinav Varma G**, Director, Exalt Design Engineers Pvt. Ltd. The speakers delivered an astonishing message to our Future Engineers on this occasion, It was followed by a small celebration with all the Data Science Students.

Dr. Lakshmi Jagannathan
Chief Executive Officer,
DERBI

It is an ideal time for engineers to start and work on their ideas. Entrepreneurship is growing exponentially in world. There are ample number of funding agencies available.

Mr. Abhinav Varma G
Director,
Exalt Design Engineers Pvt. Ltd.

The core values learnt during the engineering course was implemented by Mr. Abhinav for his company.

"Data is the most valuable asset in the world."— Brittany Kaiser

CELEBRATION OF SARASWATHI & AYUDHA POOJA

Under the DataScience@DSU club, the Department of CSE (Data Science) organised Saraswati Pooja & Ayudha Pooja on 30th September 2022. The event was organised by Dr. Shaila S G, Professor and Chairperson, Dept. of CSE (DS), Prof. Shivamma D, Prof. Monish L, Assistant Professor. On the auspicious day of Saraswati Puja, the students and faculty of DSU came together to seek the blessings of the goddess of knowledge, music, art, and culture. All the faculties and students from Data Science enlightened on the concept of worshiping the Goddess of knowledge, ending the event by serving prasad to everyone present.

"Data's just the world making noises at you."— Erin Shellman

CODEATHON-C CONTEST

Under the DataScience@DSU club, Department of Computer Science and Engineering (Data Science) conducted one-day CODEATHON-C for 3rd and 5th Semester Students on 24th September 2022. The event was organised by Dr. Shaila S G, Professor and Chairperson, Dept. of CSE (DS), Prof. Shivamma D, Prof. Monish L, Prof. Sindhu A, Assistant Professor. A total of 40 students have been attended the session. The activity was highly appreciated by the students. At last, the event ended with the codeathon contest. At the end of the course an evaluation was carried out and the students performed satisfactorily, feedback was taken from the students and it was found to be satisfactory.

Winners of the event:

1st Place: Sohan Nath
2nd Place: Kishore Kumar K
3rd Place: Sukrutha G and Rudra Narayan Chetty

"The data speaks for itself. That's the easiest measure of success." — Caitlin Smallwood

# LAUNCHED 1ST DATA SCIENCE NEWSLETTER "DATA GLIMPSE" (VOLUME 1 ISSUE 1)

Department of Computer Science and Engineering (Data Science) launched its **1st Newsletter** "**DATA GLIMPSE" (VOLUME 1 ISSUE 1)** on 5th September, 2022 on the occasion of Teacher's Day, which has captured the glimpse of Data Science events, Students achievement and Faculty achievement, Research articles, and publications. The Chief Guest for the function was **Dr. S. S. Prabhu, Former Professor, IIT, Kanpur and IIIT, Bangalore**. The president of the function was **Dr. KNB Murthy, the Vice Chancellor of DSU**.

"Passion provides purpose, but data drives decisions." — Andy Dunn

"ORGAN DONATION AWARENESS AND PLEDGE – NSS ACTIVITY"
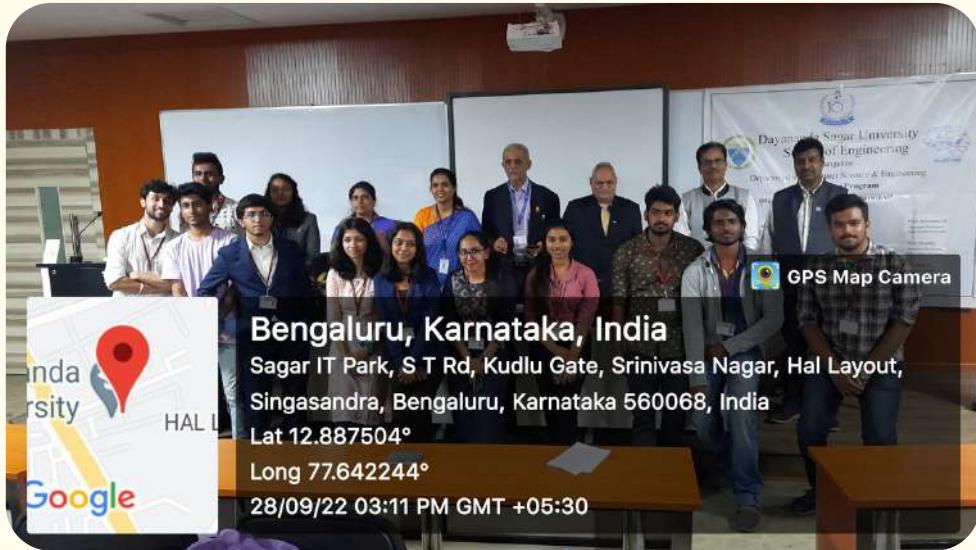
Under the DataScience@DSU club, Department of Computer Science & Engineering (Data Science) conducted **Organ Donation Awareness and Pledge – NSS Activity** on 28th September, 2022. The event was organised by Dr. Shaila S G, Professor and Chairperson, Dept. of CSE (DS), Prof. Shivamma D, Prof. Monish L, Prof. Sindhu A, Assistant Professor. The Speaker **Mr. M.K. Krishna, Founder President GGGC, Bangalore** gave a brief insight into awareness of organ donation and motivated the students to pledge for organ donation. The Special Invitees **Ln C.K. Krishnamurthy, PMJF, PDG / PMCC**, **Lions District 317f, Ln. Venugopal, District Chairperson – Organ Donation,** and **Ln Prakash T.N, Secretory Lion**s **club of Peenya, Yeshwanthpur** gave information on the other services for this social cause. A total of 70 students attended the session. The awareness program was highly appreciated by the students and faculties. At the end of the event, an evaluation was carried out and the students performed satisfactorily, feedback was taken from the students and it was found to be satisfactory.

"The goal is to turn data into information, and information into insight." — Carly Fiorina

FACULTY ACHIEVEMENTS

Dr. Shaila S G
Professor and Chairperson
Department of CSE (Data Science)

Research Publication

- Gurudas, V.R., **Shaila S.G**. & Vadivel, A. Breast Cancer Detection and Classification from Mammogram Images Using Multi-model Shape Features. SN COMPUT. SCI. 3, 404 (July 2022).

- Kumar Bhadra, A., **Shaila S.G.**, Banga, M.K. (July 2022). Review on Sentiment Analysis and Polarity Classification of Sarcastic Sentences using Deep Learning in Social Media. In: Bhateja, V., Khin Wee, L., Lin, J.CW., Satapathy, S.C., Rajesh, T.M. (eds) Data Engineering and Intelligent Computing, Lecture Notes in Networks and Systems, vol 446. Springer, Singapore.

- **Shaila S.G.** et al. (July 2022). Analysis and Prediction of Breast Cancer using Multi-model Classification Approach. In: Bhateja, V., Khin Wee, L., Lin, J.CW., Satapathy, S.C., Rajesh, T.M. (eds) Data Engineering and Intelligent Computing. Lecture Notes in Networks and Systems, vol 446. Springer, Singapore.

- **Shaila S.G.,** Gurudas, V.R., Hithyshi, K., Mahima, M., PoojaShree, H.R. (July 2022). CNN-LSTM-Based Deep Learning Model for Early Detection of Breast Cancer. In: Bhateja, V., Khin Wee, L., Lin, J.CW., Satapathy, S.C., Rajesh, T.M. (eds) Data Engineering and Intelligent Computing. Lecture Notes in Networks and Systems, vol 446. Springer, Singapore.

- **Shaila S.G.,** Prasanna, M.S.M., Shazia, Bhavya Shree, C., Arya, S., Deshpande, K.P. (July 2022). Polarity Classification of Sarcastic Sentence Patterns Based on N-Gram Technique for Twitter Dataset. In: Bhateja, V., Khin Wee, L., Lin, J.CW., Satapathy, S.C., Rajesh, T.M. (eds) Data Engineering and Intelligent Computing. Lecture Notes in Networks and Systems, vol 446. Springer, Singapore.

"Good Big Data teams will be very tolerant of failure".— Graham Oakes

FACULTY ACHIEVEMENTS

Prof. Shivamma D
Assistant Professor
Department of CSE (Data Science)

- Gained a certification on "Python for Data Science" awarded by IBM on 20th September, 2022

Prof. Monish L
Assistant Professor
Department of CSE
(Data Science)

- Monish L from Dayananda Sagar University has participated in the Train the trainer program on Full Stack Engineering held during June and July 2022 by Virtusa. He is the certified trainer for Full Stack Engineering

- Attended a Faculty Development Program on **"Implementation of Data Science Application using Python"** organised by E&ICT Academy, NIT Warangal and CMR Engineering college, Hyderabad on 11th – 21st July, 2022.

"Data fabric is the next middleware" - Todd Papaioannou

STUDENT ACHIEVEMENTS

Sheetal P

- **Sheetal P,** Khushi Periwal, Kashish Verma, Nainesh Dalai, Christina Rebello, and Pranam Gowda Won the **2nd Prize** in **Group dance** in the Samskruthi Fest organised by BMS College of Commerce & Management and BMS Evening College of Arts and Commerce, Bangalore on 8th July 2022, and **3rd prize** in inter college competition held at Sindhi College on 22nd July 2022.

Sukrutha G

Rudra Narayan Chetty

- **Sukrutha G and Rudra Narayan Chetty** 3rd prize in One day **Codeathon-C** organised by the Department of Computer Science and Engineering (Data Science) on 24th September 2022.

- **R D Lohith** and **Rudra Narayan Chetty** published a Research paper titled **"Gene Expression Analysis Using Particle Swarm Optimization and Machine Learning Algorithms for Diagnosing Liver Breast Cancer"** at ICESC 2022, Department of ECE, Hindusthan Institute of Technology, Coimbatore held between 17th - 19th August, 2022.

"The world is one Big Data problem" - Andrew McAfee

EDITORIAL COMMITTEE

Dr. Kakoli Bora
Associate Professor
Department of CSE
(Data Science)
SOE, DSU

Prof. Monish L
Assistant Professor
Department of CSE
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SOE, DSU

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"Data beats emotions." — Sean Rad

PROGRAMME OUTCOME (PO'S)

- **PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.

- **PO2. Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

- **PO3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

- **PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

- **PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

- **PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

- **PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

- **PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

- **PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

- **PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- **PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

- **PO12. Life-long learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

"One person's data is another person's noise." — K. C. Cole

PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

- **PEO1.** Possess confident professional engineering skills to build powerful AI models to generate actionable insights, necessary for making data-driven decisions

- **PEO2.** Apply the structured statistical and mathematical methodology to process massive amounts of data in to detect underlying patterns to make predictions under realistic constraints and to visualize the data.

- **PEO3.** Promote design, research, product implementation and services in the field of Data Science and Artificial Intelligence by using modern IT tools.

- **PEO4.** Learn and advance their careers by attaining professional certification and seeking higher education

PROGRAM SPECIFIC OUTCOMES (PSO'S)

- **PSO1.** Apply the knowledge of Mathematics, Science, Big Data Analytics and AI concepts to solve real world business problems under the guidelines of principles of computational intelligence.

- **PSO2.** Inculcate the principles of Data Analysis, Data Warehouse, Analytics, Data visualisation and develop predictive models.

Department of Computer Science and Engineering (Data Science)
Dayananda Sagar University
Innovation Campus, School of Engineering
Kudlu Gate, Hosur Road, Bengaluru - 560 068

"Data is the new science. Big Data holds the answers." – By Pat Gelsinger