Sagar Jha

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Last Updated: May 2023

Education

- **Thapar Institute of Engineering and Technology, Patiala** CGPA: 9.73
  Bachelor of Engineering - Computer Science and Engineering *July 2020 - June 2023*
  Courses: *Computer Vision, Reinforcement Learning and Conversational AI, Machine Learning, Edge AI & Robotics (NVIDIA), Operating Systems, Data Structures, Artificial Intelligence, Networks, Databases, Quantum Computing, Theory of Computation.*

- **Indo-Swiss Training Centre, CSIR-CSIO, Chandigarh** ***(a national lab for research)*** Gold Medal
  Advanced Diploma - Mechatronics and Industrial Automation *Aug 2012 - July 2016*
  Courses: *Network & Circuits, Electronics, Transducers & Signal Conditioning, Embedded Systems, Digital Circuits, Control Engineering, Instrument Science, Electronic Devices & Circuits*

Professional Experience

- **JPMorgan Chase & Co.** Bangalore, India
  Software Engineer (Technology Stack: Python, Q, kdb+) *Jan 2023 - Present*
  - Developed strategic analytic layer integrating KDB for surveillance **analytics**, facilitation of strategy generation, management reporting, and back-testing. Also, analyze data generated from both pre & post trades.
  - Working on the application that is a data repository of derived datasets. The app subscribes to raw data, such as market data or trade data, and processes this data **to provide a real-time view** of the actual running trades information that users care about. It simplifies fetching/streaming derived data that clients are interested in.
  - Developed **KDB-based scripts** for providing data checks among the application architecture and deploying new KDB+ application migrations to **AWS Cloud**.

- **FANUC India Pvt. Ltd** Gurgaon, India
  Engineer, Turnkey Solutions, Robots PROJECTS *Aug 2016 - July 2020*
  - Responsible for Logic Development, Robot Teaching and Cycle-time prove out for the projects. Developed **Vision Based** (product identification and location) systems for identification of objects in real time and implement decisions.
  - Installed Robots across **Industry segments** from Inspection, Clean Room, Palletizing, Extraction, Packaging & Labelling, Foundry, Automotive, Food & Beverage and many more.
  - **Complex work areas** were Visual Tracking - *picking objects on the fly*, Bin-Picking, Vision with Forged components, Synchronous Robot-Link - *multiple robots in Master-slave configuration & doing motion based on single 3D-data.*
  - Worked on more than 25 major projects in the entire India. **Major Works**: 2D-iRVision, 3D-Vision, COBOT, Ladling, LUL. Among few members in entire team in India to be trained on **Paint & Foundry Robots.**

Research Experience

- **MITACS Globalink Research Internship - Mount Royal University** Calgary, Canada
  Research Intern — Mentor: Prof. Yasaman Amannejad *June 2022 - Aug 2022*
  - Working on **Distributed Machine Learning** approaches (Federated and Split Learning). **Split learning** is a new technique developed at the **MIT Media Lab's Camera Culture group** that allows for participating entities to train machine learning models **without sharing any raw data**.
  - **SplitFed Approach:** Federated learning (FL) and split learning (SL) are two popular distributed machine learning approaches. Developed a novel distributed architecture for SplitFed Learning (SFL) using both the benefits of Split and Federated learning. It is faster than SL by performing parallel processing across clients.
  - **Threading and MPI:** Developed an implementation of Split Learning using Multi-threading; also used mpi4py to develop a distributed version of split learning to train the neural network using heterogeneous devices in distributed fashion without sharing raw data.
  - **Server-Client:** Developed a way to implement the same on server-client scenario using zeroMQ, where the server is hosted on **GCP** and client from anywhere can connect and train a split learning model without sharing any raw data.
  - **Experiments:** Tested on different Homogeneous and Heterogeneous hardware such as an EDGE device (Pi and Jetson) - ranging from a small end GPU device to the big high end servers.
  - **Configurations:** Implemented different configurations of Split learning such as **without label sharing** and **vertically partitioned data.**

- **Visual Information Processing and Learning Lab (VIPL) - UCAS** Remote
  Research Intern — Mentor: Dr. Abhijit Das *Sep 2021 - Dec 2022*
  - Developed JTCNet a **Joint transformer and CNN-based architecture** for predicting HR & Blood volume pulse (BVP) signals based on facial videos.
  - Uses Vision Transformer which decomposes the video into small patches and seperately applies temporal and spatial attention.
  - This approach uses both the benefits of CNN and Transformer to extract features and uses it to predict Heart rate.
  - In particular, the proposed method is a hybrid of Transformer and Convolutional Network (JTCNet), where convolution is expected to capture local facial details and Transformer is expected to capture long-range spatial correlations. Therefore, the learned features can complement each other well.

- **Thapar Institute of Engineering and Technology - TIET** Patiala, India
  Research Student — Mentor: Dr. Joohi Chauhan and Dr. Jatin Bedi *Jan 2022 - Dec 2022*
  - Developed a faster inference framework, **XAMINE: X-ray Multi-class Inspection using Neural Networks** for detecting prohibited items from x-ray images. The project can be implemented as a tool at different security checkpoints. Used various architectures such as SSD and YOLO-v3, v4, v5, v7 with different backbones.
  - Developed a pipeline to segregate the positive and negative samples at the very first level of checking. Images having prohibited items are then further passed to the object detection portion to finally locate the correct location of unwanted objects.
  - As a result, we developed a GUI and finally used SSD-Mobilenet in the backend to predict the prohibited items in the images due to a **higher inference rate** and considerable **mAP of above 90%**.
- **Tech-in-Farm - IIT Kharagpur** Remote
  Computer Vision Intern (Volunteer Work) *Nov 2021 - Feb 2022*
  - Implementing CV approaches to detect crops, intruder entry into fields on a live feed from a Quadcopter.
  - Implementing deep learning algorithms such as **YOLO-v5**, v4 and SSD. Also implemented transfer learning using MobileNet & VGG16 models. Created a extensive database on different crops in India.
  - Developed dataset on different local crops available and trained the models on them. Used object detection algorithms to detect the crops available in the farm.
  - Also trained a separate model for detecting disease in plants, pests and poor nutrition of farms.

Publications

- S. Kansal, **S. Jha**, P.Samal. "DL-DARE: Deep Learning-based Different Activity Recognition for the Human-Robot Interaction Environment". ***NEURAL COMPUTING AND APPLICATIONS.*** NCAA-D-22-03054
- P. Samal, **S. Jha**, R. K. Goyal. "CPU Burst-Time Prediction using Machine Learning". ***IEEE Delhi Section International Conference on Electrical, Electronics and Computer Engineering (DELCON-2022)***. Link

Papers under review

- A. Das, **S. Jha**, P.Samal, H. Lu, H. Han, A. Dantcheva. "JTCNet: Joint Transformer and CNN Network for Remote Heart Rate Estimation". ***IEEE TRANSACTIONS ON BIOMETRICS, BEHAVIOR, AND IDENTITY SCIENCE.***
- P. Kaushik, S. Dhiman, **S. Jha**, P.Samal. "XaMINe: X-ray Multiclass Detection of Prohibited Items using Neural Networks". ***EXPERT SYSTEMS WITH APPLICATIONS.*** ESWA-D-23-01068

Projects

- **Content Auto-Backup (Python, Google Drive API)**: Github
  - Python program developed using Google Drive API for automatically backup contents from a **local system to cloud** on a triggered or interval basis. Using the tool myself on a regular basis for small files.
  - **Automatic authentication** to the cloud is made as soon as the device is turned on or tries to make a backup. It caters to all types of files and directories.
  - **Maintains the directory structure** similar from where the data is getting backed up. Only backups those files that are new or have some modifications present, **does not make redundant data** while backing up.
  - Also **maintains a detailed log** for every changes/modification done in the backup. Backups are done at a certain interval or when the machine tries to turn off. The advantage of the project is that it works like a **fail-safe mechanism** even though we have version control software.
- **DL Optimization and Deployment (TensorRT, Triton Server, Deepstream, Pytorch, Tensorflow)**:
  - **Optimization:** Implemented methods - **Layer & Tensor Fusion**, **Precision Calibration** and **Kernel Auto Tuning** to convert a trained neural network to an optimized one. Executed the optimized version on hardware and different types of domains such as pose-estimation, redaction, segmentation and many more. Performed real-time inference and fine tuned to different **quantization** approaches.
  - **Deployment:** Implemented the optimized weights on **Triton** Inference Server and also on **Deepstream** for better video inferencing. Checked video outputs on different Real Time Streaming Protocols **(RTSP)**.

Skills Summary

- **Languages**: Python, C++, Matlab, Q
- **Frameworks**: Pytorch, Scikit, TensorFlow, Keras, Django, NodeJS, mpi4py, kdb+
- **Tools**: TensorRT, PostgreSQL, MySQL, SQLite, Pandas, Numpy, zeroMQ

Achievements

- Received a funded research offer for 6 month intern at **INRIA** *(French National Institute for Research in Computer Science and Automation)*, Sophia Antipolis, France.
- Selected in the prestigious **MITACS Globalink Research Internship 2022** at *Mount Royal University, Canada.*
- Awarded **TIET Merit Scholarship 2021 & 2022** with **full tution-fee waiver** based on academic performance.
- Awarded **Director's Gold Medal** in *Advanced Diploma* from renowned research labs in India (CSIR-CSIO).
- Awarded **full tution-fee waiver** based on academic performance at **both Diploma & Bachelor's level**.
- Ranked **4th for Mitsubishi Electric Cup** a *National Level Competition.*
- Trained on **Advanced Vision and Collaborative Systems** at FANUC CORPORATION, Japan.