

Prabhdeep Singh Sethi

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EDUCATION

- **Government College of Engineering, Nagpur** Maharashtra, India
Bachelor of Engineering - Computer Science; GPA: 9.5 *July 2017 - July 2021*
Courses: Operating Systems, Data Structures, Analysis Of Algorithms, Artificial Intelligence, Machine Learning, Networking, Databases

RESEARCH INTERESTS

Person Re-Identification — SLAM — Holistic Video Understanding — Object Tracking — Neural Architecture Search

EXPERIENCE

- **Wobot Intelligence** New Delhi, India
Computer Vision Engineer - II *Feb 2022 - Present*
 - **Person Re-Identification For Ticket Grading:**
 - * Implemented person re-id after a tracking ID was lost to check if the person was the same throughout the journey.
 - * A **multi-attribute classification head** fetches the attributes of a person like gender, age, the color of the dress, glasses, and other such details apart from feature embedding to make a more powerful depiction of that person.
 - * Used **Variational Auto Encoder as a feature fusing layer** to fuse features embedding generated from **global and local attention layers**.
 - * Created a **local online threshold which uses k-means clustering** to automatically tailor a threshold value of cosine similarity metric to each camera stream.
 - * This process **reduced** the number of false tickets due to **ID switching by 65%**.
 - **Object Tracking:**
 - * Invented a custom object tracking algorithm robust enough to track a person with **55 HOTA on MOT17**.
 - * Capable of running on an edge system with **low compute resources** and improving the company's tracking system and **reducing** the number of **false tickets by 28%**.
 - * Currently working on a central tracking server similar to model-serving architectures for a wholly managed independent tracking server.
 - **Computer Vision Projects:**
 - * Spearheaded Customer Dwell Time and Person Entry-Exit Specific Door use cases.
 - * Dwell time focused on mapping each customer's complete journey in the store and raise a ticket when a person leaves the store.
 - * Employed the entry-exit specific door at safety critical locations to raise an alert if a person enters via an exit door or vice versa.
 - * Both the tasks are currently working with **90%+ accuracy in the production environment**.
- **Solar Industries India Ltd. (Research and Development Lab)** Nagpur, India
Senior Executive - Computer Vision *Aug 2021 - Jan 2022*
 - **Team Lead - Smart Blast Project:**
 - * Blast safety in the mining field depends predominantly on fume toxicity calculation, achieved the same via **background subtraction to extract smoke**, followed by **colour segmentation using k-means clustering**.
 - **Object Detection Training Pipeline:**
 - * Designed a training pipeline using **Flask, TensorRT and DeepStream** for the object detection task.
 - * It had connectors to several databases and could train a variety of models with integration of TensorFlow and PyTorch and, after training, could automatically deploy the model to DeepStream after optimising it via TensorRT
- **Computer Vision Intern** Jan 2020 - Aug 2021
 - **Team Lead - Machine Vision Security Project:**
 - * **Led a team of 5 people** where successfully delivered Autonomous Surveillance using Drones & Autonomous Trespasser Detection and Tracking using Sensor Networks and UAVs.
 - **Product Inspection Multi-Mode Hand Grenade (MMHG):**
 - * Worked with a vendor to train custom **YOLOv3** models along with template matching and clustering to increase overall **mAP** of detecting nine parts by **99.5%**
 - **Computer Vision Proof of Concepts:**
 - * Overspeeding and ANPR - Developed using YOLOv4 for car and number plate detection; **PaddleOCR** for fetching number plates from the image, and **DeepSORT** for tracking and finding the relative speed of a car.
 - * Smart Attendance system - Uses YOLOv3 for face detection and **MobileNet SSD** for classification. It creates a log of employees along with in-time and out-time. Deployed in 15+ plants of Solar Industries with 97% accuracy

RESEARCH EXPERIENCE

- **Researcher at Intelligent Mobility Labs** Remote
Worked on class-agnostic object detection; improved unknown object detection by 12.5%. June 2021 - Dec 21
- **ML Engineer at Omdena** Remote
Built a 92% top-5 model for an NGO to detect harmful situations in videos to protect children. July 2021 - Jan 2022

PROJECTS

- **UAV Detection (Small Object Detection, Bird Vs Drone Classification via flying pattern):**
 - Unmanned Aerial Vehicle (UAV) Detection is an extremely safety-critical project.
 - The system takes in Infrared (IR) video streams and detects drones using **YOLOv5s PyTorch with 99.91% mAP with 0.5 IoU** on the Anti-UAV Challenge Hosted by **ICCV**.
 - **Tiling and augmentation via GAN** were done for the training pipeline, along with general image augmentations. **Quantized using TensorRT**, it could detect up to 37 FPS on a Jetson TX2.

Affiliation: Zmotion Autonomous Systems Pvt Ltd and Solar Industries India Ltd

Tech: Python, PyTorch, OpenCV, Numpy, Scikit-Learn, Matplotlib, YOLOv5, TensorRT, JetsonTX2 Aug 2020 - Feb 2021
- **Smart AI Autonomous Drone (Person Tracking via UAV, Intruder Detection via UAV):**
 - A smart autonomous drone with Object Tracking and Detection capabilities. The project has two major parts:
 - * A novel person following logic in a **3D environment**
 - * An autonomous drone designed and constructed from scratch for intrusion detection with an app designed to control it and a website to receive real-time alerts.
 - For the person-following drone phase, a DJI Tello live streams over UDP to an edge server, and people get detected using YOLOv3 implementation of **Darknet and OpenCV**.
 - Next, **distance calculation in a 3D space** takes place, which sends the coordinates to tracking logic, ensuring the UAV is always 2 inches away from a person along with **Tello API via Node.js** to move the drone in physical space.
 - For the autonomous intruder detection phase, a drone is developed from scratch using Pixhawk PX4 as the flight controller and Ardupilot as the flight controller software.
 - A companion computer (Jetson TX2) gave autonomous capabilities to the drone and was accustomed to detecting intrusion. A Raspberry Pi Zero W pre-process the frames and serves them over HTTP.

Affiliation: Government College of Engineering, Nagpur and Solar Industries India Ltd

Tech: Python, C++, Tensorflow, OpenCV, TensorRT, AWS, YOLOv4, YOLOv3, MAVROS, Dronekit, Ardupilot, React.js, Node.js, Flutter, DJI Tello, Jetson TX2, Pixhawk PX4, Raspberry Pi Zero W May - Nov 2021

- **Fragmentation Analysis to check accuracy of blast (Holistically Nested Edge Detection, Segmentation):**
 - Fragmentation Analysis is a necessary check used by mining engineers after blasting to determine the blast accuracy.
 - **Fragments are rock pieces** created after a blast, and their normal distribution is checked to find the blast's accuracy.
 - Implemented **Holistically-Nested Edge Detection using Caffe** coupled with a **Mask-RCNN** for segmentation of rocks using **TensorFlow** and deployed it using a **Flask server on Docker over an EC2 instance**; accessible via a React.js website.
 - Found normal distribution of rock size in varied conditions with **78% accuracy**.

Affiliation: Solar Industries India Ltd

Tech: Python, Caffe, OpenCV, Numpy, Scikit-Learn, Matplotlib, YOLOv5, TensorRT, JetsonTX2 Aug 2020 - Feb 2021

- **Image Forgery Detection (Image Processing, Benford's Law, DCT):**
 - This project focuses on detecting a specific form of image forgery known as a **copy-move attack**, in which a portion of an image is copied and pasted elsewhere.
 - The input image is divided into blocks followed by feature extraction using **direct cosine transform**. Next, dimensionality reduction via JPEG quantization is performed and sorted lexicographically.

Affiliation: Independent Project

Tech: Python, OpenCV, Numpy Nov 2021

PUBLICATION

- **Digital Interface for Real-Time Monitoring of Electrical Appliances and Reducing Electricity Wastage (Metricity):** IJEEBS, ISSN 2349-6967, Volume 7, Special Issue 2, (March-April 2020), PP. 303-312 Mar 2020

HONORS AND AWARDS

- Awarded title of Best Undergraduate Project *July 2021*
- Awarded title of Best Research Paper at IJEEBS Journal *Mar 2020*
- Won hackathon by Mayor Innovation Council in the Home Energy Consumption category, Nagpur *Aug 2019*
- Won regional level PoC competition by Institution's Innovation Council & Smart India Hackathon *June 2019*

POSITIONS OF RESPONSIBILITY

- **Community Lead at Google Developer Student Clubs GCOEN** Maharashtra, India
Conducted online and offline AI & CS training impacting over 1000 students. *Jan 2019 - Present*
- **Secretary at Computer Science Student Association, GCOEN** Maharashtra, India
Led 2 inter-college & 3 intra-college events with total footfall of over 5000+ students. *June 2021 - Dec 21*

SKILLS SUMMARY

- **Languages:** Python, C++, Go, Julia, JavaScript, C, SQL, Bash, DART
- **Frameworks:** PyTorch, TensorFlow, Triton, DeepStream, OpenCV, Scikit, Keras, Django, Flask, Flutter, React.js
- **Tools:** Kubernetes, Docker, GIT, Ansible, PostgreSQL, Tesseract, LaTeX
- **Platforms:** Linux, Web, Windows, AWS, Azure, GCP, Jetson, Raspberry Pi, Arduino
- **Soft Skills:** Leadership, Time Management, Organizational, Writing, Public Speaking

CERTIFICATIONS

- **Deep Learning Specialization by Andrew Ng** *Dec 2021*
- **An Introduction to Programming the Internet of Things (IOT) Specialization by University of California, Irvine** *May 2019*