

AKSHAT SOOD

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Forever a Student of Life

Publication

A Computationally-Efficient and QoS-Aware Data Offloading Framework for Biased Fog Networks

IEEE Transactions on Circuits and Systems II: Express Briefs

Abstract: Fog computing addresses the limitations of cloud-centric models in the Internet of Things. However, the dynamic nature of fog computing introduces a significant challenge: the uneven distribution of workload among fog nodes, which affects both data latency and network efficiency. To address this bottleneck, data packet offloading offers dual benefits: the fog node performing the offloading reduces latency, while the receiving fog node benefits financially by leasing its available processing resources. Inspired by these advantages, we propose a novel load-balancing approach designed to maximize financial gains without compromising Quality-of-Service (QoS) constraints for IoT users in a biased fog network. Our approach introduces an Optimized Matching Theory (OMAT)-based data offloading framework that leverages many-to-many matching without externalities. This method results in a novel matching among diverse fog nodes, achieving a uniform workload distribution.

Work Experience

MathWorks (Bangalore) | *Associate Engineer in Engineering Development Group*

Jul 2023 – Present

- Enhanced the Simulink Mask popup option by enabling parameter tuning during runtime and code generation phases. Investigated support for string as member values and optimized their serialization within the model (SLX) file.
- Advanced Simulink model development by implementing and deploying two in-canvas checks, ensuring strict adherence to industrial modeling guidelines established by the Japan MBD Automotive Advisory Board (JMAAB).
- Conducted a comprehensive analysis by evaluating over 100 MonkeyProof guidelines to assess the feasibility of incorporating these style directives into code written within the MATLAB Function Block and the MATLAB Editor.
- Designed and implemented a sophisticated architecture that links workspace variables with four types of mask parameters, resulting in a 20% increase in user efficiency and optimizing workflows for model building.

MathWorks (Bangalore) | *Intern in Engineering Development Group*

May 2022 – Jul 2022

- Piloted the migration of the existing codebase to a new pcode generation model, streamlining code obfuscation process by reducing the number of required files by 35% and integrating the latest build harness into the codebase.
- Collaborated with a team of developers to refactor over 60 components, resulting in a 50% reduction in the build time.
- Demonstrated ownership by designing and implementing a comprehensive Bash script to automate the component refactoring process, ensuring coherence and effective component builds across global development teams.

Education

Indian Institute of Technology (BHU) Varanasi

B.Tech in Electronics Engineering

Jul 2019 – May 2023

Cumulative Performance Index (CPI): 9.43

Projects

gRPC based API Rate Limiter | *Golang, gRPC, Redis, Protobuf, Helm Charts, Docker, Clean Architecture*

Github

- Designed a gRPC-based API traffic management solution with rate-limiting algorithms, including Fixed Window and Rolling Window, to ensure optimal resource allocation. Integrated the solution with Redis and PostgreSQL databases.
- Promoted long-term sustainability and maintainability of the code by adhering to principles of Clean Architecture.
- Deployed the application on Kubernetes using Helm Charts to facilitate scaling and manage client rate limits.

Expressio - Facial Expression Recognizer | *React, Tailwind CSS, Tensorflow (Keras), Firebase, Flask*

Github

- Developed a web application using React and styled it with Tailwind CSS. The application accurately predicts four basic human emotions—Happy, Sad, Angry, and Surprise—and displays the model's predictions on a pie chart.
- Implemented Flask for backend operations and utilized Firebase for blob storage, ensuring efficient data management.
- Performed a comprehensive analysis of the FER-2013 dataset and trained a (DCNN) Deep Convolutional Neural Network using Keras. This training achieved an accuracy of 85.51% on the training set and 83.73% on the validation set.

To Do App Micro-service | *Python, FastAPI, Go, Typescript, gRPC, Docker, Kubernetes, PostgreSQL*

Github

- Developed a to-do application using a microservices architecture, leveraging gRPC for scalable service orchestration.
- Implemented authentication and authorization features with FastAPI to ensure secure user interactions.
- Enhanced data retrieval and storage by integrating PostgreSQL and MongoDB databases with the application.

Avishkaar - Student Data Management System | Python, MySQL, Tkinter, mysql-python-connectorGithub

- Built a robust student data management system featuring a Tkinter-powered user interface and MySQL database.
- Established client-server (Python ↔ MySQL) communication leveraging the mysql-python-connector package.

DES Algorithm | MATLAB, DES Algorithm, Cryptography Encryption Techniques, Mathematical ModellingGithub

- Implemented a simplified version of the DES (Data Encryption Standard) algorithm tailored for educational purposes.
- Developed a comprehensive MATLAB script designed to implement an 8-bit encryption scheme. This script processes an 8-bit plain text message in conjunction with an 8-bit initial key, performing a series of cryptography operations.
- Engineered a robust encryption process featuring four rounds of cryptographic operations, utilizing permutations, XOR operations, compression, expansion, and substitutions to effectively obfuscate the plain-text input message.

Two Stage Miller Compensated Op-Amp | Simulink, Simscape Electrical, Analog Circuit DesignGithub

- Designed a two-stage Miller-compensated operational amplifier circuit optimized for driving capacitive loads.
- Developed and simulated the circuit using LTSpice, achieving the following design specifications:

Gain	Power Dissipated	Gain-Bandwidth	Slew Rate
120 dB	8 mW	50 MHz	1 V/s

Vision 2.0 | Python, OpenCV, Image Segmentation, PyBullet URDFs, Aruco Markers, Breadth First SearchGithub

- Conducted simulations using PyBullet to model a URDF-based robot car operating within a pre-configured arena.
- Applied image segmentation techniques to accurately extract distinct shapes and objects from the arena.
- Implemented the Breadth-First Search (BFS) algorithm to systematically explore all possible pathways. This approach ensured the selection of the shortest route for traversal by the robot car during each simulation iteration.

Baxter - Simultaneous Multi-tasking | Python, PyBullet, OpenAI Gym, Reinforcement LearningGithub

- Created a gym environment addressing the intricate challenge of simultaneous operations in the field of Robotics.
- Deployed Baxter, an industrial humanoid robot developed by Rethink Robotics, for testing concurrent actions.
- Leveraged the Soft Actor-Critic Algorithm to facilitate robot learning, in conjunction with the application of Bezier Curves to formulate the trajectory of the robot’s hands to perform the required set of simultaneous actions.

Technical Skills

Tools and Frameworks: React, MongoDB, Express, Node, Vue, MySQL, Tensorflow, Docker, PyTorch, Git, Kubernetes
Languages: CPP, Javascript, Python, Java (Basic), Go, HTML, CSS, Typescript (Basic), MATLAB, Bash, SQL

Courses

- | | | | |
|-----------------------------|----------------------|-------------------------|-----------------------|
| • Digital Signal Processing | • Basic VLSI Design | • Computer Programming | • Solid State Devices |
| • Wireless Communication | • Internet of Things | • Analog Communications | • Signals and System |

Extracurriculars

- Secured the Theme Prize in the Wild Hacks II hackathon, organized by Major League Hacking (MLH), for engineering Wild Ones, an initiative for ensuring intelligent fauna exploration, harnessing the power of tech in natural habitats.
- Bagged first prize in Cassandra where I played a pivotal role in the development of a high-precision machine learning model designed to predict loan defaulters. My responsibilities included conducting thorough analysis of historical customer payment data and applying advanced feature aggregation techniques to uncover patterns within the dataset.
- Served as the Co-Coordinator for Pixelate, a nationwide Computer Vision event hosted under the banner of Technex. Offered mentorship to multiple teams and played a pivotal role in formulating the Problem Statement.
- Served as a Core Team Member for iMaze, where I had the privilege of mentoring five teams, guiding them through intricate challenges of the competition. Beyond mentoring, my responsibilities encompassed significant contributions to the event’s foundational elements including the development of a simulation environment on a physics engine.
- Awarded First Prize in the Snakes and Hackers II hackathon, organized by Major League Hacking (MLH), for building Akio’s Conquest, an immersive application that promises a competitive gaming experience for the visitors.
- Coordinated Cassandra, and conducted workshops on Python, Data Analysis and Processing, Feature Engineering Model Building and Generative Adversarial Networks. Secured ChiSquareX as event sponsor for formulating problem statement and hosted a Kaggle competition that saw remarkable participation from 55 teams within the institute.