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Certified SAFe 6 Practitioner

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Computer Vision Engineer | ML & Image Processing Specialist

Expert in designing and deploying computer vision and machine learning solutions for edge devices with strong foundation in image processing and computational imaging. Proficient in complete ML development pipeline from data collection and model architecture design to quantization-aware training and production deployment. Skilled in Python, C++, PyTorch, and TensorFlow for developing optimized algorithms targeting embedded platforms (Snapdragon, Jetson). Specialized in real-time image processing, vision-oriented tasks, and performance optimization for resource-constrained environments. Experienced in translating research innovations into practical, deployable solutions for latency-critical applications.

Work Experience

Research Scientist: Image Processing and Machine Learning

Denmark

GN Store Nord

02/2022 - Present

- **Algorithm Development & Optimization for Real-Time Systems**
  - Led the development of real-time image processing and machine learning solutions for resource-constrained edge devices, ensuring high performance with minimal latency.
  - Implemented efficient image processing pipelines that combined traditional algorithms with neural networks, balancing computational complexity with accuracy requirements.
  - Optimized machine learning architectures (MobileNet, YOLO variants) for real-time inference (≤20ms latency) through quantization-aware training and post-training optimization techniques.
  - Designed automated experimentation frameworks for comparing model architectures and image processing approaches, enabling data-driven decision making.
- **Multi-Sensor Data Integration & Processing**
  - Developed processing pipelines for multi-camera systems, implementing algorithms for sensor calibration.
  - Engineered hybrid datasets (synthetic and real-world) to train models capable of handling varied environmental conditions and sensor characteristics.
  - Designed benchmarking systems for evaluating algorithm performance across different hardware platforms and processing architectures.
- **Algorithm Optimization & Embedded Implementation**
  - Implemented optimized C++ algorithms for image processing that achieved maximum computational efficiency on target embedded hardware.
  - Deployed 8-bit quantized models on ARM-based platforms, optimizing execution across heterogeneous compute units (CPU/NPU/GPU).
  - Analyzed performance bottlenecks and optimized processing pipelines to meet strict latency and throughput requirements.
- Collaborated with cross-functional teams (hardware engineers, product managers) to align technical solutions with business requirements.
- Primary technologies: Python, C/C++, MATLAB, PyTorch, TensorFlow, ONNX Runtime.

Researcher: Image Processing and Compression *Denmark*
Technical University of Denmark 08/2018 - 01/2022

- **Algorithm design and optimization for multi-view image processing**:
  - Developed novel algorithms for real-time processing of multi-view data, combining traditional image processing techniques with machine learning approaches.
  - Designed low-complexity image processing methods with high-fidelity reconstruction requirements, achieving significant improvements over standard methods in terms of complexity, speed, and quality.
  - Created optimization techniques specifically tailored for resource-constrained devices with limited computational capabilities.
  - Implemented statistical modeling approaches for image reconstruction and enhancement from partial or corrupted data.
- **Experimental analysis and validation**:
  - Designed comprehensive experiments to validate algorithms across varied conditions and scenarios.
  - Conducted comparative analysis of different algorithmic approaches, providing quantitative metrics for performance, computational efficiency, and accuracy.
  - Published research findings in peer-reviewed journals and international conferences.
- Technologies used: MATLAB, Python, C/C++, PyTorch, TensorFlow.

Software Developer *Pakistan*
Karachi Institute of Economics & Technology (IGNITE) 08/2017 - 02/2018

- Spearheaded the implementation of a CNN-based face recognition system.
- Utilized multiscale techniques to enhance recognition accuracy.
- Applied C/C++ for efficient face localization.

Researcher: Computational Imaging *Turkey*
Medipol University 02/2015 - 07/2017

- Designed computational imaging systems for multi-view image processing including:
  - **Super-resolution for micro-lens array-based multi-view imaging cameras**:
    - Combined captures from conventional photosensors and multi-view imaging sensors.
    - Fused multiple multi-view images captured sequentially after applying sub-pixel shifts using a mechanical translation stage.
  - **Synthetic enhancement of multi-view cameraaperture**: Utilized structure from motion techniques to improve multi-view image quality.
  - **Optical hardware experiments**: Conducted experiments using the Raytrix R10 camera for multi-view imaging microscopy projects.

Founder and Engineer *Pakistan*
Jiddat Technologies 01/2013 - 01/2015

- Established a company focused on developing affordable pocket-sized microcontroller programmers for AVR and PIC microcontrollers, emphasizing USB connectivity to enhance accessibility for engineers.
- Designed the complete product lifecycle, including:
  - Developing firmware for the USB-enabled programmer.
  - Designing PCBs and creating Gerber files for manufacturing.
  - Coordinating with a manufacturing company in China for PCB production, component soldering, and packaging.
- Developed educational kits for control theory courses to facilitate student learning and hands-on experience.

Education

PhD in Electrical and Photonics Engineering *Denmark*
Technical University of Denmark 08/2018 - 01/2022

- Designed efficient solutions for multi-view image enhancement and compression.
- Proposed both rule-based and learning-based approaches.

MS in Electrical Electronic Engineering and Cyber Systems *Turkey*
Medipol University 02/2015 - 08/2017

- Focused on designing computational imaging methods.
- Applied multi-view geometry concepts for high-quality image acquisition.

BE in Industrial Electronics Engineering *Pakistan*
NED University of Engineering & Technology 01/2010 - 12/2013

- Developed skills in image processing, control systems, and embedded systems.
- Gained hands-on experience with industrial controllers like FPGAs and PLCs.
- Worked with various embedded tools in industrial settings.

Technical Skills

Image Processing & Computer Vision
- Camera geometry, multi-view imaging, computational imaging, camera calibration
- Feature detection/matching, homography estimation, epipolar geometry, structure from motion
- Image restoration, denoising, super-resolution, HDR imaging, image enhancement

Machine Learning & Neural Networks
- Architecture design: CNNs, Transformers, YOLO, MobileNet, UNet
- Model optimization: Quantization (QAT, PTQ), Pruning, Knowledge Distillation
- Training approaches: Multi-GPU, hyperparameter tuning (Optuna), Transfer Learning

Programming & Scientific Computing
- Languages: Python, C/C++, MATLAB
- Scientific libraries: NumPy, SciPy, Pandas, scikit-learn
- Algorithm implementation and optimization for embedded targets

Data Engineering & Experimentation
- Data acquisition pipelines, hybrid dataset generation (synthetic + real-world)
- Experimental design, automated testing, comparative analysis frameworks
- Performance evaluation metrics and benchmarking methodologies

Embedded Systems & Hardware Acceleration
- Resource-constrained computing, heterogeneous processing (CPU/GPU/NPU)
- ARM platforms, ONNX Runtime, TensorRT, hardware-specific optimizations
- Real-time performance analysis, latency/power optimization techniques

Software Development & Collaboration
- Git, CI/CD pipelines, code documentation, test-driven development
- Agile methodologies (Scrum, SAFe), cross-functional team collaboration
- Technical documentation and knowledge sharing

Languages

English	Professional proficiency
Danish	Beginner proficiency
Urdu	Native proficiency
Turkish	Beginner proficiency

Publications

Deep Decompression for Low Complexity Compression of Multi-View Images

Journal of Visual Communication and Image Representation, 2024

Leveraged a low-complexity DPCM encoder and CNN-based deep decoder to enhance multi-view image compression, improving both speed and quality using 2D and 3D CNN architectures.

Attention Mechanism-based View Synthesis

IEEE Access, 2024

Developed an attention-based machine learning model using a convolutional block attention mechanism integrated with a CNN architecture, enabling high-quality image reconstruction in challenging conditions such as occlusions and reflections.

AI-powered Distributed Source Coding for Multi-View Images

IEEE Open Journal of Circuits and Systems, 2021

Developed a machine learning model to estimate pixel-level prediction uncertainty for intermediate view synthesis, improving decoding performance in a distributed coding system. This system is optimized for efficient encoding of multi-view images on low-power devices.

Rule-based Lossless Compression of Multi-View Images

IEEE Access, 2020

Designed a rule-based prediction method for lossless compression of multi-view images, achieving significant improvements in speed, computational efficiency, and decoding quality compared to HEVC-based methods, making it highly suitable for real-time applications.

References

Esben Høgh Rasmussen, Lead Video Processing Engineer *Denmark*
Sky-Watch A/S
esben.hr@gmail.com

Søren Forchhammer, Professor, DTU Electro *Denmark*
Technical University of Denmark
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