Nirbhay Sharma

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Education

M.Tech, AI | Indian Institute of Science (IISc) Bangalore | AIR-6 GATE DA	07/2024-Present
B.Tech, CSE | Indian Institute of Technology (IIT) Jodhpur | CGPA: **8.97**/10	06/2019-05/2023
Class 12th | Dehradun public school | Percentage: **96.4**	03/2018-03/2019
Class 10th | SD public school | CGPA: **10/10**	03/2016-03/2017

Technical Skills

Programming Languages: Python, C/C++

Skills: Machine Learning, Deep Learning, Computer Vision

Tools and Frameworks: Pytorch, Django, Flask, Docker, AWS Lambda, Regex, Git, Github, Firebase, MySql

Research Interests

Computer Vision (CV), Generative Adversarial Networks (GAN's), Natural Language Processing (NLP), Transformers, Federated Learning (FL), Object Detection

Publications

- **An Extremely Lightweight CNN Model For the Diagnosis of Chest Radiographs in Resource-constrained Environments** | *International Journal of Medical Physics* 2023 | **Paper**
- **Aggregation-Assisted Proxyless Distillation: A Novel Approach for Handling System Heterogeneity in Federated Learning** | *International Joint Conference on Neural Networks (IJCNN)* 2024 | **Paper**

Industry Experience

Faaya Astu India | **Full Time** (ML Engineer)   06/2023-07/2024
- Trained **Stable Diffusion ControlNet** models on **Lineart** and **Colorbox** control on **VastAI** GPU instance and deployed them on **RunPod** for more flexibility and control on print generation
- Trained **Low Rank Adaptation (LoRA)** with **Kohya_SS** for custom **face** and **background** generation
- Experimented with custom **ComfyUI** workflows with integrated **ControlNet**, **LoRA**, **InstantID** models
- Containerised ComfyUI with **Docker** and deployed them as **Serverless Endpoints** on **RunPod** and exposed endpoint APIs to **AWS Lambda** to create **APIs for APP** using **AWS API gateway**

ExaWizards India | **Intern** (ML Engineer)   06/2022-07/2022
- Worked on **Split Neural Network** ML paradigm and Splitted **Mask-RCNN, FCN_Resnet50, YOLOv5** models for **Instance segmentation, segmentation, face detection** tasks
- Implemented **Autoencoder** model for efficient **image compression to latent space** and setup **Pysyft** to communicate latents from **Jetson Nano** to GPU server, **preserving data privacy** at Jetson Nano

Research Experience

FedAgPD: Aggregation-Assisted Proxyless Distillation | IIT Jodhpur   08/2022-05/2023
Research Project | Supervisor: **Dr. Deepak Mishra**
- **Proposed** a **novel** FL Framework **FedAgPD** to simultaneously handle **model and data heterogeneity**
- Leveraged **Deep Mutual Learning** at **Client** and **Aggregation** followed by **Gaussian Noise based data free distillation** at the **Server**, eliminating need of **proxy dataset** or **GAN's**
- FedAgPD achieved **2x** better performance compared to SOTA FL algorithms like **FedDF**, **FedMD**, **Kt-pfl**

Extremely Lightweight CNN for Chest X-Ray Diagnosis | IIT Jodhpur | **Paper**   06/2021-03/2022
Research Project | Supervisor: **Dr. Angshuman Paul**
- Designed a novel **Lightweight CNN model (ExLNet)** for the abnormal detection of **Chest Radiographs**

- Fused **Squeeze and Excitation** blocks with **Depth-wise convolution** to create **DCISE** layer as a component of **ExLNet**, which outperforms SOTA models like **Mobilenet**, **Shufflenet** on **NIH**, **VinBig** medical datasets

Cell Detection and Classification | IIT Jodhpur | 08/2022-03/2023

Research Project | Supervisor: **Dr. Angshuman Paul**

- Detected and classified cells data sample into **necrotic** and **apoptotic cells**
- Finetuned various SOTA object detectors such as **YOLO**, **SSD**, **RetinaNet**, **DeTR**
- Achieved remarkable results using **DeTR** with a Mean Average Precision (MAP) of **40.0**

Projects

Regularizing Federated Learning (FL) via Adversarial Model Perturbations (AMP) | **Github** | FL

- Analyzed the effect of integrating **AMP** on SOTA FL algorithms like **FedAvg**, **FedProx**, **FedNTD**, **SCAFFOLD**. Observed a boost of **2-3%** accuracy on CIFAR10/100 dataset with AMP integrated FL algorithms

Image Captioning using Detection Transformer (DeTR) | **Github** | Transformers

- Implemented modified **DeTR** from **scratch** in **pytorch** for **image captioning** task. Trained **DeTR** on **Flickr30k** dataset for **500** epochs and achieved a **BLEU** score of **57.36** on **Flickr8k** dataset

Transformers-Implementation | **Github** | Transformers, CNN

- Implemented **11** SOTA research papers on **vision transformers** variants like **Swin Transformer**, **Pyramid ViT**, **Convolution ViT** etc. for **Image Classification** from scratch in **pytorch**

CNN Algorithms Comparison | **Github** | Pytorch, Numpy, Matplotlib, PIL, Python

- Implemented and analyzed **7** SOTA **CNN** architectures like **Squeezenet**, **Mobilenet**, **Inceptionnet**, **Shufflenet**, **Googlenet**, **Resnet**, **Efficientnet** from **scratch** on **Retinal Eye disease dataset**

Image Colorization | **Github** | Pytorch, PIL, Python

- Implemented **pix2pix** GAN from scratch in **pytorch** for converting **grayscale image** to **colored image** in **LAB** space to **RGB** space

Mask-NoMask Detection | **Github** | Pytorch, Numpy, PIL, OpenCV, Python

- Leveraged **transfer learning** with **Mobilenet v2** for classifying images under **mask** and **no mask** category with an accuracy of **99.6%** on dataset of size **5300**
- Combined the trained model with **OpenCV** for real time classification

Coursework

Probability and Statistics, Optimization for Machine Learning, Pattern Recognition and Machine Learning (PRML), Deep Learning, Dependable AI, Time Series Analysis, Cryptography, Blockchain, Computer Graphics