Gourav Wadhwa

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Education

Indian Institute of Technology (IIT), Ropar — *Punjab, India*
B.Tech in Electrical Engineering and Computer Science — *July 2017 - Present*
Current C.G.P.A: 9.42 / 10 **Department Rank**: 1

PML SD Public School — *Chandigarh, India*
Central Board of Secondary Education (CBSE) — *2015 - 2017*
AISSCE (Class 12): 95% **AISSE (Class 10)**: 9.20 / 10.00

Research Interests

Computer Vision, Machine Learning, Reinforcement Learning, Image Processing, and Applications of Deep Learning.

Technical Skills

Programming Languages: C / C++, Java, Python, Matlab.
Web Platforms: HTML, CSS, Javascript, PHP.
Deep Learning Frameworks: TensorFlow, PyTorch, Keras.
Software / Tools: Android Studio, Photoshop, Linux (Ubuntu).
Micro Controllers: Raspberry Pi, Nvidia Jetson Nano, Google Coral (with TPU).

Publications

[1] **Gourav Wadhwa**, Abhinav Dhall, Subrahmanyam Murala, and Usman Tariq. Hyperrealistic Image Inpainting using hypergraphs. In IEEE Winter Conference on Computer Vision (WACV), 2021.

Highlights:
- Introduced a novel image inpainting network using a **hypergraph convolutional layer** to produce globally consistent completed images. Introduced **gated convolution discriminators** to develop local consistency.
- Presented a new **data-dependent trainable technique** to compute the incidence matrix for the hypergraphs convolution layer.
- Our method achieved superior performance compared to all the state-of-the-art methods on four publicly available datasets, including **Places2, CelebA-HQ, Paris Street View**, and **Facades** dataset.

[2] **Gourav Wadhwa**, Amandeep Kharb, Satyam Mishra, Mohit Kumar, and Shreyansh Srivastav. A Comprehensive Survey on Real-Time Voltage Stability Assessment for Power Systems. In IEEE International Conference on Industrial and Information systems (ICIIS), 2020.

Highlights:
- Analyzed different types of methods for determining the **real-time voltage stability margins** of the given power system.
- Compared the advantages and disadvantages of different online algorithms for various power systems.

Internships

Image Inpainting using Hypergraphs convolutions — *Monash University, Australia*
Guide: **Dr. Abhinav Dhall, Dr. Subrahmanyam Murala, and Dr. Usman Tariq** — *May 2020 - August 2020*

- Studied the state-of-the-art **Image Inpainting** methods, . Also analyzed the importance of the **Hypergraph Convolution Layer**.
- Implemented a state-of-the-art Deep Learning algorithm using a hypergraph convolution network to **improve the accuracy of Image Inpainting**. Also implemented a **GUI for image inpainting** using our method.
- Trained our network on four publicly available datasets, **CelebA-HQ, Places2, ParisStreetView,** and **Facades** Dataset with different missing regions.

Door Locking System Using Face Recognition
National Chung Cheng University, Taiwan
Guide: **Prof. Pao-Ann Hsiung** *May 2019 - July 2019*

- Implemented a Basic Face Recognition system which was **trained on more than 100 thousand images**. Further performed the Basic **Face Recognition in Server Version**.
- Used **Convolutional Neural Networks (CNN) and Histogram of oriented gradients (HOG) technique** to implement the basic Face Recognition system.
- Successfully implemented a Real-Time Face Recognition Door Locking System using **Google Coral, Nvidia Jetson Nano, and Raspberry Pi**.

Gesture Recognition
IIT Ropar
Guide: **Dr. Puneet Goyal** *November 2018 - January 2019*

- Made a Gesture Recognition System using **Myo Armband** for generating **secure passwords** for **electronic devices**.
- The **Myo Armband** senses the user's series of movements. It sends **raw EMG, Accelerometer, and Gyroscope Data**, which is further used to identify the user's high-level movements.
- Trained to recognize **ten gestures using RNN**, with each gesture having a total of 100 thousand training data points.

Relevant Projects

Vehicle Detection and Compilation (SIH'20)
Python
Guide: **Dr. Subrahmanyam Murala** *August 2020*

- Participated and **won** the national level hackathon, **Smart India Hackathon (SIH'20),** under the problem statement **vehicle detection and compilation**.
- Found **the vehicle's attributes** from the surveillance camera, such as **peculiarities** (Stickers, Dents, etc.), **color, license plate, the person driving the vehicle** (if visible), etc., and stored it in the database.
- Designed a **website to query the database** for information relating to the vehicle. Also made a **visualization** to **track** all the **places visited by a particular vehicle.**

Skin Lesion Segmentation
PyTorch / Tensorflow, Python
Guide: **Dr. Puneet Goyal** *November 2019 - January 2020*

- Implemented a novel deep learning approach **using Jaccard distance, and Instance Normalization** which further improved the accuracy of skin lesion segmentation on dermoscopy images.
- Trained our network on four publicly available datasets, including **ISIC 2016, ISIC 2017, ISIC 2018**, and **PH2 dataset**. Our network outperformed all the previous state-of-the-art methods.

Image Deblurring
Tensorflow, Python
Guide: **Dr. Subrahmanyam Murala** *June 2020 - October 2020*

- Studied the recent state-of-the-art blind image de-blurring algorithms used to remove the blur from the images without any prior information about the blurring kernel.
- Implemented some of the recent De-Blurring algorithms, such as **DeBlurGAN, DMPHN,** and **VMPHN**. These methods predict both the blurring kernel and deblurred image.
- Implemented an end-to-end deep learning algorithm using the image's **edge information** to get a deblurred image. We used **GoPro, HIDE,** and **REDS dataset**. (Submitted at CVPR 2021)

Depth Refinement
Tensorflow, Python
Guide: **Dr. Subrahmanyam Murala** *June 2020 - Present*

- Implementing a novel deep learning algorithm using **occlusion information for refining the depth estimation**. It has multiple applications, including 3D reconstruction, Augment Reality.
- We trained our network on two publicly available datasets, including **BSDS300 and NYUv2**.

Automatic Attendance System
OpenCV, Python
Guide: **Dr. Asad Sahir** *January 2019 - April 2019*

- Used **Haar Cascade Algorithm** for Face Detection and **LBPH Algorithm** for Face Recognition.
- After training the algorithm, we implemented the algorithm for making the **Attendance System using a class image**.

Miscellaneous Projects
C++ / Java / Python

- Implemented **Reinforcement Learning** algorithms for many **OpenAI Gym** Environments.
- Implemented many clustering algorithms including **K-means**, **EM, DB-Scan**, and **Denclue** in python
- Trained a deep neural network for the **Machine Translation** task (From English to Hindi).
- Implemented a **Deep Neural Network** for binary Classification from scratch in Python.

- Made a **Library Management System** using Java's swing Library and made an android app to access all the information.

Relevant Courses

Data Structures and Algorithms	Database Management	Data Mining
Computer Vision	Artificial Neural Networks	Computer Networks
Artificial Intelligence	Reinforcement Learning	Operating Systems
Linear Algebra	Probability and Stochastic Processes	Differential Equations

Achievements

JEE Rank	Secured a rank in the top 0.2 % students (out of 1.5 million students) in Joint Entrance Exam, 2017
Smart India Hackathon	Won the National level SIH'20 for the problem statement "Vehicle Detection and Compilation."
College Rewards	Receiving the Merit scholarship (given to top 7% students) from the past five semesters.
Department Rank	Current department rank 1 (out of 63 students). Current Batch rank 2 (out of 260 students).
Competitive Coding	Ranked 1 in Competitive Programming Competition in Advitya, 2018 National Level Tech Fest.

Miscellaneous

Batch Representative	Representing the Electrical Batch of 2017 in the Academic Section of IIT, Ropar
Sports	Represented my district in a state-level cricket tournament.
Coding Club	Mentor at the coding club, IIT Ropar. We taught the basics of competitive coding to students.
BAJA	Volunteered and Led the Pits team while organizing SAE INDIA, BAJA, 2018 in IIT, Ropar.
National Social Service	Was a member of NSS, IIT Ropar (2017-2019)