MACHINE LEARNING-ASSISTED COMB LINE IDENTIFICATION IN CAVITY RING-DOWN COMB VERNIER SPECTROSCOPY

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In this work, we propose a novel approach for spectroscopic analysis in Cavity Ring-Down Comb Vernier Spectroscopy (CRDCVS) by exploiting FPGA architecture and an Arm-based embedded Linux system. This approach takes advantage of the high-speed data processing and acquisition capabilities of FPGA. In the Vernier configuration, a mode-resolved comb spectrum should align non-equidistant comb peaks in different scans and fitting the ring down time for each comb line. Especially a significant challenge in spectroscopic analysis is presented when the sample accumulation is required for improved sensitivity or temporal resolution. To address this challenge, we developed a machine-learning framework to predict comb line appearance in the operating platform. This enables ring-down-time accumulation for different comb peaks in CRDCVS. We demonstrated the proof-of-principle performance of the developed system with CRDCS measurements of toluene using a 3.3um chip-scale Interband Cascade Laser (ICL) comb. We will discuss the overall performance and the potential to advance the field of CRDCVS by improving measurement accuracy and reliability.