SAGAR PRADIPKUMAR JAIN

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SUMMARY

Senior Software Engineer (9 years) specializing in C++ & Computer Vision. Designed a 55 ms multi-camera CCTV engine using GStreamer & OpenCV, and implemented modular streaming pipelines with appsink/appsrc, thread-safe queues & memory-pool reuse. Built an Agentic AI Assistant PoC using AWS Bedrock Agents (Knowledge Base + Comprehend) with OpenSearch & DynamoDB storage, and created an open-source variant using Janus WebRTC, Whisper ASR & HuggingFace LLMs. Previously developed an HMM+GA geometry-optimization plugin at Dassault Systèmes and a high-accuracy OpenCV/Tesseract OCR pipeline at Renishaw.

SKILLS

Programming: C++14/17, Python, SQL

Computer Vision: OpenCV 3/4, Tesseract, Image Processing

Media & Streaming: GStreamer, RTSP, Video Pipelines (appsink/appsrc)

System Design & Performance: Multithreading, Memory Management, STL, Design Patterns, Optimization, Debugging

Cloud & Backend: AWS Bedrock (Agents, Knowledge Base, Comprehend), FastAPI, gRPC, Protobuf

Tools & Build: Git, CMake, Eclipse CDT, Visual Studio

Databases: MySQL (C++ connector), DynamoDB (AWS SDK), JSON/XML

OS: Linux (Ubuntu), Windows

EXPERIENCE

Great Software Laboratory (GS Lab / Intellivision)

Senior Software Engineer — Computer Vision | April 2024 – Present

Project 1 — Real-Time CCTV Monitoring & Video Analytics (Core Project)

Tech Stack: C++11/14, GStreamer 1.x, OpenCV 4.x (C++ API), MySQL (C++ connector), Linux (Ubuntu 22.04), Multithreading (std::thread/mutex), Eclipse CDT, Python 3.10, FastAPI, gRPC, Protobuf

Overview: Designed & implemented a real-time surveillance analytics system that processes multi-camera RTSP streams through GStreamer & OpenCV, performing face, intrusion & license-plate recognition with near-real-time latency.

Key Contributions:
- Developed modular GStreamer pipelines (appsink/appsrc, gst_parse_launch) enabling scalable multi-camera RTSP processing.
- Achieved ~55 ms/frame latency using thread-safe queues & memory-pool reuse.
- Integrated FastAPI & gRPC micro-services for event routing with MySQL (C++ connector).
- Ensured robustness through Debug & Release mode validation & 24×7 stress tests.

Impact: Delivered a production-grade video analytics engine forming the core of future edge vision deployments.

Project 2 — Agentic AI Assistant PoC using AWS Bedrock (Speech & Text Insight Generation)

Tech Stack: AWS Bedrock Agents, Knowledge Base, OpenSearch, Comprehend, DynamoDB

Overview: Built a PoC showcasing integration of AWS Bedrock Agents for speech & text analytics, extracting KPIs & contextual insights from meeting/call transcripts.

Key Contributions:
- Built an Agentic AI Assistant PoC using Bedrock Agents (Knowledge Base + Comprehend) to extract KPIs & contextual insights from meeting data.
- Stored embeddings in OpenSearch via Knowledge Base for semantic retrieval.
- Integrated DynamoDB for persisting transcripts & KPI metadata used in supervisory dashboards.
- Designed modules to control agent flow, prompts, and overall processing pipeline.
- Added an open-source variant replacing Bedrock with Janus WebRTC, Whisper ASR & HuggingFace LLMs.
- Authored workflow documentation covering end-to-end architecture, data flows, & security considerations.

Impact: Demonstrated feasibility of LLM-driven speech & text analytics in enterprise environments, laying the foundation for future production integration.

Siemens Digital Industries Software

Software Engineer | November 2022 – March 2024

Project: Teamcenter — Process Planning & Work Instruction
Tech Stack: C++11, Teamcenter ITK APIs, BMIDE, SQL, XML/JSON, Linux

Overview: Developed & enhanced core Teamcenter PLM modules for Process Planning & Work Instructions. Focused on extending product-lifecycle functionality using C++ ITK APIs, improving data extraction, & automating high-volume cloning workflows.

Key Contributions:
- **Automated Cloning Utility:** Designed & implemented a stand-alone C++ console application using Teamcenter ITK APIs to clone complete product structures based on Product IDs, handling deep hierarchies, datasets, forms & naming rules.
- **Database Integration:** Implemented SQL queries & transaction-safe routines to retrieve & update BOM & process-planning data during cloning operations.
- **Search & Filtering Optimization:** Enhanced Teamcenter client search module with multi-parameter filtering & caching mechanisms, improving cloning & search performance by ~25%.
- **Feature Maintenance:** Resolved critical bugs & refactored legacy C++ code in process-planning workflows to improve code stability, maintainability & consistency across modules.
- **Testing & Validation:** Developed Python scripts for batch testing, data-integrity checks & verification of cloned product structures post-migration.
- **Configuration Management:** Updated BMIDE data models, attribute definitions & preferences to support new cloning functionalities.

Impact: Delivered a fully automated product-cloning solution that reduced manual data-replication time from hours to minutes & significantly improved efficiency in PLM process-planning operations.

Dassault Systèmes (3DPLM)

R&D Engineer | May 2018 – October 2022

Project: CATIA — Idealization of CAD Geometry for Meshing

Tech Stack: C++11, CAA RADE SDK (CATIA V5R27), Visual Studio, XML, Hidden Markov Models, Genetic Algorithms, Custom Math Modules, CATIA Geometry APIs

Overview: Developed an intelligent C++ plug-in within the CATIA CAA RADE framework to automatically detect, optimize & repair CAD features that degrade mesh quality. Combined probabilistic geometry classification with optimization to generate "idealized" proxy models for meshing.

Key Contributions:
- **Algorithmic Architecture:** Designed a closed-loop geometry-optimization pipeline integrating a Hidden Markov Model (HMM) for feature-risk classification, a Genetic Algorithm (GA) for controlled deformation & a multi-parameter scoring function for fitness evaluation.
- **Feature Extraction:** Implemented C++ topology traversals over CATIA Part/Body structures to compute geometric metrics (edge lengths, radii, corner angles, clearances, area, perimeter) normalized to target element size.
- **Probabilistic Analysis:** Built a custom HMM engine to classify geometry into Good / Borderline / Bad using edge-level observations (short edges, angle deviation, clearance risk), improving spatial consistency vs. rule-based heuristics.
- **Evolutionary Optimization:** Developed a GA framework with simulated-binary crossover, Gaussian mutation & topology-repair operators to evolve deformation parameters (fillet delta, taper shift, corner adjustments).
- **Scoring Model:** Authored a normalized fitness function combining seven geometric indicators—orthogonality, aspect ratio, size continuity, short-edge ratio, clearance, radius stability & deformation cost.
- **Iteration Controller:** Implemented multi-iteration feedback control to track global score deltas & terminate when improvement < threshold, ensuring convergence within ≤ threshold iterations (default is 12).
- **CAA Integration:** Integrated algorithms with CATIA APIs (CATCommand, CATDialog, CATTopData, CATModify, CATCreateTopo) & registered the plug-in via CAA Add-in Registry; executed background GA threads with mutex-protected CATIA calls.
- **Validation & Performance:** Achieved ~40% reduction in meshing time, 71% drop in poor-aspect-ratio elements & 83% fewer meshing failures across benchmark models.
- **Robustness:** Added safeguards for thin features, symmetric parts & coupled-hole regions; implemented rollback & repair mechanisms to maintain topological validity.

Impact: Delivered a fully automated CAD-idealization plug-in that intelligently optimized geometry while preserving design intent—cutting meshing preparation time by ~40%, improving mesh quality by ~60% & laying groundwork for AI-assisted geometry optimization inside CATIA.

Renishaw Metrology Systems Pvt. Ltd.

Associate Software Engineer - Vision & Automation R&D | July 2016 - April 2018

Project: Automated GD&T Extraction from Engineering Drawings

Tech Stack: C++ (Visual Studio 2015), OpenCV 3.x, Tesseract 3.04, Windows 10, JSON Export, MODUS DLL Integration

Overview: Developed a computer-vision & OCR pipeline to automatically detect & extract Geometric Dimensioning & Tolerancing (GD&T) symbols & associated values from scanned 2D engineering drawings (PDF format). The extracted data was formatted as structured JSON for direct import into Renishaw's MODUS CMM inspection software.

Key Contributions:

- Image Pre-processing: Implemented grayscale conversion, adaptive thresholding, morphological closing, de-skewing, & contour filtering to isolate GD&T regions from line drawings.

- Symbol Detection: Built a library of 15 standard GD&T templates ($\varnothing$, Flatness, Parallelism, Position, etc.); used multi-scale template & contour matching (Hu Moments) with rotation invariance to detect symbols at ~90% accuracy on 100+ drawings.

- OCR Integration: Leveraged Tesseract 3.04 for text recognition of adjacent tolerance values & datums; post-processed output via regex cleanup to handle notations like "$\varnothing$0.01 | A | M."

- Feature Frame Reconstruction: Combined symbol & text regions through rule-based grammar parsing to form feature control frames (symbol type, tolerance, datums, modifiers, coordinates).

- MODUS Integration: Exported results as JSON & developed a Windows DLL invoked by MODUS during drawing import to auto-visualize 3D inspection features.

- Performance: Reduced manual GD&T data-entry time by about 80% per drawing (10 to 2 min) while maintaining about 90% symbol/OCR accuracy.

Impact: Delivered an automated GD&T extraction system that significantly accelerated CMM inspection planning & laid the foundation for later computer-vision R&D at Renishaw.

EDUCATION

College of Engineering, Pune (COEP)

Master of Technology - Mechatronics | June 2014 - May 2016

Thesis: *"Neuro-Fuzzy Robot Navigation System"*

- Focused on intelligent control systems, mechatronic integration, & applied robotics.
- Developed a fuzzy-based path planning & obstacle avoidance algorithm implemented in MATLAB & embedded microcontrollers.

Government Engineering College, Aurangabad

Bachelor of Technology - Computer Science & Engineering | June 2009 - May 2013

Project: *"Intrusion Detection System using Fuzzy Logic"*

- Built a network-level intrusion detection prototype using rule-based fuzzy logic for anomaly classification.

CERTIFICATIONS

- Certified SAFe® 6 Practitioner - Scaled Agile, Inc. | Dec 2023