Fabio Antonini

Senior Software Engineer & AI/Machine Learning Practitioner
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Professional Summary

Seasoned **Software Engineer** with 20+ years of experience in embedded systems and telecommunications, now specialized in **Artificial Intelligence and Machine Learning**. Proven track record in software architecture and firmware development for networking devices, combined with strong proficiency in **Python** and deep learning frameworks (**TensorFlow, PyTorch**). Passionate about applying AI/ML solutions to real-world problems – from optimizing network routers to deploying **on-device AI** and developing **LLM-powered** applications. Active contributor to the AI community (recognized as a *Participating Mentor* by DeepLearning.AI) and author of technical articles on Medium about machine learning applications. Always eager to learn cutting-edge technologies and integrate them into innovative products.

Technical Skills

- **Programming & Scripting:** Python (primary for ML/AI), C/C++ (embedded/firmware), Bash, VHDL (FPGA design). Experienced with Python libraries for **Avahi**, **DBus**, and **MQTT** protocols.
- **AI/ML Frameworks & Libraries:** TensorFlow, Keras, PyTorch, scikit-learn, Fast.ai, Hugging Face ecosystem, OpenCV (computer vision)
- **ML Domains:** Deep Neural Networks (CNNs, RNNs/LSTMs), Large Language Models (Transformers, GPT), NLP, Computer Vision, Time Series Analysis
- **MLOps & Data:** TensorFlow Extended (TFX), TensorFlow Lite, ONNX, data augmentation & preprocessing, model quantization & optimization for edge deployment
- **Tools & Platforms:** Docker, Linux development, Git, CI/CD pipelines, Hugging Face Hub, REST APIs, Embedded Linux driver development
- **Languages:** Italian (native), English (fluent)

VoIP and Communication Platforms

- Extensive experience with **FreeSWITCH** and **Asterisk**, including the development and customization of **channel drivers** for specialized telecom applications.
- Designed and implemented high-performance, production-ready channel drivers to enable seamless integration of custom VoIP hardware and signaling protocols.
- Deep understanding of **SIP, RTP, SDP** stack behaviors, audio codec negotiation, and media handling in real-time environments (Echo cancllers)
- Developed test frameworks and debugging utilities to validate channel driver functionality and performance under stress scenarios.

- Integrated custom modules with both FreeSWITCH and Asterisk environments to support M2M and emergency communication use cases.

AI & Machine Learning Projects

- **Multi-Agent AI System:** Developed a collaborative AI agent framework where multiple specialized LLM-based agents work in tandem to automate complex tasks. Leveraged an open-source multi-agent library (crewAI) to assign roles, memory (short/long-term), and tools (e.g., web search) to each agent, enabling the team to **generate documents, review technical articles, and simulate interviews** collectively. *(DeepLearning.AI "Multi AI Agent Systems" project)*
- **AI-Powered Text Adventure Game:** Built an interactive text-based adventure game driven by a **Large Language Model**. The system generates game worlds, characters, and storylines from simple prompts while maintaining narrative consistency. Demonstrated hierarchical content generation using an LLM with structured output (JSON) to manage game state (inventory, events). *(Project from DeepLearning.AI "Building an AI-Powered Game" short course)*
- **On-Device Computer Vision:** Deployed a deep learning model for real-time image segmentation on an Android smartphone. Converted and optimized a TensorFlow model to **TensorFlow Lite**, applying model quantization to reduce size and improve inference speed (4x faster, 4x smaller with minimal accuracy loss). Achieved smooth on-device performance and tested accuracy on-device. *(DeepLearning.AI "Introduction to On-Device AI" practical project)*
- **Data-Centric ML Competition:** Participated in DeepLearning.AI's **Data-Centric AI Competition**, focusing on improving model performance through data quality. Created data cleaning and augmentation pipelines for a noisy dataset, resulting in a more robust model without changing the model architecture. Gained experience in the data-centric approach to AI development and the importance of dataset curation.
- **Cycling Time Prediction (Medium Article):** Analyzed personal cycling data (over 800 indoor/outdoor routes from Strava) to build a regression model predicting ride "Moving Time" for virtual cycling routes. Features included distance, elevation gain, and gradient. Demonstrated end-to-end ML workflow: data extraction via Strava API, feature engineering, model training, and evaluation. Published results and insights in a Medium article titled *"Rouvy, Strava and Machine Learning – How to predict route 'Moving Time' by ML"* (Jan 2025).

Collaboration & Version Control Tools

- Proficient in the professional use of **Atlassian tools**, including **Jira** for project and issue tracking, **Confluence** for technical documentation and team collaboration, and **Bitbucket** for source code versioning and continuous integration workflows.
- Extensive experience using **Git** for version control in both solo and team environments. Skilled in managing complex branching strategies, performing code reviews, handling pull requests, and maintaining clean, consistent codebases.
- Familiar with Agile methodologies and the integration of CI/CD pipelines to streamline and automate software deployment processes.

Professional Experience

Tiesse SpA – Ivrea, Italy *(2014 – Present)*

Senior Software Engineer & Software Architect

- As Software Architect, I am responsible for overseeing the entire software development process and ensuring that software solutions meet the needs of the project and end-users. My key responsibilities include:
    - Evaluating and identifying software solutions based on project requirements and selecting optimal technologies and platforms.
    - Designing system architecture, writing high-quality code, and validating software solutions through rigorous testing to ensure performance, compatibility, and reliability.
    - Leading development teams with hands-on guidance, promoting adherence to best practices, coding standards, and agile methodologies to ensure productivity and goal alignment.
    - Creating technical documentation including software architecture plans, user manuals, and development guides for stakeholders and end-users.
    - Planning and scheduling software deliverables, tracking progress against milestones, and ensuring timely, on-budget delivery.
    - Troubleshooting issues by debugging, performing performance evaluations, and implementing optimizations to enhance functionality and scalability.
    - Providing mentorship and technical leadership to ensure development teams are aligned with the latest advancements and best practices in the software engineering field.
- As a Senior Software Engineer I lead architect for embedded software in a line of industrial routers and IoT/M2M communication devices. Define key components of system software architecture, including the **embedded Linux OS, device drivers, networking stack, VoIP PBX engine,** and command-line interface.
- Manage a small engineering team (3 developers), coordinating closely with hardware engineers to meet customer specifications and regulatory certifications. Oversee integration testing, troubleshoot complex issues, and guide the internal certification process for telecom equipment.
- **Key Achievements:**
    - **VoIP Module for Telecom:** Architected a VoIP module (“Imola”) for an Italian telecom carrier’s router, from design to deployment. Oversaw debugging and feature enhancements; currently undergoing certification with an expected production of 500 units/month.
    - **Emergency Lift Communication:** Designed a custom VoIP-based emergency phone system for elevator gateways. Developed low-level drivers and application interfaces to ensure reliable emergency calls from elevators, meeting strict safety requirements.

Kasko Networks (for Tiesse) – Ivrea, Italy *(2002 – 2014)*

Firmware and Software Engineer

- Led a variety of networking and telecom projects both in-house for Tiesse and for external clients as a consultant. Developed firmware and embedded software primarily in C/C++ on embedded Linux for routers and IoT gateways.
- Worked on-site with customers to integrate networking products into their systems, identify and fix issues, and customize solutions. Served in versatile roles including **FPGA designer** and **software architect** on joint projects, often traveling to client locations for deployment and support. Also mentored junior engineers and collaborated with university interns on research-oriented tasks.
- **Key Achievements:**
    - **Next-Gen Router Prototype:** Developed the "Imola" router prototype, contributing significantly to its design and software stack. The product achieved Telecom Italia certification and over **40,000 units** were produced and deployed to customers.
    - **Innovative M2M Protocol:** Created a proprietary lightweight communication protocol for the "Siena" M2M system, enabling reliable low-power data collection and control. This solution scaled to **120,000 devices** in the field, providing cost-effective IoT connectivity.
    - **Rugged Network Interface:** Built an interface application for the "Levanto" mobile network project, enabling connectivity in high-security, extreme environmental conditions (e.g., industrial and military contexts).
    - **VoIP Optimization:** Developed a VoIP module for a residential gateway, tuning audio quality (minimizing latency and jitter) to meet telecom standards. Extended the VoIP system to transmit remote radio control signals over IP for specialized use-cases.
    - **Highway SOS System:** Designed and integrated device drivers for IP telephones used in highway emergency (SOS) stations (for Ducati networking systems). Ensured the phones met real-time reliability requirements; ~500 units are in active use along highways.

Siemens ICN – L'Aquila, Italy *(1997 – 2002)*

Hardware/Firmware Engineer (R&D Laboratory)

- Designed digital hardware boards and FPGA firmware (VHDL) for Siemens telecommunication systems. Worked in the R&D lab creating prototypes and new features for large-scale telecom switches and cross-connects.
- Received extensive internal training through numerous Siemens technical courses. Frequently collaborated with Siemens headquarters in Munich, contributing to international projects and assisting with product certifications for major clients.
- **Key Achievements:**
    - **Synchronization Board Lead:** Acted as product owner for a synchronization module used in telecom networks. Developed firmware using Motorola 68340/68360 microcontrollers and oversaw its integration into the overall system.
    - **FPGA & PLL Development:** Gained in-depth expertise in VHDL, designing multiple

FPGA components. Notably developed a **digital Phase-Locked Loop (PLL)** in VHDL for the synchronization card, improving timing accuracy.

- **International Certification:** Served as the synchronization system test expert and was instrumental in achieving formal certification of Siemens SDH (Synchronous Digital Hierarchy) cross-connect systems for deployment in Czech Republic and China.
- **Automated Testing Tools:** Created an automated test toolkit that enabled remote data retrieval and diagnostics for telecom equipment, significantly improving testing efficiency and support for field installations.

Education

- **Ph.D. in Electrical and Telecommunications Engineering** – University of L'Aquila, Italy (2005)
  Thesis: "An Ultra Wide Bandwidth Framework for Wireless Sensor Networks" – Researched advanced communication frameworks for low-power sensor networks.
- **M.S. (Laurea) in Electrical Engineering** – University of L'Aquila, Italy (1994) Graduated *cum laude* (110/110) with specialization in power systems and telecommunications. **Top 1%** of class. Completed projects on smart grids and renewable energy integration.

Certifications & Specialized Training

- **DeepLearning.AI TensorFlow Developer Specialization** (Coursera, 2022) – Credential in building and training neural networks with TensorFlow (incl. CNNs, NLP with TF, time series forecasting).
- **Machine Learning Engineering for Production (MLOps) Specialization** (DeepLearning.AI/Coursera, 2021) – End-to-end MLOps: data pipelines, model deployment, monitoring in production environments.
- **Deep Learning Specialization** (DeepLearning.AI/Coursera, 2020) – Comprehensive deep learning program by Andrew Ng (Neural Networks, Hyperparameter tuning, CNNs, Sequence Models).
- **Mathematics for Machine Learning Specialization** (Imperial College London via Coursera) – Linear algebra, calculus, and statistics foundation for ML.
- **Stanford Machine Learning (Coursera)** – Andrew Ng's machine learning course covering fundamental algorithms (regression, SVM, clustering, etc.).
- **Generative AI with Large Language Models** (DeepLearning.AI & AWS, 2023) – Specialized courses on building applications with LLMs, prompt engineering, and AWS AI services.

DeepLearning.AI Short Courses

Fabio has successfully completed the following short courses offered by DeepLearning.AI, focused on cutting-edge AI technologies:

- **ChatGPT Prompt Engineering for Developers** – in collaboration with OpenAI

- **LangChain for LLM Application Development**
- **Building Systems with the ChatGPT API**
- **LangChain Chat with Your Data**
- **Functions, Tools and Agents with LangChain**
- **Building Generative AI Applications with Gradio** – in collaboration with Hugging Face
- **Evaluating and Debugging Generative AI** – in collaboration with Weights & Biases
- **Understanding and Applying Text Embeddings** – in collaboration with Google Cloud
- **Pair Programming with a Large Language Model** – in collaboration with Google
- **Large Language Models with Semantic Search** – in collaboration with Cohere
- **Finetuning Large Language Models** – in collaboration with Lamini
- **LLMOps** – in collaboration with Google Cloud
- **Automated Testing for LLMOps** – in collaboration with CircleCI
- **Building Applications with Vector Databases** – in collaboration with Pinecone
- **Prompt Engineering with Llama 2&3** – in collaboration with Meta
- **Open Source Models with Hugging Face**
- **Quality and Safety for LLM Applications** – in collaboration with WhyLabs
- **Building and Evaluating Advanced RAG** – in collaboration with TruEra e LlamaIndex
- **Reinforcement Learning From Human Feedback** – in collaboration with Google Cloud
- **Advanced Retrieval for AI with Chroma** – in collaboration with Chroma
- **Build LLM Apps with LangChain.js** – in collaboration with LangChain
- **Serverless LLM Apps Amazon Bedrock** – in collaboration with AWS
- **Knowledge Graphs for RAG** – in collaboration with Neo4j
- **Efficiently Serving LLMs** – in collaboration with Predibase
- **JavaScript RAG Web Apps with LlamaIndex** – in collaboration with LlamaIndex
- **Red Teaming LLM Applications** – in collaboration with Giskard
- **Preprocessing Unstructured Data for LLM Applications** – in collaboration with Unstructured
- **Quantization Fundamentals with Hugging Face**
- **Getting Started with Mistral** – in collaboration with Mistral AI
- **Prompt Engineering for Vision Models** – in collaboration with Comet
- **Quantization in Depth** – in collaboration with Hugging Face
- **Building Agentic RAG with LlamaIndex** – in collaboration with LlamaIndex
- **Building Multimodal Search and RAG** – in collaboration with Weaviate
- **Multi AI Agent Systems with crewAI** – in collaboration with crewAI

- **Introduction to on-device AI** – in collaboration with Qualcomm
- **AI Agentic Design Patterns with AutoGen** – in collaboration with Microsoft e Penn State University
- **AI Agents in LangGraph** – in collaboration with LangChain e Tavily
- **Building Your Own Database Agent** – in collaboration with Microsoft
- **Function-calling and data extraction with LLMs** – in collaboration with Nexusflow
- **Carbon Aware Computing for GenAI Developers** – in collaboration with Google Cloud
- **Prompt Compression and Query Optimization** – in collaboration with MongoDB
- **Pretraining LLMs** – in collaboration with Upstage
- **Intro to Federated Learning** – in collaboration with Flower Labs
- **Federated Fine-tuning of LLMs with Private Data** – in collaboration with Flower Labs
- **Embedding Models: from Architecture to Implementation** – in collaboration with Vectara
- **Improving Accuracy of LLM Applications** – in collaboration with Lamini e Meta
- **Building AI Applications With Haystack** – in collaboration with Haystack
- **Large Multimodal Model Prompting with Gemini** – in collaboration with Google Cloud
- **Multimodal RAG: Chat with Videos** – in collaboration with Intel
- **Retrieval Optimization: Tokenization to Vector Quantization** – in collaboration with Qdrant
- **Introducing Multimodal Llama 3.2** – in collaboration with Meta
- **Serverless Agentic Workflows with Amazon Bedrock** – in collaboration with AWS
- **Practical Multi AI Agents and Advanced Use Cases with crewAI** – in collaboration with crewAI
- **LLMs as Operating Systems: Agent Memory** – in collaboration with Letta
- **Safe and reliable AI via guardrails** – in collaboration with GuardrailsAI
- **Building an AI-Powered Game** – in collaboration with Together
- **OpenAI API: Multimodal Development with GPT-4** (LinkedIn Learning, 2024) – Practical use of OpenAI's GPT-4 API with image understanding and function calling to build multimodal AI applications.

Awards & Recognition

- **Participating Mentor – DeepLearning.AI (2021/2022):** Received recognition from DeepLearning.AI for active mentorship in the AI community. Assisted fellow learners in forums and projects, contributing expertise and guidance. This award highlights leadership and knowledge-sharing in the global machine learning community.