Yudhistira Yoga Semeru

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Summary

M.Sc. graduate in Visual Computing from Saarland University with 4 years of industry and 4 years of research experience in graphics programming, computer vision, augmented reality, robotics, and software engineering. Specialized on building lightweight, scalable, and high-performance for real-time visual computing solutions.

Work Experience

CAD-IT Consultants (Asia) Pte Ltd, Computer Vision Engineer (Indonesia) **Nov 2020 – Apr 2023**

- Supervised a team of 4 engineers delivering end-to-end machine learning, computer vision, and augmented reality (AR) solutions for clients in Southeast Asia and Europe from ideation to deployment and documentation.
- Designed and implemented 14 production-ready machine learning solutions using Python, PyTorch, scikit-learn, and C++ covering real-time object detection, image segmentation, anomaly detection, hand gesture recognition, object tracking, warehouse drones, operator guidance systems, indoor navigation systems, and data acquisition using OCR.
- Collaborated directly with product managers to define technical requirements, explain complex ML concepts, and ensure solution alignment with business goals.
- Enforced version control (Git) for clean code and reviews, and produced technical documentation, developer tutorials, and step-by-step integration guides for smooth project handover.
- Recognized in the top 10% of employees for innovation and measurable contributions to company growth.

Multipolar Technology, Application Developer (Indonesia) **Nov 2019 – Nov 2020**

- Implemented an API protection system in Identity and Access Management (IAM) project for banking application using a third-party enterprise security provider, enabling biometric authentication and multi-factor authentication for one of Indonesia's largest banking applications.
- Configured bare-metal deployment infrastructure and conducted load testing to validate performance and reliability of high-volume banking APIs.

Bandung Institute of Technology, Mechatronics laboratory assistant (Indonesia) **Aug 2018 – June 2019**

- Instructed 2nd–4th year Mechanical and Mechatronics Engineering students in laboratory courses on electrical components, PLC programming, and microcontroller systems (Arduino), covering both theory and hands-on applications.

Robomarine Indonesia, Robotics Simulation Intern (Indonesia) **June 2018 – Aug 2018**

- Utilized ANSYS Fluent for CFD-based optimization, performing meshing, geometry preprocessing, and simulation parameter tuning to maximize hydrodynamic efficiency.
- Optimized Autonomous Underwater Vehicle (AUV) design using physical-based Computational Fluid Dynamics (CFD) simulation, allowing higher performance on underwater operating periods by 306% of its initial design.

Research Experience

Computer Graphics Group, Universität des Saarlandes - Thesis Research. (Germany) **Aug 2024 – July 2025**

- Developed a GPU-accelerated physically based path tracer using CUDA and NVIDIA OptiX for high-performance, efficient light transport simulation using Monte Carlo methods.
- Implemented advanced rendering techniques including Multiple Importance Sampling (MIS), homogeneous & heterogeneous volumetric rendering, and integration of neural and hardware-accelerated ray tracing.
- Modified the Mitsuba3 inverse rendering pipeline to support gaussian volume primitive training for arbitrary heterogeneous volume.
- Applied neural-based optimization to improve GPU path tracing performance by 1600% and reduce volume data size by 99.6%, enabling stable 1080p global illumination path tracing at 30–60 FPS, even with dense heterogeneous volumes.

Autonomous Vehicle Research Group, Bandung Institute of Technology - Robotics Engineer. (Indonesia) **Sept 2016 – Nov 2019**

- Led and advised an 8-member mechanical team in CAD design, simulation, manufacturing and assembly to develop 9 autonomous mobile soccer robots and a telepresence robot.
- Developed a custom omnidirectional camera system using a catadioptric mirror, ray-tracing simulation for wide-angle visual perception, and CNC manufacturing. It enables scene segmentation over an entire field with only a fraction of the original device price (<2%). This includes an image processing pipeline to detect ball and segment playing fields, achieving real-time performance ~30FPS and suitable for remotely tuning the parameter.
- Conducted bachelor's thesis on the design and control of a high-speed (~6 m/s) ball-handling mechanism, meeting RoboCup Middle-Sized League requirements and delivering a generalizable control algorithm.
- Ensure research schedule and manufacturing pipeline in coordination with other division (electronics and software), including hardware development lifecycle (CAD design, simulation, manufacturing vendors, final assembly, and testing)

Education

M.Sc., Visual Computing, Mathematics & Computer Science Dept., Universität des Saarlandes **Apr 2023 – July 2025**

- Thesis topic: Neural-precomputed scattering for real-time rendering of heterogeneous volumes.
- Relevant coursework: Computer Graphics, Image Processing and Computer Vision, High Level Computer Vision, 3D Computer Vision, Image Compression, Digital Signal Processing, and System Architecture.

B.Sc., Mechanical Engineering (Mechatronics minor), Bandung Institute of Technology **Aug 2015 – Oct 2019**

- Thesis topic: Design and control system of ball handling mechanism for mobile soccer robots.

Selected Projects

3D Gaussian Splatting for Lightweight Autonomous Driving Simulation [Vulkan, CUDA, TensorRT,] – Personal project (2026)

- Developed a real-time autonomous driving simulation engine using 3D Gaussian Splatting integrated with Vulkan, CUDA, and TensorRT for lightweight, high-fidelity rendering and deep learning inference.
- Implemented a Multi-Anchor Gaussian Splatting approach to limit GPU VRAM consumption at just 650MB, achieving 215 FPS at 480p and 90 FPS at 1080p for a large-scale scene.
- Engineered a zero-copy pipeline utilizing Vulkan-CUDA interoperation, enabling zero-copy data transfer between simulation rendering and DeepLabv3+ inference (running at 60 FPS at 480p)
- Built a custom CUDA-accelerated semantic segmentation pipeline to generate 2D costmaps, providing critical environmental data for downstream local path planning.

Hybrid Neural GPU Path Tracer [CUDA, OptiX, TinyCUDA-nn] – Thesis project **(2025)**

- Developed a hybrid path tracing engine integrating neural inference with hardware-accelerated ray tracing, achieving 1600% performance improvement and 99.6% data compression. Optimized for high-performance, bandwidth-constrained platforms to deliver stable 1080p rendering performance at ~30-60 FPS with highly dense heterogeneous volumes.
- Used NVIDIA Nsight Compute and CUDA Memcheck extensively for GPU performance profiling, debugging, and memory error detection during development.
- Strong understanding of GPU architecture and the CUDA programming model, enabling efficient use of hardware acceleration features in combination with a neural inference pipeline (CUDA, TinyCuda-nn, and OptiX simultaneously).

Indoor Navigation System [Android studio] – Work project **(2022)**

- Developed a real-time indoor navigation app combining probabilistic sensor fusion (visual odometry, GNSS, WiFi fingerprinting) to achieve accurate localization on resource-constrained mobile platforms.
- Implemented optimized rendering and directional guidance using OpenGL ES and GLSL shaders.
- Ensured robust, low-latency performance with advanced debugging and profiling tools.

Computer Vision with Azure Cloud (Hackathon) [Azure cloud, PowerBI] - Competition project **(2021)**

- Designed Dago-AInspector, an AI-powered system to detect defective products in real time on mass manufacturing lines, enabling data-driven quality assurance and cost impact analysis.
- Built and integrated an image classification pipeline using Azure Functions, Azure Computer Vision, and cloud databases, with defect insights visualized in PowerBI.
- Won the competition by delivering the top-rated solution among 100+ participants, recognized for its scalability and real-world applicability in dynamic manufacturing environments.

Mobile Soccer Robots for RoboCup Middle Sized League (MSL) [ROS1, OpenCV]– Competition, Thesis project **(2016-2019)**

- Led a team of 8 engineers to develop 9 autonomous soccer robots and a telepresence robot for RoboCup MSL, overseeing the full hardware development lifecycle including CAD, simulation, manufacturing, and testing.
- Designed a custom omnidirectional vision system using a ray-tracing with only 2% of commercial device cost, enabling full-field perception, real-time image processing (~30 FPS), and remote parameter tuning.
- Achieved various awards over 3 years, and developed state-of-the-art ball handling mechanism for bachelor thesis.

Top 5 Achievements

- **5th Place and Highest Accuracy Awards in Road Damage Detection (RDD) AI Competition (2023),** *Ministry of Public Works and Public Housing, Republic of Indonesia.*
  Recognized for 5th place and awarded highest accuracy in AI-based road defect detection and quality reporting web application.
- **Talent Recognition Award (2022),** *CAD-IT Consultants (Asia) Pte Ltd, Indonesia.*
  Given to the top 10% contributor upon the company's growth.
- **The Winner of Accenture case challenge HackaTUM (2021),** *Technische Universität München (TUM), Germany.*
  An annual hackaton by TUM with given cases from various German companies in München.
- **1st Winner and Best Strategy in Middle Size Soccer Robot (2019),** *Ministry of Research, Tech., and Higher Education Republic of Indonesia.*
  The best team with autonomous gameplay in football robotics competition between universities in Indonesia based on RoboCup rule.
- **Best Strategy in Middle Size Soccer Robot (2018),** *Ministry of Research, Tech., and Higher Education Republic of Indonesia.*
  The first team with fully-autonomous gameplay in football robotics competition based on RoboCup rule.

Top Publications

- **Neural-Precomputation for Real-Time Rendering of Heterogeneous Volumes**
  Master Thesis, Faculty of Mathematics and Computer Science, Universität des Saarlandes 2025
- **Mechanical Design and Control System of Ball Handling Mechanism in Mobile Soccer Robot**
  Bachelor Thesis, Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung (ITB) 2019
- **Development of the Wheeled Soccer Robot Dagozilla Version 2.1 for the Middle Size League (MSL) Competition.**
  The Indonesian Symposium on Robotic Systems and Control (ISRSC) 2019

SKILLS

- **Programming Languages**
  Python, C++, C#, C, Java, JavaScript, GLSL.
- **Machine Learning, Deep Learning, Computer Vision**
  TensorRT, PyTorch, TensorFlow, scikit-learn, OpenCV, TensorBoard, MLflow, Weights & Biases (Wandb), Tinycuda-nn.
- **Rendering & GPU Programming:**
  Vulkan, CUDA, OpenGL, OpenGL ES, NVIDIA OptiX, NVIDIA Nsight Compute.
- **Robotics & Embedded Systems**
  Arduino, STM32 Nucleo (Mbed), ROS 1, ROS 2, PLC, Scala.
- **Software Engineering & Development Tools:**
  Git, CMake, Visual Studio, Android Studio, Qt++, Jenkins, Docker, Apache Airflow, Minio, Ansible.
- **Deployment, DevOps & MLOps:**
  Docker, Jenkins, CI/CD pipelines, baremetal deployment, microservices architecture
- **Communication Protocols & APIs:**
  gRPC, REST API, WebSocket, RTMP, WebRTC
- **3D Modeling & Simulation:**
  Blender3D, Autodesk Inventor, SolidWorks, Mitsuba3, Unity3D