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Summary

Computer Vision specialist with 5+ years professional experience, including 2 years devoted to developing real-time vision modules for national defense and 2 years to building image and video processing service for a social media platform. I specialized in neural network interpretability and its applications to weakly supervised semantic segmentation as part of my master's degree. As a work student at Terraloupe, I designed a training data management tool for geospatial annotations and at Edge Case Research I designed new APIs for measuring safety of an autonomous vehicle perception system.

Professional Experience

ML Engineer	Edge Case Research Gmbh	May 2020 – Present
<i>Improving Core ML Products and Production Infrastructure (Python, Go, Kubernetes)</i>		
<ul style="list-style-type: none">Designed 4 new safety performance indicators to measure safety of autonomous vehicles.Designed benchmark to evaluate internal defect predictors on real data as well as synthetically introduced defects.Integrated serving and testing of pytorch models and integrated tracking metrics to benchmark multi-object tracking associators.		
ML Engineer	Terraloupe Gmbh	April 2018 - April 2020
<i>Training Data Management Tool (Python, Django, Postgres)</i>		
<ul style="list-style-type: none">Development of postgres-based inventory database.Development of inventory query service with support for filtering over data distribution to extract desired subset for training neural networks.		
<i>Core Deep Learning Pipeline (Python, Keras, Tensorflow)</i>		
<ul style="list-style-type: none">Development of single pipeline supporting Image Classification, Object Detection and Semantic segmentation tasks.Optimization of training and inference phase with resulting GPU and CPU utilization to over 90%.Object based metrics implemented for semantic segmentation.		
Image Team Lead	Roposo, India	Nov 2015 – Oct 2017
<i>Image Processing Service Development (Java, AWS, OpenCV, ffmpeg)</i>		
<ul style="list-style-type: none">Optimizations to efficiently use servers, leading to 70% cost reduction.Enable dynamic compression using SSIM metric increasing user retention by 40%.Quantifying social posts ownership by measuring plagiarism using image metadata analysis.Implemented Beauty filter based on variational approach by Farbman, Zeev, et al. [1]		
Software Development Engineer	Amazon, India	Oct 2014 – Nov 2015
<i>Resell Product Form (Java, DynamoDB)</i>		
<ul style="list-style-type: none">Development of data model to reduce user interaction for form completion and data payload for mobile usage.Improved form completion rate by 500% with reduction of data payload by 99.5%.		
<i>Catalog Labelling Quality Platform (Python, Apache Spark)</i>		
<ul style="list-style-type: none">Implemented platform to analyze and cluster amazon catalog data.Reduced workload for catalog quality check from over weeks to less than an hour.		
Software Development Engineer	KritiKal Solutions Pvt. Ltd., India	June 2012 – Oct 2014
<i>Atmosphere Turbulence Removal Module (C++, Cuda, DLib, OpenCV, Qt)</i>		
<ul style="list-style-type: none">Development of Atmosphere Turbulence Removal Module based on Non-Rigid Registration method [2].Optimizations added using libpthread and cuda, achieving 240x speedup.		
<i>Wide Area Tracking Module (C++, OpenCV, Qt)</i>		
<ul style="list-style-type: none">Designed and implemented a module for controlling Pan and Tilt Device.Real time stitching of multiple CCD/Infrared Cameras to produce a wider view.Change Detection and Tracking module to detect and track objects of interest.		

Academic Projects

Master Thesis	CAMP*, Technical University of Munich	Dec 2020 – June 2021
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Weakly Supervised Semantic Segmentation using Low-level neural network features

- We proposed a novel approach of dissecting classification neural networks to extract semantic maps.
- The method improves mIOU metric by over 20% on vgg and resnet backbone models w.r.t. class-activation maps.

Research Assistance Project	Technical University of Munich	Dec 2019 – May 2020
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Neural Response Interpretation through the Lens of Critical Paths, CVPR 2021 (Pytorch, python) [3]

- Improving interpretability using path selection via neurons' contributions to the response.
- Accepted at CVPR 2021

Killing Fusion, CVPR 2017 (C++, Matlab) [4]

- Use Killing energy, Level-set energy and data energy to provide non-rigid registration between RGBD frames.
- Scan completion and semantic segmentation (Python, Pytorch, hdf5)*
- Multi-task learning to improve scan completion of RGBD Voxel Grid of indoor scenes.
- We proposed additional learning of semantic information loss will improve scan completion of indoor scenes.

Student Tutor	Technical University of Munich	Oct 2018 – March 2019
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Machine Learning (IN2210) †

- The course is offered to master students at TUM and is attended by more than 500 students.
- Involved in creating assignments for the course and helped students with the homework.

Education

Munich, Germany	Technical University of Munich	Oct 2017 – Present
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- M.Sc. in Informatics, GPA: 1.4/1.0
- Graduate Coursework: Machine Learning; Multiple View Geometry; Deep Learning; Protein Prediction; Tracking and Detection in Computer Vision; 3D Scanning & Motion Capture; Principles of Computer Vision.

Dhanbad, India	Indian Institute of Technology	July 2008 – May 2012
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- B.Tech. in Computer Science and Engineering, CGPA: 7.51/10.0
- Undergraduate Coursework: Object Oriented Programming; Data Structure and Algorithms; Theory of Computation; Operating System; Computer Networks; Computer Architecture and Digital Image Processing.

Technical Skills

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- Programming Languages: C, C++, Python, Java, Matlab.
 - ML/CV Toolkits: PyTorch, Keras, Tensorflow, OpenCV, Numpy, SciPy, Rasterio, ffmpeg, Dlib.
 - Application Development: REST, Django, Neo4j, PostgreSQL, MongoDB, AWS, Docker and Kubernetes.

Additional Experience and Awards

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- Achieved All India rank 1159 in All India Engineering Entrance Exam, 2008 out of 950,000 participants.
 - Hiring Experience and leading Image Team at Roposo.
 - Open source contributions: torchvision, metadata-extractor and imantics[‡].

References

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- [1] Zeev Farbman et al. "Edge-preserving decompositions for multi-scale tone and detail manipulation". In: *ACM Transactions on Graphics (TOG)* 27.3 (2008), pp. 1–10.
 - [2] Daniel Rueckert et al. "Nonrigid registration using free-form deformations: application to breast MR images". In: *IEEE transactions on medical imaging* 18.8 (1999), pp. 712–721.
 - [3] Ashkan Khakzar et al. "Neural Response Interpretation through the Lens of Critical Paths". In: *CVPR*. 2021.
 - [4] Miroslava Slavcheva et al. "Killingfusion: Non-rigid 3d reconstruction without correspondences". In: *CVPR*. 2017.

*<http://campar.in.tum.de/Chair/ResearchIssueComputerVision>

†<https://www.in.tum.de/en/daml/home/>

‡<https://resume.github.io/?saurabheights>