

# Sourour Hammoud

Computer & Communications Engineer — Machine Learning, Software & Systems

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## Professional Summary

Computer & Communications Engineer working across machine learning, software, and connected systems, with a focus on building solutions that are robust, secure, and explainable. Hands-on experience with large language models, LangChain, RAG and agentic systems from a research internship in Paris, alongside a deep-learning graduate thesis that built a four-pipeline multimodal system for automated dental-implant risk classification, reaching 92.7% AUC-ROC on lesion detection and 95.1% accuracy on tabular risk classification under missing-data conditions. Open to research and engineering opportunities.

## Education

### M.Eng. in Computer & Communications Engineering

Oct 2021 – 2026

*Lebanese University — Faculty of Engineering, Tripoli (ULFG)*

Lebanon

Five-year engineering program. Key topics: signal processing, machine learning, computer networks, embedded systems (IoT), cryptography & security, algorithms, and software engineering. Final-year project on multimodal AI for dental CBCT analysis (see below).

### M.Eng. in IoT and Smart Systems

Sept 2025 – 2026

*Lebanese University — Faculty of Engineering, Tripoli (ULFG)*

Lebanon

Final year taken concurrently with the last year of the Computer & Communications Engineering degree, under ULFG's dual-enrollment allowance for the final year. Key topics: deep learning, explainable AI, medical imaging, distributed ML (Apache Spark), generative AI, IoT architectures, embedded intelligence, edge computing, and multimodal data fusion.

## Research & Professional Experience

### Graduate Thesis — Multimodal AI for Dental-Implant Risk Classification

2025 – 2026

*Lebanese University (ULFG), with Zaka and Dr. Joe Basil Dental Clinic*

Supervisor: Dr. Samer El Zant

[Github](#)

- Designed and built a four-pipeline multimodal AI system estimating ITI SAC (Straightforward/Advanced/Complex) implant risk from CBCT, panoramic and intraoral imaging plus 18 structured clinical factors, aggregated under a worst-case clinical decision rule across 8 datasets.
- CBCT bone-factor pipeline:** benchmarked 7 architectures (DenseNet121, ResNet50, EfficientNetV2-S, ConvNeXtV2, DINOv2, Detectron2, TorchXRyVision) on 538 annotated sagittal CBCT slices. Diagnosed a train/test coordinate-leakage failure (accuracy collapsed to 40% when annotation coordinates were withheld at test time) and resolved it with a two-phase training curriculum, reaching **67% held-out accuracy** — a 23-point gain over the majority-class baseline (43.9%).
- Panoramic lesion pipeline:** YOLOv8s tooth detector (99.5% mAP@50) feeding a ResNet50 lesion classifier, trained across 4 pooled datasets. Traced a lesion-recall gap to an over-tight crop margin and fixed it, recovering **46% more positive training crops**; reached **92.7% AUC-ROC** with 1.4% calibration error after Platt scaling.
- Intraoral pipeline:** YOLOv8s tooth detector (94.6% mAP@50) driving geometric proxies for prosthetic-space and edentulous-span factors (91.7% F1), plus a ResNet50 soft-tissue-quality classifier (80.6% AUC).
- Tabular pipeline:** TabNet classifier over 18 clinical factors (10,000-row dataset), reaching **95.1% accuracy** even with 15 of 18 factors missing at inference, with attention-based per-factor attribution surfaced to the clinician.
- Stack:** Python, PyTorch, DenseNet121, EfficientNetV2, ConvNeXtV2, DINOv2, YOLOv8, TabNet, SHAP, Grad-CAM, Optuna, OpenCV, Streamlit.

### AI Agents & Security Intern

Jul – Sep 2025

*VersifAI — Paris, France*

Remote

- Built LLM-powered agentic AI systems during a supervised research program with a Paris-based AI & cybersecurity company: designed agent prototypes with **LangChain** and Smolagents (extended with custom tools), applied **retrieval-augmented generation (RAG)** and prompt engineering, and benchmarked competing agent architectures.
- Developed anomaly-detection components using classical ML (Isolation Forest and related methods); passed oral examinations on AI security principles, attack methodologies, and defenses; published the project as “Holmes Analytics” on GitHub.

### Image Annotation Intern

2024

*DOT Lebanon*

Tripoli, Lebanon

- Structured image annotation for AI/ML training datasets using the Tagadam framework, ensuring labeling accuracy and consistency across large image sets.

- Studied digital switch design, tele-traffic engineering, and NGN/LTE/IMS access networks; hands-on MDF surveying and fibre-optic (FTTH/FTTC) testing and splicing.

Selected Projects

Explainable AI Benchmark (Rossmann Store Sales)

Python, PyTorch, Captum, LIME | [Github](#)

- Implemented and compared SHAP (Tree/Deep/Gradient), LIME, Grad-CAM, Integrated Gradients, and saliency maps across tabular and image classification models.

Trustworthy Credit Scoring

Python, scikit-learn, SHAP, Fairlearn, XGBoost | [Github](#)

- Fair, explainable credit-risk pipeline (XGBoost + logistic regression with fairness constraints); SHAP feature attribution; evaluated demographic parity and equalized odds.

Holmes Analytics — Anomaly Detection Platform

Python, ML, Streamlit | [Github](#)

- Interactive anomaly-detection web app (Isolation Forest, One-Class SVM, LOF) with live dataset upload and a Streamlit UI; developed during the VersifAI AI-agents program.

Distributed Multiplayer Game (Java RMI)

Java, RMI, client-server

- Multiplayer client-server game built with Java RMI (remote method invocation / RPC), handling concurrent players and distributed shared state.

PRINCE — Low-Latency Block Cipher

Python, Jupyter | [Github](#)

- From-scratch implementation of the PRINCE lightweight block cipher (FX construction,  $\alpha$ -reflection), validated against official ASIACRYPT test vectors.

**Other projects:** *YOLOv8+DeepSORT real-time object tracker; Chicago Crime Analysis (Apache Spark distributed ML); Smart Traffic Light Management (IoT/MQTT); Speech Recognition (CNN); Online Gaming Behavior Prediction; Personal web portfolio (JavaScript/Netlify); Antenna Simulation & Digital Signal Processing (MATLAB).*

Technical Skills

|                        |                                                                                                              |
|------------------------|--------------------------------------------------------------------------------------------------------------|
| Deep Learning & ML     | PyTorch, TensorFlow/Keras, scikit-learn, CNNs, LSTMs, Transformers, GANs, Diffusion Models                   |
| LLMs, Agents & GenAI   | LangChain, Smolagents, RAG, prompt engineering, agentic systems, LoRA fine-tuning, HuggingFace               |
| Medical AI & XAI       | DenseNet121, EfficientNet, TabNet, SHAP, Grad-CAM, LIME, Captum, medical image analysis (CBCT, segmentation) |
| Computer Vision        | YOLOv8, DeepSORT, OpenCV, object detection & multi-object tracking, real-time video pipelines                |
| Big Data & Distributed | Apache Spark, Hadoop, distributed ML pipelines, Java RMI (RPC)                                               |
| Networks & Security    | TCP/IP, network configuration, RF / fibre-optic fundamentals, adversarial robustness, cryptography           |
| IoT & Embedded         | MQTT, LoRa, Raspberry Pi, ESP32, AVR microcontrollers                                                        |
| Programming            | Python, C/C++, C#, Java, SQL, JavaScript, MATLAB                                                             |
| Tools & Platforms      | Docker, Kubernetes, Google Colab, Streamlit, Linux                                                           |
| Languages              | Arabic (native), French (B2), English (B2)                                                                   |

Certificates & Achievements

- AI Security Training Program (AI Agents Development) — VersifAI, Paris | Oct 2025
- Artificial Intelligence Course — Samsung Innovation Campus | Aug-Oct 2025
- “Build Your Own ChatGPT” Workshop — AI Club ULFG1 | Apr 2025
- Annual Robotics Competition — ARC10, Sumo Open Challenge | Apr 2025
- “Introduction to ROS 2” Workshop — ULFG1 Robotics | May 2025
- Telecommunications Internship Certificate — OGERO | Sept 2024
- Basic AI Certificate — DEEP Project (DOT Lebanon) | 2024
- Career Development Course (“From Where to Begin”) — Irshad & Islah, Skills Development Institute | Dec 2023

Volunteering

Event Organizer & Coordinator — Alumni Foundation, Tripoli

North Lebanon

Plan and coordinate community festivals and social events; manage logistics, teams, and resources for large-scale cultural activities.