AVINASH KUMAR

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LinkedIn | GitHub | Google Scholar | Portfolio

Engineering Profile

Computer Vision Engineer based in Seoul with 4+ years of experience in **computer vision, deep learning, and AI system development** with research and industrial applications. Experienced in developing **AI-based AOI inspection systems**, including defect detection and pixel-level segmentation using **U-Net, nnU-Net, and custom segmentation models**. Strong in building end-to-end pipelines covering **dataset engineering, model training, evaluation, defect analysis, post-processing, and model verification**. Experienced in deploying and optimizing deep learning models using **ONNX, NVIDIA TensorRT, FP16, C++, and CUDA**, including GPU inference optimization with **CUDA Graph/Capture** for low-latency, high-throughput inspection. Research background in **Generative AI, GANs, diffusion models, and image synthesis**, with peer-reviewed publications, patent contributions, and hands-on experience developing production-oriented computer vision systems.

Technical Skills

- **Computer Vision:** AOI/Industrial Inspection, Defect Detection, Semantic Segmentation, Instance Segmentation, Object Detection, Image Processing, Defect Analysis, Image-to-Image Translation
- **Deep Learning:** U-Net, nnU-Net, YOLO/YOLOv8, DeepLab, Mask R-CNN, Custom Segmentation Architectures, GANs, cGAN, StyleGAN, DCGAN, StarGAN, Diffusion Models
- **Data & Model Development:** Dataset Engineering, Data Preprocessing, Data Cleaning, Annotation Validation, Data Augmentation, Class Balancing, Model Training, Hyperparameter Tuning, Model Evaluation, Model Verification, Error Analysis
- **Defect Analysis & Post-Processing:** Segmentation Mask Processing, Argmax, Thresholding, Connected Components, Blob/Region Analysis, Defect Measurement, Area/Width/Height/Length/Intensity Analysis, Defect Grading, Severity Scoring, Detection Filtering, Overkill Reduction
- **Model Deployment & Inference:** PyTorch, ONNX, NVIDIA TensorRT, FP16 Inference, C++/TensorRT, Model Conversion, GPU-Accelerated Inference, Production Deployment
- **GPU & Performance Optimization:** CUDA, CUDA Graphs, CUDA Capture, GPU Memory Optimization, CPU–GPU Data Transfer Optimization, Inference Profiling, Low-Latency and High-Throughput Inference
- **Generative AI:** Diffusion Models, GANs, Neural Style Transfer, Perceptual Loss, Feature Matching, Generative Image Synthesis
- **Programming & Frameworks:** Python, C++, C, JavaScript, Bash, PyTorch, TensorFlow/Keras, OpenCV, NumPy, Pandas, scikit-learn, PIL
- **Development Tools:** Linux, Git/GitHub, VS Code, Jupyter, LaTeX, Django, REST APIs

Professional Experience

- **HyVision Systems** *Mar 2026 - Present*
  AI Engineer / Research Engineer — AOI & Computer Vision Seoul, South Korea
  - Developed **AI-based defect inspection solutions** for AOI systems using **U-Net, nnU-Net, and custom segmentation models** for pixel-level defect detection and segmentation.
  - Managed the complete **AI data pipeline**, including data preprocessing, cleaning, annotation validation, dataset analysis, augmentation, class balancing, model training, and performance evaluation.
  - Analyzed segmentation results to extract **defect width, height, area, length, intensity, and shape information**, and developed **defect grading, severity scoring, threshold, and filter logic** to improve inspection accuracy and reduce overkill/false positives.
  - Developed **model post-processing and verification pipelines**, including **argmax, mask processing, thresholding, connected-component/blob analysis, region filtering, and defect measurement** for final inspection decisions.
  - Converted and deployed PyTorch models using **ONNX and NVIDIA TensorRT with FP16**, and implemented **C++/TensorRT inference and post-processing** for industrial AOI inspection systems.
  - Optimized high-speed GPU inference using **CUDA, CUDA Graph/CUDA Capture, memory-transfer optimization, and inference pipeline optimization**, improving inspection speed and reducing overall inference latency.

- **System Software Lab, Soongsil University** *Sep 2022 - Feb 2026*
  Research Associate — Computer Vision & Generative AI Seoul, South Korea
  - Built component-aware computer vision pipelines for **Korean Hangul font generation**, combining **YOLOv8 segmentation** with generative models to enable component-level decomposition and style-consistent character synthesis.
  - Developed and maintained **mywriting.kr**, an end-to-end handwriting/font generation service capable of generating **2,780 Korean characters from 43 handwritten samples**, integrating image preprocessing, model inference, character synthesis, and font delivery workflows.

- Implemented research and production-oriented training/inference pipelines in **PyTorch** for GAN- and diffusion-based generative models, including dataset preprocessing, augmentation, configuration management, checkpointing, reproducible experiments, and evaluation.
- Conducted experiments on **computer vision, image generation, segmentation, and generative AI**, including model training, inference optimization, ablation studies, and quantitative and qualitative evaluation.
- Analyzed experimental results and generated figures, tables, and evaluation reports for **peer-reviewed journal and conference publications**.
- Co-authored peer-reviewed publications in **Electronics (2023/2025), HCLT (2024), and ICOIN/arXiv (2025)**, and contributed to **patent applications** related to font-generation quality and style verification.
- Collaborated with researchers and lab members on model development, experimental design, ablation studies, qualitative comparisons, quantitative evaluation, and preparation of research results for publication.

• **Cubix** *Feb 2022 - Aug 2022*
Assistant Software Engineer — Blockchain / Full-Stack Karachi, Pakistan
- Developed and tested **Solidity smart contracts** for gaming-related tokens and NFTs using Remix IDE and Truffle.
- Integrated blockchain functionality with JavaScript-based decentralized applications and contributed to decentralized exchange features, including **liquidity pools and token workflows**.
- Developed test scenarios and validation scripts to improve the **reliability, correctness, and security** of smart-contract functionality.

EDUCATION

• **Soongsil University** *Sep 2022 – Aug 2024*
M.S. Computer Science and Engineering Seoul, South Korea
- **GPA:** 4.34 / 4.50
- **Thesis:** *Korean Font Generation using Position-based Components* (YOLOv8, GANs)

• **Mehran University of Engineering and Technology (MUET), SZAB Campus** *Oct 2016 – Jan 2021*
B.E. Software Engineering Khairpur Mir's, Pakistan
- **GPA:** 3.86 / 4.00
- **Final Project:** *FIS Hostel Finder* — Android app to help students locate hostels; supported by Ignite funding (Pakistan).

SELECTED PROJECTS

• **mywriting.kr — Generative Handwriting/Font Service**
YOLOv8, GANs (PACGAN), PyTorch, Web Service [🌐]
- End-to-end font generation workflow: segmentation → generation → packaging/delivery.
- Generates **2,780 Korean characters** from **43 handwritten samples** (few-shot style acquisition).
- Focus on preserving component geometry and style consistency across syllables.

• **Component-Guided Hangul Font Generation (Electronics 2025)**
YOLOv8 Segmentation, Adversarial Style Transfer [🌐]
- Position-aware component decomposition and recombination for Hangul font image generation.
- Uses deep semantic segmentation to guide local structure and adversarial transfer to maintain style.

• **Text-Conditioned Diffusion for Korean Font Generation (arXiv/ICOIN 2025)**
Diffusion Model, Style Encoder, Text Conditioning [🌐]
- Diffusion-based automatic font generation for complex scripts (Korean), enabling controllable synthesis via text conditioning.
- Emphasis on stable training and high-fidelity details compared with GAN baselines.

• **FontFusionGAN — Refinement of Handwritten Fonts by Font Fusion (Electronics 2023)**
StyleGAN-style Fusion, Style Transfer [🌐]
- Published method to refine imperfect handwriting by fusing handwriting/printed styles to improve readability while retaining author style.

Publications

[1] **Avinash Kumar**, Irfanullah Memon, Abdul Sami, Youngwon Jo, Jaeyoung Choi. *Positional Component-Guided Hangul Font Image Generation via Deep Semantic Segmentation and Adversarial Style Transfer.* **Electronics (MDPI)**, 14(13), 2699, 2025. DOI: 10.3390/electronics14132699

[2] Abdul Sami, **Avinash Kumar**, Irfanullah Memon, Youngwon Jo, Muhammad Rizwan, Jaeyoung Choi. *Text-Conditioned Diffusion Model for High-Fidelity Korean Font Generation.* **arXiv/CoRR**, 2025. arXiv: 2504.21325

[3] Youngwon Jo, **Avinash Kumar**, Uijong Yang, Jinyeong Jang, Daeun Kim, Jaeyoung Choi. *Korean Handwriting Font Generation Service using Image Generation Model.* **Annual Conference on Human and Language Technology (HCLT)**, 2024, pp. 50–55. KoreaScience

[4] **Avinash Kumar**, Irfanullah Memon, Abdul Sami, Youngwon Jo, Jaeyoung Choi. *Ckfont3: Component-Based Korean Font Generation Using Positional Aware Component Decomposition.* **SSRN**, 2024. SSRN

[5] **Avinash Kumar**, Kyeolhee Kang, Ammar ul Hassan Muhammad, Jaeyoung Choi. *FontFusionGAN: Refinement of Handwritten Fonts by Font Fusion.* **Electronics (MDPI)**, 12(20), 4246, 2023. DOI: 10.3390/electronics12204246

[6] Hyston Kayange, **Avinash Kumar**, Yejung Lee, Hoonseo Jung, Jongsun Choi. *Deep Adaptive Feature Selection in Deep Recommender Systems.* **KIISE (Korean Institute of Information Scientists and Engineers) Conference Proceedings**, 2023. DBpia

[7] **Avinash Kumar**, Kyeolhee Kang, Ammar ul Hassan Muhammad, Jaeyoung Choi. *A Study on the Refining Handwritten Font by Mixing Font Styles.* **MITA 2023**, Technical University of Ostrava, Czech Republic, 2023.

Patents (Applications)

- **Font verification method for style consistency & shape accuracy (KIPO)**
  Patent Application: 10-2025-0047215 (Submitted: 2025-04-11)
- **Font image generation method to improve handwriting quality (KIPO)**
  Patent Application: 10-2025-0045652 (Submitted: 2025-04-08)

Honors & Awards

- **Best Research Paper Award** *2023*
  MITA 2023, Czech Republic
- **Sakura Science / Exchange Program** *2018*
  Japan
- **Ignite Funding (Undergraduate Project Support)** *2020–2021*
  Pakistan

References

Available upon request.