Prabhdeep Singh Sethi

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Education

- **Government College of Engineerning, 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.
    - Used **multi-attribute classification head** to fetch 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***:
    - Developed 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 **reduced** 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 Use-cases***:
    - 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***:
    - Calculating blast safety in the mining field depends predominantly on fume toxicity detection, achieved via **background subtraction to extract smoke**, followed by **colour segmentation using k-means clustering**.
  - ***Object Detection Training Pipeline***:
    - Developed 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 company to train custom **YOLOv3** models along with template matching and clustering to increase overall **mAP** of detecting nine parts by **99.5%**
  - ***Other Computer Vision Use-cases***:
    - Overspeeding and ANPR - Developed using YOLOv4 for car and number plate detection followed by **PaddleOCR** for OCR, also used **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.

  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 built from scratch used for intruder detection with an app designed to control it, and a website to receive real-time alerts.
  - For the person-following drone phase, DJI Tello was used, which streamed live stream over UDP to an edge server, and person gets detected using YOLOv3 implementation of **Darknet and OpenCV** on it.
  - It is followed by **distance calculation in a 3D space** which is sent to tracking logic, ensuring the UAV is always 2 inches away from a person and coordinates are sent to **Tello API via Node.js** to move the drone in physical space.
  - For the autonomous intruder detection phase, a drone is built 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 also was used for intruder detection. Used a Raspberry Pi Zero W to pre-process frames and serve them over HTTP.

  Tech: Python, C++, Tesnsorflow, 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**.

  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.
  - Input image is divided into blocks followed by feature extraction using **direct cosine transform**. Next, dimensionality is reduced via the quantization of JPEG and is sorted lexicographically.

  Tech: Python, OpenCV, Numpy *Nov 2011*

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** — *June 2021 - Dec 2021*

- **An Introduction to Programming the Internet of Things (IOT) Specialization by University of California, Irvine** — *May 2019*