

ARSALAN KHAWAJA

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OBJECTIVE

Computer Vision engineer with 5+ years developing automated inspection systems using advanced imaging (hyperspectral, RGB-D) and robotics (ROS). Expert in detecting surface anomalies invisible to standard cameras, real-time processing, and autonomous systems.

EDUCATION

Ph.D. in Computer Science (Joint), Norwegian University of Science and Technology (NTNU) & Université de Bourgogne 2021 - Present (*Finishing*)

Thesis: Artificial Intelligence for Acquisition and Modelling of Appearance of Surfaces.

Master of Science in Computer Vision, Université de Bourgogne, France 2019 - 2021

Thesis: Computer Assisted Open Liver Surgery

Focus: Robotics, Image Processing, Computer Vision, Medical Image Analysis, Visual Perception, Real-time Imaging and Control, Scene Segmentation and Interpretation, Visual Tracking, Sensor Fusion.

Bachelor of Science in Aerospace Engineering, Institute of Space Technology, Pakistan 2014 - 2018

Thesis: Robust Control of Inverted Pendulum Focus: Flight Control Systems, Aerodynamics, Aero-Vehicle Design, Instrumentation and Control Theory. Gold Medalist.

SKILLS

Computer Vision	Object Detection, Registration (3D, 2D), Depth Estimation, Segmentation, Classification, Real-time Processing, Hyperspectral/Multispectral Imaging, PCA, Spectral Analysis, Defect/Anomaly Detection, Object Tracking, Structure from Motion (SfM)
ML/DL Frameworks	PyTorch, TensorFlow, Keras, Scikit-Learn, NumPy, Pandas, Wandb, Hugging Face
Programming	Python (expert), C++, MATLAB, Linux, FastAPI, Git, Docker, PyQt
Robotics	ROS, Linux, Point Cloud Processing, Sensor Integration, Visual Servoing, Feedback Control, Path Planning
Development	Agile/Scrum, CI/CD (GitHub Actions), Jira, Version Control
Simulation	Gazebo, Simulink, Modelica, Rviz

EXPERIENCE

Computer Vision Researcher Sept 2021 - Present
NTNU, Norway & Université de Bourgogne, France *Gjøvik / Dijon*

- Designed and developed computer vision algorithms for Reflectance Transformation Imaging (RTI), optimizing image acquisition and surface analysis.
- Designed and implemented deep learning pipelines for object fragment matching and clustering under challenging conditions (degradation, occlusion, damage) in collaboration with Kulturhistorisk Museum in Oslo.
- Published 5 peer-reviewed papers in international venues, including ICCV and Nature Portfolio Journal Heritage Science ([Google Scholar](#))

Computer Vision Research Intern Jan 2021 - June 2021
EnCoV Research Group *Clermont-Ferrand, France*

- Developed 3D registration method for computer-assisted liver surgery using RGB-D sensors (Intel RealSense D435i) and point cloud processing for Augmented Reality (AR) application ([Project Report](#)).
- Implemented real-time sensor fusion pipeline combining RGB-D cameras, ICP algorithms, and 3D reconstruction (Kinect Fusion, SfM).

- Collaborated with surgeons to acquire data during open liver surgeries at CHU Estaing hospital.
- Conducted extensive testing on depth sensor accuracy under various lighting conditions, discovering 2x error increase under surgical lighting.

RELATED PROJECTS

Autonomous Robot Navigation using ROS: Implemented complete autonomous navigation pipeline for Turtle-Bot3 using ROS Kinetic, including SLAM-based mapping, Monte Carlo localization (AMCL), and path planning with dynamic obstacle avoidance. Developed custom nodes for robot control and sensor integration, creating occupancy grid maps with RViz visualization. Designed a waypoint-based navigation system for autonomous sequential goal execution in Gazebo simulation environment. ([Project Link](#))

Hyperspectral Imaging for Early Defect Detection: Developed automated apple bruise detection system using hyperspectral imaging to identify subsurface damage within 30 minutes of impact - invisible to RGB cameras and the human eye. Implemented PCA-based spectral analysis in near-infrared (700-900nm) ([Project Link](#)). Technique applicable to runway inspection for detecting invisible hazards (fuel spills, ice, contaminants).

Interactive Segmentation and 3D Reconstruction of Tumor and Prostate Lobes: Developed a semi-automatic prostate segmentation system using Active Contour Models. Created a comprehensive DICOM image processing pipeline including anonymization, format conversion (DICOM/JPEG), and multi-zone segmentation of prostate anatomy. ([Project Link](#))

Robust Control for Inverted Pendulum System: Designed and analyzed classical (PID), optimal (LQR), and robust (H_∞) controllers for an inverted pendulum system using MATLAB/SIMULINK and Modelica simulation environments. Implemented H_∞ controllers via mixed sensitivity and loop shaping methods, developing nonlinear models with 3D visualization. Conducted Monte Carlo simulations (300 iterations) to evaluate controller robustness under parameter uncertainties ($\pm 50\%$) and external disturbances, demonstrating LQR's superior robustness and H_∞ 's excellent performance for stabilization tasks. ([Project Report](#))

LEADERSHIP AND EXTRA-CURRICULAR ACTIVITIES

- Lead researcher on international joint PhD project spanning two institutions (NTNU, Norway and UBE, France), managing research direction, timelines, and deliverables across multiple partners and supervisors.
- Co-ordinating functional collaboration between computer scientists, cultural heritage experts, and museum professionals for imaging and digitization projects.
- Received DION Grant 2024 Award for organizing "Financial Literacy Seminar". Led event planning, coordinated speakers, and delivered presentations on investment strategies for NTNU employees.
- Founded and managed the NTNU Padel Sports community at the departmental level; managed sports sessions focused on a better workplace environment for employees.
- Volunteer language instructor for "Langues et Cultures Autrement" program at Université de Bourgogne Europe, facilitating cross-cultural exchange and language learning for international students and the general public.

LANGUAGES

Native: English, Urdu, Sindhi, — **Intermediate:** French (B1) — **Basic:** Norwegian (A2)

REFERENCES

Prof. Jon Yngve Hardeberg Professor NTNU, Norway Email: jon.hardeberg@ntnu.no	Prof. Sony George Professor NTNU, Norway Email: sony.george@ntnu.no	Ramamoorthy Luxman Robotics Engineer Flanders Make, Belgium l.ramamoorthy01@gmail.com
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