

# TAHIRA SHEHZADI

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## Introduction

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I am a fifth-year PhD researcher (thesis submitted) at RPTU Kaiserslautern and DFKI, Germany, under the supervision of Prof. Didier Stricker, and a DAAD-funded scholar working on semi-supervised learning and 2D object detection. My research interests include medical imaging, document layout analysis, and autonomous driving, with a particular focus on detection methods requiring minimal supervision.

## Notable Publications

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1. **Tahira Shehzadi**, Khurram Azeem Hashmi, Shalini Sarode, Didier Stricker, Muhammad Zeshan Afzal “*STEP-DETR: Advancing DETR-based Semi-Supervised Object Detection with Super Teacher and Pseudo-Label Guided Text Queries*”, **ICCV 2025**.

Contribution: A SOTA semi-supervised object detection framework targeting rare categories.

2. **Tahira Shehzadi**, Khurram Azeem Hashmi, Didier Stricker, Muhammad Zeshan Afzal “*Sparse Semi-DETR: Sparse Learnable Queries for Semi-Supervised Object Detection*”, **CVPR 2024**.

Contribution: A SOTA semi-supervised object detection framework targeting small objects.

3. **Tahira Shehzadi**, Didier Stricker, Muhammad Zeshan Afzal “*A hybrid approach for document layout analysis in document images*”, **ICDAR 2024**.

Contribution: AI framework for understanding and segmenting complex document layouts.

## Education

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**RPTU Kaiserslautern-Landau, Germany**

*Ph.D. in Computer Science* **Publications: 18**

**Oct 2021 - March 2025**

*Kaiserslautern, Germany*

**Pakistan Institute of Engineering & Applied Sciences**

*M.S. in Computer Science* **German Grade: 1.3/4.0**

**January 2019 - November 2020**

*Islamabad, Pakistan*

**University of Engineering and Technology**

*B.Sc. in Electrical Engineering* **German Grade: 1.4/4.0**

**September 2014 - June 2018**

*Lahore, Pakistan*

## Technical Skills

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**Languages**: Python, C++, MATLAB, SQL, Bash, JavaScript, HTML/CSS

**Libraries/Frameworks**: PyTorch, TensorFlow, Keras, OpenCV, Scikit-learn, NumPy, Pandas, Seaborn, Matplotlib

**Cloud & DevOps**: AWS (SageMaker, EC2, Lambda, S3), Google Cloud, Azure, Docker, Git, GitHub, GitLab

**Hardware & Sensors**: Raspberry Pi, Arduino, STM32L4, TIVA C, Sensor integration

## Work Experience

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**German Research Center for Artificial Intelligence (DFKI)**

**October 2021 – December 2025**

*PhD Researcher*

*Kaiserslautern, Germany*

- Led research on semi-supervised object detection for challenging 2D environments under the BMBF project.
- Designed and deployed a vision-guided multimodal pipeline for document layout analysis under the LUMINOUS project, achieving approximately 98% precision.
- Developed computer vision-based medical anomaly detection systems under the AIRISE project, ensuring compliance with medical standards and minimum annotation and processing time by 70%.
- Supervised Master’s students in research on semi-supervised, unsupervised, and multimodal learning.

**Tensorlake startup**

**January 2025 – October 2025**

*Applied AI Scientist*

*Tensorlake, USA (Remote)*

- Worked as an Applied AI Scientist focusing on document intelligence and computer vision research.
- Trained models for generating document layout data and implemented advanced post-processing pipelines to improve layout consistency and OCR accuracy.
- Developed a strikethrough detection pipeline involving data creation, model training, and automatic strikethrough removal prior to OCR, improving text recognition precision.
- Led VLM integration for document analysis, defining a JSON annotation schema and benchmarking Azure Document Intelligence, Amazon Textract, Google Gemini, and DotsOCR for accuracy, and latency.

## Selected Projects

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### **STEP-DETR: Advancing DETR-based Semi-Supervised Object Detection with Super Teacher & Pseudo-Label Text Queries**

Augmented Vision Group @ DFKI / RPTU, 2025

- Proposed STEP-DETR, a semi-supervised DETR framework tackling noisy pseudo-labels, confidence bias, and weak query generation in transformer-based object detectors.
- Introduced a Super Teacher (static + dynamic) architecture that produces high-quality pseudo-labels for unlabeled data, significantly boosting the student detector's learning efficiency.
- Developed Pseudo-Label Guided Text Queries and Denoising Text-Guided Object Queries to improve discrimination between objects and background and strengthen learning of rare categories.
- Achieved +1.9 mAP on MS-COCO with only 10% labeled data, setting a new state-of-the-art in semi-supervised DETR while reducing training cost.

### **Unified Document Parsing with Fine-Grained Element Detection**

Applied AI Scientist @ Tensorlake, 2025

- Developed a unified document parsing system to improve detection reliability in dense and visually complex document layouts with diverse and tightly packed elements.
- Enhanced spatial reasoning to stabilize category confidence and enforce structural coherence across heterogeneous documents.
- Extended detection beyond text, tables, forms, and figures to fine-grained targets including handwritten and digital formulas, strikethroughs, stamps, and watermarks.
- Enabled high-fidelity document intelligence for legal, academic, and financial workflows by supporting strikethrough removal prior to OCR.

### **FD-SSD: Semi-supervised Detection of Bone Fenestration and Dehiscence in Intraoral Images**

Augmented Vision Group @ DFKI / RPTU, 2025

- Introduced FD-SSD, a semi-supervised object detection framework tailored for detecting bone fenestration and dehiscence (FD) in intraoral images, addressing limited labeled data and subtle anatomical cues.
- Employed a teacher-student architecture alongside an adaptive query strategy and query filtering module that jointly leverage labeled and unlabeled intraoral images to generate reliable pseudo-labels and reduce noise.
- Achieved 68.3% mAP, outperforming the supervised baseline at 62.08% and the prior FD-SOS model at 65.67% using the same limited labeled dataset.
- Demonstrated practical effectiveness for clinical dental imaging by enhancing FD detection in accessible intraoral photographs, reducing reliance on CBCT scans and costly annotation workflows.

### **Sparse Semi-DETR: Sparse Learnable Queries for Semi-Supervised Object Detection**

Augmented Vision Group @ DFKI / RPTU, 2024

- Introduced Sparse Semi-DETR, a DETR-based semi-supervised object detection model that addresses inaccurate one-to-one pseudo-labels and overlapping predictions from one-to-many assignments in SSOD.
- Introduced a Query Refinement mechanism that enhances object queries for challenging objects by fusing multi-level features and suppressing redundant or low-quality queries.
- Designed a Reliable Pseudo-Label Filtering module that selectively uses only high-confidence pseudo-labels from unlabeled images to reduce training noise and improve consistency.
- Achieved 44.3 mAP on MS-COCO with only 10% labeled data and 51.3 mAP with full labeled + extra unlabeled data, outperforming prior DETR-based SSOD methods.

## Awards & Fellowships

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- **DAAD Fellowship:** Received PhD Scholarship (2021–2026)
- **NSF Travel Grant:** For WiML Workshop at NeurIPS 2024
- **PIEAS Fellowship:** Received merit based full scholarship for complete Masters
- **Awards:** Nominated for the Two Academic Excellence Medals 2014 in Intermediate Studies