

Swadha Gupta

Data Scientist, PhD

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Overview

Dr. Swadha Gupta is a highly skilled Data Scientist with over 7 years of experience in Python, and expertise in machine learning, deep learning, and AI-driven systems. She holds a PhD in Computer Science and Engineering from Thapar Institute of Engineering and Technology, India, and currently works at Shiratech Knowtion GmbH, Germany. In her role, she focuses on developing machine learning algorithms for optimizing electric vehicle (EV) charging using solar energy and building AI-powered real-time systems for motor performance monitoring. With strong proficiency in DevOps (Azure), SQL, C/C++, and embedded systems, Dr. Gupta seamlessly bridges data science with software engineering. Her research contributions in AI-driven cognitive analysis and engagement detection for e-learning have been widely recognized, resulting in multiple publications and over 250 citations. Dr. Gupta's blend of technical expertise and applied AI research makes her a leading figure in the integration of machine learning with real-world solutions.

Experience

2023– Present **Data Scientist**, *Shiratech Knowtion GmbH*, Germany

[1] EV Charging and Solar Energy Forecasting Algorithm

- **Project Scope:** Developed a forecasting algorithm to optimize electric vehicle charging using solar energy data from Silla Industries' EV chargers and net energy consumption.
- **Role and Responsibilities:**
 - Created a prototype to predict optimal charging times and power usage, integrating external weather data for solar output forecasting.
 - Analyzed EV charger data and net energy consumption to identify patterns for efficient and sustainable charging schedules.
 - Implemented the solution in Python, interfacing with a Grafana dashboard, and deployed the software on a Linux server.
 - Focused on maximizing solar energy utilization while ensuring the model adapts to changes in user behavior over time.
 - Collaborated with stakeholders to define key data sources, prediction horizons, and algorithm parameters.
 - Delivered the algorithm in a virtual machine environment for seamless deployment on Silla's infrastructure.
- **Technologies Used:** Python, time series analysis, solar energy forecasting, data integration, EV charger optimization, system deployment.

[2] CMFF PROJECT

- **Project Scope:** Development of a Condition Monitoring Flex Feedback (CMFF) system using STM32 microcontrollers to monitor and analyze motor performance through real-time sensor data acquisition, including speed, temperature, acceleration, and vibration.
- **Role and Responsibilities:**
 - Designed and implemented the FreeRTOS-based firmware, configuring the operating system for the microcontroller to manage multiple tasks and sensors efficiently.
 - Worked on reading data from multiple sensors, including a 3-axis accelerometer, winding and feedback temperature sensors, and motor speed sensors, via SPI and I2C communication protocols.
 - Implemented algorithms for calculating speed and angular acceleration using encoder signals and incremental data, ensuring real-time data processing.
 - Developed functionality for data storage in EEPROM and FRAM, creating histograms of speed, acceleration, and temperature for trend analysis and long-term monitoring.
 - Configured the USB CDC interface for real-time data transmission to external systems for visualization and further analysis.
 - Used Python to analyze the collected sensor data, applying fault detection algorithms and pattern recognition to identify potential failures in the system, such as abnormal vibrations, overheating, or acceleration spikes. This allowed for preemptive maintenance and system optimization.
 - Automated data parsing and generation of reports using Python for statistical summaries, helping clients visualize key performance indicators (KPIs) such as speed histograms, acceleration profiles, and temperature trends.
- **Technologies Used:**
 - C, C++, FreeRTOS, RS485 UART, SPI, I2C, EEPROM, FRAM, STM32 Microcontrollers, 3-axis accelerometer, PT1000 temperature sensor, incremental encoders.

[3] GearBox Vibration Data Analysis Project

- **Project Scope:** Analysis of vibration data from a gearbox under different operational stages, focusing on detecting harmonics, sidebands, and gear mesh frequencies.
- **Role and Responsibilities:**
 - Designed and implemented Python-based scripts to perform order tracking on vibration data.
 - Analysed gear mesh frequency, sidebands, and harmonics to detect potential mechanical issues such as misalignments or wear.
 - Processed large datasets data from multiple operational steps and identified critical mechanical signals.
 - Applied advanced signal processing techniques to filter and analyse data for accurate diagnostics of the gearbox's performance.
 - Automated the calculation of frequency and harmonics of gears over time, optimizing the extraction of mechanical insights from sensor data.
- **Technologies Used:**
 - Python (Pandas, NumPy), signal processing algorithms, data visualization.

[4] Predicto Project

- **Project Scope:** The project involves predictive analysis of various manufactured equipment by collecting sensor data over the cloud and providing real-time data analysis. The platform is designed to enhance decision-making based on equipment performance and maintenance needs.
- **Role and Responsibilities:**
 - Developed and customized interactive dashboards tailored for different clients, integrating real-time data from cloud-based sensors.
 - Conducted data analysis on the Predicto dashboard interface to identify equipment performance trends and forecast maintenance needs.
 - Collaborated with data engineers and software teams to ensure seamless data collection, processing, and visualization within the user interface.
 - Provided insights and recommendations for enhancing predictive models based on sensor data patterns.

2018–2023 **Doctor of Philosophy**, *Computer Science Engineering and Technology*, Thapar Institute of Engineering and Technology, India

* **PROJECT ENTITLED: COGNITIVE ANALYSIS BASED SMART LEARNING SYSTEM FOR ONLINE EDUCATION**

- **Project Scope:** The project focuses on developing an AI-driven smart learning platform that analyzes cognitive patterns of students to personalize the online education experience. The system leverages machine learning algorithms to adapt content delivery based on student performance, engagement, and learning behaviors.
- **Role and Responsibilities:**
 - Led the development of machine learning models to perform cognitive analysis and personalize learning pathways for students.
 - Implemented data-driven insights from student interactions to enhance course recommendations and optimize content delivery.
 - Integrated real-time feedback loops to assess student progress and dynamically adjust difficulty levels of learning modules.
 - Worked closely with educational content creators to ensure alignment between AI-driven recommendations and course objectives.
 - Developed dashboards to visualize student learning patterns and provide educators with actionable insights for improving teaching strategies.

2016–2018 **Artificial Intelligence Researcher and Educator, MIET, India**

[1] **DESIGN AND DEVELOPMENT OF ALGORITHM FOR AUTOMATIC SPELLING CORRECTION USING SMC**

- **Project Scope:** The project focuses on developing an algorithm for the automatic identification and correction of spelling mistakes (semantic errors) in English writing using Natural Language Processing (NLP) and machine learning techniques. The primary aim is to enhance communication by automatically detecting and correcting errors in real-time.
- **Role and Responsibilities:**
 - Designed and implemented a spelling correction algorithm based on trigram and Bayes methods for real-word error correction.
 - Utilized both supervised and unsupervised learning techniques to optimize the accuracy of spelling corrections.
 - Conducted experiments to modify the algorithm for performing multiple corrections per sentence, improving overall system efficiency.
 - Integrated the algorithm into text-processing applications to ensure seamless and accurate spelling correction for end-users.
 - Analyzed the algorithm's performance on large datasets, continuously refining the model for better accuracy and reduced false positives.

[2] **IMPLEMENTATION OF SECURE MESSAGE AGENT**

- **Project Scope:** The project aims to bridge the gap between personal computers and mobile messaging devices by enabling users to securely access and manage their PC data through messaging applications. The solution is based on Wireless Application Protocol (WAP) and ensures seamless operation across multiple devices.
- **Role and Responsibilities:**
 - Developed a secure message agent that allows users to retrieve and manage PC data via mobile messaging devices.
 - Ensured compatibility with a variety of messaging devices, considering power supply, network support, and device limitations.
 - Implemented secure data transfer protocols using WAP to protect sensitive user data while maintaining efficient communication between devices.
 - Tested and optimized the application across targeted devices to ensure smooth operation under varying network conditions.
 - Collaborated with stakeholders to ensure the application met security and functionality requirements for real-world use.

[3] **DESIGN AND DEVELOPMENT OF ALGORITHM FOR AUTOMATIC SPELLING CORRECTION USING SMC**

- **Project Scope:** The project focuses on developing an algorithm aimed at identifying and correcting spelling mistakes, particularly semantic errors, in the English language. It employs Natural Language Processing (NLP) techniques and machine learning to enhance written communication by detecting and rectifying real-word errors automatically.
- **Role and Responsibilities:**
 - Designed and developed an automatic spelling correction algorithm leveraging trigram models and Bayes methods for real-word error detection.
 - Implemented both supervised and unsupervised learning strategies to train the algorithm, improving its ability to accurately identify and correct spelling mistakes.
 - Enhanced the algorithm's capabilities to perform multiple corrections per sentence, ensuring more robust error detection.
 - Conducted rigorous testing and validation of the algorithm to ensure high accuracy across diverse text samples.
 - Integrated the solution into text-based applications, providing users with real-time spelling and semantic correction functionality.

Education

- 2018–2023 **PhD**, *Thapar Institute of Engineering and Technology*, Computer Science and Engineering, India
 2013–2015 **Master of Engineering**, *Chandigarh University*, Computer Science and Engineering, India
 2009–2013 **Bachelor of Technology**, *Shri Mata Devi University*, Computer Science and Engineering, India

Technical Skills

- [1] C/C++ language
- [2] Python language
- [3] Jira Software
- [4] Agile methodologies
- [5] Docker
- [6] kanban board, Azure DevOPs
- [7] Git Lab, Git
- [8] Embedded Artificial intelligence
- [9] Tensorflow, numpy libraries, pandas, scikit learn, pytorch
- [10] CNN models such as VGG16, VGG19

Research Interest

- [1] Machine Learning
- [2] Deep Learning
- [3] Statistical Analysis

Publications

International Journals

- [J1] S.Gupta, P. Kumar, R. Tekchandani, "Artificial intelligence based cognitive state prediction in an e-learning environment using multimodal data", *Multimedia Tool and Applications*, 2024.
- [J2] S.Gupta, P. Kumar, R. Tekchandani, "A multimodal facial cues based engagement detection system in e-learning context using deep learning approach", *Multimedia Tool and Applications*, 2023.
- [J3] S.Gupta, P. Kumar, R. Tekchandani, "Facial emotion recognition based real-time learner engagement detection system in online learning context using deep learning models", *Multimedia Tool and Applications*, 2022.
- [J4] S.Gupta, P. Kumar, R. Tekchandani, "Facial cues and EEG signal-based system for effective e-learning using artificial intelligence", *SPIE, Journal electronic imaging*, 2022.
- [J5] S Gupta, S. Sharma, "Scaling of agile software development in industry", *International Journal of Engineering Science and Technology*, 2014

- [J6] S Chauhan, M Mittal, M Woźniak, S Gupta, R Pérez de Prado, “A technology acceptance model-based analytics for online mobile games using machine learning techniques”, *Symmetry*, MDPI, 2021.

International Conferences

- [C1] S Gupta, P Kumar, “Attention recognition system in online learning platform using eeg signals”, *IEEE Emerging Technologies for Smart Cities (EGTET)*, India, 2020.
- [C2] S Gupta, D Gouttam, “Towards changing the paradigm of software development in software industries: An emergence of agile software development”, *IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM)*, India, 2017.
- [C3] S Gupta, S. Sharma, “A spelling mistake correction (smc) model for resolving real-word error”, *Computational Intelligence in Data Mining*, India, 2016.

Achievements

- Secured 1st University position in M.E (University Topper) with 9.0 CGPA
- Volunteered in the Zonal NASA 2010, conducted at Shri Mata Vaishno Devi University
- Have a number of certification of honor in cricket, badminton and painting at school and college level
- Have a number of certification of honor in symposium and debate at school and state level
- Have participated in scouts and guides

Personal Information

Father's name – Rajinder Gupta

Date of Birth – 15, September 1991

Marital Status - Married.

Languages Known - English, Hindi

Nationality – Indian.

VISA- Holding EU Blue Card visa in Germany.

Google Scholar link- <https://scholar.google.co.in/citations?user=l3MYAKUAAAAJ&hl>