Umesh Timalsina

Nashville, TN | +1 (618) 303-8828 | umesh.timalsina26@gmail.com
github.com/umesh-timalsina | umesh-timalsina.github.io

Summary

I am a full-stack research software engineer with 7+ years building learning technologies and real-time multimodal data analytics platforms. I have worked as the lead engineer on ed-tech systems used in U.S. classroom studies and in an OECD randomized controlled trial across hundreds of European schools, including an LLM tutor and LLM-powered content pipelines. I am well versed in taking ideas from learning scientists, teachers, and international partners and turning them into rapidly prototyped research software. In my next role, I want to deliver similar results at a larger scale while growing my technical skills.

Experience

System Engineer, Lead Mar 2025 – Present
ICONS (formerly Institute for Software Integrated Systems), Vanderbilt University *Nashville, TN*

- Created and lead **Betty's Math**, a SvelteKit/TypeScript math assessment and AI-tutoring platform embedded in the **OECD's PILA**, deployed in a **randomized controlled trial across hundreds of schools** in France, Germany, the Slovak Republic, and Latvia.
- Integrated an **LLM tutor** into the student experience: built the context it receives (problem, the student's current solution, a learner model, progress stats), persistent chat history, and prompt logging for evaluation.
- Built **LLM pipelines** (Claude, GPT) that translate problems, concepts, and misconceptions for four-country deployment, and that generate knowledge graphs used to assign students to concepts.
- Built the platform's research layer: RCT sequencing, xAPI event logging, and a real-time teacher dashboard; worked directly with the OECD team on wording, translations, and dashboard design.
- Lead **SyncFlow**, an open-source Rust/Next.js/WebRTC platform for real-time multimodal classroom data, sustaining **200 concurrent streams** at **∼200 ms latency** and archiving **400+ hours (>10 TB)** for **1,000+ researchers and students** (US-RSE 2025).
- Deployed SyncFlow in classroom studies across Indiana, Tennessee, and North Carolina for the NSF AI Institute for Engaged Learning, on **Amazon ECS** (CloudFormation, GitHub Actions, CloudWatch) and on-premises, keeping student data on school networks; integrated the C2STEM, SPICE, Crystal Island, and EcoJourneys learning environments.
- Building real-time AI feedback for classrooms: NVIDIA Riva and AWS Transcribe for speech, computer vision models on edge and cloud (NVIDIA Jetson, AWS, Jetstream2), and **on-device LLM summarization** of live classroom transcripts on Jetson.

Research Engineer, Senior May 2022 – Mar 2025
Institute for Software Integrated Systems (ISIS), Vanderbilt University *Nashville, TN*

- Designed and built SyncFlow from scratch, re-architecting ChimeraPy's cluster-based design into a cloud-first WebRTC platform so it could run in real classrooms; wrote its Rust API, Next.js dashboard, desktop capture app (Tauri, GStreamer), and Node.js and Python client libraries.
- Co-developed **ChimeraPy**, a Python/ZeroMQ distributed streaming framework for real-time multimodal data, used in Nashville-area classroom studies by 100+ users (IEEE BigData 2023).
- Built ChimeraPy's orchestration layer and SvelteKit dashboard for building pipelines and managing clusters live over WebSockets, plus its pipeline library (video, audio, people tracking, live transcription, and video anonymization for participant privacy).
- Developed deep active learning and surrogate models for underwater vehicle hull design optimization with a combined CAD–CFD simulation pipeline (*Ocean Engineering* 2024; IEEE DESTION 2024).

Research Engineer Aug 2019 – May 2022
Institute for Software Integrated Systems (ISIS), Vanderbilt University *Nashville, TN*

- Core contributor to **DeepForge** (**700+ GitHub stars**), an NSF-funded visual environment for building and running deep learning pipelines; led its Keras parser modernization and Svelte web components.
- Used DeepForge to reproduce a CNN-based photometric redshift study on SDSS galaxy images, published as first author (*Astronomy and Computing* 2022), and turned it into tutorials in the official docs.
- Led development of **GMSO**, the core topology library of the NSF-funded MoSDeF ecosystem, created forcefield-utilities, and set up CI, Docker publishing, and release tooling across MoSDeF libraries.
- Built Symbench Circuit Maker for DARPA's Symbiotic Design for CPS program, a web-based circuit design studio using deep learning to predict the next likely component, with Dockerized CI/CD to AWS.
- Built a Python client for scripted UAV design evaluation and optimization, and Fusepack, a genetic-algorithm component placement tool for UAV fuselages, for the same DARPA program.

Graduate Research Assistant Jan 2018 – May 2019
College of Applied Sciences and Arts, Southern Illinois University *Carbondale, IL*

- Built a data insights dashboard for the aviation department; published on incentivized IoT service sharing with OSGi and Hashgraph (IEEE ICDIS 2019).

Technical Skills

Languages: Python, TypeScript, JavaScript, Rust, SQL, Java, Bash

Front End: SvelteKit, Svelte, Next.js, React, Tailwind CSS, XState, WebSockets, WebRTC (LiveKit)

Back End & Data: FastAPI, Actix Web, Node.js, PostgreSQL, MongoDB, RabbitMQ, ZeroMQ, S3/MinIO

GenAI & ML: LLM integration (Claude, GPT), prompt and context engineering, Amazon Bedrock, on-device LLMs (NVIDIA Jetson), PyTorch, TensorFlow/Keras, NVIDIA Riva, speech-to-text, computer vision, surrogate modeling

Cloud & DevOps: AWS (ECS, CloudFormation, CloudWatch, S3, Transcribe), Docker, GitHub Actions, Linux, Google Cloud

Learning Analytics: xAPI, randomized controlled trial infrastructure, multimodal learning analytics, IRB-compliant data handling

Education

MS, Data Science (part-time), Vanderbilt University, Nashville, TN — Aug 2025 – Present
MS, Computer Science, Southern Illinois University, Carbondale, IL — May 2019
BE, Electronics and Communication Engineering, Tribhuvan University, Nepal — Mar 2015

Selected Publications

U. Timalsina, E. Davalos, N. Sanda, J. H. Fonteles, A. TS, and G. Biswas. "SyncFlow: A Scalable Platform for Multimodal Learning Analytics." *US-RSE Conference*, 2025.

E. Davalos, **U. Timalsina**, Y. Zhang, J. Wu, J. H. Fonteles, and G. Biswas. "ChimeraPy: A Scientific Distributed Streaming Framework for Real-time Multimodal Data Retrieval and Processing." *IEEE BigData*, 2023.

H. Vardhan, D. Hyde, **U. Timalsina**, P. Volgyesi, and J. Sztipanovits. "Sample-efficient and Surrogate-based Design Optimization of Underwater Vehicle Hulls." *Ocean Engineering* 311, 2024.

U. Timalsina, B. Broll, K. Moore, T. Budavári, and Á. Lédeczi. "DeepForge for Astronomy: Deep Learning SDSS Redshifts from Images." *Astronomy and Computing* 40, 2022.

B. Crawford, **U. Timalsina**, et al. "MoSDeF-GOMC: Python Software for the Creation of Scientific Workflows for the Monte Carlo Simulation Engine GOMC." *J. Chem. Inf. Model.* 63(4), 2023.

B. Broll, **U. Timalsina**, P. Völgyesi, T. Budavári, and Á. Lédeczi. "A Machine Learning Gateway for Scientific Workflow Design." *Scientific Programming*, 2020.