Kevin Ting-Kai Kuo

Contact

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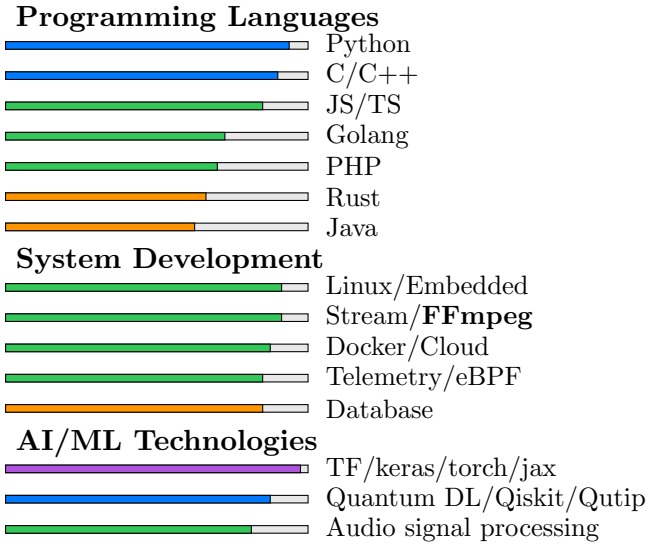
- Medium/article list about science
- Interactive novel/Quantum Animation/Baby book

Fast Navigation

You can jump to Software Development and Experience section

Technology Stack Dashboard



Experience

Senior engineer, IKG Team, 2024 Sep. - now

- Develope browser-end multimedia player for video streams using **FFmpeg**, WebGPU,WebAssembly, accelerating streams with NVIDIA encoder and customizing **AI-masking frames** from SRS **mediaserver**. One of the features is parsing **unixtime** values embedded in **H.264 SEI** fields by **FFmpeg** at the streaming end from the player's decoder side, used for synchronizing game states across different servers worldwide for the same game
- **Monitoring/Logging/Telemetry** for network TTFF/latency with Grafana/Prometheus on AWS, google analytics, Sentry (Python/Javascript SDK) **on cloud server**. Built private cloud monitoring infrastructure for all on-premise and cloud servers and connected devices in Taipei and Europe, including multiple **ZCAM cameras** used for streaming, using **Grafana dashboards** with data sources from **Prometheus/Loki/Telegraf/Zabbix**
- Authentication for stream requests
- Serial port communication (USB, RS232) for game machine **micro-controller(MCU)**
- **Object storages** for **VODs** with **Tencent/BytePlus** cloud services
- Websockets/MQTT for game state machine message passing to Database (**PostgreSQL, MongoDB**)
- Monte Carlo for event stochastic process outcome simulations.
- Technology stacks: Python/C++/ Typescript/JavaScript/Go
- Documenting with **Confluence**
- **Co-working with Europe team** for game projects without obstacles

Senior engineer, Arcadyan Technology Co. Ltd., 2023 Dec.- 2024 July

- **Google xTS** test suite for **Android TV** development, deployed and ran on Ubuntu Linux server
- Test automation cluster build-up (24-48 physical devices) for passing over 1-million test cases nightly by **sharding**.
- **Leadership:** Dispatch/Schedule remote contractors to complete a xTS test suite cycle per week
- **OTA/eMMC firmware update**

Senior engineer, Marvell Technology Co. Ltd., 2023 Jan.-Dec.

- **SSD NVMe controller** protocol front-end test/simulation tool development/test for **SSD controller firmware**, including device enumeration,function level hot reset features **for cloud server storage**
- Test tool GUI development with PySide2
- Used qTest for regression test documenting, Jfrog for constructing CI upstream and software release. CI/CD and release.Wrote Java/Groovy/Shell scripts for CI/CD code on Jenkins.
- Docker/Manylinux to make software release more portable
- Slack/Jira for agile development

Software Freelancer, 2022 Sep.-Dec.

- AI pose detection for body training posing correction with PoseNet.

Algorithm engineer, Tyrafos Technology, 2022 Mar.-Jul.

- Real-time face recognition/fingerprint verification on embedded devices using neural network quantization in **TF-lite**
- Real-time Image signal processing (**ISP**) such like **HDR**, **3A** on mobile camera in **OpenCV**
- Optical **TRNG** encryption module on mobile phones obeying **NIST** entropy extraction test suite

Full-stack engineer and Co-founder, Eunomia (a legal-tech startup), 2020 Jul.-2022 Jan.

- Build-up the **GUI** of a document editor with **Sequence-to-Sequence** model with **PyTorch** for **NLP** core, for the purpose of collaboration with lawyers and other workers in legal industry. Our WebUI was implemented with **Vue.js**/**Quill.js**, deployed on **GCP**/**Firebase**.
- Obtained the 2nd place in the 1st **Lawsnote Legaltech Hackathon**, 2020, Taiwan.
- Assisted by **NCCU** innovation center start-up incubator.

Skills

Programming Languages

- **Python**, **C/C++**, **Javascript/Typescript**, **Golang**, **Rust**, **Java**, **Lean**, PHP, **Ruby on Rails**, Julia, Shell scripts, Mathematica, R

Working OS Platforms

- Ubuntu Linux, CentOS Linux, Android Linux, RaspberryPi OS, Windows

DL/ML/HPC/Statatistics

DL Frameworks/AI compiler

- **Tensorflow**:**TF**/**TF-lite**/
  Tensornetwork/**Tensorboard**/
  Tensorflow C++ API
  Jax
- **Pytorch**: **torch**/**torch_geometric**
- **ONNX**, **MLIR**
- HPC tools: **Pybind11**/**BLAS**/**OpenMP**

Algorithms

- ML/DL theory
  Especially, I am sophisticated at a family of **physics-inspired** algorithms called **tensor network** (also called **tensor-train decomposition**,TT, or **higher order singular value decomposition, HOSVD**), which are used in **LoRA** in the **LLM** field.
- Image signal processing (**ISP**)
  Edge CV using pre-trained NN models then fine-tuned/migrate learning to in-firm data, **quantized to FP int8** and deployed on **RK3399 SoC** equipped with camera lens collaboratively RD with **FocalTech**, for the face verification system.
  HDR tonemapping, color space conversion for **CIS** camera lens **ISP** pipeline (with **OpenCV**). Spherical aberration calibration for the robotic vacuum.
  Circle/edge detection for the eye-moving instrument.
- **Quantum Machine Learning**
  quantum-classical **hybrid CNN architecture** implemented with Google **Qiskit**/**Tensorflow**/**Pannylane**/**Strawberryfield** running on **IBMQ** quantum server for solving the ground state energy of the molecule in the **IBMQ Quantum Computing**

Hackathon.

- **Statistics**
  multivariate time series such like **ARIMA** model, **VAR**, **GARCH** etc, with **ARIMA**(R) and **Statsmodel**(Python). Currently I am interested in the generalized version of **AIC**/**BIC** call **WAIC**/**WBIC** using algebraic statistics (algebraic geometry + statistics) invented by Watanabe, Riken.
- Numerical methods
  tensorization/**Monte Carlo**/**Quantum Monte Carlo**/**Markov Chain Monte Carlo**/**Simulated annealing** for solving combinatorical problem, e.g. the variant of travelling saleman problem (**TSP**) called **QAOA**, and physics problem (phase transition classification and ground state solution).
- Cryptography: randomness(entropy) extraction, optical-based **TRNG** implemented by **LED** packaged on circuit for the electric network data transfer, which was inspired by **Samsung** mobile phone hardware encryption module.

Software Development

- Profiler: **perfetto**/**logcat**/**protobuf** on **Android Linux** platform.
- **Real time, Low latency System design on Linux**: **NVMe SSD** controller tool development and test for several Linux distributions (**Ubuntu**/**CentOS**/**RPI**) using **Pybind11** for binding top python API to C++ core library to call the **NVMe**/**PCIe** syscalls to the Linux kernel. Besides, we replaced the original ring buffer backend of **NVMe** devices with **IOUring**/**Liburing** for better I/O performance. Use Intel/WindRiver **Simics** during the development and test.
- Web: **Vue**/**Node**/**Django**/**GCP**/**Firebase**
- Emulator/Simulator:**Qemu**(open-source)/ **AVD**(**Android**)/**Simics**(Windriver) for **SSD** device development and test.
- GUI: **PyQt5**, **PySide2**
- **Cloud Container virtualization**:**Docker** and **Docker-compose**, **LXC**(Linux generic container technology), **Proxmox**
- **OpenTelemetry** for monitoring/logging/telemetry: **Prometheus**/**Grafana**/**Datadog**/**Sentry**

Test

- **Database: PostgreSQL, MongoDB**
- Agile: **Scrum**, **Jira**
- CI/CD: **Jenkins**/**Groovy**/**Git** action
- Test automation framework: **Pytest**/**Postman**/ **Selemium**

Education

BA, Economics, National Chengchi University, 2016-2018

- RA (Ministry of Science and Technology), Taiwan Policy Center, 2017-2018
- Graduate/undergraduate maths courses: advanced calculus, stochastic process, advanced probability, stochastic PDE (2016 summer school, NTU), differential geometry
- Graduate/undergraduate econ courses: Financial time series, Econometrics, Game theory, Macroeconomics, Microeconomics
- TWSIAM conference 2018, poster paper, forecasting for win rate of NBA teams using HMM model with Dirichlet prior implemented by R

MA, Economics, National Chengchi University, 2018-2019 (incomplete)

- ICAPE 2020 Conference (San Diego), oral presentation: *Shinn-Shyr Wang, Ting-Kai Kuo and Wen-Chieh Lee, National Chengchi University: Combating thick polar networks: is there any effective way other than the strategic network formation?* Contribution: theoretical proof/numerical simulation for studying opinion convergence speed of manipulated social networks with echo-chamber effect implemented by Networkx and Numpy. I also set-up a manipulated chatroom with Node.js and Firebase providing for experimenters to use and monitored the opinion dynamics from the back-end.
- TA, principle of economics, 2018 autumn
- **RA, Music and Culture Technology Lab, Institute of Information Science, Academia Sinica, 2019**: Music score learning using graph neural network and topological data analysis with Tensorflow, Scikit-learn, Librosa.

MA, Applied Physics, National Chengchi University, 2019-2020 (incomplete, master thesis defense passed)

- RA, Condensed Matter Center, NTU/ Institute of Applied Physics, NCCU
- TA, computational physics, 2019 spring, teaching quantum Monte Carlo
- Research: tensorize neural networks on condensed matter physics and conventional supervised learning task (image recognition) implemented by Tensorflow/Keras/Tensornetwork
- Courses: quantum computing, quantum mechanics, statistical mechanics, computational physics
- Seminar project: implemented quantum exponential adder with qiskit in quantum computing course

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Math/Physics/TCS Research Interest

- Mathematica/Sagemath(Python) for symbolic/numerical computation for the Mathematical Physics.
- Computer Automatic Proof in Lean4/Coq/ Isabelle language.
- **Currently, I am working with Dr. Kuo, En-Jui (UMD) and Dr. Kam, Chon-Fai (SUNY Buffalo) with: (1) Mack polynomial in string theory and (2) Hyperdeterminant in quantum entanglement, respectively.**