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WORK EXPERIENCE

10/07/2023 – CURRENT Douliu, Taiwan

UNIVERSITY RESEARCH ASSISTANT FUTURE TECHNOLOGY RESEARCH CENTER, NATIONAL YUNLIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

Mentor: Dr. Naveed Ishtiaq Chaudhary

• Implementation of a novel variable fractional order Adam and Stochastic Gradient Descent in PyTorch, focusing on its potential application in Recommender Systems Problems.

• Participating in the development of an Unsupervised Artificial Neural Network (UANN) based on Modified Bessel Polynomial and Veita-Lucas Wavelet, intended for solving Fractional Differential Equations.

• Exploring applications of the developing UANN to diverse problem areas, including Singular Decay Ricatti Equations, Financial Models, and Mathematical Models of Parkinson's Disease.

• Successfully submitted the manuscript TII-23-3491 titled, *"Characterizing Neural Collaborative Filtering with Generalized Fractional Stochastic Gradient Descent Algorithm*" to IEEE transactions on Industrial Informatics.

• Presently engaged in the development and implementation of Item-based Autoencoders for Recommender Systems, with a focus on leveraging Generalized Fractional Stochastic Gradient Descent (GF-SGD) optimization technique to enhance recommendation algorithms (ratings' prediction).

• Striving to harness the potential of fractional calculus-based optimization techniques in Convolutional Neural Networks (CNNs) for the purpose of advancing medical imaging analysis.

15/08/2022 – CURRENT Islamabad, Pakistan

RESEARCH INTERN - RESEARCH MEMBER PREDICTIVE INTELLIGENCE AND SYSTEM MODELLING, INTERNATIONAL ISLAMIC UNIVERSITY

Research Lead: Dr. Zeshan Aslam Khan

• Joined the Predictive Intelligence and System Modelling group as an intern, specializing in the application of machine learning techniques to address complex big data challenges.

• Collaborated with the PRISM group to successfully submit an industrial project titled "Embedded Intelligence Based Portable Uroflowmetry Device" through an industrial partnership with the National Radio and Telecommunication Corporation (NRTC) in Haripur, Pakistan.

•As a research member of the PRISM team, conducted thorough research and rigorous testing on various Recommender Systems methodologies, such as Probabilistic Matrix Factorization, Neural Collaboration Filtering, and Autoencoders-based systems. This experience provided a comprehensive understanding of their applications and limitations.

• Played a crucial role in enhancing fractional stochastic gradient descent, thereby improving its capability to handle intricate data patterns effectively.

• Engaged in the initial stages of research for the paper titled "Novel Elastic Net Regularized Fractional Adaptive Strategy for Chaotic Users' Rating Patterns," which allowed for the development of a strong comprehension of the research and publication processes.

06/03/2022 – 25/05/2023 Islamabad, Pakistan

RESEARCH AND PROJECT TEAM MEMBER TUKL-NUST DEEP LEARNING LAB, NATIONAL CENTRE OF ARTIFICIAL INTELLIGENCE

Advisor: Dr. Faisal Shafait Co-Advisor: Dr. Adnan ul-Hasan

• Collaborated with Technische Universit¨at Kaiserslautern, Germany in the successful development of "*PCL-FPGA*", an innovative high-level synthesis (HLS) framework for the deployment of 3D point cloud deep learning models on Xilinx FPGAs, under the final year project titled,"*3D Point Clouds on Embedded Platforms*".
• Initiated the project with a meticulous literature review on FINN, BNN, and the state-of-the-art model 3D point cloud classfication model called "PointMLP", setting a robust foundation for the project.

• Successfully enhanced the latency and throughput of the state-of-the-art model, leveraging FPGA as an accelerator via our developed framework, thereby contributing to the advancement of deep learning model deployment.

• Authored a commendable final thesis, illustrating intricate project details and outcomes, and skillfully communicated these insights to a diverse audience of faculty, students, researchers, and professionals during various exhibitions and open house events.

• Delivering a conference paper for DATE 2024, highlighting the significance of our work.

EDUCATION AND TRAINING

12/02/2024 – CURRENT Douliu, Taiwan

MASTERS IN COMPUTER SCIENCE AND INFORMATION ENGINEERING CSIE, National Yunlin University of Science and Technology

Website https://www.csie.yuntech.edu.tw/

02/09/2019 – 15/06/2023 Islamabad,, Pakistan

BACHELOR IN ELECTRICAL ENGINEERING National University of Sciences and Technology

Website https://seecs.nust.edu.pk/ |

Field of study Electrical Engineering (Embedded Systems and Artificial Intelligence) | **Final grade** 3.52 |

Thesis 3D Point Clouds on Embedded Platforms

PUBLICATIONS

Design of elastic net regularized generalized fractional gradient strategy for recommendation systems

Experts System with Applications (Under-Review)

Characterizing Neural Collaborative Filtering with Generalized Fractional Stochastic Gradient Descent Algorithm

IEEE Transactions on Industrial Informatics (Under-Review)

Generalized Fractional Optimization-based Explainable Lightweight CNN Model for Malaria Disease Classification

Computers in Biology and Medicine (Under-Review)

Intelligent heuristic computing paradigm: A novel strategy to singular differential difference equations analysis

Published in Issue 1,Volume 6,Year 2024

Journal of Innovative Technology

Investigating Differential Difference Equations: An In-Depth Review

Published in Issue 1,Volume 6,Year 2024

Journal of Innovative Technology

Stochastic-Deterministic Modeling of Immune Responses and Tumor Evolution under Therapeutic Influence: Intelligent Predictive Supervised eXogenous Networks

Manuscript ID: TCBB-2023-09-0582. Dated: 11/09/2023

IEEE/ACM Transactions on Computational Biology and Bioinformatics. (Under-Review)

Design of hemorrhagic dengue fever model with passive immunity: treatise on time delay exogenous neuro-structure

Manuscript ID: EAAI-23-9186 Dated: 26/10/2023

Engineering Applications of Artificial Intelligence (Submitted)

Supervised autoregressive eXogenous Networks with Fractional Grünwald–Letnikov finite differences: Tumor Evolution and Immune Responses under Therapeutic Influence fractals model

Manuscript ID: CIBM-D-23-11863. Dated: 19/11/2023

Computers in Biology and Medicine (Under-Review)

LANGUAGE SKILLS

Other language(s):

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken production	Spoken interaction	
ENGLISH	C1	C2	C1	C1	C1

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

PROJECTS

3D Point Clouds on Embedded Platforms

Led a collaborative effort with Technische Universität Kaiserslautern, Germany, to develop 'PCL-FPGA,' an innovative high-level synthesis (HLS) framework for Xilinx FPGA. The project, titled '3D Point Clouds on Embedded Platforms,' began with an in-depth literature review on FINN, BNN, and the cutting-edge 'PointMLP' 3D point cloud classification model, laying a strong foundation. By optimizing latency and throughput through FPGA acceleration using our framework, we significantly advanced deep learning model deployment. This work culminated in an exemplary final thesis and a conference paper for DATE 2024, where we highlighted the project's significance.
Git Links: *https://github.com/aspaul20/pointMLP-fpga*
https://github.com/aspaul20/syn

Characterizing Neural Collaborative Filtering using Generalized Fractional Stochastic Gradient Descent

Characterized the performance of a Neural Collaborative Filtering model in recommendation systems by employing Generalized Fractional Stochastic Gradient Descent (GF-SGD). Through this innovative approach, I successfully enhanced the efficiency and effectiveness of the model, demonstrating the potential of GF-SGD in optimizing deep learning techniques for recommendation systems.

User and Item based Autoencoders for Collaborative Filtering using GF-SGD

Implemented User and Item based Autoencoders for Collaborative Filtering and leveraged Generalized Fractional Stochastic Gradient Descent (GF-SGD) to optimize the recommendation system. By employing a streamlined single-layer encoder-decoder architecture, I achieved notable improvements in Root Mean Square Error (RMSE) for rating predictions. Additionally, I employed advanced normalization techniques to further enhance RMSE, resulting in a more efficient and accurate collaborative filtering system.
ML-1M RMSE:0.8294. *Research Article in Progress.*

Stochastic Optimization of Plain Convolutional Neural Networks on MNIST

Achieved State-of-the-art on MNIST dataset: 99.67% accuracy.
https://github.com/junaidaliop/MNIST-SOPCNN

Unsupervised Artificial Neural Network (UANN) based on Modified Bessel Polynomial and Veita-Lucas Wavelet

Development of an Unsupervised Artificial Neural Network (UANN) based on Modified Bessel Polynomial and Veita-Lucas Wavelet, intended for solving ordinary as well as fractional Differential Equations. Exploring applications of the developing UANN to diverse problem areas, including Singular Decay Ricatti Equations, Financial Models, and Mathematical Models of Parkinson's Disease.

Fractional Calculus based Optimizers in PyTorch

Developed custom fractional calculus-based optimizers in PyTorch, including a generalized fractional stochastic gradient descent and an innovative fractional derivative variant of the Adam optimizer. These optimizers leverage fractional derivatives, departing from the conventional integer-order derivatives, to enhance the training and convergence properties of deep neural networks. This project demonstrates a novel approach to optimization within the PyTorch framework, offering potential improvements in the efficiency and robustness of machine learning models.

Complexion Bias in Different Search Engines

Procured and meticulously preprocessed a dataset of 20,000 images representing 10 different nationalities from three distinct search engines, exhibiting strong data acquisition and preprocessing skills. Through extensive analysis, found that these search engines did not exhibit bias based on the complexion corresponding to nationality, contributing to the ongoing dialogue about bias in technology. Successfully developed a robust complexion classifier utilizing the Resnet50 model, demonstrating a deep understanding of convolutional neural networks and their application in image classification.

Sentiments Analysis on Social Media Data

Applied NLTK library to preprocess the Sentiment140 dataset, and leveraged NLP and neural networking concepts for the classification problem, showcasing proficiency in data manipulation and model implementa tion. Utilized BERT-transferred learning to accurately classify tweets, demonstrating a strong understanding of advanced machine learning techniques.

Brain Tumor Detection

Leveraged transferred learning on ResNet50 model to train our model effectively, classifying brain tumors into several types or no tumor, contributing to the advancement of medical diagnostics.

Recommender Systems (Matrix Factorization) on Various Datasets

Implemented several types of matrix factorization (Probabilistic Matrix Factorization, BiasMF, TemporalMF) on FilmTrust, MovieLens100k, and MovieLens1M datasets, exhibiting a thorough under standing of various recommendation system models and their real-world applications.

Manga Recommendation System

Leveraged STL, advanced OOP concepts and file handling to implement a user-driven interface that recom mends manga based on specific inputs in C++.

Online Exam Invigilator using openCV and YOLOv2

Developed an online exam invigilation system using openCV and YOLOv2 to monitor and detect any unfair means during an examination.

Facial Recognition using Eigenfaces

Used MATLAB and the Eigenfaces method for implementing a robust facial recognition system.

Mathematical Modeling of a 3D Mechanical System

Designed a mathematical model of a 3D mechanical system in MATLAB, demonstrating a deep understanding of engineering mechanics.

Density Based Traffic System using ATMega8 Controller

Developed a density-based traffic system using the ATMega8 Controller, programmed in Embedded C and simulated using Proteus.

CONFERENCES AND SEMINARS

20/07/2023 AI Center, Yuan Ze University, Taiwan
ARTIFICIAL INTELLIGENCE: CURRENT TRENDS AND FUTURE PROSPECTS

Participation in the seminar titled, "ARTIFICIAL INTELLIGENCE: CURRENT TRENDS AND FUTURE PROSPECTS" at the AI Center of Yuan Ze University organized by the Yuan Ze University, Taoyuan City, Taiwan on July 20, 2023.

18/07/2023 Graduate School of Intelligent Data Science, National Yunlin University of Science and Technology
Machine Learning and Artificial Intelligence

Participation as a *speaker* in the seminar titled "*Machine Learning and Artificial Intelligence*" at the Graduate School of Intelligent Data Science, National Yunlin University of Science and Technology on July 18, 2023. His topic of presentation was "*3D Point Clouds on Embedded Platforms*"

ONLINE COURSES AND CERTIFICATIONS

Programming for Everybody (Getting Started with Python)

An online non-credit course authorized by University of Michigan and offered through Coursera

Neural Networks and Deep Learning

An online non-credit course authorized by deeplearning.ai and offered through Coursera

Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization

An online non-credit course authorized by deeplearning.ai and offered through Coursera

Structuring Machine Learning Projects

An online non-credit course authorized by deeplearning.ai and offered through Coursera

Python for Data Science and Machine Learning Bootcamp

Taught by Jose Portilla on Udemy.

CURRENT
Recommender Systems and Deep Learning in Python

Taught by The Lazy Programmer on Udemy.

CURRENT
The Complete SQL Bootcamp: Go from Zero to Hero

Taught by Jose Portilla on Udemy.

CURRENT

The Complete Data Structures and Algorithms Course in Python

Taught by Elshad Karimov on Udemy.